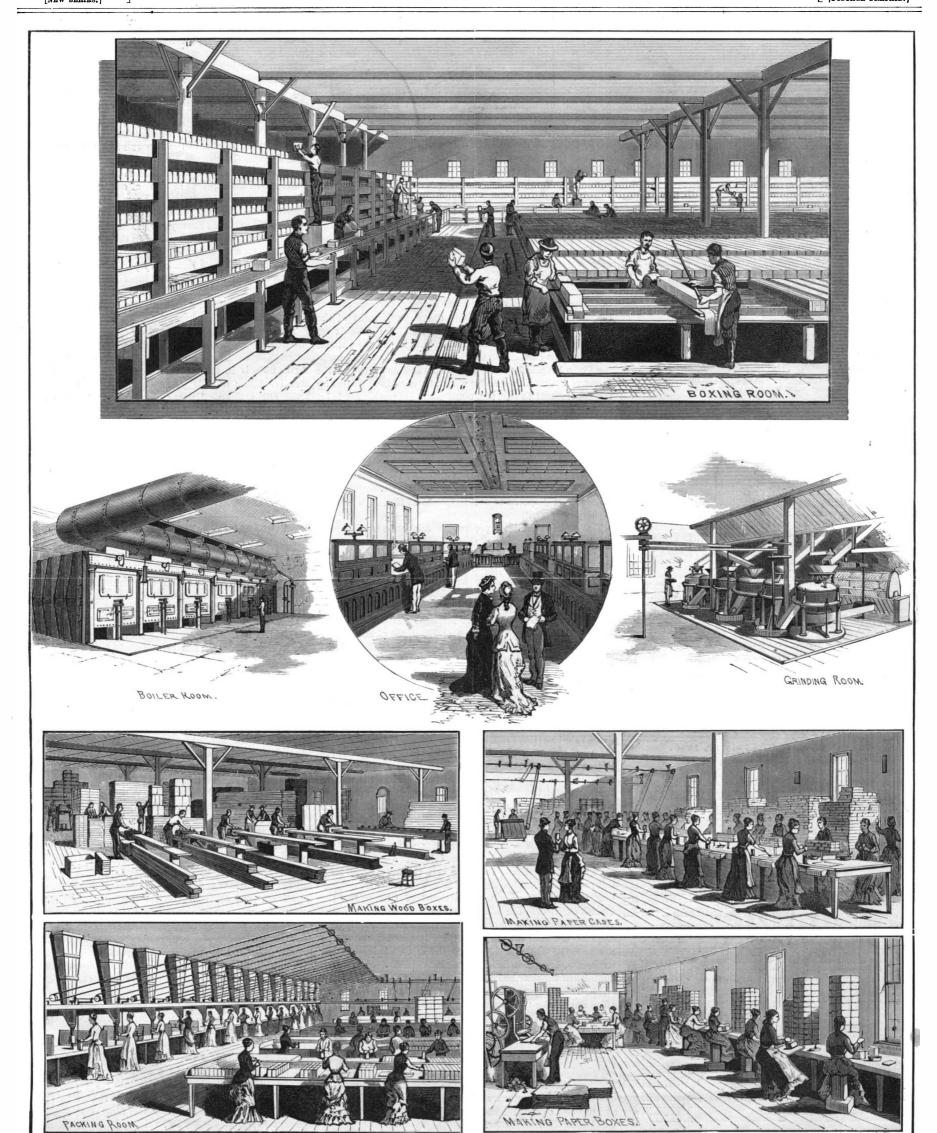
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART. SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLIII.—No. 3. NEW SERIES.]

NEW YORK, JULY 17, 1880

\$3.20 per Annum. [POSTAGE PREPAID.]



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH,

TERMS FOR THE SCIENTIFIC AMERICAN.

Clubs. - One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address MUNN & CO, 37 Park Row, New York.

To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now Fifty Thousand Copies weekly. For 1880 the publishers anticipate a still larger circulation

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size WITH SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates. - The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information: (2. Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, \$5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. [FF] Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., \$6 | Park Row. New York. CO., 37 l'ark Row, New York.

NEW YORK, SATURDAY, JULY 17, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

Alcoholic liquors, testing.

American indust ies*.

American Science Association.

American Science Association.

American wood engraving.

Apple jelly.

Barometer tube, to clean (2)

Basal plane quartz crysta's

Butter and cheese, rise of at sea.

Canan, ship, Florida, projected.

Car moyer, new*. Canal, ship, Florida, projected.
Car mover, new *.
Cartridge, improved *.
Castrings, steel, increasing use of
Coal tar dyes, manufacture of.
Cock, cylinder, automatic safety*
Color printing process, new.
Copper-plating on zinc
Cucumbers, to pickle (3)
Dyes, coal tar, manufacture of.
Elevator, Erie, new.
Engineering inventions
Engraving, wood, American.
Experiment, in magnetism
Fish parasites *.
Fleet, quar, for the Mississippi. Experiment, in magnetism
Fish parasites *
Fleet, quar. for the Mississipi.
Framemaker's putty (1).
Gate closer, novel *
Georgla meteor, a.
Glass globes, to silver (4).
Glass, phate, largest sheets of.
Government use of patents.
Horse, large, a.
Lie without freezing
Industries, American, *
Industries, American, illus.series
Industries, textile, Philadelphia.
Loventions, engingering. nventions, engineering... nventions, miscellaneous nventors, opportunity for acquer gold (1)..... Lacquer gold (1)...
Lake Ontario's shad
Lamp, street, improved *
Liquors, alcoholic, testing
Lock makers, opportunity for.
London's stock Co.'s, limited

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT No. 237,

For the Week ending July 17, 1880.

Price 10 cents. For sale by all newsdealers.

- 1. ENGINEERING AND MECHANICS.—Engines of H.M.S. Nelson. Illustrated...

 British Gun Tests. Competitive tests of Hotchkiss and Nordenfelt guns

 Mode of Sub-Aqueous Excavation, Driving Piles, or Making Solid Foundations in Quicksands or Unstable Solis. By CHAS. 3768 PONTEZ. Illustrated.
 An Iron Roof of 42 Feet Span. Many figures showing plan and details of construction.
- II. ELECTRICITY, MAGNETISM, ETC.—The Large Electric Works of Paris. The stores of the Louvre,—The Hippodrome.—1 illustration. The large electric machine hall at the Paris Hippodrome.
 Electrical Abstracts. Induction machines. By A. TOEPLER.—Influence of atmospheric electricity on long underground telegraph conductors. By MASSMAN.—Is there danger in carrying a lightning conductor into a powder magazine? By HERMAN ARON.—Un lerground telegraph wires.

 —Un lerground telegraph wires. Transmission of Motion by Electricity. Deprez's system 3772

GOVERNMENT USE OF PATENTS.

Inventors are to be congratulated upon three recent decisions of the courts which open the way to an efficient judicial remedy for use of patents by government officers. There has been a vague idea that obtaining a patent does not protect the inventor against gratuitous use of his invention by authority of government. This view was founded upon English practice; an English patent is understood to be inoperative against the crown. But the reasons for this do not prevail in America. In this country a patent is a compact with the inventor to induce him to disclose his invention for the public benefit. In England patents are a preserved class of "monopolies"-a privilege which the sovereign is allowed to give to favored persons.

Although the right of an inventor as against government has been for some years recognized, to see how he could have a remedy has not been so easy. As long ago as 1858 a claim was preferred to the Secretary of War for payment for government use of the Sickles' cut-off. The government contracted with Merrick & Son to build a steamboat. The contractors attached the cut-off to the engine without paying royalty, considering that government was entitled to the free use of the invention. Sickles applied to the Secretary of War, and that officer asked the opinion of the Attorney General. The Attorney General of the day, Judge Black, advised that the government was equally bound with an in dividual to pay a royalty; and that the Secretary might pay a reasonable one if there were an appropriation available. This "if" gravely embarrasses the inventor's right in most cases. What he has needed has been an efficient remedy in the courts. But the courts cannot render judgment against the government for wrongs done by its officers. Nor can they enjoin the government directly from using an invention and if they could, or could stop the use by enjoining the officers personally, this is not what the inventor wishes; he wishes his invention used and a royalty paid.

In 1863, and again in 1868, suits were argued in the Court of Claims seeking to recover royalties for government use of inventions. In the first of these cases the Warden of the United States Penitentiary in the District of Columbia set up six patented broom making machines in the prison, and employed the convicts in making brooms. There was nothing like a bargain between him and the inventor; and the Court of Claims said that for want of some contract binding the government to pay, that court could not render any judg ment. In the other case, a patented army tent was adopted by the War Department and a contract was made by direction of the Secretary, with the inventor, to pay him a royalty For reasons connected with his participation in the rebellion the payments were stopped; but on proof of the special con tract, he recovered judgment. Obviously these views gave no protection in all that large class of cases where executive officers were disposed to use inventions as if they were free to the government.

Three recent decisions present the subject in new aspects, and indicate the law to be that if, upon request of the inventor, an officer competent to contract for use of an invention makes use of it without payment, the Court of Claims may award compensation to the inventor upon a theory of an implied promise to pay him, while if the invention is used against the inventor's consent, or by an inferior officer or contractor, the individual thus infringing is personally liable in substantial damages, recoverable in the circuit courts. In one of the cases, Lieutenant McKeever, being the patentee of an improved cartridge box, submitted it to the War Department in the hope that it might be adopted. It was adopted. But upon the theory that government is not bound to pay royalties, none was paid to the inventor. He brought suit in the Court of Claims. That court decided that the government has not the right to use an invention, and that as the cartridge box had been submitted by the inventor to the department, the presumption must be that the government used it under an implied license and upon an obligation to pay a reasonable royalty. It could not be supposed that the inventor intended to give a gratuitous leave or that the Secretary intended a lawless infringement. A judgment for a substantial compensation founded on this theory of contract was therefore awarded.

Another suit was brought against an officer—the Postmaster of New York-who refused to enter into any contract with the inventor, believing and claiming upon English precedents that he ought not to do so. There was, therefore, no ground for a suit in the Court of Claims, but the as an infringer. The patent in this case was for an improvement in canceling the letter stamps. It enabled the clerks to cancel the stamp on a letter by the same implement and stroke which imprinted the postmark. The device obviously diminished the time consumed in stamping letters by nearly one half; and the pecuniary saving realized in the New York office during the term covered by the suit was shown to have been \$63,000. That is to say, the officer had saved, and presumably had remitted to the government at Washington, \$63,000 of postal moneys, which he otherwise must have expended in paying salaries of stamping clerks. The court adjudged him personally liable for this sum to the inventor. The fact that he had paid it over to government did not protect him. The inventor was declared entitled to his damages, and the task of coaxing the money back from the Treasury was left to the Postmaster.

The third of the decisions mentioned, earlier in date than

manufacturing for government, assumed to use, as they supposed government had the right to do, the complainant's invention without paying him. But the Circuit Court very promptly told them that they had no such privilege.

These decisions are subject to the ultimate approval of the Supreme Court at Washington. Should they be finally sustained they will enable an inventor to seek redress in the courts, whatever may be the way in which his invention is pirated under pretense of a use for government.

AMERICAN INDUSTRIES. OUR ILLUSTRATED SERIES.

Not only our home subscribers, but our patrons abroad, express great satisfaction with the feature adopted by this journal, more than a year ago, of publishing illustrated articles on the prominent industries of this country. To some of our foreign contemporaries it seems to be a mystery how it is possible to gather the material and prepare for every weekly issue the full page illustrations which embellish the initial page, together with the other not less beautiful wood cuts which appear in other portions of the paper.

Nothing like it has ever been attempted before by any weekly newspaper devoted to industrial and scientific subjects, and only to a publication having a very large circula tion could the expense attending the preparation of so many costly, original engravings be afforded.

From every number of the Scientific American our Eng lish, French, German, Spanish, Italian, and frequently Rus sian contemporaries, also transfer to their pages the illus trations and descriptions of some of our best inventions and more important discoveries, and some of them have reproduced the full page cuts of some of our industrial series.

This will explain to many perplexed persons whose works or machines have been described in these columns what has been to them a mystery.

They receive letters from every part of the world inquiring about their wares or their inventions, as the case may be, often in a language they understand not, and they wonder how the writer, in such an out-of-the-way place, ever heard of them or their inventions.

The London Printing Times and Lithographer, of June 15, just received at this office, referring to our series of articles descriptive of American industries, makes mention of the three subjects in their special line which appeared in consecutive issues of this paper not long ago, with extracts from our articles. Farmer, Little & Co.'s type casting works; Geo. Mather's Sons printing ink manufactory; and the Albion Paper Company's extensive works at Holyoke The editor might with propriety have added to the list the printing press manufactory of Cottrell & Babcock, which appeared in the issue next preceding the three industries to which the writer refers, and this would have rendered more nearly complete the range of subjects to which our contem porary is allied.

A QUARANTINE FLEET FOR THE MISSISSIPPI.

The terrible visitation experienced in 1878, by yellow fever, by the cities along the lower Mississippi, indicated clearly to the United States Medical Department the great need of a more perfect system of quarantine regulation, in spection, and disinfection. Also, the want of swift, properly appointed craft to relieve passing vessels of sick per sons and to convey such to the quarantine stations along the river. To meet the peculiar requirements of the case a fleet of four steamers has been designed by Dr. J. F. Turner. Secretary of the National Board of Health, and these have just been completed at Pittsburg, leaving that city, June 23, for duty on the Mississippi between Cairo and New Orleans. The fleet comprises the hospital and supply steamer H. H. Benner, and the steel launches Sentinel, Lookout, and Picket. The Benner is a stern wheel iron hull steamer of the Western high-pressure type, 112 feet long, 18 feet beam, 4 feet hold. On the main or boiler deck she carries an iron disinfecting tank for the reception and steaming of bedding, etc., supposed to contain the germs of fever. This tank is 6 x 8 feet, of boiler iron. The upper deck is fitted up with bath room, physician's quarters, and medicine chests. The main cabin is a clear, well ventilated space 14 x 50 feet, fitted with thirty iron cots for the reception of the sick. The launches are of handsome model and are 36 feet long by 7 feet beam, and 31/2 hold. Engine vertical, driving propeller of 32 inch diameter and 6 feet pitch, making 250 revolutions per minute with steam at 120 lb. Each launch carries a small cannon for calling passing and sus-Circuit Court held the officer personally liable for damages pected steamers to a prompt halt. Their swiftness will enable them to hurry the unfortunate sick to the nearest quarantine station, and a physician will be on board each launch. The Benner will be in charge of Dr. F. W. Reilly, of Chicago, and the crew will be selected from men who have run the dread gauntlet of "Yellow Jack." The cost of this laudable enterprise to the government will be about \$35,000. The quarantine stations already provided for are located at Cairo, Vicksburg, Memphis, and New Orleans, and also at the mouth of the Red River.

INCREASE IN THE RUBBER MANUFACTURE.

It is interesting to note, in connection with the extended description of the rubber manufacture we published last week, that the total imports of crude rubber and gutta percha for the United States, for the nine months to April 1, amounted to 13,444.750 lb., valued at \$7,436,560, against importations for the nine months to April 1, 1879, of 11,the others, applies the same principles to the simpler and 010,677 lb., valued at \$4,387,071. This shows a material adeasier case where certain contractors, because they were vance in prices within the past year, the average rate for

scriptions, the best rubber having been all the time a good importers at 90 to 95 cents a pound for choice Para. The advance in prices was primarily due to a speculative combination of Spanish houses in the trade, although it is also largely attributable to the greatly increased demand for rubber in Europe as well as here, and the difficulty in obtaining the requisite labor for getting it in and curing it at all the South American producing points. In the valley of the Amazon particularly, whence the choicest rubber comes, the trouble in obtaining efficient labor for any kind of work is the most serious bar to the progress of that fertile country, the climate being a very trying one, and the natives lazy and indolent.

The wonderful variety of useful articles into which rubber is worked up makes it one of the most important of our imports of crude material, and the large place it fills in the supply of such necessities as belting, hose, and packing, either in competition with or as superseding the use of leather, gives it an importance in our industries far beyond the money value that the figures showing the importations seem to represent.

A PATENT CASE OF GENERAL INTEREST.

All the shoe manufacturers in the country have been particularly anxious to know, for about a year past, how much longer they would have to pay the royalty, averaging 1½ to 2 cents a pair, on shoes bottomed by the McKay sole sewing machine. A case bearing upon this point came before Judge Blatchford, of the United States Circuit Court | gas. for the Southern District of New York, on the 25th ult., and his decision, though not conclusive as to the whole question at issue, has an important bearing thereon.

The patents owned by the McKay Sewing Machine Association have, from 1860 to the present time, been those under which probably nine-tenths of the machine-made shoes worn in the United States were bottomed. The association made the machines and leased them to manufacturers, under a license by which the latter were obliged to pay a royalty on each pair made, which was done by placing on the shoes stamps purchased from the McKay Association. Over one thousand boot and shoe manufacturers, embracing all the large establishments in the country, are in this way licensees of the McKay Association. This license is a very carefully drawn up document, and, besides everything else therein calculated to protect the interests of the association, it has a provision by which the licensee agrees not to contest the McKay patents during their existence. No real resistance has been made in many years to the validity of the patents, and, the business of the association having been from the first conducted with marvelous energy and ability, the patents have returned clear profits to their owners of several millions of dollars. In July and August of last year two of the most important of these patents, with the extensions which had been granted thereon, ran out, and, although the machines were covered by other and less important patents, the shoe manufacturers have, since that time, been debating the question of how long they must continue to pay these royalties. The obvious answer is that so long as they use a McKay machine, and are bound by their license, they must pay. In this connection it is important to note that the McKay Association have, during the past year, been taking back many of their old machines, where the manufacturers would allow them to do so, and furnishing in their stead new and improved machines, but the latter have patents in them bearing date of 1879, and, of course, cover their use for the full term of the last patent.

To meet this difficulty, and provide a way of using only the McKay patents that had expired, Andrew H. Jackman, of Nyack, N. Y., has lately obtained a patent on a machine direct the reader's special attention to the beautifully exeof his invention, which he has used since May last, sewing cuted engravings which embellish this number of the SCIEN 3,000 pairs of soles weekly thereon, and which he was about to offer to the trade. The McKay Association immediately commenced proceedings against Jackman, and moved for a preliminary injunction on the ground that two of their patents had been violated, one on the "process" and the other on the "product," as separate from the machine, and also favorably known in every part of the civilized world. because the defendant had violated his license. Considerable evidence was introduced, and able arguments were made, the validity of the patents, and decided to grant the injur tion on the license alone, holding that it was of the sub stance of a contract, and until it was broken, or the defend ant released from its provisions, the association had a good case against him. The license provides several ways whereby the association may terminate it, or where it would be broken and become inoperative, but it is not at all clear that there is any easy way for the manufacturer to get rid of its provisions without the consent of the association, who are likely to be as tenacious of their contract rights under its provisions as they have heretofore been determined in up | his shaving and hair cutting establishment into a stock comholding their patent claims.

An Opportunity for Inventors and Lock Makers.

The present kind of mail lock and key having been in new and different kinds of locks and keys for this purpose, and can only be made profitable by industry; therefore we'ly needed.

the earlier period being not quite 40 cents a pound, while He does not prescribe a model, and on that point says that, for the nine months ending April 1 last, it was over 55 cents as the public exposure and searching examination necessary a pound. This average includes the importations of all de- to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further deal higher than these figures, and now being quoted by the utility of all such locks and keys for the purposes of the mails, the Postmaster General prescribes no model or sample for bidders, but relies for a selection on the mechanical skill and ingenuity which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

BURNING OF OIL TANKS BY LIGHTNING.

The suggestions recently made by us in connection with the late disastrous fire at Titusville, Pa., caused by the firing of an oil tank by lightning, have called forth a variety of interesting communcations from different correspondents. Our suggestion was that the light vapors from the oil, rising high above the tanks, formed a conductor and led to the firing of the gas in the tank.

One of our correspondents, whose letter we publish in another column, suggests a different theory. He thinks that the electricity enters the tank by running along the oil supply pipe, and that sparks are discharged from the end of the pipe at its termination within the roof of the tank. He further thinks that the electrical charge may fall upon the pipe at some distance from the tank and yet the gas in the tank will be ignited. Our correspondent may be right. His theory is worthy of careful consideration. The smallest spark produced in this way will do the business. We all know how minute an electrical spark will fire an explosive mixture of gas. Even the rubbing of the feet on a carpet and a touch of the finger to an open gas pipe will light the

Although it might be expected that any electricity received by the underground tank nine would be wholly dissipated be fore reaching the tank, still if the original electrical charge were sufficient, and if the exterior of the pipe was more or less insulated, as it might be if it passed through dry earth, or if its surface were covered with oil, it would seem that there might be a leap of a spark from the extremity of the metallic pipe, within the roof of the tank, to the side or interior casing of the tank, and mischief would result.

When the tank is made wholly of iron, and the end of the supply pipe, where it enters the tank, is attached to and forms a good contact with the iron of the tank, then no spark could be expected. But if the roof of the tank is made of wood, and the sides of iron, as is frequently the case, no actual connection existing between the iron casing and the supply pipe, then some portion of a charge of electricity, running along the pipe, might enter the tank and leap from the pipe as we have mentioned. As a measure of prudence it would be advisable for tank owners to connect their ground pipes electrically with the iron casings of the tanks. This may be readily done by means of stout copper or iron wires outside the tanks, the ends of the wires being well soldered respectively to the pipes and to the iron casing, so that if any electricity comes along the pipes it will pass, without resistance or sparking, to the iron case and so to earth.

We are greatly obliged to those correspondents who have sent us their views on this matter, and we hope to hear from others. The subject is one of such importance that it ought to be discussed and studied until a sure protection is discovered and an end put to the long series of lightning disasters that for years past have regularly occurred in the oil regions.

The fire at Titusville on June 11 was followed June 30th by the burning of another iron oil tank, at Olean, N. Y., holding 25,000 barrels, which was also set on fire by lightning. This tank belonged to the Acme Refinery.

SERIES FORTY-NINE

Not with egotism, but with a commendable pride, do we TIFIC AMERICAN. The reader will also find profit and be interested in the somewhat lengthy description of the extensive industry carried on by the Kingsford Starch Works, whose product is not only laundry starch, as the title of the works might imply, but a dietetic commodity which is

The Kingsford Works, illustrated in this week's issue, comprises the forty-ninth of our industrial series already but Judge Blatchford finally put aside all question regarding | published; and we would here announce that we have in paration engravings of a number of other extensive lishments, illustrating the processes of manufacturing other to think it was due to the bursting of one of the boiler articles, not generally known, which we are confident will flues. be of equal interest to any of the industries which have been already illustrated and described in these columns.

London's Stock Companies-Limited.

The English people are famous for forming stock companies (limited) in conducting all sorts of enterprises. Some time ago Truefit, the celebrated London barber, converted pany, at which some of the newspapers made considerable fun, naming several lords and bankers as among the shareholders. But Truefit understands his business, and, it is said, has made a fortune out of it, and in all probability the use for a long time, it has been deemed expedient to make a stockholders in his company will receive larger dividends. a notice, which will be found in our advertising page, an their means in some other more pretentious companies. Mr.

see no reason for our London contemporaries casting slurs at any of the stock owners, if they be princes or lords.

