SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1891, by Munn & Co.

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

Vol. LXV.—No. 16.
ESTABLISHED 1845.] NEW YORK, OCTOBER 17, 1891. [$3.00 A YEAR.
WEEKLY.

BROADWAY AND SEVENTH AVENUE CABLE ROAD.

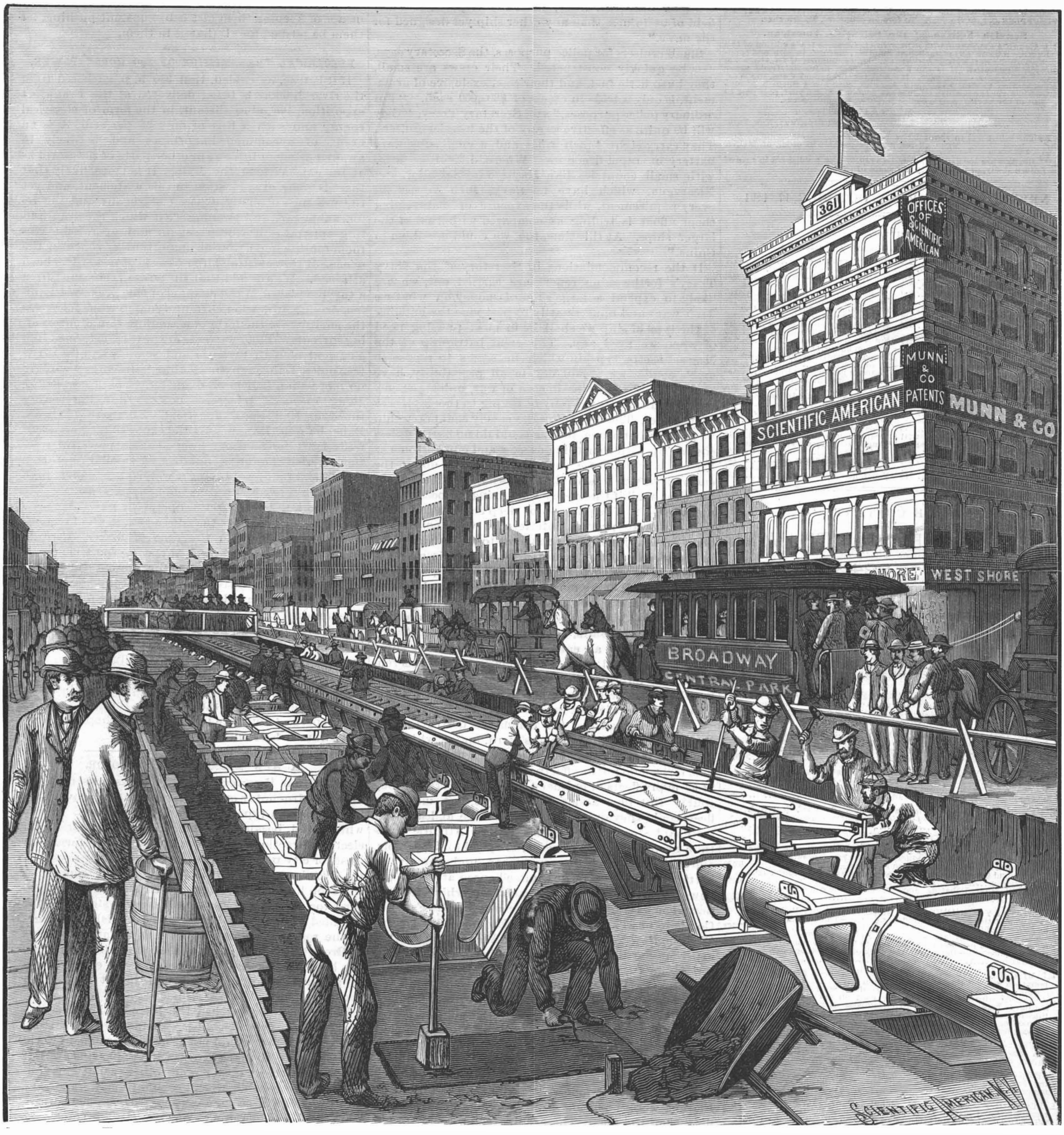
No other city of the same size is so unfavorably situated for the equable distribution of business places and residences as the city of New York. In this city, beginning at the lower part of Manhattan Island, the business element has grown northwardly, displacing the dwellings which have filled the upper portion of the island; while Long Island, New Jersey and Staten Island have received the overflow. The lateral travel from the long narrow island to Brooklyn and the adjoining cities of Long Island, to Jersey City and other places in New Jersey, is fairly well disposed of by the bridge and ferries, but the passenger traffic lengthwise of the island has presented a problem which has not been completely solved either by the existing surface roads, the elevated roads, or the regular railways entering the upper part of the city.

It is but a few years since the old time omnibuses which coursed up and down Broadway were displaced by a horse railroad, which very speedily showed itself inadequate to fulfill the requirements. It was evident to residents, and even to visitors, that Broadway, being the principal thoroughfare, required better means of transportation than the horse cars.

Among all the available systems applicable to Broadway, the cable system was selected as being the best and most practicable, since it provides larger and better cars, a higher speed without noise or other nuisances, and gives to the traveling public the space formerly occupied by the horses. Furthermore, it renders the street more wholesome and cleanly.

At the present time Broadway, from one end to the other, is a scene of great activity, as the building of the duplex system of cable road is progressing with great rapidity, and, great as the inconvenience is, it is hoped and expected that the advantages secured will more than compensate. The road being built is 5·17 miles long, extending from the Battery to 59th Street. At

(*Continued on page* 246.)



THE BROADWAY CABLE RAILWAY, NEW YORK.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.................$3 00
One copy, six months, for the U. S., Canada or Mexico................ 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year.*

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, OCTOBER 17, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 824.

For the Week Ending October 17, 1891.

Price 10 cents. For sale by all newsdealers

THE SHIPS WE WANT NOT THE KIND WE ARE GETTING.

The statements made by Secretary Tracy respecting the future necessities of the navy and the announcement that his forthcoming report will recommend that no more unarmored cruisers like those of the white squadron be constructed have aroused much interest among naval officers. The Secretary is reported as saying:

"We need three distinct classes of ships. First, battle ships such as the Massachusetts, Indiana, and Oregon will be when completed; second, fleet commerce destroyers like the New York; and third, a large number of small thousand-ton vessels for police purposes. Our battle ships can fight anything afloat. There is nothing in the English, French, or Italian navies that they cannot fight. As a matter of fact, the number of vessels in any of the foregoing navies that could successfully oppose them are comparatively few. With a dozen such vessels added to our monitors for harbor defenses, we could in our own waters successfully withstand an attack from Great Britain herself. The New York is an armored cruiser. She is now building at Cramps' yard at Philadelphia at a cost to the government of $3,000,000. Her purpose is to destroy an enemy's commerce. Four such ships distributed in various quarters would put an effectual stop to the depredation of as many fleets of ordinary cruisers