But a new joint stock company (limited) has just been registered which is nothing more nor less than an old curiosity shop. From the prospectus we learn that the company seeks to raise £2,000, and proposes to buy, sell, and exchange works of art, books, and used foreign postage stamps. No doubt the venture is a bona fide one, and it is satisfactory to note that the promoter takes 1,000 of the 2,000 shares. But it is somewhat of a reductio ad absurdum, Capital and Labor thinks, to turn such a business into a joint stock company. Will there be any directors? the writer inquires; What will be their remuneration, and where will they meet? Perhaps, he adds, in the shop among the old foreign stamps, the works of art, and the books and mummies! The capital of the company is certainly not extravagant, but probably sufficient to conduct the canceled postage department, if it does not go far towards purchasing "old masters."

Basal Plane Quartz Crystals.

Until within a very few years crystals of quartz with the basal plane have been accounted excessively rare. So recently as the year 1877, Professor Egleston, of Columbia School of Mines, remarked, in a lecture before the Academy, on some rare quartz crystals, that five years before "only

three crystals of quartz with the basal plane were known to the scientific world: one owned by the British Museum; one by the Imperial Museum at Vienna; the other in St. Petersburg, and these came from Brazil. They were considered priceless treasures, and the very ultima Thule of rarity in the mineral kingdom."

In a communication dated Morgantown, N. C., May 20, Mr. W. E. Hidden, mineralogist, informs us that in a locality in the South Mountains of Burke county, North Carolina, quartz crystals with the basal plane are comparatively abundant. Mr. John T. Humphreys, who discovered the locality, has more than a dozen of them, and Mr. Hidden himself has seven. In these specimens the apex of the pyramid of the crystal is cut off at an exact right angle to the sides of the crystal, as shown in the annexed cut.

THE BOSS PUZZLE ABROAD.

The "fifteen puzzle" epidemic, which prevailed so alarmingly here last year, has extended to England and the Contident, and our foreign exchanges come to us laden with solutions of the problem. Scientists even have taken the subject up, and communicate to their favorite papers the formula which expresses the mathematical possibilities of it, and editors write columns on the subject for their respective papers. It was a good while reaching the other side of the ocean, but, like the phylloxera, is doing its devastating work.

The American Science Association.

The twenty-ninth meeting of the American Association for the Advancement of Science will begin August 25, in the Massachusetts Institute of Technology, Boston. An exceptionally large gathering of prominent scientific workers is anticipated. One of the morning sessions will be held at Cambridge, and the rest of the day will be devoted to an inspection of the various departments and museums of Harvard University and the Observatory.

DISASTROUS STEAMBOAT ACCIDENT.

On the afternoon of June 28 the fine passenger steamer Seawanhaka, carrying 350 or 400 passengers, while going at full speed up the narrow and dangerous pass known as Hell Gate, between New York and Brooklyn, was discovered to be on fire. The flames spread with amazing rapidity. Captain Smith with remarkable bravery kept his place at the wheel, was surrounded with fire and badly burned, but nevertheless directed and grounded the boat on a safe point ashore, free from rocks. But during the brief period that elapsed before the boat touched, many of the terrified passen gers were compelled by the flames to leap into the water About sixty lives were lost.

The cause of this accident is not yet known; but so far as we can gather from the newspaper reports we are inclined

It would seem from the reports that the boat was carrying about all the steam allowed by her certificate, that a slight explosion was heard, that steam first appeared in the upper cabin, then fire, and that flames blew out of the furnace door. These circumstances indicate a probability that by the bursting of a flue the gases of the furnace fire were driven out against the woodwork of the vessel and instantly set her in a blaze. The steamer carried two boilers, set in the hold. Whether our theory of the cause of the fire is correct cannot be determined till the boilers are raised

This dreadful disaster forms but another evidence of the inadequacy of the present means for safety on steamboats. We hope that our inventors will exercise their ingenuity in change. To this end the Postmaster-General has just issued and be more secure in their investments than if they placed discovering new appliances by which such accidents will be rendered impossible. A light fireproof material, to take the nouncing that proposals will be received for furnishing five Truefit's business is certainly legitimate, and a useful one, place of the dry woodwork now used for cabins, is especial-

AMERICAN INDUSTRIES .- No. 49.

THE STARCH MANUFACTURE

About forty years ago Mr. I nomas Kingsford, whose son from his success then and improvements subsequently intro- tion of the pure starch from all the other constituents of the place where the bar is to be broken, when another work-

duced have grown up an industry of great magnitude. In other countries starch had been manufactured from very early dates, but principally from potatoes, beans, the sago palin, Iceland moss, peas, and wheat, and the manufacture was carried on in a comparatively expensive way, giving a generally imperfect product. The principle involved in the manufacture is perhaps best explained by a simple illustration. If a little wheat flour be made into a paste in the hand, and then held under a small stream of running water, kneading continually, there will be left a tough substance of dirty white color, principally gluten, and the milky fluid which has passed off, when allowed to settle, deposits a white powder, which is principally starch, with more or less impurities. The perfect process of manufacturing corn starch is that which economically takes from the kernel all of the starch, and thoroughly frees it from the oil, gum, and glutinous products contained in the whole grain; this requires many washings, in some of which chemical solutions are employed, and most careful mechanical ma-

great deal of experience in the workmen. page, we represent some of the most important of the processes distributions of the contents of the vats, besides four miles

the Oswego Starch Factory, the largest establishment of its kind in the world. Here, on the Oswego River, near where it empties into Lake Ontario, in close proximity to the great corn producing area of the West, and with the lowest possible cost for carriage over the waters of the great lakes and their tributaries, Messrs. Thomas Kingsford & Son, in 1848, commenced the manufacture and erected a factory. The buildings at present cover five acres of ground, and give twelve acres of floor room, while the ground actually occupied for factory purposes amounts to seventeen acres. Here the corn comes direct from its place of first shipment to the immense storage bins of the establishment-"the deepest corn bins in the world "-extending to the full height of the five story buildings, and with a capacity to hold two hundred thousand bushels at a time. Of course these buildings are very strongly put up and heavily braced to

employed to discharge the grain from the vessels and after- ing and careful separation requiring a practiced eye and the rized corn starch, or prepared corn for culinary use, is packed. ward remove it as it is to be used in the works.

afterward injure the machinery. Thence it is passed to stituents more easily separated, that the starch may be ex- quantity desired for each package.

tracted. After a sufficient time here the grinding process follows; and for this purpose twentv-four pairs of burr stones and six pairs of heavy iron rollers are used; these mills work day and night, and, operating on wet grain, change it into pulp rather than into flour, the object being to crush and thoroughly disintegrate the particles. This pulp then passes through a great number of screensanddrum sieves, which do the first part of the work of separating the starch from the hull, the refuse being used as a

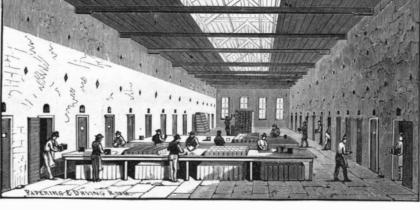
food for cattle.

The milky fluid which results from the washing is conducted into immense cisterns or vats, of which there are in all the factories 689, having an aggregate capacity of is at present the head of the firm of T. Kingsford & Son, of 3,150,000 gallons. The liquid, however, has to receive several tables, where the starch has been tipped out of the moulds, Oswego, N. Y., invented a process for the economical manu- washings, during which various solvents and filtered water and a workman may be seen standing over one of the bars facture of a superior article of starch from Indian corn, and are used for the removal of all impurities, and the separa-



nipulation, with the aid of elaborate machinery, besides a grain. For this purpose the establishment has forty-eight banking institution; on the right is seen a representation of pumps, capable of raising 850,000 gallons of water per hour, In our first page illustrations of to-day, and also on this and there are 61/4 miles of gutters in use for the various and details connected with the manufacture of pure and sil- of water pipes varying in size from 2 to 24 inches in diame-

ver gloss starch for the laundry, and prepared corn (or corn | ter. The purification of the starch, however, depends more starch) for culinary use, as carried on at Oswego, N. Y., by upon the practical experience of the workmen or manager this they run ten steam engines of 845 horse power, and



best of judgment. After this is done the starch water, as it remove chaff and dirt, or any substances which might it has entirely settled, the deposit will have made a long, box-like cake, which may be broken into the required enormous vats, where it is soaked, so as to render its con- | squares, each weighing about seven pounds after drying, the

The illustration at the top of the first page shows one of the immense rooms where the latter part of the work is being carried on. The middle of the room is filled with long of starch and marking it with a sight indentation at each

> man following places a knife under this point and deftly breaks the bar, the practice of the workman and the consistency of the starch being such that it is seldom there will be a variation of an ounce in the weight of the squares broken off. Others may also be seen passing these squares of starch to the side of the room, where they are placed on an endless belt to be taken up and placed in the ovens above. Here they are kept at a low heat until dried, when a thin yellow crust is found on the surface, representing what has been left of gum or husk after the previous purifications. This is scraped off by hand with large knives, when the cakes are wrapped in blue paper and again placed in ovens untildry crystallization takes place, so that, on opening the paper, the starch will split into columnar masses, in which form it is generally sold.

> The other illustrations on the first page require but little explanation further than that given by their titles. The office, as shown in the center, is a large, high room, beautifully fitted up, which would do credit to many a

one of the mills for grinding the corn, and on the left the furnace and boiler room. The establishment has the advantage of an excellent water power from the Oswego River, for utilizing which fourteen turbine wheels, of an aggregate of 1,200 horse power, are employed, but besides

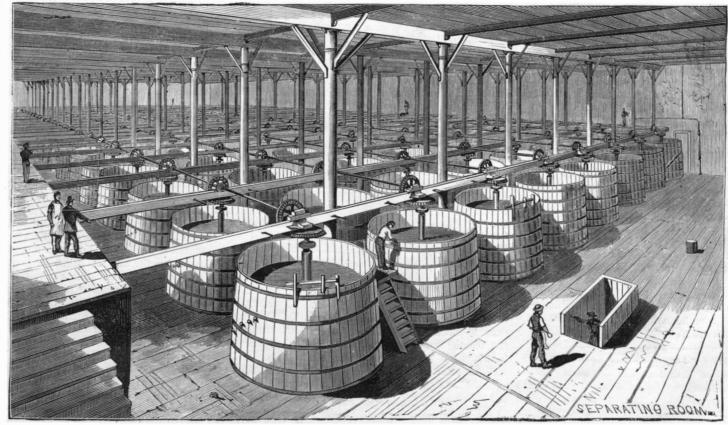
> have thirteen large steam boilers, 331/4 miles of steam pipes being in use for drving purposes and warming the works. The making of paper boxes and cases and the wood box making are the subject of separate sketches. In the latter department 5,000,000 feet of lumber are used yearly; two nailing machines are kept at work here, but, so minutely is every detail economized, the sides and ends are dovetailed, as making not only a better box, but contributing an important saving in the way of nails. In the making of paper boxes and cases 600,000 lb. of paper are required annually. This work is principally done by hand, but some machines crease the sheets where folds are to be made, and others cut the paper and press it into the required shape when the form of package calls for such work.

In the packing room may be seen a little machine, under which empty packages are

carry such an immense weight, capacious elevators being than upon any rules which can be given, the thorough wash- held to be filled from a spout. This is the way the pulve-The little machine is so arranged that it will let out just The grain first passes through immense fan mills, to may be called, is allowed to run into moulds, where, when enough for a package, and then the stream stops until the touching of a little spring shows that the operator has placed another empty package in place to be filled. The number of packages put up by a girl in one day will average from 1,400 to 1,500, and the whole operation is so conducted that

no dust escapes. This pulverized corn starch, as it is known here, is hardly known by that name in many foreign ports, to which it is shipped in large quantities, and where it is called only prepared corn. It is exported to every part of the world, and has obtained a high reputation for its dietetic excellences.

The large view on this page, entitled the "Separating room," shows a prominent department in this industry, and one in which the ingenuity of the Messrs. Kingsford has been attended with most important results. It represents the



THE SEPARATING ROOM.

ter of much experiment, to churn up and separate the different constituents of the grain, an operation which is now conducted far more expeditiously and efficiently than was the interior of a nicely furnished hall which the establishment furnishes for the use of its employes for holding meet- door. ings, etc., and which is christened "Firemen's Hall." as being the headquarters of a volunteer organization of that kind among the men employed. In the papering and drying room, also shown here, the work is all done by men, glass. We understand that there are now about one thoualthough a large force of women and girls find employment in the establishment; and it is perhaps as well to remark isfaction. here that the firm exercise the utmost care in the selection of their employes, not only as to their personal character, but insisting on the most thorough neatness and cleanliness in every department.

The main buildings of this immense establishment are all of stone, brick, and iron, some portions being seven stories high, making a total frontage of 800 feet by 200 feet deep. Besides these there are other large buildings, such as the box factory, storehouses, machine shops, etc. The works are now making at the rate of 21,500,000 lb. of starch and prepared corn annually, or about 35 tons per day, giving employment to upwards of 950 operatives. The Kingsfords have been continuously engaged in the manufacture of starch for about half a century. The Oswego Starch Factory was incorporated in 1848. Dr. S. Willard, of Auburn, N. Y., was elected President of the Company at its first organization, and has held that office continuously to the present time. A. G. Beardsley, Esq., of Auburn, N. Y., is the Secretary and Treasurer of the company. T. Kingsford & Son is the style under which the manufacturing business is carried on at Oswego, and E. C. Chapin, of 146 Duane street, New York, who is also one of the Board of Trustees, is the general agent.

IMPROVED STREET LAMP.

We give an engraving of an improved street lamp recently patented by Mr. John Stewart, of Chicago, Ill. The invention relates entirely to the frame of the lamp, which is made of cast, malieable, and sheet metal. In external appearance it is much like the ordinary lamp, but it is better calculated to resist the wind and other forces which frequently destroy the common lamp.

The socket fitting the lamppost and the base plate of the lamp frame are made in one casting, and the sides of the base plate are provided with flaring flanges having at Paradine, of Erie, Pa. It is capable of letting the water of the corners sockets for receiving the malleable iron corner pieces which are fastened by riveting, as shown in Fig. 2, which represents a portion of one of the corners in section.



STEWART'S STREET LAMP.

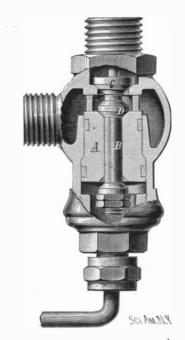
grinding and crushing by the rollers. In the immense cir- in Fig. 3. The upper ends of the corner pieces are soldered cular vats here shown a shaft revolves to which is attached to a sheet metal frame, which supports the upper glasses arms of particular shape and form, which has been a mat- and the chimney. The door frame, of tin, is hinged to the upper frame of the lamp so as to swing vertically, and is provided with a small bolt at the bottom, which is easy of access, and will hold the door locked by its own gravity. formerly the case. A smaller view on the same page shows | The hinges are made entirely of brass, and cannot therefore | of thirty days, to enable the search for whales to be prosecorrode, so as to interfere with the opening or closing of the

> The inventor says that the lamp sets perfectly solid on the post, and is entirely free from the warping and twisting so common to the ordinary lamp and so destructive to the sand of these lamps in use in Chicago giving excellent sat-

For further information address Mr. John Stewart, Department of Public Works, Chicago, Ill.

AUTOMATIC SAFETY CYLINDER COCK.

The improved safety valve and cylinder cock shown in the annexed engraving is the invention of Mr. Thomas J.



PARADINE'S CYLINDER COCK.

condensation out of a steam cylinder without waste of steam, and is a perfect safeguard against injury to the cylinder by an accumulation of water.

The safety valve and exit cock are arranged in a casing connected directly with the cylinder and communicating with the steam chest by a small pipe entering the lower end.

The safety valve, A, has two seats in the casing, one above, the other below the lateral discharge opening of the casing, and it is pressed upward by steam acting on its lower end, the difference in the area of the two ends being sufficient to secure this result. The valve, A, is bored longitudinally to receive a spindle, B, carrying at its upper end two valves, C D, which are seated in the valve, A, above and below a chamber in the upper end of the valve. The lower end of the spindle, B, is also provided with a valve which has its seat on the lower end of the valve, A. The upper valve, C, is somewhat larger in area than the other valves attached to the spindle, and controls the escape of water from the cylinder.

Under ordinary conditions the pressure of steam on the lower end of the valve, A, will hold it to its seat, but when an extraordinary pressure is brought to bear upon it, as, for instance, when there is more water in the cylinder than the clearance will contain and the piston is just completing its stroke, the valve will be forced from its seat, and the water will escape through the lateral opening in the casing. In working regularly, when the steam is acting on the piston, it also presses the valve, C, to its seat so that neither steam nor water can escape, but when the steam exhausts the pressure on the valve. C. is less than that on the lower end of the spindle, B, consequently the spindle is forced upward and the valve, C, is opened, allowing the water to escape. When steam is shut off from the engine, the valve, A, will drop of its own gravity and allow all of the water in the cylinder to drain out.

Two circumferential grooves formed in the valve, A, are filled with wicking or other packing to prevent grit from working into and around the valve.

The working of this valve is entirely automatic, and it is claimed by the inventor that it is less expensive and more durable than ordinary cylinder cocks. The inventor informs us that he has had this valve at work on a pair of large engines day and night for fifteen months without once failing or showing signs of wear.

Further information may be obtained by addressing the inventor as above.

Whaling on the Pacific Coast.

According to the present practice of whalers the blubber These corner pieces are angled to receive the glass, and are is chopped off at sea and the rest of the carcass is left tobeaded at the outside corner to give them strength and ri-sink or float as it may until it decays or is devoured by gidity. Small thin tongues project from the angle, and are sharks and birds. A less wasteful system has been adopted L. Kincannon, of Verona, Miss.

operation to which the pulp is subjected first after the bent over the edges of the glasses to retain them, as shown by a company at San Francisco, which has organized a whaling and fertilizer industry, to be carried on at that point and along the coast.

The first vessel for whale hunting has just been finished. It is a screw steamer, 65 feet long and 16 feet wide, completely decked over, and very strongly built. It is fitted with two compound engines, and will carry coal for a run cuted along the Alaska shore if necessary. The whales are to be killed by the whaling rocket or bomb lance. They are then to be towed to the reduction works on shore, where the carcass will be treated by an improved process, which utilizes every part. In this process the whale is cut up, without separating blubber or flesh, and digested by steam at high pressure in large iron tanks. The process requires about eight hours, when the oil is drawn off and the residue of flesh and bones is taken out, dried, and ground together to produce a fertilizer. Three digesters have been set up, each large enough to hold a ten foot section of a whale, and three "tries" can be made in a day.

ENGINEERING INVENTIONS.

Mr. Robert E. Greenwell, of Osage Mission, Kan., has patented improvements in railway joints of that form in which a set of bolts project through the fish plates and have ends slotted lengthwise to receive a key which is driven in in a plane parallel with the bolt.

A machine for deepening river channels has recently been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. This machine is so constructed as to deflect the current of a river downward, and thus cause the current to deepen the channel of the river.

A device for insuring a more perfect combustion than is usual in the fire boxes of steam boilers, evaporators, etc., has been patented by Mr. John Mailer, of San Francisco, Cal. The invention is an improvement upon the device for which Letters Patent No. 219,283 were granted to the same inventor, September 2, 1879.

Mr. Frank Laufkotter, of Collinsville, Ill., has patented an improved safety stop for elevators, buildings, mine shafts, and other purposes, so constructed as to stop the elevator cage and hold it securely should the hoisting rope break.

Ice without Freezing.

A new skating surface, called "crystal ice," has been invented by Dr. Calantarients, of Scarborough, England. Considering that after all ice is merely a crystalline substance, and that there is no lack of substances that are crystalline at ordinary temperatures, Dr. Calantarients experimented with a variety of salts, and after a time succeeded in making a mixture consisting mainly of carbonate and sulphate of soda, which, when laid as a floor by his plan, can be skated on with ordinary ice skates; the resistance of the surface is just equal to that of ice, it looks like ice, and indeed when it has been skated on, and got "cut up" a little, the deception is quite astonishing; a small experimental floor has been laid in the skating rink at Prince's, and has proved so successful that no doubt a large floor will be laid there or at some other convenient place in the autumn. This floor will obviously have great advantages, both over artificial ice floors, which are very expensive indeed, and over floors for roller skating. The surface can at any time be made smooth again by steaming with an apparatus for the purpose, and the floor itself, when once laid, will last for many years. The mixture of salts used contains about 60 per cent of water of crystallization, so that after all the floor consists chiefly of solidified

A NOVEL WHEELBARROW.

The engraving represents an improvement in the class of wheelbarrows whose body is pivoted to adapt it to dump its contents by tilting or turning on its pivots. The improve-



KINCANNON'S IMPROVED WHEELBARROW.

ment consists in the extension of the front end of the frame beyond the wheel and body of the wheelbarrow, so that when the frame is suitably inclined its front end will rest on the ground, and together with the wheel, constitute a firm support for the pivoted body while being tilted.

This invention was recently patented by Messrs. J. and F.

REPAIRING SPIRAL SPRINGS.

BY E. N. MAXWELL

I find the impression is common among mechanics that it is not possible to mend a broken spiral spring. It might be well, therefore, to place the readers of the Scientific AMERICAN in possession of my method, which is inexpensive, very simple, and thorough.

Take a piece of flat metal, of, say about one sixteenth inch in thickness, and cut it in the shape of a parallelogram, the length being one eighth inch greater than the diameter of the broken spring, the width equal to four of its coils; bore two holes on each side exactly the diameter of the spring apart, | Surrounding it, also, in this stage, was a dense vapor of | been demonstrated at Montreal. On June 30 the steamer

and sufficiently large to admit the spring wire; make, with a round file, a slight groove just opposite each hole, as shown in the smaller view in the engraving. Screw the broken ends of the spring into these holes from opposite sides, and the job will be complete, and at a trifling cost of material, time, and labor.

It will be seen at a glance that two springs of different diameters can be coupled together by the same process. Also, that a piece of similar metal with two holes upon

rior end piece for securing spiral springs. The angles of the piece of metal used for mending, should equal those formed by the coils and side of the

Copper-plating on Zinc.

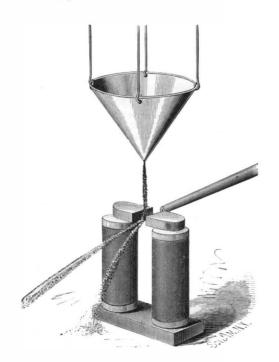
The use of cyanide baths for plating on zinc has the double disadvantage of being poisonous and expensive. Hess has overcome the objections by rendering the cyanide bath unnecessary. This he accomplishes by the use of an organic salt of copper, for instance a tartrate. Dissolve 126 grammes sulphate of copper (blue vitriol) in 2 liters water; also 227 grammes tartrate of potash and 286 grammes crystallized carbonate of soda in 2 liters of water. On mixing the two solutions a light bluish-green precipitate of tartrate of copper is formed. It is thrown on a linen filter, and afterwards dissolved in half a liter of caustic soda solution of 16° B., when it is ready for use.

The coating obtained from this solution is very pliable, smooth, and coherent, with a fine surface, and acquires any desired thickness if left long enough in the bath.

Other metals can also be employed for plating in the form of tartrates. Instead of tartrates, phosphates, oxalates, citrates, acetates, and borates of metals can be used, so that it seems possible to entirely dispense with the use of cyanide baths.

NEW ORE SEPARATOR.

In one of our recent issues we described a device invented by Mr. Edison for separating magnetic sands from the nonmagnetic particles of ore by altering the trajectory of the



EDISON'S ORE SEPARATOR.

falling magnetic substance by means of an electro-magnet We now give an engraving of another magnetic ore separator recently invented by Mr. Edison, which operates on an entirely different principle, and effects a still further concentration of the ore by the separation of the metallic from the non metallic part by diamagnetism.

The auriferous sands are placed in the hopper and allowed to fall between the poles of a powerful electro-magnet, and a blast of air is directed at right angles against the falling stream of sand just as the latter passes between the poles of the magnet. The non metallic substances are readily blown away, while the metallic portions are retarded by diamagnetism, so that the blast of air has less effect on them than it has on the non-metallic substances. The consequence of this operation is that the sands are divided into two heaps, one containing a large percentage of metal, the decreased both by evaporation and the formation of acid. other containing a very small percentage, or none at all.

A Georgia Meteor.

About midnight, June 30, an exceptionally brilliant meteor was seen from Macon, Ga. The light is described as like an electric light, but whiter and vastly more powerful. The course of the meteor was from the zenith straight toward the horizon, which it would have reached at a point between north and northeast. At the zenith it appeared as large as a barrel and intensely white At 45° elevation the light changed to a brilliant red, paled into saffron, and then into all shades of green. As it began to change its hue it emitted particles or balls of fire that followed or lingered in its wake.



MENDING BROKEN SPIRAL SPRINGS

one side and one hole on the other side will make a supe | smoke that reflected all the colors through which the ball | furiously on, submerging wharfs, sinking many small veshad gone. At 30° elevation the light went out. Three minutes after a heavy report was heard, mixed with a metallic ruin in every direction. It is said that the deluge of water ring not heard in thunder or in ordinary explosions. The set the huge ocean steamships in the harbor of Montreal meteor was visible about five seconds. It is to be hoped that specimens of this body may yet be found.

The Largest Sheets of Plate Glass in the World.

The "Société Anonyme des Manufactures de Glaces et Produits Chimiques de St. Gobain, Chauny, et Cirey," owns the works of St. Gobain, Chauny, Cirey, and Montlucon, in France, and Mannheim and Stolberg, in Germany. There are two other factories besides at Jeumont and Aniche.

The following plain white and silvered plates were exhibited by these firms, says Mr. C. Colné, in his report on glass, at the Paris Exhibition:

 St. Gobain; 1 plate 21:15 feet x 13:48 = 285:10 feet, white, 7-16 in.
 1,573

 St. Gobain; 1 plate 17:90 feet x 9:94 = 117:92 feet, silvered.
 770

 Jeumont; 1 plate 17:81 feet x 11:51 = 205 feet, white.
 1,100

 Jeumont; 1 plate 17:21 feet x 10:82 = 182:12 feet, silvered.
 770

 Aniche; 1 plate 15:76 feet x 10:48 = 164:38 feet, white.
 660

 Aniche; 1 plate 14:76 feet x 9:05 = 182:58 feet, silvered.
 550

The St. Gobain Works furnished a number of mirrors to the new Grand Opera of Paris; among others one 21:29 x 9.67 feet; others from 45 12 to 52.48 feet long.

St. Gobain also exhibited 3-16 inch thick plate glass for windows, weighing only 22 to 26 pounds per square meter; thick polished slabs, such as were used in the aquarium, 7.56 feet long by 2.60 feet wide, 9-16, 11-16, 14-16 inch thick; a series of silvered reflectors, deck lights, bull's eyes, plates of a rough cast glass, smooth on one side and corrugated on the other, used for roof covering, weighing about 27 pounds per square meter, from 1 to 2-8 inch thick. The designs on the surface consist of fine parallel corrugations or small and large corrugated and plain lozenges. The large lozenges are used as a substitute for painted or stained glass in churches for economical reasons. The small lozenges are used for partitions, doors, panels, windows, covered yards, hothouses, roofs, etc.

They also make glass tiles, pressed in imitation of the clay article. These tiles are used for roofing, and are moulded in such a shape that they can be laid alongside of one another, making tight-fitting joints without any cement or mortar; it takes 13 tiles to cover a square meter; each tile weighs about 5½ pounds.

Glass flooring made of flags or slabs of rough cast glass are also manufactured in large quantity by these works; they consist of pieces 6 x 1% inches thick, 11 inches long, and weigh 165 pounds per square meter; the upper surface is generally moulded in diamonds. Pavements of glass are also exhibited; these are mude in the same style as the slabs, with the upper surface moulded in diamonds, but are much thicker, and are intended for pavements for carriage ways. They are made of cubes of about 6 x 61/2 inches, and weigh each 19:80 pounds; they are sold by weight. Rough slabs are also made of 6.56 x 2.65 feet, varying in thickness from 9-16 inch to $1\frac{1}{2}$ inches; weight from 213 to 492 pounds.

This company also exhibits all the different rough cast glasses used in the manufacture of lighthouse apparatus, such as rings, parts of rings, and rough lenses. As a speci men of the thickness that can be given to cast glass, there was shown a disk 4.03 feet in diameter by 81/2 inches thick, weighing more than 1,320 pounds. This disk is an exact duplicate of the one offered to the French Observatory to make a mirror for their large telescope.

Testing Alcoholic Liquors.

The following hints in regard to alcoholic liquors are given by Dubrunfaut in a French journal: Commercial alcohol and alcoholic drinks differ from each other partially by a characteristic flavor, partially by different chemical properties. A characteristic distinction is the amount of acid in the different liquors. All pure alcohols contain only 1 per cent of acid, while freshly distilled cognac shows 3 per cent, and this increases considerably when kept long in barrels. In ten or twelve years the same cognac will have 8 or 9 per cent of acid, while the original percentage of alcohol is reduced from 641/2 to 50 per cent. The quantity of alcohol is All other alcoholic liquors show the same changes, and in

addition also contain copper. The presence of this metal is easily proved by ferrocyanide of potassium or sulphydric acid. If there is only a trace of copper the dry residue is burned and the ash tested. As a rule, industrial alcohol also contains copper. The percentage of acid varies enough to furnish a test for the addition of commercial alcohol to rum, brandy, etc., as an adulteration, or to strengthen it. The copper, however, furnishes no reliable clew.

A Steamer Runs Down a Lock Gate.

An unexpected source of danger in canal navigation has

Bohemian, carrying fifty passengers and an assorted cargo, entered canal lock No. 2 from the Lachine Canal Basin at half speed. For some cause, as yetunexplained, a full head of steam was put on and the steamer was hurled against the gate which separated the lock from a mass of water thirteen feet higher, a mile in length, and several hundred feet in width. The gates were smashed, and the flood which poured out carried everything before it. The Bohemian was driven back and sank almost instantly. The water drove

sels, ingulfing numbers of laborers, and carrying terror and dancing like so many cockle shells.

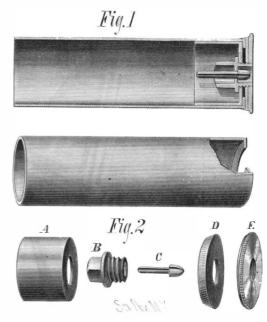
The outrush of water from basin No. 2 left the vessels in it on the bottom, many of them with broken backs. Others were severely strained and their cargoes much damaged. Several weeks will be required to repair the mischief; meantime navigation will be impeded and several important mills stopped.

Progress in Rifle Shooting.

The victory of the American rifle team at Dollymount, June 27, with a score of 1,292 against 1,280 for their Irish competitors, six shooting on each side, shows that the limit of progress in rifle making and in rifle shooting has not yet been reached. This may be safely inferred from the fact that the best previous shooting in any match has been exceeded in this, and yet there is a considerable margin between its record and absolute perfection. The precision already arrived at, however, is such that but one of the 540 shots fired at Dollymount would have missed a man, the ranges being 800, 900, and 1,000 yards.

IMPROVED CARTRIDGE,

Cartridges as commonly made consist of four pieces—the ube, the head rimmed disk, an inner disk fitting in the tube, and a screw connecting the disks together and clamping the tube. This construction necessitates the use of a re-enforcing strip at the base of the shell, and the head disks lack strength. Our engraving represents a new method of constructing cartridge shells or cases, recently patented by Mr. Julien Saget, of New Orleans, La.



The tube, which is of paper, has one end flanged internally to receive the thimble or cup, A, which is threaded to receive the hollow screw or anvil holder, B. A flanged plate, D, is fitted over the end of the cartridge, and the plate, D, and thimble, A, are drawn tightly together by the anvil holder, B. The shank of the anvil, C, is now inserted in the holder, B, and a circular steel plate, E, is screwed on the anvil holder, completing the cartridge shell, as shown in Fig. 1. The shell is charged in the usual way, and a cap is placed on the anvil, C, and pressed home.

Should the paper tubes be injured by the explosion or otherwise, it is readily replaced by a new one, thus saving the more expensive parts of the cartridge.

The steel plate added to the portion of the cartridge which receives the blow of the hammer, renders the cartridge more durable than those of ordinary construction.

Further particulars may be obtained by addressing the inventor as above.

ELECTRO-THERMIC TELEPHONE.

To the Editor of the Scientific American:

Some of the recent European scientific papers contain an abstract of a paper read by Mr. W. H. Preece before the Royal Society, in which he describes a telephone receiver, whose action is due to the linear expansion of a thin wire under tension when placed in a microphonic circuit. According to his own statement the instrument is inefficient, as it fails to articulate distinctly, and requires a very strong current, which would soon destroy any microphone or telephone transmitter.

This experiment is exceedingly interesting and is undoubtedly new to Mr. Preece, but, as many of my friends can testify, I tried the same experiment long since, and as it seemed to give promise of being a good telephone receiver, I followed the idea with great avidity, until I found, after a great deal of experiment with wires of different metals and of different lengths and thicknesses, that only tones ples will make five or six pounds. Not over twenty or: 3. Experiments were then tried with wires six inches in with their modulations could be produced;

articulation being almost entirely wanting. Among the metals tried were iron, steel, copper, aluminum, magnesium, and platinum. The only alloys tried were brass and German silver. I also tried very thin pencils of carbon.

The apparatus by means of which these experiments were carried on was so similar to that of Mr. Preece that I send a sketch of it herewith. The head of an ordinary telephone case containing a thin iron diaphragm. 21/4 inches in diameter, was secured to one end of a board about three feet in length. Near the opposite end was placed a post sup-

porting a hook, to which was attached one end of the wire twenty-five bushels of apples are ground or worked at a to be subjected to electro-thermic influence, the other end of the wire being attached to the center of the diaphragm.

circuit, and a long copper wire attached to the base of the post was wound several times around the expansion wire, so that it could be moved along to expose more or less of The wholesale price of the jelly is eight cents per pound, the expansion wire to the action of the current, thus virtually altering the length of the wire.

Currents of various strengths were employed during the course of the experiments; but with all the modifications of the apparatus, or of the current applied to it, I was utterly unable to get anything like the distinct and perfect articulation secured by either the Bell or Edison receiver when used in connection with a good transmitter. However, I soon found a practical application of the electro-thermic principle, in a telegraphic relay, and adapted mechanism to the expansion wire which would faithfully render the impulses of a line in a local circuit, not withstanding the variable expansion of the wire under different strengths of cur-

Although the electro-thermic telephone receiver was practically a failure, I do not regret the course of experiment, as it has resulted in the development of an invention of practical utility, but widely different from that which was originally sought for.

GEORGE M. HOPKINS.

New York, June 28, 1880.

American Wood Engraving.

In a review of the volume of proof impressions of wood cuts from Scribner's Monthly and St. Nicholas, Mr. Philip Gilbert Hamerton, the distinguished English art critic, says that "modern wood engraving, imitating the qualities of many different kinds of art, has never been carried so far in Europe as it is now in America. A more versatile process it would be impossible to imagine. The only objection that strikes us is the painful sense of the toil involved when we know how the work is done; but this toil may be pleasurable to the engravers themselves when they have reached such a high degree of skill."

Apple Jelly.

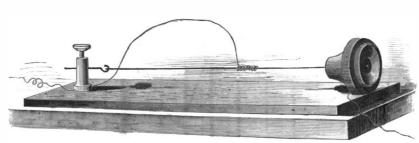
Much inquiry has been made of late years for the best way to utilize the surplus crops of apples in abundant years. As the promise is strong for a heavy crop in 1880, it will be well for owners to prepare for the best modes of marketing. In addition to selecting and shipping fine specimens, drying, and converting into vinegar will be largely employed. Another mode, less known, and less extenadopted, is manufacturing the fresh juice into jelly

One of the most successful manufacturers of apple jelly, and who succeeds in making uniformly an excellent product, is Isaac Mekeel, of Poplar Ridge, Cayuga county, N. Y. By several years' experience he has brought the process to great perfection. The first, and a most essential requisite, is to use good apples-such as would be regarded as excellent table sorts. They must be fully ripe. If not quite ripe, they must be allowed to remain in heaps after gathering. Autumn table sorts are first employed, and as the manufac ture continues, winter varieties ripened in a warm place come into use.

The next essential requisite is a cool temperature. The juice being separated with a grater cider mill, will ferment never range higher than 60° in the middle of the day; 40° or thereabouts is preferred. The work is commonly com menced about the middle of October, and is continued till; the first of December. If a warm day occurs, the manufacture is omitted till the weather is cooler. The slightest be inserted in the circuit containing a microphone trans-

fermentation of the juice spoils the character of the jelly. In cold weather the whole process may extend through three or four hours, from the grinding of the apples to the com pletion of the jelly; but if the temperature is as high as 60°, the time must be less than an hour.

Cook's copper evaporator is used for boiling down the juice. Iron will not answer. The evaporator is thoroughly washed daily. The juice is reduced to about 30° or 32° of the saccharometer, and three quarters of an hour to one pounds—or nearly five gallons are made from a barrel of juice. The evaporator is twelve feet long, the process is continuous, and one barrel or more is reduced per hour. of the wire that gave the best effect, and after repeated The jelly is poured into the moulds while hot and liquid.



ELECTRO-THERMIC TELEPHONE.

time, as it is all-essential to evaporate before there is any fermentation. The fruit should be well assorted, so as to The diaphragm and the post were placed in a microphonic have all of equal ripeness. The cost of manufacturing is about a cent and a half per pound, including fuel. The price of the best apples is of course greater than the labor. and large quantities are shipped to purchasers. The jelly will keep any length of time; it has been found good and fresh after the lapse of four years.

It is probable that the process of manufacture might be continued into winter, in a large basement, any desired degree of coolness being secured by ventilation. - Country Gentleman,

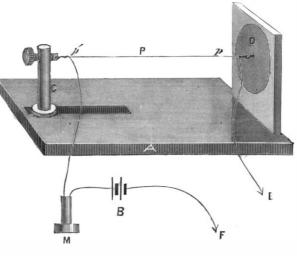
NEW TELEPHONE EXPERIMENTS.

At a recent meeting of the Royal Society a paper was read "On some Thermal Effects of Electric currents," by William Henry Preece, General Post Office:

I have been engaged for some time past in experimenting on the thermal effects of electric currents, but the final results of those experiments are not sufficiently ripe at present to justify my bringing them before the Royal Society. I have, however, obtained one result which I believe to be sufficiently novel to justify a short preliminary note.

The most striking facts elicited by these experiments are: 1. The extreme rapidity with which thin wires acquire and lose their increased temperature.

2. The excessive sensibility to linear expansion which fine wires of high resistance evince.



Now as the rate of heating, and therefore of expansion and contraction, varies very nearly directly as the increment or decrement of the currents when these variations are very small, it occurred to me that if a long wire of small diameter and high resistance were attached to a sounding board or to the center of a disk (such as one of those used for telephones and phonographs) and it formed part of a circuit conveying telephonic currents, sonorous vibrations ought to be repro

The sketch shows the arrangement of the apparatus used for the experiment.

- A was a stout base of mahogany, on which a brass suptoo soon if the weather is warm. The thermometer should port, C, was attached so that it could slide and be fixed at any distance from D
 - D was at first a disk of thin paper, and then of thin iron. P was the wire experimented upon whose loose ends we're connected to terminals on the wooden base, so as to

mitter, M, and a battery, B, of six bichromate of potash cells in another room out of hearing.

A platinum wire of 0.003 inch diameter and six inches long from p to p was first used, and the sonorous effects were most marked and encouraging when the microphone transmitter, M, was spoken into. The articulation, though muffled, was clear, and words could easily be heard.

- 1. Experiments were first made to determine the length which gave the loudest sound and the clearest articulation, hour is required for the process. A barrel of juice will and, after repeated trials with every variation of length from make fifty pounds of jelly. A gallon will weigh about eleven one inch to six feet, it was found that a wire six inches long gave the maximum effect.
- 2. Experiments were then made to determine the diameter trials with every gauge drawn from 0 0005 inch to 0 005 Mr. Mekeel manufactures more largely in abundant years. inch, it was found that wire of the diameter 0 001 inch gave

length and 0.001 inch diameter of different materials, namely, gold, iron, aluminum, silver, copper, palladium, and platinum, and they came out in the following order of merit:

Platinum, very clear; aluminum, very variable; palladium, clear; iron, clear; copper, faint; silver, faint; gold, very poor.

4. The effect of mechanical strain was tried. It was found not to vary the effect. When once the requisite tension, which varied with each metal, was obtained, further tightening up did not vary the clearness or loudness of articulation. Gold would scarcely bear the tension required to reproduce sonorous vibrations, hence its low position.

5. Very thin carbon pencil, 0.0625 inch diameter, was tried under compression and under tension, but no effect whatever was experienced unless a bad joint was made, when at once a faint microphonic effect was apparent.

6. No sibilant sounds whatever could be reproduced.

7. That the effect was due to heating and cooling was shown by the fact that it was possible to increase the current to such a strength as to render the temperature of the wire sensible to the touch, and then to make its elongation and contraction by low sounds evident to the eye

It therefore appears from these experiments that wires conveying those currents of electricity which are required for telephonic purposes expand and contract as they are heated and cooled, and as the variations in the strength of the current are small compared with the strength of the current itself, the expansion and contraction vary in the same ratio as the condensation and rarefaction of the air particles conveying the sonorous vibrations which produced these vibrations.

The mechanical changes, or molecular vibrations in the wire, due directly or indirectly to telephonic currents, which result in the reproduction of sound, bear a close analogy to the mechanical changes due to the direct transmission of sound, but with this important difference, that while the vibrations due to sound are progressive along the wire, and their velocity is low and easily measured, those due to thermal effects are practically instantaneous, and therefore affect simultaneously the whole length of the wire.

Note.—De la Rive, in 1843 (vide "Electricity," vol. i, p. 304), observed that an iron wire emitted sounds when rapid discontinuous currents were passed through it; but he attributed the effect to magnetism, for he failed to obtain the same effect in non-magnetic wires like platinum or silver.

Graham Bell found, in 1874, that a simple helix without an iron core emitted sounds, and (in 1876) that very distinct sounds proceed from straight pieces of iron, steel, retort carbon, and plumbago, when conveying currents.

· Professor Hughes showed that his microphone was reversible, that is, that it could receive as well as transmit sonorous vibrations.

Mr. Weisendanger (Telegraphic Journal, October 1, 1878) reproduced sounds on a microphonic receiver which he called a thermophone, and attributed the effect to its true cause, namely, the expansion of bodies under the influence of heat, which, in fact, is the explanation of all microphone receivers.

Ader reproduced speech by the vibrations of a wire conveying currents of electricity, but he found that only magnetic metals were effective, and therefore, like De la Rive, he attributed the result to magnetic agencies (vide Count du Moncel. Telegraphic Journal. March 1, 1879).

These and many other sonorous effects of currents on wires may be really due to such heat effects as I have described.

The Hudson River Tunnel.

The bill "to provide for excavating and tunneling and bridging for transportation purposes within the villages and cities of this State," passed by the New York Legislature, has been signed by Governor Cornell. The completion of the Hudson River Tunnel is now authorized, and becomes purely a question of scientific and financial engineering.

Honors to Electricians.

A committee appointed in 1876 and presided over by M. Dumas, have reported to the French Chamber of Deputies in favor of granting the first Volta prize of 50,000 francs to Prof. Graham Bell, of telephone fame, and the second prize of 20,000 francs to M. Gramme, the well known inventor of the dynamo-electric machine bearing his name. The first one to receive this distinction was Ruhmkorff.

NOVEL GATE CLOSER.

The engraving shows a simple and effective device for closing gates automatically without the application of springs or weights. The gate rises bodily as it opens, and is closed by its own gravity. It is hung upon hinges and the whole apparatus constitutes a balanced force pump for adjusting the blade to suit the different kinds of work. having long pintles, and is supported by an inclined rod, | that may be fitted in open or bored wells and driven by having a bearing at its upper end in a socket attached to horse, wind, or steam power.

eccentrically to the pintles of the hinges. Opening the gate causes it to rise bodily by throwing the inclined rod into a more nearly vertical position, when the gate is released its own weight closes it.

The socket which receives the upper end of the inclined rod is rigidly attached to the hinge strap, making a strong and durable bearing.

A patent for this device was recently issued to Messrs. John Köhnmann and Samuel R. Latta, of Dyersburg, Tenn., who may be addressed for further information.

Philadelphia's Textile Industries.

Mr. Lorin Blodgett, who has in charge the census of the textile industries of Philadelphia, finds 460 power mills or groups of mills in the city, and about 200 hosiery and carpet manufactures, not using steam power. In a recent statement concerning this branch of industry Mr. Blodgett said:

"It is well known that Philadelphia is the greatest manufacturing center of the world, but it is not so generally known that the textile manufacturers contribute more than any other class to this marked distinction of our city. The census now being taken will show that the value of the products for the present year of the various manufactories of our city will reach the grand total of \$600,000,000. To this the textile manufacturers will contribute: In woolens and cottons of the general

table, \$48,500,000; in carpets, \$23,000,000; in hosiery and improvement in paper-cutting machines. The invention reknit goods, \$23,000,000; in worsted yarns, \$12,500,000; in silks and mixed goods, \$7,000,000—an aggregate of \$115,-000,000—over one sixth of the whole, an amount of which they may justly feel proud, not only on account of the position which it aids in giving to our city, but also because of the means of subsistence which it affords to so many of its people. The outlying districts, of which Philadelphia is book or paper, and a knife used for the trimming or cutting the business center, will add \$38,000,000 to this, making for process. Philadelphia and vicinity \$153,000,000."

NEW CAR MOVER.

a short-distance. It consists of a wooden lever having on one side two triangular steel bars whose edges are capable of biting into the side of the car wheel. A stout bolt bent at a right angle projects from the side of the lever near the triangular steel bars, and is threaded so that it may be adjusted to wheels of different thicknesses.

When in use one end of the lever is placed against the car axle as a fulcrum, and the edge of the wheel is clamped between the triangular steel bars and the hooked end of

By pulling or pushing on the long arm of the lever the car wheel is turned and the car moved. When pushing, the lever is placed over the axle; when pulling, it is placed under the axle.

This device was recently patented by Mr. O. B. Blakeslee, of Rankin, Ill., and is manufactured by J. T. Mug & Co., Lafayette, Ind., who may be addressed for further information.

Lake Ontario Shad.

The attempt to stock Lake Ontario with land-locked shad turns out less favorably than seemed probable a short time ago. The Times, of Watertown, N. Y., says that on the 19th of June the Edith Sewal, on her trip to South Bay, passed through compact masses of dead or dying fish, extending in windrows ten feet wide and miles in length, while scattered fish in countless numbers covered the waters between the rows.

The fishermen, who say that each fish has a mossy spot upon it, of a yellow cast, with a red look about the edges, have had hard work to get rid of the multitudes of dead fish, whose stench polluted the air.

MISCELLANEOUS INVENTIONS.

Mr. William V. Henry, of Sacramento, Cal., has patented an improved pumping apparatus. The object of this in an improved tug attachment which is designed to render the vention is to furnish simple and durable apparatus, especi- tug elastic to a certain extent, and thus relieve the horses from the stable in a moment and without entering the ally adapted for raising large quantities of water for ir-I from undue strain.

rigating purposes and for draining mines. The invention consists in pump barrels suspended from a walking beam and reciprocating upon a valved piston head that is held upon a fixed rod. The barrels are fitted with check valves,

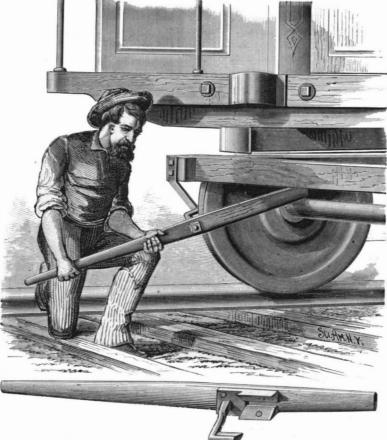
the gate, and at the lower end in a socket attached to the post Mr. Granger W. Smith, of Chili, N. Y., has invented an win, of South Manchester, Conn. The invention consists



KOHNMANN'S GATE CLOSER.

lates to a machine for trimming the edges of magazines. pamphlets, or books, and for cutting paper into sheets of different sizes, and for other similar purposes; and it consists in a novel arrangement of an adjustable table for holding the book or paper to be trimmed or cut, a frame for supporting said table, and an adjustable bar for clamping the

An improved starch press has been patented by Mr. Richard Johnson, of Madison, Ind. This invention relates to means for extracting water from starch, which has hereto-The device shown in the annexed engraving is applied to fore been accomplished by means of ovens and other devices one of the wheels of a car when it is desired to move it for involving the necessity for the employment of heat.



BLAKESLEE'S CAR MOVER.

William L Waddy, of Peytona, Ky. The object of this the complete operation without extra machines. invention is to enable a harrow to be reversed and slid on runners.

Mr. Silas Courtright, of Hooker's Station, O., has patented

Mr. John Tuggle, of New Middleton, Tenn., has invented an improved currying knife. The improvement consists in a novel construction and mode of attachment of the blade and stock of a currying knife, whereby provision is made

A novel and convenient device for supporting window shades and curtains has been patented by Mr. George Bald-

> in a combination of brackets, shade rollers, curtain cornice, and curtain rod.

> A button so made that the face and shank can be readily separated and again united, has been patented by Mr. Henry H. Schmitt, of South Brooklyn, N. Y. The invention, although simple, cannot be described without engravings.

> Mr. William P. Owen, of Mount Pleasant, Tenn., has patented an improved folding extensible fire screen, which is composed of hinged or both hinged and sliding sections.

> Mr. John L. Paxson, of New Hope, Pa., has patented an improved register adapted especially to the tallying of lumber, but applicable also to indicating the speed of machinery, or for adding a column of figures, or for measuring distances, etc.

> Mr. Joseph B. Eaton, of Shamokin, Pa., has patented an improved machine for making lozenges which is simple, convenient, and effective in operation. It consists in arranging narrow belts between the cutters so as to allow the lozenges to pass through, while they hold the scrap down and feed it forward.

> Mr. August Hoen, of Baltimore, Md., has patented an improved process of lithocaustic engraving, consisting in drawing parallel crossed lines on the etching ground covering the lithographic stone, for the purpose of giving a roughened surface of even texture to the stone, then applying an acid for the purpose of deepening and broadening the lines and producing pyramidal points, then

covering the lines with a solution of gum arabic in water, then rubbing down or otherwise reducing the points to produce the uneven surface required for the lights and shades of the engraving.

An improvement in dividers for striking circles with chalk or pencil points has been patented by Mr. Charles F. A. Reimann, of Pine Bluff, Ark. The object of the invention is to strike two or more concentric circles at one sweep of the instrument. It consists of dividers with the pencil foot adapted to receive two points, and in providing the dividers with an adjustable arm adapted to receive several points and hold them on a level with the feet of the di-

An adjustable smoke stack especially designed for steam

fire engines, whereby the draught from the boiler can be increased or diminished at will. has been patented by Mr. Asa W La France, of Elmira, N. Y. It consists of a section of a flanged and longitudinally-ribbed pipe, smaller than the outer section of the smoke stack set within said stack and vertically adjustable therein, whereby the exit of the smoke stack may be diminished or increased at pleasure.

Mr. William Klemm, of Pittsburg, Pa., has patented an improved curtain cord tightener, consisting of a cam pivoted in a clamp that slides on the vertically-placed rack, so that the tension of the cord that is passed around the outer end of the cam forces the inner end of the cam against the face of the rack and holds the cam and clamp immovable

Mr. William Keane, of Stratford, Ontario, Canada, has patented an improved tow-cleaning machine. Heretofore the tow has been cleaned by hand by tow pickers and beaters, operations involving considerable expense and waste of tow, besides not being effective. For a proper understanding of the nature and objects of this invention, it should be understood that the tow is the refuse from flax scutching machines, which are made in various forms, but generally using revolving cutters, which remove the rough fibrous shives and other refuse while the flax is held by the scutcher. The tow is then partially cleaned from the shives and refuse by separate operation. In this machine the beaters of the scutching machine are used for cleaning the tow after it is removed from the flax, and deliver the cleaned tow sepa-

An improvement in harrows has been patented by Mr | rately from the shives and other refuse, thus accomplishing

Mr William E. Huse, of Brookfield, Mass., has patented an improved cattle stanchion. The object of this invention is to furnish attachments for cattle stanchions so constructed that cattle may be released from their stanchions and

THE TEREBELLA AND HERMELLA.

While wandering along any of our sandy coasts, we fre-

set of forked filaments which, like the tube itself, are composed of fragments of sand agglutinated to gether. The substance of this tube is very soft, but very tough, and will endure a tolerably hard pull without breaking. If the inhabitant of these tubes be sought, it will not be found without much labor, for the terebella retreats to the further extremity at the least indication of danger; and as the tube is a foot or more in length, and is always conducted under stones or among rocks, it is not easily dislodged.

As in the case of the sabella, this annelid performs its architectural labors by means of its tentacles, which are most wonderfully constructed, so as to be capable of extension or retraction, and at the same time can seize or throw away a particle of sand at any part of the tentacle. The method of working is very well given by Mr. T. Rymer Jones in "Wood's Natural Histo-

"If a specimen be dislodged from its tube, it swims by violent contor tions in the water, after the manner of various marine annelids; the tentaculæ and the branchiæ are compressed and contracted about the head, like a brush; and as the animal is very soon exhausted by

such unnatural exertions, it soon sinks to the bottom. Should a quantity of sand be now scattered from above, the tentaculæ, speedily relaxing, extend themselves in all directions to gather it up, sweeping the vessel quite clean, so that in a very short time not a particle is left behind that is within their reach, the whole having been collected to be employed in the construction of a new artificial dwelling, adapted to shelter the naked body of the

"We will suppose a tube to have been partially constructed into the side of the aquarium wherein a speci- Malactobdelles. In other words, there are leeches which oc | placed them in the "hospital tank" for treatment. The course

noon. But scarcely has the sun passed the meridian than the creature begins to become restless; and towards four or five it will be seen to have risen upwards, the tentaculæ extending with the approach of evening, until after sunset, when they are in full activity. They are now spread out from the cr: fice of the tube like so many slender cords; each seizes on one or more grains of sand, and drags its burden to the summit of the tube, there to be employed according to the service required. Should any of the tentaculæ slip their hold, the same organs are again employed to search eagerly for the lost particle of sand, which is again seized and dragged toward its destination.

"Such operations are protracted during several hours, though so gradually as to be apparently of little effect. Nevertheless, on resuming inspection next morning, a surprising elongation of the tube will be discovered; or, perhaps instead of a simple accession to its walls the orifice will be surrounded by forking threads of sandy particles agglutinated together."

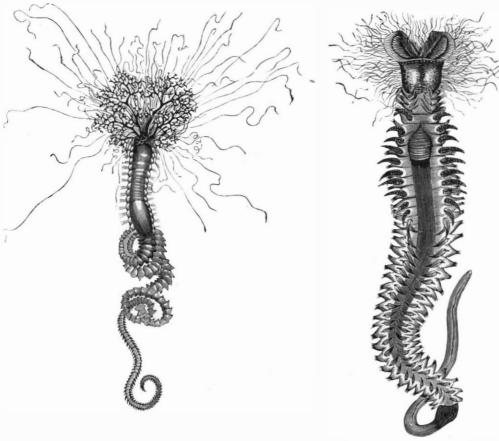
There are many species of terebella, and even on our own coasts we may be gratified with several beautiful forms of these interesting annelids. They have, to a considerable extent, the power of reproducing lost portions of the body; and it has been found that even the whole mass of plumy tentacles can be removed without much injury to the terebella, which retreats to its tube, and after a while reproduces the whole of the missing organs.

FISH PARASITES.

BY A. W. ROBERTS.

The leeches which commonly swim free in the water, and only occasionally attach themselves to the bodies of verte-

brate animals to drink themselves full, have their nearest re- skinned animals. The accompanying illustration represents lations in those which attach themselves to the exterior of the skate sucker, Pontobdella muricata (natural size). From quently come across some moderately large tubes projecting | fishes and crustaceans. While, however, the free swimming | the fact that it is more frequently found adhering to the from the sand, and rather conspicuous in the little puddles leeches have ringed bodies, the parasitic leeches of fish different members of the skate or ray family of fishes, it is left by the receding tide. Round their mouth is usually a and crabs have soft and smooth bodies, especially in the most commonly known as the skate sucker. This genus of



TEREBELLA EMMALINA,-[Natural size.]

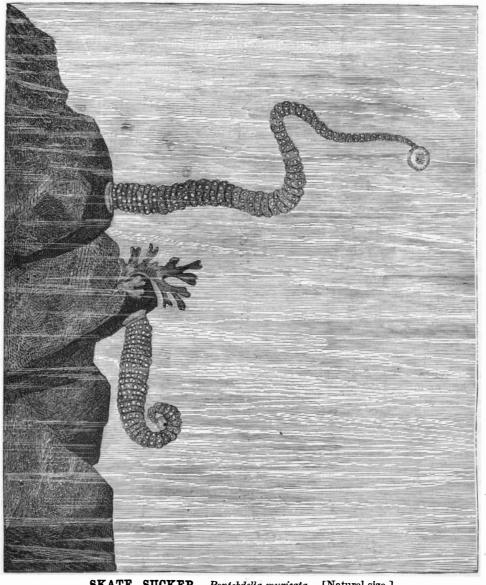
HERMELLA,-[Magnified.]



TUBES OF THE HERMELLA,-[Natural size.]

men is about to take up its permanent abode. During the casionally prey upon warm-blooded animals, and are hardly of treatment was to rapidly pass them through a bath of earlier part of the day the animal is found lurking in its to be called parasites. Others are to be found only on the interior, with only the extremities of the tentaculæ protrud skin of cold-blooded vertebrates, and, finally, those of tho- This salt bath I never knew to fail in destroying leeches

ing beyond the orifice, and it will so remain until towards roughly parasitic character, which adhere to crabs and soft-land fungus, if the fish so treated were not too far gone.



SKATE SUCKER.—Pontobdella muricata.—[Natural size.]

marine leeches can be generally distinguished by the numerous tubercles on the rings of the body, which produce a very curious effect. The prevailing color of the skate sucker is a greenish gray.

These marine leeches are provided with a large and powerful sucking disk, by which they can maintain themselves in a horizontal or perpendicular position; but their most common position, when at rest and attached to inanimate objects, is a spiral, the head being in the center.

On my return to the aquarium, one of the large fresh water tanks which had been neglected for several months had become so infested with a small variety of parasitical leech that it was with difficulty the glass front could be kept clear of them. Even the extreme tops of the aquatic plants growing in the tank swarmed with thousands of them constantly extending themselves in their endeavors to catch on (they not being free swimmers) to the tails and fins of the lake dogfish, or the large specimen of freshwater eels contained in the tank. The eels instinctively avoided resting on the floor of the tank or coming in contact with the plants or rock-work sides of the tank, but remained suspended night and day in the open clear mid-water. Still,

with all the precautions taken by the eels, many of them became fringed with hundreds of the leeches. I have seen the eels repeatedly loop themselves so as to bring the head and tail together, in which position they would strip off the leeches with their teeth; and in so doing they often bit or tore off small pieces of their flesh and fins, so that in course of time (when the wounds did not heal rapidly) they became badly covered with fungus. What with the leeches and the fungus the eels had become floating skeletons. To save the few remaining, I

warm and very salt water (a nearly saturated solution).

The bottom of the "hospital tank" contained a heavy flooring of Coney Island sand, in which the eels embedded themselves as if only too glad to take a rest after their long suspension. At night they were fed to repletion on raw beef. Under this treatment they soon became "solid" and happy.

The tank out of which the eels were taken was then cleared of all the fish remaining, after which a half barrel of quicklime was cast into it, and in one hour's time the lime had done its work, everything living was burnt up, the tank was then drawn off, scrubbed, and washed out, and a heavy bottom of fine sand introduced.

One of the most beautiful tanks I ever had, and of which I was very proud, contained some twenty-five weakfish, thirty kingfish, twenty striped bass, two pilotfish, and several bluefish. They were all in perfect health, high color, and feeding well. In one night all the kingfish died; the next day the weakfish departed, then the pilots, and the blues

I had nothing in the way of an explanation, as I had never in all my long experience known of fish dying in this unaccountable manner. I examined the dead fish carefully; both externally and internally they appeared to be in perfect health; their gills seemed to be unusually healthy for fish kept so long in confinement.

Next to this tank was a tank of plump and healthy blackfish, who were fed as blackfish were never fed before; and these, too, died in the same unaccountable manner a short time after the other fish.

Next to the blackfish was a tank containing over one hundred spotted codlings, and who were so fat that they seldom swam for more than five breath

A day or two after the death of the weakfish, kingfish, and blackfish, the codlings began to go. Every few minutes through the day my assistant was scooping out dead fish Still I could not detect the cause, but I came to the conclu sion that when blackfish and codlings (the toughest of all aquarium fish) die the reason ought to be discovered

All of these fish, from their first illness, had been fed on the very choicest of marine diet-soft crabs, shrimp, hard as he did shortly, that Mr. Greth was at his wits' end, and and soft clams, and even oysters and scallops. The cod- that he was wholly unable to perfect the practical applica lings would churn the surface of the water when fed on soft tions of the process, they parted company Mr Radde then crab, so keen were their appetites, and yet a minute after struck out for himself and continued the experiment, assisted they would retire to the bottom of the tank, straighten out, by Mr. C. R. Linde, a technically trained architect and en and die I watched the codlings with painful anxiety, for gineer. By bringing to the enterprise trained skill and en I began to fear that an epidemic was spreading through the ergy that has overcome all obstacles, and by the employment entire range of tanks, and that in a few days all the fish of a not inconsiderable fortune, Mr Radde succeeded, about would be lost. I had noticed that when a codling began to the year 1876, in making the process of real practical value die it lost its rich colors and took on a sickly brownish. It was about this time that Mr. Radde wrote to me on the white color, and that its death ended in a quivering and subject and sent me many beautiful specimens of his work, spasmodic action, after which it would straighten out and and offered his American patents for my consideration become rigid. These are the exact symptoms of smothering

Again I determined to make another examination, this greatly improved on Radde's results. time under a microscope, and placing a minute portion of a of oxygen, in other words, had smothered.

in the affected tanks, and thus stop the spreading of the papractical worth of the invention. rasites through the entire circuit of tanks and into the storage reservoirs. The few codlings that still remained alive were treated the same as the eels, and with like good results. The locked up water was filtered through a large filter, consisting of blankets, sponge, animal charcoal, and fine sand. after which it was allowed to pass into the reservoirs. I afterwards discovered that these parasites had been introduced into the tank through the medium of twenty five small Eastern lobsters that, in all probability, through long | from lightning. confinement in "cars" and smack wells, had become in fested with parasites. All these lobsters died shortly after being introduced in the tank.

Correspondence.

The New Color Printing Process.-Honor to whom

To the Editor of the Scientific American:

In your issue of June 29, you repeat in an article with the title of "A New Process of Simultaneous Color Printing," certain statements which in a similar form have fallen under my eye at least a dozen times in various journals within the

So long as these statements were confined to the regular daily or weekly journals, and were referred to as items for the casual reader, I left the misstatements they embodied unnoticed, although always in the possession of facts to correct them. But now as I observe their appearance in your well informed technical journal—a journal which I am happy to say is considered an authority in all technical matters by its readers-I beg to be permitted to say what I know about the very valuable and ingenious invention referred

The process of polychrome printing for producing com plicated color effects in one single impression—the printing from a kind of mosaic plate or ground—was the idea of many an inventive mind during the last century. Senefelder, the genial inventor of lithography, was, so far as I am aware, the first to conceive the idea of reproducing oil paintings, etc., by mechanical means, and in the course of his various experiments he also invented a process which he called mo

there is still to be seen "an original mosaic plate, consisting common experience with lightning? Rods put on other of minute sticks of color, very carefully put together, with structures save them; but rods have been put on oil tanks, finished and unfinished impressions taken from it." (See Ferchl, Geschichte der Errichtung, etc., München, 1862.)

As Senefelder died in 1831, his priority is established beyond dispute. Experiments in this direction were followed helps to support our theory. by a Berlin artist, Liepman, who, in the first half of this century, produced reproductions of oil paintings, especially It seems, however, that he was only partially successfulthat he was unable to perfect the process so as to make it perfect conductor to the earth. practically useful, and carried it only to the experimental stage; for after his first successful reproductions, of which tect them? Because the lightning did not come at those plates are developed, intensified, fixed, and washed exactly several were regularly published, we hear no more of it. points (if it did, it would, of course, be conducted into the Liepman also published a book describing his invention and entitled "Der Oelgemulde Druck," Berlin, L. Sachse & Co., directly into the tank where the explosive matter was tion and before drying. You will be glad to hear that sev-

Similar attempts were also made in the United States. A person prominently identified with this invention was one rels; from another well, possibly forty rods distant, an iron ing of making the emulsion on a large scale."

the process about the year 1870.

enthusiasts in the enterprise, leaving one for another how assistant in this way was Mr Otto Radde, an able and ener getic Hamburg merchant, who not only invested money in the enterprise, but who became himself thoroughly interested in the principles of the process. When Mr Radde found,

After perfecting his process Mr. Radde organized a color Yet how could these fish die of suffocation when I was printing establishment in Hamburg and one in Paris, the lat-of a milky color, and everything was silvery with globules, tablishment to Mr. W. G. White. I observe in the technical papers in Germany that Mr. Greth now claims that he has

I will only add that the description of the process given in gill of one of the dead codlings under the glass, I was as- your article is in the main correct, and that I have no interest tonished to find it literally packed solid with very minute in the matter other than that of a color printer who takes a marine leeches, every one of which was gorged with blood lively interest in whatever tends to further develop our ground, was interposed, especially if the iron tank was contaken from the gills of the fish. Here was the secret; these beautiful and important art. I believe that a great field of nected, as tanks in this country are, with pipe lines many thousands of minute parasites had so packed the delicate usefulness can be found for this new process in this country, breathing apparatus of the fish that they had died for want and now that it is being brought to the attention of the American public I desire that at least the tribute of honor Evidently these parasites were fast spreading from tank able mention should be given to Mr. Otto Radde and Mr. to tank; the only way to stop this was to lock up the water C. R. Linde for their really important contribution to the

Boston, June 25, 1880.

Louis Prang.

Another Theory for the Oil Tank Explosions.

To the Editor of the Scientific American:

I notice in your paper of July 3, 1880, an article headed "Cannonading Oil Tanks," under which you advance a certain theory as to the probable cause of the frequent oil fires

It is unquestionable that at all times a certain amount of gas or vapor escapes from such a body of oil, but that such a column, or "vapor rod," as you term it, should act as a conductor of electricity, we think is quite incorrect.

We give you our opinion, not as a scientist, but from a practical point, or, rather, from that which observation has led us to believe.

Perhaps all of your readers may not be familiar with the facts, therefore it will require a little preliminary explanation

Connected with each of these large iron tanks are a great number of iron pipes, leading oil from great distances and from different points into the tanks, the pipes ending abruptly within the tanks, which are closely covered, except at these openings or hatches in the upper parts of the tanks, where the pipes are admitted.

Now to illustrate, suppose a powerful currect of elec tricity conducted by a rod of iron to a point where the rod terminates in the air—what is the result? A stream or sparks of fire are produced from the end of the conductor.

Just so in the case of oil tanks; at some point along these pipe lines the lightning has come in contact with some one of them. That which might be expected is just what does occur: the pipe line, acting as a conductor, leads it directly to and inside of the tank, where, reaching the end of the iron line, sparks are produced, and, of course, from the nature of the gas contained in the tank above the oil, an explosion and terrible fire is at once produced.

You say, "Ordinary buildings, when properly provided with rods, are comparatively safe, etc., and that structures of iron, simply resting on the ground without rods, are al ways exempt from electrical damages. Such structures al ways present a continuous body of conducting material for the free passage of electricity to arth. Why is it, then, In the collection of lithographic incunabula at Munich that iron oil tanks form such conspicuous exceptions to our masts with rods have surrounded the tanks, but the tanks were exploded by lightning all the same."

Now this, together with other things I will mention, just

In the first place, we doubt whether any one can show an instance where lightning struck a tank direct. If such an portraits, by this process, which were of wonderful accuracy. instance should occur, what would be the result? Just as advantage of gelatine emulsion (high sensitiveness) with the you have stated above, the iron covering would furnish a advantages of collodion emulsion. It appears to keep any

Why did not all those rods on and around the tanks pro earth), but it came from other points, by the iron-pipe lines,

firm in Maiden lane or in John street, New York, whose came under my own observation. Lightning struck a large its success to the Society for the Advancement of Photoname I cannot now remember, published some maps printed oak tree, possibly fifty rods distant from an oil well, at graphy. You may smile over all these wonderful things, from mosaic blocks, a number of years ago; but the next which was a wooden tank capable of holding about 150 bar- but they are so convincing to me that I am seriously think

minutes at a time without resting half an hour to take Julius Greth, also a German, who began experimenting with pipe led the oil to this tank also Immediately after the tree was struck this tank was on fire. Fortunately but little He succeeded in interesting successively various wealthy oil was in the tank, and before the fire had consumed the gas sufficient to reach the oil (as there was but little chance ever as fast as their enthusiasm cooled His last financial for air), wet blankets were placed over the hatch, and the fire smothered out No signs or marks of lightning could be traced, either about the derrick or on the building with which the tank was closely housed, or on the closely fitting cover containing the hatch. It seemed positive that the line conveyed the electricity into the tank, thereby igniting the gas. Possibly this theory is not correct and I would be pleased to see anything further upon this subject.

F. G. SACKET,

Knox P. O, Clarion Co, Pa, July, 1880.

Oil Tanks Struck by Lightning.

To the Editor of the Scientific American:

In your issue of July 3 you say that ' lightning is pecuharly attracted by iron oil tanks, causing disastrous fires." This seems contrary to our experience as well as our philosophy The tank struck here June 11 was not an iron tank, but was one of the old fashioned tanks with wooden and gravel tops, and iron sides only. Many iron tanks were destroyed here at that time, but they were not ignited by lightning.

Your theory about the ascending column of vapor attract ing the electric current has no doubters in these parts, but we fail to see why the lightning would not leave the oil vapor and oil if such a splendid conductor as a 20,000 barrel oil tank, built entirely of boiler iron and sunk well into the miles in length, making the best kind of a ground connec-

Titusville, Pa, July, 1880.

To the Editor of the Scientific American:

I notice your article about lightning being attracted by the iron oil tanks. The remedy for this has been found long since. The use of the iron top instead of wood. There has never been a tank of oil with iron top burned by lightning. D. B. MASON.

Pittsburg, Pa., July, 1880.

The Oil Tank Question.

To the Editor of the Scientific American:

I have read your remarks referring to our late oil fire here, and giving a reason or explanation of the cause of it. I think you are out of the way in your statement, for the vapors from petroleum are oftentimes heavier than the atmosphere and rather seek the ground. Practical refiners always fear this most in and about a refinery, as these vapors hugging the ground are frequently drawn toward their furnace fires and lead to fearful explosions. Then the tops of these iron tanks are generally if not always tight, it being as necessary to keep out rain as to keep in the oil and vapor. In this particular instance the lightning struck this tank at 7 o'clock in the morning, before the sun could have generated any vapor to speak of, and these tanks are often struck in winter time, when the atmosphere is not warm enough to cause the vapors to be generated. Then, too, why is it that iron tanks with iron tops are not struck by lightning, while those of wood tops (covered with turf) are. I am anxious to get at the cause, and have written this solely to bring out more thought on the subject. C. M. C.

Titusville, Pa., July, 1880.

The Relative Cost of Motive Power.

Mr. Bissinger, M.E., at Carlsruhe, Germany, gives the following results as obtained in his examinations of the several motors in regard to the relative cost per horse power for each hour. It will be observed that the examination pertained principally to small motors.

The relative cost per effective horse power per hour is as

100	horse power	steam engine	7.6
2	66	46	
2	64	Lehmann's caloric engine	26.5
2		Hock's motor	
2	6.4	Otto gas engine	
2	"	Otto Lang gas engine	
2	46 .	Schmidt's hydraulic motor, supplied with	
		water from the city water works	95 00
2	44	obtained by horses and a gin.	45.00
9	**	obtained by manual labor	900 M

Otto's gas motor and Lehmann's caloric engine are the cheapest of the small motors, but are, nevertheless, four times as expensive as the 100 horse power steam engine.

A New Photo Emulsion.

Dr. Vogel writes to the Photographic News: "I have a new emulsion with remarkable qualities. It combines the length of time, and, best of all, it may be poured like collodion upon the glass, drying as quickly as the latter. The like collodion plates, and dry like these. Moreover, the film may be exposed in the camera seven minutes after preparaeral of our Berlin photographers-Prumm, Schaarwachter, To further prove this theory, I will give an example that and Reichard—have tried the emulsion, and reported upon

THE STRUCTURE OF MATTER.

Read before the New York Academy of Sciences by Prof. C. F. Kroeh, of the Stevens Institute of Technology.

> [Continued from page 25.] LEIBNITZ.

Leibnitz (1646-1716), one of the inventors of the calculus, maintained that extension is not a fundamental, but a derived idea. It can be explained by the assumption of some thing of which it is the property, of something that is itself simple, without parts, and consequently without extension, shape, or divisibility. He imagined the universe to be made of such simple, ultimate things, and gave them the for the existence of the physical universe, and reject creation, name of monads. Although a monad has no parts, it may nevertheless be the exponent of numerous perceptible rela tions, just as a point in space may be viewed as the vertex of numerous angles. Great numbers of these monads are continually acting upon our senses with infinite rapidity, and and the nature of matter (Phil Mag, 1844), reasons as folproducing in our minds confused images of the external world. We perceive what we call the properties of matter only because we are incapable of analyzing the impressions made upon us by these immaterial monads.

A monad can be produced by creation only, and can be destroyed by annihilation only. This follows from the assump tion that it has no parts. Nothing can be added to it nor taken from it. Being a created thing, it must be subject to platinum is a conductor, space, being its only continuous at the free surface, will form rings, if too great differences continual change, and the cause of this change must lie within it. In consequence of this changeability there must exist an infinite variety of monads. They appear to us to occupy space, because they have certain positions with regard to one another, certain geometric relations, and because many of them act upon our senses at once. Motion is the sum of infinitely small impulses exerted by them; yet they in no wise act upon one another, but each monad moves independently by virtue of the force that is in it, and enters into various relations with other monads in obedience to a predestined harmony which is the law of its being.

To account for the phenomena of life Liebnitz goes so far as to endow his monads with greater or less degrees of consciousness, of perception and volition; but in these speculations we need not follow him.

KANT.

Kant (1724-1804), the originator of the nebular hypothesis, fixed upon mobility in space as the essential property of matter. Our senses can be affected by motion alone. Extension is explained in this system by supposing that a body fills space by reason of the resistance it offers to all motion tending to displace it. This resistance is itself motion in a direction contrary to that of the invading body. It may be called a repulsive force, and must be inherent in all its parts. If every particle of matter is endowed with repulsive force, we have an explanation of expansion, elasticity, and impenetrability. Infinite divisibility also follows from this conception, because the mobility of every particle makes it separable from every other particle. The divisibility of matter must, therefore, be commensurate with the mathematical divisibility of space.

To account for the occupation of definite space by a body we must also endow its particles with an attractive force, which counteracts repulsion and prevents the particles from flying off into space.

It will be perceived that we are now entering a region of thought more familiar to the modern chemist and physicist. BOSCOVITCH.

The idea that the particles of matter are endowed with both attraction and repulsion constitutes the basis of the atomic theory of Boscovitch (1759), which has formed the working theory of scientific men until quite recently.

When bodies are said to touch each other they are by no means in mathematical contact, but separated by an insuperable repulsive force, so that a distance of $\frac{1}{5\,00\,0}$ to $\frac{1}{2\,0\,0\,0}$ of an inch intervenes. Within this interval, according to Boscovitch, there are several alternations of attraction and repulsion. In other words, if two atoms, separated by $\frac{1}{5000}$ of an inch, are brought a little nearer together they will attract each other; if still nearer, they will repel, and so on, with this limitation, that no force however great can bring them into mathematical contact. At distances greater than $\frac{1}{2000}$ of an inch atoms attract each other according to the law of gravitation. It is evident that at smaller distances there will 20,000 cm.; one may contain 1,000 bricks, and the other 999 be intermediate positions of stable and unstable equilibrium, bricks and two half bricks. They would then be sensibly and that atoms moved from these positions in any direction will oscillate to and fro by virtue of their inertia, until they might contain 2 whole bricks and the other 1 whole and 2 either return to their old position or arrive at a new one, the phenomena of cohesion and elasticity are explained.

Boscovitch interprets the three states of matter as follows: In a gas, the repulsive force prevails between the particles, so that it would expand indefinitely if no external force in terfered. In a liquid, the particles are maintained at a definite distance by mutual attraction and repulsion; and each particle is free to rotate in any plane. In a solid, the distances between the particles are also determined by both forces; but the particles are polarized or obliged to rotate in certain definite planes. If any particle is swung out of its their centers of gravity, in insulating media, would merely natural plane, it will return to it again after performing a certain number of oscillations.

In this and all the other atomic systems the fundamental assumptions are:

That matter does not continuously fill space.

That its particles are separated by distances which are great in comparison to the size of the particles.

That they act upon each other at a distance, and not by

That the particles are extremely hard, and both indivisible and unalterable by any means, physical or chemical.

That the particles are impenetrable and possess inertia. That the chemical and physical properties and behavior of bodies depend upon the collocation and motions of its atoms; and consequently,

That our senses deceive us when they convey to our minds the impression that bodies are continuous, and when they appear to reveal to us any other changes than changes of

Those who endeavor to make the atomic system account are obliged to make certain additional assumptions, which will be examined elsewhere.

FARADAY.

Faraday, in his speculations touching electric conduction lows: Of the two constituents of matter involved in the atomic hypothesis (atoms and spaces), space is the only continuous one. Consider, then, he says, the case of shellac, a constituent, must be a conductor. Space, which is every where uniform, is therefore both a conductor and a nonconductor. "Any ground of reasoning which tends to such conclusions as this must be false." He then adds, Why should we assume the existence of matter independent of force at all? and he modified the system of Boscovitch by substituting the term "center of force" for atom. According to this view matter, in the ordinary acceptation of the term, disappears entirely, to make room for the emanations of force which fill the universe, and the atom is replaced by He used a common wooden box of a capacity of about two points at which lines of force converge.

THE LATEST VIEWS.

Since by the labors of Joule, Clausius, Krönig, Maxwell, and others, the science of thermodynamics has been created, the hypothesis of atoms and molecules has been greatly developed by the mathematical study of their motions, so that we are no longer obliged to define them after the vague manner of former theories; but we possess tolerably definite information relative to their size, weight, distances apart, velocity, and energy. I shall have to content myself this evening with giving a single example of this new knowledge, postponing the evidence. Thus we know with tolerable certainty of the hydrogen molecule:

- 1. That its weight is $\frac{46}{10^{25}}$ gramme.
- 2. That its volume is subject to great variation in its compounds. In its elemental state its volume is taken as the unit of comparison, and corresponds to a diameter of $\frac{5.8}{10^{10}}$ meter (5.8 tenth-meters).
- 3. The distance between two neighboring molecules of hydrogen is $\frac{965}{10^{10}}$ meter (965 tenth-meters).
- 4. The velocity of vibration 0° C., 1,859 meters per sec-
- 5. The number of collisions between hydrogen molecules per second is 17,750 millions.
- 6. Nobert can draw 4.000 lines in the breadth of a milli meter. The interval between two such lines can be seen with a good microscope. I have calculated that a cube with an edge of $\frac{1}{4000}$ mm. would contain about 17 million molecules of hydrogen.

The theory that matter is continuous has been revived to a certain extent. In studying elastic bodies Prof. Stokes has availed himself of the idea that the smallest portions into which we can divide them are sensibly homogeneous. The theory of fluxions and modern mathematics then become applicable, provided we do not carry the divisibility too far. The smallest particles considered must be sensibly similar. Sir Wm. Thomson illustrates this by the statement that contiguous cubes of water $\frac{1}{1000}$ cm. in breadth are sensibly similar, but cubes of $\frac{1}{10000000}$ cm. must be very sensibly different. Take two lengths of masonry, he says, each of similar. If, however, you take two lengths of 40 cm., one halves. They would be sensibly dissimilar.

In Boscovitch's theory there is no contact of atoms, and all action is therefore action at a distance. Of this it is impossible, at least for me, to form a clear and philosophical conception. Clerk-Maxwell in his electrodynamics drops this assumption entirely, together with that of hard atoms. He imagines the ether filling space to contain a system of cells with elastic walls and cylindrical cavities, in which elastic balls can rotate and be flattened out by centrifugal force. In the cells there must be other balls of invariable volume as friction rollers. These would rotate freely, but be displaced by elastic yielding of the cell wall; in conduct ing media every displacement would be attended with resistance similar to friction in a viscous liquid. Motion is trans ferred in these balls by surface adhesion only. Their displacement produces dielectric polarization in the medium, and their onward motion an electric current. The rotation of the elastic balls corresponds to the magnetizing of the medium, the axis of rotation being the direction of the mag

as too artificial, he admits that Maxwell has developed from it a complete and mathematically very elegant theory of all electrical phenomena. An entirely novel and suggestive view of the construction of matter was originated by Sir William Thomson.

Vortex Atoms.—Helmholtz had shown that if any portion of a perfectly homogeneous fluid, incompressible, continuous (not made up of molecules), and devoid of internal friction, is caused to rotate, it will form a vortex ring of invariable volume. The matter partaking of this rotation is thereby differentiated from all the rest, and will remain so for ever. Nothing short of a creative art can start or stop such rotation. If two such rings are linked together, they can never be separated, and if a single one is knotted on itself, it can never be untied.

The formation and properties of such rings may be studied experimentally, bearing in mind that we have only imperfect fluids to deal with. Prof. Wm. B. Rogers, in the American Journal of Science, 1858, p. 246, described various methods of producing them. Prof. J. Trowbridge, in the Philosophinon-conductor, space in it must be an insulator, whatever cal Magazine, 1877, says. "All liquid drops falling from such the atoms may be; for if it were a conductor, the shellac a height that the surface of the liquid in which they are could not insulate. But now take the case of platinum, about to diffuse themselves is not too much disturbed to which must also be composed of atoms and spaces. Since enable the drop to be acted on symmetrically by the forces of density do not exist." To render them visible the drop may be colored. "That a drop of pure water will descend through the same liquid in a vortex ring can be shown experimentally by covering the free surface of the water with a fine light powder." (I would suggest lycopodium.) "Particles of the powder will be carried down by the drop and will be seen to rotate in a ring shape far below the surface."

> Prof. Tait rendered visible the formation of vortex rings in air by means of a cloud of finely divided sal ammoniac. cubic feet. In one end there was a circular hole about six to eight inches in diameter, while the other end had a towel stretched over it. By sprinkling ammonia over the bottom and then generating in it hydrochloric acid from common salt and sulphuric acid, he obtained a copious evolution of sal ammoniac vapor, which rendered the rings visible. They were produced by sudden blows upon the stretched towel. Two such rings impinging upon each other behave like rings of solid India-rubber. As such a ring approaches one's face its inner particles are seen to rotate forward, and its outer ones backward, while the air in the center moves forward faster than the ring itself and strikes the face first.

> These rings suggested to Sir Wm. Thomson the idea that the universe is continuously filled with a perfect fluid, and that whatever produces upon us the impression of matter is portions of this fluid in vortex rotation. In other words his atoms are vortices, and it proposed to explain all the properties of matter by the laws governing vortex motion.

> While the atoms with which we have dealt heretofore are in reality patch-work, altered and amplified to suit each new discovery in chemistry and physics, the vortex atom is not capable of such adjustment. As Maxwell puts it: "His primitive fluid has no other properties than inertia, invariable density, and perfect mobility, and the method by which the motion of this fluid is to be traced is pure mathematical analysis. The difficulties of this method are enormous, but the glory of surmounting them would be unique."

> Rankine, in a paper on "Molecular Vortices," before the Royal Society of Edinburgh, 1849-50, illustrated knotted vortex atoms by means of diagrams and wire models. "Their endless variety," says Sir Wm. Thomson, "is infinitely more than sufficient to explain the varieties and allotropies of known simple bodies and their mutual affinities."

> Helmholtz, Tait, Maxwell, Rankine, Stokes, and other celebrated men have all contributed to this theory.

CONCLUSION

Having now passed in review the leading theories of the tructure of matter up to the present day, I shall conclude my paper by a brief statement of the manner in which it is my purpose to continue my studies.

I shall, in the next place, examine the idea of an atom and the question whether the material universe can logically be constructed according to the requirements of the atomic system. Then will be presented the evidence metaphysical and experimental of the existence of molecules. This will include the beautiful experiments of Crookes. Another chapter will be devoted to the facts ascertained about molecules, such as their weight, relative and absolute; size, relative and absolute, shape, velocity of motion, length of path, number of collisions per second, etc. I may mention in this connection that I have no less than seven different lines of argument based on experimental data, all of which concur in assigning to molecules a diameter not far from the $\frac{1}{5000000000}$ of an inch.

Finally, I shall endeavor to show how such a knowledge of atoms enables us to explain the behavior of gases under pressure; the spectra of gases, liquids, and solids; heat resulting from chemical action, quantivalence, and other phenomena,

A Large Horse.—One of the largest horses ever seen in this city arrived from Ohio June 22. His registered height is 20 hands and 1 inch, or 81 inches; his weight is said to be 2,450 lb The animal was bred from native draught stock, is of a dark bay color, well proportioned, and in excellent health. It is said that a horse measuring 21 hands 2 inches was shown in this city many years ago; and more netic force. While Helmholtz designates such a conception recently one which measured 19 hands 1 inch.

Wages and Earnings in Pennsylvania.

Mr. Miles Humphreys, chief of the Pennsylvania Bureau of Industrial Statistics, has issued a report embodying the for shipping. information gathered by him last year by circulars addressed to employers in various parts of the State. Mr. Humphreys 18 careful to mention the fact that in many cases the returns | nautical miles, divided as follows: received show only the weekly wages paid, and that, in tabulating them on a basis of fifty-two weeks, the aggregate earnings must be considerably over-estimated. When the necessary deductions are made for lost time the total must be materially reduced. Many circulars were issued to ascertain earnings from the wages worker's standpoint, but not a sufficient number of intelligible replies were received to furnish the information desired. The failure is attributed to the fact that workingmen as a rule do not keep accurate yearly accounts of earnings and expenditures.

The summary of employers' reports is given in the following table,

SHOWING THE AVERAGE WEEKLY WAGES OF EMPLOYES THE AVERAGE WEEKS EMPLOYED DURING THE YEAR, WITH THE TOTAL EARNINGS FOR THE YEAR 1879:

		Average.	
			Faminas
Occupation.	Weekly	Weeks	Earnings for the
Occupation.	Wages.	Worked.	Year.
Miners, coal (anthracite)	_	43	\$399.04
Miners, coal (bituminous)		40	340.40
Blast furnace employes	9.04	48	433.92
Blast furnace employes	15.14	38	575.37
Heaters (iron)	17.98	40	719.50
Rollers (iron)	23.52	37	870.24
Heaters (iron). Rollers (iron). Roll turners (iron). Roughers (iron). Catchers (iron).	17 04	. 44 44	1,802.68 789.36
Catchers (iron)	9.50	45	427.50
Refiners (fron). Forgemen (fron). Hammermen (fron). Roll hands (fron not specified).	16.97	46	780.62
Forgemen (iron)	15.56	39	606.84
Hammermen (iron)	17.50	40	700.00
Hollmands (iron not specified)	22 66	47 34	1,065.02
Shearer sheet (iron)	18 90	43	374.00 812.70
Helpers (iron). Shearer, sheet (iron). Straightener (iron). Hammer driver. Steel melters. Steel converter.	10.00	52	520.00
Hammer driver	12.00	43	516.00
Steel melters	30.48	39	1,188.72
Steel converter	16.50	22	363.00
Neilorg	10.00	38½ 36	502.50
Tack maker	32.70	26	693.72 850.20
Nail cutter	12.00	25	300.00
Steel helper. Nailers Tack maker Nail cutter Spike maker	9.00	48	432.00
Nail packer Rivet maker	8.40	52	436.80
Rivet maker	20.00	36	720.00
Wire drawer	15.00	52 50	780.00 450.00
Moulders (iron)	11.26	43	484.18
Blacksmiths	10.33	48	495.84
Blacksmiths	12.87	43	553.41
Carpenters Cabinet makers Carriage makers Engineers Glass workers	10.61	48	509.28
Cabinet makers	7.80	46	358.80
Engineers	8.62 15.10	48 48	413.76 724.80
Glass workers	18.39	45	827.55
machinists	10.84	47	509.48
Painters	9.86	42	414 12
Plasterers	7.71	44	339.24
Printers	8.66 15.78	50 35	433.00
SawyersShoemakers	8.08	45	552.30 363.60
Stonecutters		41	382.53
Stonemasons	9.02	33	297.66
Tailors		46	368.00
Hatters	6.00	52	312.00
Tanners	7.53	50 51	376.50 567.12
TinsmithsGasfitters	10.50	36	378.00
Track foremen (railroad)	10.00	53	530.00
Brakemen (railroad)	11.94	49	585.06
Flagmen (railroad) Firemen	7.30	51	372.30
Toomstors	7.74 8.50	50 46	387.00 391.00
Teamsters Slater Quarrymen Laborers	6.00	39	234.00
Quarrymen	6.25	46	287.50
Laborers	7.08	42	297.36
Butcher	10.00	36	360.00
Calker.	9.00 6.75	31 45	279.00 303.75
Brass finisher	6.75	45 48	299.52
Coopers. Brass finisher. Iron ore miner. Lead furnace helper	9.00	48	432.00
Lead furnace helper	7.00	41	287.00
Carpet weaversLoom fixer	6.50	51	331.50
Loom fixer	11.71	52	608.92
Beamer Dyer	10.00	50 52	5º0.00 520.00
- J 01	10.00	U.	020.00

The Projected Florida Ship Canal,

The survey of the route of the proposed ship canal across the peninsula of Florida has been completed under the direction of General Q. A. Gillmore, who reports in favor of the work. The principal direct benefits expected are the saving of about five hundred miles in the passage from our Atlantic ports to Gulf ports, and the avoidance of the dan gerous passage through the Florida Straits.

The eastern terminus of the canal is fixed at Camp Pinck ney, at the head of ship navigation, and twenty-nine miles above the town of St. Mary's. From here it will run southwesterly to and through the Okefinokee Swamp, crossing the Suwanee River, near Blount's Ferry, in Columbia County, and thence to Ellaville, in Madison County. At first it was contemplated making St. Mark's the western terminus of the canal, but General Gillmore failed to approve this selection, owing to the increased distance involved. The St. Mary's castings formerly used. It is claimed also that nearly all the River is ascended by means of seven lift locks, each of fifteen | locomotive builders and makers of large steam engines are feet lift to the summit level, one hundred and eight feet now using the Chester castings, and that the fifteen thousand above tide. No guard lock is required, as the lift of the first lock exceeds any rise or flood in the river. The summit level enters the Okefinokee Swamp, through which it extends twenty-two miles, eleven and a half miles above for the same uses. Camp Pinckney. Fourteen miles beyond the Suwanee River is reached, near Blount's Ferry, the waters of which will be raised by means of a dam to the height of the summit level and taken into the canal. Crossing the river in the lake so formed the canal continues eighteen miles beyond to the end of the summit level, which has a length in Germany. There are employed over 1,000 workmen, in is that some unknown freight vessel had been lost at that of sixty two miles. From this point the line descends by two locks, each of ten feet lift, crosses the Alapaha, and, turning again to the south, crosses the Withlacoochee River, near Ellaville, and thence runs through the center of San Pedro Bay, descending from it by five locks of fifteen feet of potash, 280,000; caustic soda, 1,245,000; sulphuric acid, refrigerators in which the packages were stored had only and one of ten feet lift directly to the level of the Gulf.

A channel will have to be dug from the mouth of the canal cohol, 91.500; and sundry chemicals, 3,560,000.

to the deep water of the Gulf, seven or eight miles from the shore. The protecting jetties will form a harbor of safety

The length of the canal route is about one hundred and sixty-nine statute miles, or one hundred and forty-seven

From the bar to mouth of St. Mary's River Navigation of St. Mary's River to Camp Pinckney Canal To deep water in Gulf	122:0
Total	

The plan contemplates a cross section of canal eighty feet wide at the bottom and twenty-five feet deep. The water surface will be one hundred and eight feet in width. The canal is widened, however, to one hundred and fifty-five feet at the bottom and two hundred and fifty-five at the top for one thousand feet above and below each pair of locks to permit the approach of vessels, and there are passing places one thousand six hundred feet by thirty feet every six miles.

The locks are five hundred feet in useful length (from the end of the gate chamber to face of breast wall), sixty-five feet wide at the gates, with twenty-five feet of water on the sills. They are arranged in pairs, side by side, to prevent the interruption of traffic during repairs, and the walls are carried to five feet above the water line. The lifts are ten and fifteen feet. The locks have about the same dimensions as those advised for the Panama route, except in the matter of lift.

The estimated cost of the canal is \$50,000,000. The drainage area available for the summit level is one thousand two hundred square miles, with an average annual rainfall exceeding four and a half feet.

The Nicaragua Canal Concession.

The interoceanic canal concession granted by Nicaragua to the American Provisional Society has been ratified by the Nicaragua Senate and published as a law by the Republic. It secures to the society the exclusive privilege of construct ing a ship canal across the territory of Nicaragua.

The canal is to be of sufficient dimensions to accommodate steamers of the largest class used between Europe and America, and the locks are to be not less than 500 feet long and 28 feet deep. The concession is for 99 years from the date of the opening of the canal for general traffic, and at the expiration of that period the Nicaraguan Government is to take possession of the canal in perpetuity, with the right reserved to the company to lease it for another 99 years. During the period of the concession the company is to have the privilege of constructing a railway along the whole or any part of the canal; also, such telegraph lines as it deems necessary for the construction and working of the canal, and these lines shall transmit public messages free of charge. The Government of Nicaragua will declare the terminal ports, and the canal itself throughout its length to be neutral, and that the transit in case of war between other powers and Nicaragua shall be uninterrupted. In general, the canal shall be open to free navigation of all vessels, provided they pay the dues and observe the regulations of the company. Troops of foreign nations and vessels of war will be allowed to pass through the canal under regulations of existing treaties. Vessels of war belonging to other nations engaged in hostilities with Nicaragua or any other republic of Central America will be rigorously excluded.

This concession, with all its advantages and privileges, will appertain to a construction company, and is transferable only to the company which is to be organized by the Provisional Society, and in no case can it be transferred to a foreign government or power. It is to be organized in the usual manner of such enterprises, with its principal office in New York or elsewhere, as it may deem most convenient. pany.

• • • • • The Increasing Use of Steel Castings.

The rapid substitution of steel castings for expensive forgings, and for iron castings where great strength is required, has compelled the doubling of the capacity of the works of the Chester Steel Castings Company during the past year; and now the company announce a still further extension of their establishment. Their chief success, as well as the heaviest part of their business, is in the production of heavy gear wheels, pinions, roll spindles, couplings, coupling be easily improved, is obtained in a constant manner from boxes, etc., for rolling mills and sugar mills. In heavy plate mills their steel castings outlast many times the iron crank shafts and several thousand cross-heads on locomotives of their make show a better record for durability and from Sandy Hook, June 18, a firkin of butter was seen to smoothness of wear than any equal number of forged pieces rise in the water. Others followed until three hundred and

The Manufacture of Coal Tar Dyes.

now carried is shown by the following statistics of labor addition to 40 overlookers and branch managers, 25 chem-2,250,000; muriatic acid, 4,050,000; nitric acid, 825,000; al

Photographic Prizes.

The following is the list of prizes which the Photographic Society of Vienna offer for competition in the course of the present sessional year:

VOIGHTLANDER MEDALS.

(Open to members of the society only.)

- 1. A gold medal, value 140 ducats, for a method of increasing the sensitiveness of wet plates.
- 2. A gold medal, value 140 ducats, for the most reliable and sensitive dry process.
- 3. A gold medal, value 50 ducats, for researches into the gelatine emulsion process.
- 4. Medals in gold, value from 40 to 100 ducats, in silver, and in bronze, for scientific treatises, discoveries, and improvements, which have been published in the official journal of the society—the Photographische Correspondenz.
- 5. Medals in silver and bronze for the achievement of valuable results in the practice of photography.

SOCIETY MEDALS.

(Open to members or non-members.)

- 1. A gold medal, value 140 ducats, for the production of plates in relief for printing copies of drawings in half tint.
- 2. A gold medal, value 140 ducats, for monograph on pyroxyline and collodion.
- 3. A gold medal, value 140 ducats, for an improvement of the colletype process which will render unnecessary the constant wetting of the plate between the pulls.
- 4. A gold medal, value 50 ducats, for a rigorous investigation of the conditions of sensitiveness of asphalt.

Further particulars of the competition are contained in a detached programme, which, together with the prospectus and rules of the society, will be forwarded post paid on application to Dr. E. Hornig, 9, Hauptstrasse, Vienna III., to whom also should be addressed applications for admission to membership.

Curious Experiment in Magnetism.

M. Obalski describes a pretty magnetic curiosity to the Académie des Sciences. Two magnetic needles are hung vertically by fine thread, their unlike poles being opposite one another. Below them is a vessel containing water, its surface not quite touching the needles. They are hung so far apart as not to move toward one another. The level of the water is now quietly raised by letting a further quantity flow in from below. As soon as the water covers the lower ends of the needles they begin to approach one another, and when they are nearly immersed they rush together. The effect appears to be due to the fact that when the gravitation force downwards is partly counteracted by the upward hydrostatic force due to immersion, the magnetic force, being relatively greater, is able to assert itself.

Progress in Utilization of Solar Heat.

Since May, last year, M. Mouchot has been carrying on experiments near Algiers with his solar receivers. The smaller mirrors (0.80 m. diameter) have been used successfully for various operations in glass, not requiring more than 400° to 500°. Among these are the fusion and calcination of alum, preparation of benzoic acid, purification of linseed oil, concentration of sirups, sublimation of sulphur, distillation of sulphuric acid, and carbonization of wood in closed vessels. The large solar receiver (with mirror of 3 80 m.) has been improved by addition of a sufficient vapor chamber and of an interior arrangement which keeps the liquid to be vaporized constantly in contact with the whole surface of heat-

This apparatus on November 18, last year, raised 35 liters of cold water to the boiling point in 80 minutes, and an hour and a half later showed a pressure of 8 atmospheres. On Its designation will be "The Nicaraguan Ship-canal Com December 24 M. Mouchot with it distilled directly 25 liters of wine in 85 minutes, producing four liters of brandy. Steam distillation was also successfully done. But perhaps the most interesting results are those relating to mechanical utilization of solar heat. Since March the receiver has been working a horizontal engine (without expansion or condensation) at the rate of 120 revolutions a minute, under a constant pressure of 3.5 atmospheres. The disposable work has been utilized in driving a pump which yields 6 liters a minute at 3.50 m., or 1,200 liters an hour at 1 m., and in throwing a water jet 12 m. This result, which M. Mouchot says could 8 A.M to 4 P.M., neither strong winds nor passing clouds sensibly affecting it.

Rise of Butter and Cheese at Sea.

When the schooner Eddie Pierce, from Boston, bound to Baracoa, Cuba, was southeast of Nantucket, about 300 miles twenty-seven had come to the surface. Boxes of cheese also came up, to the number of twenty-four, and were secured, when the schooner turned back to Boston, where her own-The extent to which the manufacture of coal tar colors is ers filed a libel for salvage. The marks on the packages were illegible. There are two theories regarding the origin and production at one of the principal coal tar color works of the butter and cheese thus found "derelict" at sea. One spot, and that the packages were released by its breaking ists, 1 engineer, and 30 clerks and accountants. The yearly up. The other theory is that the butter and cheese were consumption of coal amounts to 17.000.000 kilos; anthra-lost from the compartments of the Anchoria after her collicen, 825,0°0 kilos; naphtha and benzol, 950,000; chromate sion with the Queen, near that place, June 12, and that the begun to break up when the Eddie Pierce arrived upon the scene.

Business and Lersonal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue. The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every

Asbestos Board, Packing, Gaskets, Pibers, Asbestos Materials for Steam & Building Purposes. Boiler & Pipe Covering, Asbestos Pat. Fiber Co., limited, 194 B'way, N.Y Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole m'f'rs., H. Lloyd, Son & Co., Pitsb'g, Pa.

"Temper is everything," and in the pens of the Esterbrook Steel Pen Company the temper will be found all that is to be desired.

For Sale.—One Spoke Tenanter, Throater, Facer, and Sand Belt. Nearly new and improved. Edward Hollingsworth, Wilna, Md.

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

The Mackinnon Pen or Fluid Pencil is the champion writing instrument of the age. Uniform in stroke, uses any ink, always with you, always ready. Diamond pointed. See Scientific American, April 24. Mackinnon Pen Company, 200 Broadway, New York.

OLD ORCHARD HOUSE, Me., June 18, 1880.

To the H. W. Johns M'f'g Co., 87 Maiden Lane, New York: The Old Orchard House, having just been completed with two coats of Johns' Asbestos Paints, in a manner perfectly satisfactory to me, I would indorse them as being not only of the most wonderful covering capacity. but also on the point of economy and manner of working under the brush. . . . Although two coats were called for under the contract, yet under the large piazza

I found one coat was entirely sufficient.
(Signed) E. C. STAPLES, Proprietor. Road Locomotive for sale. Aveling & Porter 12 H. P. Nearly new. Apply W. C. Oastler, 43 Exchange Place, New York.

Portable Engine on Wheels for sale. English manu facture; 12 H. P.; new. W. C. Oastler, 43 Exchange Place, New York.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. 1.O. Box 205, Jersey City, N. J.

Our new Stylographic Pen (just patented), having the duplex interchangeable point section, is the very latest improvement. The Stylographic Pen Co., Room 13, 169 Broadway, N. Y.

Advertising of all kinds in all American Newspapers Special lists free. Address E. N. Freshman & Bros., Cincinnati, O.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustra ted advertisement. Send for their new circulars.

Sweetland & Co., 126 Union St., New Haven, Conn. manufacture the Sweetland Combination Chuck,

Power, Foot, and Hand Presses for Metal Workers

Lowest prices. Peerless Punch & Shear Co.,52 Dey St., N. Y, The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

For the best Stave, Barrel, Keg, and Hogshead Ma chinery, address H. A. Crossley, Cleveland, Ohio.

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

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y. Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels-The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row. N. Y.

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

Presses, Dies, and Tools for working Sheet Metal. etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y. Blake "Lion and Eagle" Imp'd Crusher. See p. 13.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284 Eclipse Portable Engine. See illustrated adv., p. 413.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J. For best low price Planer and Matcher, and latest improved Sash, Door, and Blin 1 Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Peck's Patent Drop Press. See adv., page 14. Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 13.

4 to 40 H. P. Steam Engines. See adv. p. 413.

Improved Solid Emery Wheels and Machinery, Auomatic Knife Grinders, Portable Chuck Jaws. Important, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

For Standard Turbine, see last or next number. Fire Brick, Tile, and Clay Retorts, all shapes. Borgner

k O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted-The address of 40,000 Sawyers and Lumber men for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted. For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 28.

For Wood-Working Machinery, see illus. adv. p. 23. For Separators, Farm & Vertical Engines, see adv.p.28. Elevators, Freight and Passenger, Shafting, Pulleys

and Hangers. L. S. Graves & Son, Rochester, N. Y. Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 28. Soapstone and Empire Gum Core Packing, the best

for Railroads. Greene, Tweed & Co., New York. \$275 Horizontal Engine, 20 H. P. See page 28.

For Patent Shapers and Planers, see ills. adv. p. 28. Comb'd Punch & Shears; Universal Lathe Chucks, Lam bertville Iron Works, Lambertville, N. J. See ad. p.301. For Mill Mach'y & Mill Furnishing, see illus. adv. p.29.

Patent Steam Cranes. See illus. adv., page 29.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Wairus Leather, Emery, and Polishing Goods. Greene, Tweed & Co., 118 Chambers St., New York. Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box423, Pottsville, Pa. See p. 381. C. J. Pitt & Co., Show Case Manufacturers, 226 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29. Elevators.—Stokes & Parrish, Phila., Pa. See p. 28.

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

Penfield (Pulley) Block Works. See illus, adv. p. 28.



HINTS TO CORRESPONDENTS

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

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

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

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

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

Any numbers of the Scientific American Supple-MENT referred to in these columns may be had at this office. Price 10 cents each.

- (1) J. A. S. asks for the ingredients and proportions used in making picture frame makers'putty. A. Glue, 14 lb.: resin. 7 lb.; linseed oil, 21/2 pints; water, 5 pints (more or less); whiting, q. s.; 1/2 lb. pitch is sometimes added. Melt the resin, add the oil (hot): soften the glue in cold water, then dissolve it in hot water. Add the glue to the oil and resin, beat together, and add enough warm whiting to make a stiff dough. Oil the mould with sweet oil, and mould by pressure. The dough will not keep-it soon hardens, so that it should be prepared only as required. 2. If in your power also give me the recipe for making the gold lacquer used to give silver leaf the gold color, also used by picture frame makers. A. Shellac, 21/2 oz.; gum sandarac, 2 Buffing Machinery. Patent Punches, Shears, etc. E. oz.; gum elimi, 1/4 oz.; spirits of wine, 2 quarts. Mix, Lyon & Co., 470 Grand St., New York. blood and turmeric to color, and thin with wine spirit.
 - (2) J. N. C. asks how to clean the inside of a mercurial siphon barometer tube. Having been out of use for a long time the mercury was gone and the inside of the tube has become dirty from dust and oxidation from the mercury. A. Try a small quantity of warm nitric acid. Then rinse with water, rinse with absolute alcohol, and finally with ether; warm, to expel the vapor of ether.
 - (3) J. L. W. asks (1) for the best known rocess of pickling cucumbers to keep through the winter. I want the fruit to remain firm and brittle the pickling ingredients not to be impervious. A. Steep in strong brine for a week; then pour it off, heat it to boiling, and pour it over the cucumbers. In 24 hours drain on a cloth, pack in wide-mouth bottles, fill these with strong hot pickling vinegar, and seal at once. Various spices are added in the bottles. 2. Also, why is saud worked with cement; is it done to keep the cement from cracking, or to make it go farther, or to make it harder when dry, or dry faster? A. Sand hardens and prevents cracking, and lessens the cost of the work.

(4) G. F. W. asks how to prepare the solution and the proportionate quantities necessary to silver in different colors the glass globes such as are often used to trim Christmas trees,etc. My impression is that the globes are blown of different colored glass, and but one solution is required. A. Lead, 1/2 oz.; tin, 1/2 oz.; melt together; add immediately 1/2 oz. bismuth, and carefully skim off the dross. Remove the alloy from the fire, and before it cools stir in 5 oz. of mercury (with care to avoid inhaling thefumes). When the amal gam is to be used for silvering, strain it through a linen cloth and pour it into the clean dry globe through a paper funnel reaching nearly to the bottom of the globe. When the globe is turned about the amalgam will attach itself to the glass. Pour out the excess. 2. Lead. 3 oz.; tin, 2 oz.; bismuth, 5 oz. Put the alloy into the globe, expose it to a gentle heat until the compound has melted (it melts at about 197° Fah. Then by turning the globe slowly around an equal coating may be laid on, which, when cold, hardens and firmly adheres. For the different colors use suitably colored glass.

- (5) D. F. H. asks: Can I with six cells of Daniell's battery sound an alarm on a bell located about ten rods distance, in a church tower? A. No, but you can with your battery let off mechanism driven by weight that will do the work.
- (6) J. M. asks how to take green mould belt will drive easily. off from brownstone. A. Try a little strong hot potash solution (aqueous), rinse well after.
- (7) M. B. C. writes: I have a boiler 12 feet long, 44 inches diameter, with twenty-two 4½ iuch flues, the flame passing under boiler, returning front through one half of the flues, going back through the other half. What would be the horse power of such a boiler? A. About 24 horse power. 2. The flame as it leaves the boiler, passes through a damper, with 12 inches by 23 inches opening, passing down, then up stack. Is the damper of sufficient size? Would there be any gain in passing flame up through damper? Is flue in chimney a proper size, being 21 inches at base, increasing to 26 inches at top; square brick stack, height 70 feet from bottom of ash pit? A. Make your damper opening fifty per cent larger. Instead of passing the flame through one-half the tubes and returning through the other half, return through all the tubes, and do not make the second return. Your draught is now very poor; these alterations will improve it.
- (8) G. B. asks: 1. How much power in pounds will it require to run a 16 footboat, 4 feet beam, on smooth water? A. 70,000 to 90,000 foot lb. 2. Will a smaller propeller than 11 inch run it with any success? A. No. 3. How many revolutions must the screw make to the engine's once, per minute. A. The propeller should run the same speed as the engine. 4. How many revolutions must the governors make in accordance with the screw? A. You need no governor.
- (9) P. L. C. asks what is the best solution in which to dip shingles to make them more durable. A. Zinc chloride, mercuric chloride (corrosive sublimate), and creosote, dissolved in water, have been used for this purpose. Water shed from roofs covered with such shingles is unfit for drinking or culinary purp
- (10) J. E. B. asks if a boiler with sufficient capacity to generate steam to an engine of 24 inches cylinder, at 50 lb. pressure per square inch, be capable of furnishing steam to an engine with cylinder twice the area, with only 25 lb. steam, other things being the same. A. A boiler furnishing steam at 50 lb. pressure to a given cylinder, the steam would have a total pressure, including atmosphere, of 64.75 lb., and would furnish a cylinder of double capacity (not considering radiation and condensation) with steam 32,375 lb. total pressure—equal to 32 375—14 75=17 625 lb. pressure above atmosphere.
- (11) J. L. writes: We are about building a school house of six rooms, two stories. The members of the school board differ as to the best method of ventilation and heating the building. Some are in favor of stoves, others are for bot air. I am in favor of getting the opinion of those who understand such things, and having every confidence in the opinions expressed in the Scientific American, I ask you to give us information as to the best method of ventilating and heating a school building of six rooms. A. To heat by steam, half the heating surface to be indirect coils in the basement and half long wall coils, in the rooms on the outside walls and under the windows. In the inside walls of the rooms there should be built for ventilating three flues for each room of 144 square inches cross section each. The flues for the upper rooms to start at the floor and run straight through the roof, and finished with an Emerson top, or something like it. Ihe flues from the lower rooms to start at the floor also, and to pass direct to the roof and to have no connection with the flues for the upper story. The heating flues from the basement for the indirect coils to second floor should be in the ing to two feet above the two story floor. The registers for the first floor may be through the floor near the outside walls, and opening directly over the heating coils. It is not actually necessary to warm the outlet flues, in the inner walls, if each has a separate cowl or top. The life of a good steam apparatus is unlimited, except the boiler, which will last about twenty years. The cost would be from \$750 to \$1,000. Have a competent steam heating engineer make plans, and be sure he is correct as to quantity and quality; then submit the plans to the bidders, and see that the party who gets the job carries it out to the letter. If plans are to be submitted, it is best to receive them without price, on their merits only, and throw the best plan open to competition.
- (12) W. C. writes: 1. I send you this day a sample of sand, and would like to know if it contains any of the precious metals. A. It probably contains a trace of gold. A fire assay would be necessary to determine this. 2. I would like to know how many pounds of steam I can safely carry on a small copper boiler. No. 18 of the wire gauge. Dimensions of the boiler are 12 inches in length and 9 inches in diameter. A. 30 lb. per square inch of joint head sufficiently strong. 3. Where is there a good school I could attend for study-

ing civil engineering for beginners? A. "Rensselaer Polytechnic Institute," Troy. N. Y.; "Stevens Institute," Hoboken, N. J. 4. What would be the best manner of heating the above mentioned boiler-by petroleum or coal? A. Coal.

- (13) A. W. P. asks: 1. What size engines will it require to drive a buggy that will carry two men over ordinary roads? A. Two engines, 3 inches cylinder by 6 inches stroke. 2. How many square feet of heating surface will be required to make steam for the engines? A. 100 to 120 feet. 3. Will a vertical tubular boiler be best? A. Yes. 4. Should I use one or two engines? A. Two. 5. Give the weight of boiler, engines, etc., as near as possible. A. Weight will depend much on the kind of boiler. 6. What power will I get from an engine, two inch and four inch stroke, with 60 lb. steam, and 300 revolutions? A. One horse power.
- (14) F. H. A. writes: I have the following machinery running at the speeds given: Will you give me, through the Scientific's "Notes and Queries," the horse power required to drive them all at once, or a rule by which I can find out myself? No. 1, 3,600 revolutions, 31/4 in, belt, lathes: No. 2, 2,000 revolutions, 4 inch belt, lathes; No. 3, 2,800 revolutions, 4 inch belt, circular saw, 12 inches diameter? A. Multiply the speed of the belt in feet per minute, by the width of the belt in inches. and divide by 600; the quotient is the horse power the
- (15) E. G. McD. asks: Would you consider lightning rod, on a frame building, which is run into a rain water cistern (say 10 feet deep in the ground), a good protection? Of course the lower end of the rod would be under water always. A. In order to make a lightning rod really safe, the bottom of the rod should have a large conducting surface connected with the earth or with water in the earth. Simply dipping the lower end of the rod for a short distance into the water is not sufficient. For example, if the rod is one inch square, and extends one foot into the water, you have a conducting surface of only 49 square inches in contact with the water. This is not enough. If it were 49 square feet of conducting surface, that would be better. One of the best of all ground connections is to have the bottom of the rod soldered to the exterior of an iron water pipe that extends a few hundred feet under ground. In this way a conducting surface of great extent is obtained, and comparative safety secured.
- (16) J. L. writes: Your answer to querist how to cut glass tubes for gauges, I think I can tell you a better way. Lay the glass on a pen rack or anything so it can be revolved, and scratch it with a file, and then blow with a blow pipe a flame upon it until it is quite hot, and then blow cold, and it will snap off right where it was marked every time.
- (17) D. J. writes: 1. I have an engine 31/2 x134. What size force pump would it work? A. Area of pump piston about one-third area of steam piston, if of same stroke. 2. What size should I make the air chamber? A. 8 to 12 times the capacity of pump. 3. From what depth would it suck water and about how high would it throw water? A. 20 to 24 feet suction. height depends upon the size and form of delivery nozzle. 4. What size should the feed and discharge pipes of the pump be? A. About three-fourths the area of pump piston. This thing would be of no use as a fire
- (18) C. E. R. asks: How much cold water pressure do I want to give a boiler to carry 75 lb. steam using same steam gauge in both cases; in other words, what proportion, or is there any rule? A. By government rule, 113 lb. Steam pressure allowed is two-thirds the cold water test pressure. 2. I amusing a steam engine, 12x30, with a lead the thickness of writing paper. It will not cut off till the crank has traveled within two inches of next center. How can I change it? A. If the engine is to work at a high velocity, give one-eighth inch lead, and if you wish to cut off shorter, give the valve more lap, say one-half inch. 3. Will it give any more power by cutting off sooner? No, but you will work with more economy. 4. I am not getting power enough now; my boilers are scaled bad. What is the best way to rid of the scale and keep them clean? A. Heat the water to the boiling point before forcing it into the boiler.
- (19) L. F. T. writes: In your answer, April 0, page No. 234, question 4, you did not say how I should apply the hydrofluoric acid in glass engraving.

 A. After waxing and cutting the design, place the plate face downward over a warm shallow leaden tray partly filled with powdered fluorspar thoroughly moistened with strong oil of vitriol (sulphuric acid) for half an
- (20) A. F. S. L. asks: What is the fastest time ever made by a locomotive engine? A. For a considerable distance, about 60 miles per hour; for short run, 75 miles to 86 miles.

MINERALS, ETC.—Specimens have been reoutside walls, and run from close under the cellar ceil- ceived from the following correspondents, and examined, with the results stated:

> N. C. F.-1. Clay iron stone. 2. Quartz and slate. 3. Orthoclase-feldspar. 4. Quartzose rock. 5. Quartz, hornblende and mica. 6. Mica slate 7. Principally hornblende. 8. Sandstone with molybdenite. 9. Sandstone 10. Granite. 11. Oolitic limestone. 12. Limestone pebble. Nos. 4 and 5 may carry a little silver .-R. D. McC.—1 and 5. Chiefly quartz. 2 and 6. Altered feldspar and limonite. 3. Quartz and obsidian. 4. Limonite. 7. Metallic lead (button). Some of these may contain small quantities of silver; an assay would be necessary to settle this point.—S B.-It consists chiefly of copper and iron sulphides and carbonates, probably carrying silver. If the sample is representative of the body ore, the property is likely to prove a valuable one -N. P. F.-A variety of syenite-feldspar, hornblende, and quartz. The specimen contains a small quantity of graphite (blacklead).—E. G. A.—1. Magnetite.--2. Argillite and iron pyrites. 3. Limonite 4. Chiefly feldspathic rock.

COMMUNICATIONS RECEIVED. Why the needle points northerly. By E. W. On Capillarity. By G. H. S.

[OFFICIAL.]

INDEX OF INVENTIONS

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

June 15, 1880,

AND EACH BEARING THAT DATE

[Those marked (r) are reissued patents.]

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

Adjustable seet dost etc. I & Pobinson

real and the second acceptance of the second control of the second	
Alloy plating, aluminum, J. S. Howard	228,900
Alumina, bauxite, etc., purification of, W. Chad-	
wick et al	228,867
Amalgamating apparatus, P. G. L. G. Designolle.	228,806
Amalgamating metals, P. G. L. G. Designolle	228,970
Ash pan and sifter, combined, S. Fink	228,749
Awning, blind, L. T. Seaver	228,784
Axle box, car, A. L. Anderson	228,720
Bag holder and truck, comb'd, H. M. Curtis et al.	228,733
Baking apparatus, C. Haffcke	228,753
Bale tie, E. S. Lenox	228,767
Baling press, R. P. Davis	228,876
Ball trap, M. Warne	228,959
Barrel swinging device, W. C. Rudd	228,941
Barrel washer, G. Schock (r)	9,259
Bath tub, H. Arnd	229,722
Bed bottom, spring, S L. Stockberger	228,789
Bedstead fastening, F. S. Clarkson	228,728
Beehive. A. Barnhart	228,801
Bell, electric signal, H. Amory	228,851
Bevel, E. A. Johnson	228,903
Binder, temporary, C. Richardson	228,931
Bit brace, A. D Goodell	228.811
Bit brace, ratchet, A. D. Goodell	
Blotter, W P. Dodson	228,808
Bolting apparatus for flour mills, L. Gathmann	228,751
Book, blank, J. C. Bonnell (r)	
Books with wire staples, machine for binding, W.	
L. Coop	

Bottling or canning substances, apparatus for, P.

 Bottling or canning substances, apparatus for, P.
 228,828

 Miles.
 228,723

 Bracelet, Barbier & Maloubler
 228,723

 Bracelets, chain fabric for, W. C. Edge
 228,746

 Braid, etc., holder, W. P. Deane
 228,890

 Brick fire, A. E. Hunt
 228,969

 Bridke brow band, J. F. Day
 228,872

 Buckle, harness, Collins & Penniman
 228,872

 Bung bush, G. B. Cornell
 228,731

 Burial casket, Powers & Walker
 228,836

 Burglar alarm, Terry & Dyke
 228,954

 Cake stirrer, E. J. McClellan
 228,914

 Cake stirrer, E. J. McClellan..... 228,914 Calipers and dividers, W. H. Warren 223,95' Cant hook ferrule, A. Sanford 228,94'

 Cap, heat producing, G. L. Witsil
 228,796

 Car brake, railway, C. Gentil
 228,752

 Car coupling, C. J. R. Ballard
 228,855

 Car coupling, S. B. Nickum.....

Car coupling, W. Tucker. 228,956 Car, grain, W. S. Hanson 228,814

Car mover, G. H. Bronson..... 228,726
 Car, stock, F. Rieber
 228,93

 Carpet lining, R. A. Denison
 228,73
 Cartridge packing case, E. G. Parkhurst 228,926

Carving fork, J. D. Frary.....

 Chain, J. M. Dodge
 228,785

 Chain, drive, W. D. Ewart (r)
 9,256

 Clock striking mechanism, G. W. Hendrick 228,895
 Clothes pounder, W. B. Wickes
 228,846

 Clutch for rolls, U. Haskin
 228,893

 Coal hod, hooded, H. Symonds
 228,952

 Coffee and nut roaster, W. E. Vernon (r)
 9,260

 Coffee pot, V. W. & L. S. Blanchard
 228,862

 Coffee, preparing extract of, Gue & Grant
 228,889
 Collar, horse, F. C. Scott 228,945

 Collar, norse, F. C. Scott
 220,334

 Condenser, C. B. Lee
 228,909

 Condiment compound, G. Holland
 228,898

 Corset, E. W. Bigelow
 228,725

 Cot, folding, Murray & Baker
 228,775, 228,920

 Door check, L. C. Norton
 228,776

 Door spring, G. Bauman
 228,856

 Dynamometer, electro, A. E. Dolbear
 228,809

Farm gate, J. A. Henry 228,896

rarm gate, J. A. Henry	220,090	
Faucet, P. Doran	228,736	5
Faucet, A. E. Spencer	228,950	8
Faucet. self-closing, J. C. Miller	223,917	5
Feed water heater, E. L. Morse	228,831	8
Feed water heater, J. Rhule, Jr		5
Fence, J. W. Hammett	228,891	5
Fence, portable gate, F. Villard	228,844	5
Filter, Willsey & Shiverick	228,794	5
Firearm, magazine, A. Pease	228,778	5
Firearm, revolving, W. H. Bell, Sr	228,859	
Firearms, B. 11. Williams (r)	9,261	5
Fire escape, G. Lockhart	228,822	8
Fireworks, device for lighting, E. S. Hunt	228,760	5
Fishing basket, folding, F. L. Sheldon	228,948	
Fishway, W. H. Rogers	228,936	
Forging eyes on the ends of rods, die for, C. Lanz	228,907	8
Fruit drier, G. Sikes		8
Evaporator, J. B. Sweetland		
Fruit jar lifter, E. A. Case		'

 Gas cleaning apparatus, M. Kennedy
 228,765

 Gate, D. H. Wolfe
 228,966

Gate hanger, W. A. Sharpe 228.785

 Gate pivot, F. N. Still
 228,951

 Governor, steam, W. R. Michener
 228,772
 Grindstone tool ho'der. L. Young 228,849
Gun. machine, E. G. Parkhurst 228,777

Harvesting machine, H. F. Shaw..... 228.78

Hatchway guard, W. I Ely 228,747

Gas apparatus, J. S. Wood

	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	••
	Hatchway guard, G. Parker	228,92
	Hay rake, horse, G. M. & C. C. Richardson (r)	
	Head block, A. Rodgers	
	Hides, machine for ascertaining the area of, J. S.	
	Wentworth	
	Hoisting and dumping apparatus, C. A. Haring	
·e	Holding tool, J. S. Firch	
	Horseshoe nail machine, L. W. Whipple	
	Hub, vehicle wheel, L. Rossiter	
	Hydraulic multiplier, E. D. Meier	998 77
	Jar, N. Rogers	
c.	Kneader, dough, L. Durand	
	Knit fabrics, machine for uniting, W. Beattie	
_	Label holder, J. Henderson	
y	Lamp cap, R. A. Coit	
d	Lead and crayon holder, J. Hoffman	228,89
	Leather, ornamentation of, A J. Burkett	228,72
l-	Letter box, T. R. Lowerre	228,911
ıe	Lifting jack, D. H. Morrison	228,830
w,	Lime juice, preparation of, J. & T. D. Douglas	229,881
ts	Liniment, D. Collins	228,870
	Liquids, apparatus for drawing effervescent, T.	
i-	Lieb	228,910
	Locket, O. Johanson.	
40	Loom shuttle, J. K. Smith	
00	Lubricator, Hardy & Dibble	
ω,	Mail box, J. Sherriff (r)	9,259
67	Measuring tank and cock, liquid, G. W. Aldrich	
06	Measuring tank, fluid, S. M. Cawker	
70	Mechanical movement, W. J. Perkins Metallurgical furnace, E. Savage	999 044
49	Milk cooler, C. C Haynes	
84	Millstone driver, J. R. Reynolds	
20	Motion, machine for converting horizontal into	
83	rotary, G. W. Richardson	
53	Mower, Gunnels & Shives	
67	Mower attachment, lawn, C. G. Baldwin	
76	Music chart, G. S. Rice	
59	Musical instrument insulator, C. S. Weir	
41	Noise muffler, E. D. Eames	228.744
59	Nut for screw bolts. A. T. Huff	228,816
22	Nut lock, C, R. Whitman	228,964
89	Ore concentrator, J. McColl Oven, smelting, R. P. Wilson	228,91
28		
01	Overshoe, rubber, T. J. Mayall	
51	Pamphlet trimmer, J. F. Withey	228,795
03	Paper fringing machine, S. Garrett	228,750
31	Paper, manufacture of perforated and scalloped,	
11	L. H. Rogers	
10 08	Paper pulp, and process and machine for pro-	
51	ducing the wood fiber, wood fiber for, P. H.	000 000
10	Holmes	228,899

11 de loca, Ci 10 11 miliana 11 m	***
Ore concentrator, J. McColl	228,91
Oven, smelting, R. P. Wilson	228,79
Overshoe, rubber, T. J. Mayall	228,76
Pamphlet trimmer, J. F. Withey	228,79
Paper fringing machine, S. Garrett	228,75
Paper, manufacture of perforated and scalloped,	
L. H. Rogers	228,93
Paper pulp, and process and machine for pro-	
ducing the wood fiber, wood fiber for, P. H.	
Holmes	228,89
Peach stoner, W. R. Sherman	228,94
Pencil package, E. Weissenborn	228.96
Pencil sharpener, E. E. Norton	228,92
Pianoforte bass pedal, A. Wiesbauer	228,96
Pianoforte damper attachment, C. Mahling	2.28,91
Pianofortes, stringing, B. Dreher	228,73
Plane gauge, bench, C. Kinney	228,76
Planter, potato, Jones & Stewart	228,90
Plow, G. W. Gammill	228,88
Plow, J. Hafner.	228,81
Plow, N. C. Orrick	228,83
Plow attachment, E. R. McCall	228,91
Pool ball frame, S. De Gaetano	2:28,87
Pottery, glazing, B. Morahan	228,77
Pottery ware, finishing tool for, B. Morahan	228,77
Preserving fruit, etc., compound for, G. A. Cutler	228,80
Printing machine sheet delivery apparatus, W.	
Scott	228,78
Railways, automatic switch for wire rope, J. W. C.	
D1:1-3	000 00

1 Ottery, glazing, D. Morahan	200,110
Pottery ware, finishing tool for, B. Morahan	228,774
Preserving fruit, etc., compound for, G. A. Cutler	228,804
Printing machine sheet delivery apparatus, W.	
Scott	228,782
Railways, automatic switch for wire rope, J. W. C.	
Rhind	228,932
Razor, C. D. Moody	228,829
Razor, safety, F. & O. F. Kampfe	228,904
Reclining chair, J. Clough	228,869
Refrigerater, E. H. Hughes	228,759
Rendering fats, process and apparatus for, W. E.	
Andrew (r)	9,254
Ricecleaner, G. H. Stein	228,788
Rock drilling machine, J. Wood	228,797
Rolling metal, roll for, R. C. Totten	228,842
Rolling mill, S. P. M. Tasker	228,841
Roofing and paving material, C. M. Warren	228,960
Rosette, W. P. Greenwood	228,887

Sad iron heater and receptacle, J. F. Curtice 228,732

 Sad ron neater and receptacie, J. F. Curtice
 228,732

 Salve, J. Bemis.
 228 724

 Sand band, F. M. Hurtle
 228,761

 Sash fastener, L. D. Cleaveland
 228,729

 Saw, rotary cut-off, L. W. Green
 228,836

 Scales, weighing, Vincent & Johnen 228,843 Screw tap, T. A. Fleming 228,882 Seeding machine, J. W. Mann 228,913

..... 228.850

 Shawl strap, M. Rubin
 229,92

 Sheet metal pan, A. Cox (r)
 9.250

 Shingle cutting machine, W. Goldie (r)
 9,251
 9,257
 228,803

	Sled for hauling fodder, W. H. Woods 228,967	1
	Sleeve, A. J. Tower 228,790	١
	Smelting furnace, N. Armstrong et al	1
ļ	Smelting furnace, ore. D. W. Jansen 228,818	1
	Soldering machine, can, W. D. Brooks 228,864	1
	Spark arrester, K. F. W. Neuhaus 228,922	ı
	Spark arrester for car windows, G. Williams 258,847	1
	Spinning machine flier, J. F Foss 228,809	۱
	Square and level, combined, D. Masten 228,768	;
	Steam boiler, G. J. Scott 228,783	:
	Steam brake, C. Lewis	
	Steam trap, E S. Newton 228,833	3
	Stove, C. Fulton (r)	2
١	Stove, lamp, J H Irwin 228,762	1
į	Stove pipe. W C Freeman 228,883	:
	Stoves, plated ornament for, J. Naylor, Jr 228,921	1
	Stuffing box. T Walker 228,957	1
•	Swinging gate, N 11 Long 228,823	3

8,921 Telegraph sounders circuit equalizer for, T.
 Cochran
 228,871

 Telephone, mechanical, W. J. Hutchins
 228,817
 Telephone receiver, Lockwood & Bartlett
Telephone transmitter, Lockwood & Bartlett

228,824, 228,826 Tobacco treating apparatus, P. H. Ma yo......228,770

1		
Toy, whistling, J. Chaskel (r)	9,255	
Truck frame, spring, J. Roemer	222.781	
Truck, piano, W. F. Beck	228,857	
Trunk, W. H. Bell, Sr		
Tubes, manufacture of, J. H. Seaman		
Umbrella, D. Harris		
Undergarment, T. B. Farrington		
Vacuum brake apparatus, F. W. Eames228,740,	228,741	
Vacuum brakes, air ejector for, F. W. Eames	228,742	
Vacuum brakes, drip cock valve for, E. D. Eames	228,745	
Vacuum brakes, ejector for, F. W. Eames		
Vehicle baggage attachment, E. J. Osborne		
Vehicle wheel, J. F. Darby		
	,	
Velocipede, Langmaak & Strieff		
Wagon brake, J. Riddlesberger		
Wardrobe, O. C. Morse	228,919	
Well drilling machine, R. M. Downie	228,737	
Wire twister, D. A. Kilmer	228,905	
Wood bending machine, F. Denninger		
Wrench, R. Hayden.		
Wrench, J. A. Mell		
Zinc, apparatus for treating, R. Wiester	228.965	

DESIGNS

Chain link, ornamental, D. A. Beam	11 994
Lamp bracket, F. R. Seidensticker	
Overshoes, C. A. Ensign	
Scarf pin, military, Case & Riker	
Spoon and fork handles, G. Gill	11,822

TRADE MARKS.

	Boots, L. B. Mantonya	7.94
1	Cigars, Muhn & Brandfass	7 94
	Cigars, cigarettes, and smoking tobacco, !I. Seiden-	•
ı	berg	7,94
ĺ	Hats felt Crofut & Knapp	7 04

English Patents Issued to Americans.

From June 4 to June 15, 1880, inclusive

Air engines, J. A. Woodbury et al., Boston, Mass. Colored glass windows, J. A. Farge, Newport, R. I. Compound explosive, R. H. Dimock, New Haven, Conn Diving bell, C. F. Pike, Philadelphia, Pa. Lacing hooks for boots, M. Bray, Newton, Mass.

Locomotive engines, J. B.; & G. B. Smith, Dunmore, Pa. Lubricating mechanism, C. J. A. Dick, Philadelphia, Pa. Metallic alloys, manufacture of, C. J. A. Dick, Phila., Pa. Paper pulp, manufacture of, C. & H. A. Chapin, Springfield, Mass.

Railway switch, J. S. Williams, Riverton, N. J. Rivets, manufacture of, M. Bray, Newton, Mass. Rotary steam engines, H. Thibault et al., N. Y. Sewer gas, Preventing, entering buildings, A. F. Pfleig haupt, Brooklyn, N. Y.

Spring for railway carriages, A. Middleton, Phila., Pa. Timber cutting machine, D. R. Proctor, Gloucester, Mass. Vehicle hand propeller, A. Vick et al., Mt. Carmel, Conn. Velocipedes, N. S. C. Perkins, Norwalk, Ohio. Vessels, construction of and propelling, A. Olsen

Ephraim, Utah.

Water closet trap, J. E. Folk, Brooklyn, N. Y.

Adrertisements.

Inside Page, each insertion --- 75 cents a line. Back Page, each insertion --- \$1.00 a line. (About eight words to a line.) Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thurslay morning to appear in next issue. For the publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

PROPOSALS FOR MAIL LOCKS AND KEYS.

POST OFFICE DEPARTMENT,

POST OFFICE DEPARTMENT,

WASHINGTON, D. C., June 22, 1880.

In compliance with a provision in the law entitled "An Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1831, and for other purposes," approved June 11, 1880, requiring a re-advertisement for proposals for Mail Locks and Keys, notice is hereby given that SEP ARATE SEA LED PROPOSALS will be received at this Department UNTIL 12 O'CLOCK NOON, ON THE SECOND DAY OF AUGUST, 1880, for furnishing five new and different kinds of Locks and Keys for the sole and exclusive use of the United States mails, including, besides those to be used for mail bags, such as are to be used on the street letter-boxes of the United States.

As the nublic exposure of the surface of the

united States.

As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of all such locks and keys for the purposes of the mails, the Postmaster General prescribes no models or samples for bidders, but relies for a selection on the mechanical skill and ingenuity which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

Proposals, with samples, will also be received at the same time, for Safety Chains for Mail Keys.

Specifications of conditions and requirements as to proposals, samples, kinds and quantities, contracts, etc., as of the proposal, will be furnished on application. No proposal will be considered, unless it shall have been submitted in accordance with such specifications and forms.

The Contracts which may be made will be in conformity.

The Contracts which may be made will be in conformity to the specifications and the accepted proposals.

D. M. KEY, Postmaster General.

BECKER'S PATENT WASHING MACHINE IMPROVED



\$15,000 worth sold in ten months. \$25 will be paid any one who will wash one shirt will wash one shirt clean in the same time thr eare wash-ed with this machine. Machines shipped on trial to any address. Special rates to deal-ers. Challenge com-petition. LEANDER BECKERT Sole Manufacturer, York, Penn.

WANTED-PARTIES TO MANUFACture Becker's Patent Washing Machine, Improved, on Royalty. The only mac in e having a perfect imitation of washing by hand. For terms, address LEANDER BECKER, York, Pa. No territory for sale.

*PERFECT

NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address

MUNN & CO.. PublishersScientific American



CIVIL. MECHANICAL, AND MINING ENGINEERING at the Reusselaer Polytechnic Institute, Troy, N. Y. The oldest engineering school in America. Next term begins September 16th. The Register for 1880 contains a list of the graduates for the past 54 years, with their positions; also, course of study, requirements, expenses, etc. Address DAVID M. GREENE, Director.

SCIENTIFIC AMERICAN SUPPLEMENT
Any desired back number of the SCIENTIFIC AMERICAN
SUPPLEMENT can be had at this office for 10 cents. May
also be had or ordered through booksellers and newsdealers everywhere. MUNN & CO., Publishers,
37 Park Row, New York.

AGENTS WANTED.—SEND 50 CENTS for sample, and receive by return mail myPatent Butter Tongs for handling roll butter without solling the hand or butter. AMMES H. TUCKER, Oak HIII, Me.

WANTED—A PARTNER WITH CAPITAL IN A valuable invention. Address G. D. ROBERTSON, Vienna, Dorchester Co., Md.

FOR SALE-PAT. POWER MORTISING CHISELS, Address J. D. BAXTER, Mechanicsville, N. Y.

Horse Dumping Hay and Grain Rake.
The most simple, durable, and thorough working Rake on the market. For sale on royalty or by territory. Fully covered by patent. Apply to WM. SOUTH or JNO. O. SMITH, Hagerstown, Md.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT. 116. Price 10 cents. To be had at this office and of all newsdealers.

A FIRM OF WIRE WEAVERS AND manufacturers in Canada, finding that they can, when under full work, overstock the country with goods, would like to learn or some line that they could manufacture, and thereby utilize their power and reduce expenses. Apply to WIRE, Box 773, New York.

THE BOARD OF WATER COMMISSIONers, of the City of Yonkers, invite sealed proposals for a pumping engine of 3½ million gallons capacity. Bid to be opened July 19, 1880. For particulars, apply to W. W. WILSON, Engineer and Superintendent Yonkers Water Works.

WANTED—A THOROUGHLY COMPE-tent man who understands steam and pipe and machine work, to act as salesman and to estimate on work in the South. Address A. B., Box 773, New York, giving address and references.



ists, Carpenters, Amateurs, Jewellers, Mode tc. Send for Catalogue, and state what kind TALLMAN & McFADDEN, 607 Market St., Philadelphia, Pa.

THE CONSTRUCTION OF CANVAS Canoes.—By W. P. Stephens. Complete descriptions and working drawings of two handsome and durable boats, designed for the benefit of those who do not care to got to the expense of a wooden canoe. and who prefer to build and equip their own craft. The larger boat in model is similar to the famous Patite Rob Rob, but is an improvement upon that. Dimensions: length, 14 ft; beam. 61 in; depth at bow. 12½ in; stern, 12 in; amidship, 9 in; draught, loaded, 5 in. The smaller boat is well suited for a boy, and will do for hunting, fishing, and cruising. It is very portable. Length, 12½ ft; beam, 26 in; depth, 12; 11½, and 8½ inches. By means of the detailed directions and drawings here given, any one with slight mechanical ingenuity, can construct for himself a boat which, with proper care in use, will prove very durable. Contained in SCHENTIFIC AMERICAN SUPPLEMENT, No. 216. To be had at this office and from all newsdealers.

■ AGENTS WANTED for the Enlarged Pictorial Edition of A OOL'S ERRAND By One Fools, Greatest Romance of American History since Uncle Cabin, to. which is added, by the same author,

The Invisible Empire.

Two Great Books in One Vol.; Brilliantly Illustrated.

"A thrilling book indeed."—Cincinnati Commercial. "Holds the critic spellbound." * * * English Hiterature conta ins no similar picture."—[International Review, "The most powerful national and social study since 'Uncle Tom's Cabin. '—Boston Courier. "If this book don't move men, then we have mistaken the American people."—[Chicago Inter-Ocean. "It will do more the courier. "If this provided in the courier of the c

Territory rapidly taken. For particulars and terms write at or FORDS, HOWARD & HULBERT, 27 Park Place, New York.

14 STOP ORCANS, SUB BASS and Oct. Coupler, 4 Reeds. \$65. Pianos, \$125 and upwards, sent on trial. Catalogue free. Address Daniel F Beatty, Washington, N. J.

To Business Men.

The value of the Scientific American as an advertising medium cannot be overestimated. Its circulation times greater than that of any similar journa now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circula-tion, it is worth \$4 per line to advertise in one of fortyeight thousand.

The circulation of the SCIENTIFIC AMERICAN is guaranteed to exceed FIFTY THOUSAND every week.

For advertising rates see top of first column of this page, or address

MUNN & CO., Publishers 37 Park Row, New York.

TAKE SOLID COMFORT

BY USING OUR NEW PATENT READER'S COT CHAIR.

Never equaled for piazza, lawn, mount in, beach, or steamer. Weighs less than many overcoats; as strong as a heavy all-wood chair; can't get out of order; packs to thickness of a board; is urgish, easy, or reclining chair, cot, or stretcher, as wanted; adjustable in five seconds to any of the five positions; gives the comforts of a \$20 chair for \$2. Call or send for full circulars.

READERS AND WRITERS ECONOMY CO., 27 Franklin St., Boston: 4 Bond St., N. Y.

STEAM PUMPS.

HENRY R. WORTHINGTON,

709 Market St., St. Louis, Mo.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

WORTHINGTON STEAM PUMPS of all sizes and for all purposes. 239 Broadway, N. Y. S3 Water St., Boston. 709 Market St., St. Louis, Mo.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

PATIENT OLD ROLL

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CPLEBRATED COLLINS' PAT.COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2d and 3d Avenues, Pittsburg, Pa.

190 S. Canal Street, Chicago, Ill.

3 tocks of this shafting in store and for sale by FUILLER, DANA & FITZ, Boston, Mass.

Geo. Place Machinery Ag:ncy, 121 Chambers St., N. Y.

THYSELF



THE HOLLY ZEAM HEATING. S.

The untold miseries that result from indiscretion in early life in any be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE; or, SELF-PRESER, NETVOUS and physical debility, or vitality impaired by the errors of youth, or too cose application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only \$4,\$, sent by mail, postpaid.

The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

The author refers, by permission, to Hon. P. A. BIS-SELL, M.D., prest, of the National Medical Association. Address Dr. W. H. PARKER, No. 4
Buifinch Street, Boston, Mass. The HEAL author may be consulted on all disease requiring skill and experience.

THE HOLLY STEAM HEATING CO. STEAM OF STEAM HEATING CO. LIMITED. SYSTEM OF STEAM HEATING COMBINATION CO. LIMITED. FOR CITIES AND VILLAGES HOLLYSTEATED AU IN LOCK PORT N. Y. LAST NUMBER.

TO BUILDERS OF WATER WORKS The City of Joplin, Missouri, having determined to provide a system of water supply for the protection of the city against fire, and for domestic and manufacturturing use, hereby invites proposals for the furnishing of the same. It is not proposed that the city shall erect and own the works, but shall grant proper franchises, and pay proper charges to a company which shall build, own, and operate the same and furnish the water supply. For the information of such, the following statement is made:

For the information of such, the following statement is made:

The source of water supply will be Shoal Creek, a never-failing stream of water, in every way satisfactory, distant from the city limits three and five-eighths miles. Distance from Shoal Creek to the summit where the reservoir would be hocated, two and three-quarters miles. Elevation of Summit above main street in the city, about thirty-five feet. Shoal Creek will supply a working head of about eight feet for forcing the water from the creek to the reservoir. Cross section of the stream at common stage about seventy feet.

There will be required about five or six miles of mains, and about fifty fre hydrants in the city limits.

The domestic consumption of water, and its demand for manufacturing purposes in Joplin will be exceptionally large, from the fact that there is now no water supply whatever, except that taken from mining shafts and brought by wagons to the consumer. The quality of this water is unit for domestic use or for use in steam boilers. Wells cannot be depended upon, owing to the great depth to which the ground is drained by mining shafts. The population of the city is about 10,000.

For further information, apply to the undersigned, to whom all proposals and communications shall be addressed.

J. P. NEWELLI, City Clerk, Joplin, Missouri.



Co., Limited, Syracuse.N.Y.

Co., Limited, Syracuse, N.Y.
G. G. TOUNG, Gen. Agt., 42 Cortland St., New York.

1880. Pittsburgh Exposition Society. THE FOURTH

EXPOSITION AND FAIR

will open to the public Thursday, September 2. and remain open day and evening (Sundays excepted) until Saturday, October 9th, 1890.

Blank forms of application for space, Prospectus, and Premium list may be had by addressing the secretary. Exhibitors are carnestly requested to make early application for space, thus enabling the managers to better arrange the whole Exhibition.

New Machinery Hall: new Engine and Boilers.

Manufardurers and Inventors should avail themselves of the unsurpassed facilities offered by this Exposition for the introduction of new machinery to the public.

Office, GERMANIA BANK BUILDING, 89 Wood St.

P. O. BOX 895. J. C. PATTERSON E. P. YOUNG. General Manager. Secretary.

JOHN D. BAILEY, Asst. Manager and Cashier.

BRASS WOLCOTTVILLE CONN. WIRE COPPER MATERIALS FOR METALLIC. AND IN SHEETS MMUNITION A SPECIALTY BLANKS

KEEP COOL!

WATKINS' FAN ATTACHMENT. Can be applied to any SEWING MACHINE. Will not increase labor. Will keep away files and dirt, and keep hands and face perfectly cool. Nickel-plated. Sent postraid on receipt of price, \$2.00. A. H. WATKINS, 29 HATTISON AVE., BOSTON, Mass. Send for circulars.

LARGEST ESTABLISHMENT OF THE KIND IN THE WORLD

MOSS

Incorporated April 2, 1880. Moss's New Process.

J. E. RAMSEY, Secretary. H. A. JACKSON, Ass't Secy.

535 PEARL ST., near Broadway, NEW YORK.

Important 10 Manufacturers and Publishers:

Important to Manufacturers and Publishers;

Engraved Plates for Newspaper, Book, and Catalogue Illustration executed in Type Metal in a superior manner by a new and improved Photo-Chemical method, from all kinds of Prints, Pen Drawings, Photographs, Tintypes, original Designs, Pencil Sketches, and when available from the object itself. Much cheaver than wood cuts These plates are mounted type high ready for use on any ordinary press, and are guaranteed to be fully equal to the best wood cuts. Electrotypes can be made from them in the usual manner. We also have a fully equipped steam electrotyping department. Engravings of Portraits, Landscapes, Buildings, Machinery, and miscellaneous engraving of all kinds executed in the highest style of the art at reasonable prices.

Mr. J. C. MOSS in withdrawing from the Photo-Engraving Co., 67 Park Place, has retained for himself all improvements made and used by him in Photo-Engraving since May, 1872.

Our motto is: "The best work at low prices, always on time. Send stamp for illustrated circular. Send copy for estimate. Please mention this paper.

Special.—Just issued a circular of Portraits of Presidential Candidates, five sizes. Send Stamp. Plates for Sale.

SPARE THE CROTON AND SAVE THE COST Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.



SHEPARD'S CELEBRATED 📽 \$ 50 Screw Entling Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band, Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. I., SHEPARD & CO., 331, 333, 335. & 337 West Front Stree Cincinnati, Ohio.

EXTRA BARGAINS.

Town rights, \$10; county, \$25. Best novelty yet manufactured. If you want to make money, address, with stamp,

J. H. MARTIN, Hartford, N. Y.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS. Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.

New Haven, Conn.

Lathes, Planers, Drills, &c.

For steep or flat roofs Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free.

Agents Wanted. T NEW 32 John Street, New York.



The attention of Architects, Engineers, and Builders is called to the great deciline in prices of wrought STRUCTURAL IRON.

It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

ROOFING.

RUBBER BACK SQUARE PACKING. BEST IN THE WORLD.

For Packing the Piston Rods and Valve Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.

A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.

This Packing is made in lengths of about 20 feet, and of all sizes from 1/4 to 2 inches square.

JOHN H. CHEEVER, Treas. NEW YORK BELTING & PACKING CO., 37 & 38 Park Row, New York.

•JOHN R.WHITLF:Y & CO.
European Representatives of American Houses, with
First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry,
E.C. Paris, 8 Pace Vendôme. Terms on application,
J. R. W. & Co. purchase Paris goods on commission at
shippers' discounts.



The 1876 Injector.

Simple, Durable, and Reliable. Requires no specia valves. Send for illustrated circular. W.M. SELLERS & CO., Phila.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators.
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.



Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)

PUMPS. THE NORWALK IRON WORKS CO.,

SOUTH NORWALK, CONN



ET PLUNGER STEAM PUMPS. FOR EVERY DUTY. VALLEY MACHINE CO., EASTHAMPTON, MASS.



Trow City Directory for 1880--81,

PRICE \$6.
WILSON'S BUSINESS DIRECTORY (second edition), price \$3, and WILSON'S CO-PARTNER-SHIP DIRECTORY, price \$5, are now ready.
ALL ORDERS addressed to the Trow City Directory Company, No. 11 University Place, New York, promptly attended to.

MOSQUITO CATCHER. Will clear your room in a few minutes without smoke, soil, or grease. Price 50 cents. Send for circular. Agents wanted everywhere. Good terms. L. T. JONES, 166 Light Street, Baltimore, Md.

Pond's Tools,

Engine Lathes, Planers, Drills, &c. DAVID W. POND, Worcester, Mass.

Delamater Steam Pumps, WATERWORKS PUMPING ENGINES. DELAMATER IRON WORKS,

Boiler Makers, Engine Builders, and Founders,

Office, No. 10 CORTLANDT ST., Works, Foot of W. 13th St., North River, New York. ESTABLISHED 1841.

Leffel Water Wheels, With recent improvements. Prices Greatly Reduced. 8000 in successful operation. FINE NEW PAMPHLET FOR 1879, Sent free to those interested.





ROOTS' NEW IRON BLOWER.





POSITIVE BLAST. IRON REVOLVERS, PERFECTLY BALANCED IS SIMPLER, AND HAS

FEWER PARTS THAN ANY OTHER BLOWER. P. H. & F. M. ROOTS, Manuf'rs, CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St. 8 Dey Street, WM. COOKE, Selling Agt., 6 Cortlandt Street, JAS. BEGGS & CO., Selling Agts., 8 Dey Street, SEND FOR PRICED CATALOGUE.



HOLCOMB'S Automatic Telephone, Patented in U. S. and Canada.

Works 1 mile, secures great clearness and volume of tone. Best in use. Price \$4 per set. HOLCOMB & CO., Mallet Creek, O.

MAHOGANY,

Rosewood, Satinwood. French and American Walnut, Ash, Red and Spanish Cedar, Cherry, Oak, Poplar, Maple, Holly, etc., in Logs, Planks, Boards, and Veneers. Sole manufacturers perfectly smooth and thoroughly

CUT THIN LUMBER.

Send for catalogue and price list.

GEO. W. READ & CO.,



Shafts, Pulleys, Hangers, Etc.

WM. SELLERS & CO., 79 Liberty Street, New York.



CAVEATS, COPYRIGHTS, L. REGISTRATION, E.C.

Messrs. Munn & Co., in connection with the publication of the Scientific American, continue to examine Improvements, and to act as Solicitors of Patents for

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have unequaled facilities for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents .- We also send, free of charge, a Synopsis of Foreign l'atent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five paterts-embracing Canadian, English, German, French, an | Belgian-will secure to an inventor the exclusive monopoly to his discovery among about one HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is \$75; German, \$100; French, \$100; Belgian, \$100; Canadian, \$50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 20, 1866, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the l'atent Office commenced printing the draw ings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsome!y bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address MUNN & CO.,

37 Park Row, New York.

BRANCH OFFICE—Corner of F and 7th Streets,
Washington, D. G. Publishers SCIENTIFIC AMERICAN

Advertisements.

Inside Page, each insertion - - - 75 cents a line Back Page, each insertion - - - \$1.00 a line.

(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.



PAINTERS attention: send for circulars, etc. ofnny latestMetallie Plates for graining oak, walnut, chestnut, ash, etc. in the most rapid and excellent manner, noskill required. J. i. Call.low, Cleveland, O.

TO INVENTORS

The 49th Exhibition of the American Insti-tute will open September 15. Heavy machinery will be received August 23; other goods, Sep-tember 6. For blanks and information, address

GENERAL SUPERINTENDENT,

AMERICAN INSTITUTE, NEW YORK CITY.

WANTED,
A second-hand 4 ft. Turbine Water Wheel. Must be in good running order. Address P. O. Box No. 21, Post Mills, Orange Co., Vermont.



DO YOUR OWN Printing \$3 PRESS prints
&c. (Self-inker \$4) Larger aizes for larger work. For
lider young. Great money sweet. A paying business
anywhere for all or sparee time. Send two stamps for a
catalogue of all sizes Presses, Type, Cards, Paper. &c.,
to the Manufacturers KELSEY & CO., Meriden, Conn.

WANTED.

Competent and experienced foreman for machine shop engaged mostly on mill machinery. Address, with references.

JOHN T. NOYE & SONS BUFFALO, N.Y.

FOR THE BEST

Belting, considering both quality and price as proved by all users of the largest and heaviest belts in the country, send for particulars and price list to the

NEW YORK BELTING AND PACKING CO., 37 and 38 Park Row, New York.

The Asbestos Packing Co.,

Miners and Manufacturers of Asbestos,

BOSTON, MASS.
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,

LOOSE "
JOURNAL " WICK MILL BOARD, SHEATHING PAPER

FLOORING FELT. CLOTH.



Pictet Artificial Ice Co., Limited, P.O. Box 3083. 142 Greenwich St., New York. Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

FRIEDMANN'S PATENT INJECTOR,

BOILER FEEDER

In the world. Simple, Reliable, and Effective.

40,000 IN ACTUAL USE. NATHAN & DREYFUS,

NEW YORK. Sole Manufacturers, Send for Descriptive Catalogue.

LIQUID PAINTS, ROOFING, BOILER COVERINGS, Steam Packing, Sheathings. Fireproof Coatings, Cements SEND FOR SAMPLES, ILLUSTRATED PAMPHLET, AND PRICE LIST.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Ma-hines, Packers, Mill Picks, Water Wheels, Pulleys, and earing specially adapted to Flour Mills. Send for J. T. NOYE & SONS, Buffalo, N. Y.

TELECRAPH and Electrical Supplies. C. E. JONES & BRO., CINCINNATI, O.

PERA and FIELD GLASSES of the greatest power combined with portability and low prices. Send for illustrated catalogue to R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa.



J. STEVENS & CO.,
P. O. Box 2S, Chicopee Falls, Mass.
Manufacturers of Stevens' Patent BreechLoading Sporting and Hunters' Pet Rifles,
Single and Double Barrel Shot Guns,
Pooket Rifles, Pocket Shot Guns, Callery
Rifles, Superior Spring Calipers and Dividers including the New Patent Coil Spring
Calipers; also Double Lip Countersinks and
Hathaways' Patent Combination Gauge.

Patent "AIR SPACE" Method. ASBESTOS MATERIALS,

The description of the manufacture of Kingsford's Corn Starch and PREPARED CORN, as carried on at the Oswego Starch Factory, printed on page 34 of this paper, and note with what unequaled facilities and with what thorough system the business of this immense establishment is conducted. The first factory of the kind in the world, as it is the largest, and the nearest to the great grain-producing area of the Continent, its productions have always been admitted to stand at the head of their class, as is abundantly proved by the enormous demand they have had for years. Kingsford's Oswego Corn Starch and Prepared Corn are now regular articles of export, and have an established reputation in all the markets of the world.

READ

what is said of these preparations by scientists of universally acknowledged distinction:

I have made a careful chemical analysis of Kings-FORD'S OSWEGO PREPARED CORN, handed to me by Mr. E. C. Chapin, agent, New York, and find such to be of the purest and best description, and when prepared according to the directions, with milk, etc., to be an ex-cellent article of diet. It is fully equal in chemical and feeding properties to the best Arrow-Root.

STEVENSON MACADAM, Ph.D., etc.

Lecturer on Chemistry.

THE ANALYTICAL SANITARY INSTITUTION, 14 JOHN ST., ADELPHI,

14 JOHN ST., ADELPHI,

LONDON, September 14, 1874.

I have subjected to microscopical examination and chemical analysis a sample of Kingsford's Oswego Prepared to that it consists entirely of the starchy portion, in the form of innumerable granules, of the grain of Indian Corn, free from the oil, gum, and nitrogenous products contained in the whole grain.

That it has been very carefully prepared is shown by its color and by the absence of cellulose and albuminous compounds.

The article is in fact to be regarded both chemically and dietetically as an arrow-root, and it should therefore, especially when used as a food for infants and young children, be given either in conjunction with milk or beef tea, in order to make up for the deficiency of nitrogen. Indeed such farinaceous articles are usually thus administered.

It may be remarked of this preparation, with which I

hus ādministered. It may be remarked of this preparation, with which I

ANALYTICAL LABORATORY,
SURGEON'S HALL,
EDINBURGH, July 20, 1874.
all chemical analysis of KINGSARED CORN, handed to me by
New York, and find such to be

Bare to be deen acquainted for many years past, that it is
earefully prepared, very pure, and that, taken in the
manner described, it constitutes a valuable article of
eit.
Arthur H. HASSALL, M.D.
Arthur H. HASSALL, M.D.
Detected," editor of "Food, Water, and Air."

ROYAL COLLEGE OF SURGEONS, STEPHENS GREEN, DUBLIN, **OCTOBER 21, 1876**

I have submitted to careful trials MESSRS. KINGS-FORD & SON'S OSWEGO "SILVER GLOSS" STARCH, and have satisfied myself that it is a most excellent article for the purposes for which it is applied. It is extremely white, gelatinizes strongly from a translucent mixture with water, and a small quantity of it does much work in stiffening linen, calico, and similar fabrics.

CHARLES A. CAMERON, M.D., F.R.C.S.I., Prof. of Chemistry and Hygiene to Royal College of Surgeons, Medical Office of Health, and Analyst for Dublin.

PARIS, Sept. 14, 1875.

I have subjected to microscopical and chemical analysis a sample of starch handed to me by Mr. KINGSFORD, under the name of "KINGSFORD'S PURE AND SILVEE GLOSS TARCE."

The double analysis has proved to me that this product of an extraordinary beauty and perfect whiteness is composed of amplaceous matter, perfectly pure, and obtained without any CHEMICAL PREP ARATION.

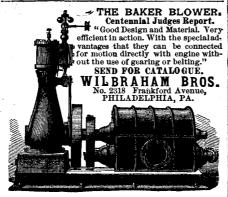
In testimony whereof, I have signed these presents. Signed, ED. LANDEIN,
Director of the Laboratory of the "Union Nationale," Professor of Chemistry at the "Chaptal College," and at the Special School of Architecture, Paris.

MACKINNON FLUID PENCIL. Particulars mailed Free.



DOGARDUS' PA'TENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oll Cake, Feed, Corn, Corn and Cob, Tobacco, Snun, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills, Also for Paints, Printers' Inks, Paste Blacking, etc., JOHN W. THOMSON, successor to JAMES BOGAR-DUS, corner of White and Elm Sts., New York.

FOOT PRESSES.
STILES & PARKER PRESS CO., Middletown, Conn



HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W.B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't. J. B. PIERCE, Sec'y.

WM. A. HARRIS.
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE

With Harris' Patented Improvements, from 10 to 1,000 H. P.



WOOD SOLE SHOES,
The cheapest, most durable,
warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers,
Miners, and all classes of laborers. Send stamp for circular
and price list.
CHAS. W. COPELAND. CHAS. W. COPELAND, 122 Summer St., Boston, Mass

MACKINNON PEN CO.,

BUY NO BOOTS OR SHOES
Unless the soles are protected from wear by Goodrich's
Bessemer Steel Rivets. Guaranteed to outwear any other
sole. All dealers sell these boots. Taps by mail for 50
cents in stamps. Send paper pattern of size wanted.
H. C. GOODRICH, 19 Church St., Worcester, Mass.

WANTED.—FIRST-CLASS PARTIES IN cities to sell Wing's Fan Ventilators. A great success. Rare chance to make money. See SCI. AM., Jan. 31, 1880, or send for pamphlets, etc. L. J. WING, or THE SIMONDS MFG. Co., 50 Cliff Street, New York.



A PLANING MILL OUTFIT FOR SALE very low for cash. Will sell all together or each machines separate. All first-class machines, good order.

J. H. KERRICK & CO., Indianapolis, Ind.

The George Place Machinery Agency Machinery of Every Description. 121 Chambers and 103 Reade Streets, New York.

The Rodier Patent Single Iron Plane.



Made of extra quality 1 on. A practical laborsaving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address J.AFLIN MANU-FACTURING CO., North Elm Street, Westfield, Mass.

EMERY WHEELS and CRINDING MACHINES.



THE TANITE CO., Stroudsburg, Monroe County, Pa

Orders may be directed to us at any of the following addresses, at each of which we carry a stock:

London, Eng., 9 St. Andrews St., Hol- Liverpool, Eng., 42 The Temple, born Viaduct, E. C. Sydney, N. S. W., 11 Pitt St. Chicago, 152 and 154 Lake St.

Cincinnati, 212 West Second St. Indianapolis, Corner Maryland and Louisville, 427 West Main St. New Orleans, 26 Union St.

Dale St.

San Francisco, 2 and 4 California St.
St. Louis, 209 North Third St.

46 811 to 819 North Second St. Nashville, 28 West Side Public

Patents for the process of Dry Copying have been issued to us, dated May 18 and June 1, 1880. The Hektograph is now the only gelatine copying pad which can be manufactured, used, or sold, without infringing our patents. All infringements will be prosecuted to the full extent of the law.

HEKTOGRAPH CO., 22 and 24 Church Street, New York.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Gil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.



COLUMBIA BICYCLE.

A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.

THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

in the world. Send for descriptive circular and new

IRON CLAD MANUFACTURING CO., 22 CLIFF STREET, NEW YORK.

Grain Speculation in large or small amounts. \$25 or \$25,000. Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., CHICAGO, ILL., for Circulars.



The New York Ice Machine Company,

21 COURTLANDT STREET. ROOM 54.

Low Pressure Binary Absorption System.

Advantages over all other Muchines.

Makes 25 percent. more Ice. Usesonly 4 water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance. Machines and production are guaranteed by C. H. Delamater & Co.

Steel Castings

From ½ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list. CHESTER STEEL CASTINGS CO., 407 Libra y St., Phila, Pa.

STUTTERING CURED by Bates' Appliances. Send for description to SIMPSON & Co., Box 236, New York.





American Scientific

The Most Popular Scientific Paper in the World. VOLUME XLIII. NEW SERIES.

Only \$3.20 a Year, including postage. Weekly, 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Archi-tecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in The Scientific AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruce terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.-One copy of The Scien-TIFIC AMERICAN will be sent for one year-52 numbers— postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, \$1.60; three months, \$1.00.

Clubs.—One extra copy of The Scientific American will be supplied gratis forevery club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 37 Park Row, New York.

To Foreign Subscribers.-Under the facilities of the Postal Union, the Scientific American is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to F ance, Austria, Belgium, German, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America Te ms, when sent to foreign countries, Canada excepted, \$4, gold, for Scientific American, 1 year; \$0, gold, for both Scientific American and Supplement for 1 year. This includes postage, which we pay. Remit by postal order or draf to order of Munn & Co., 37 Park

THE "Scientific American" is printed with CHAS, ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St. New York.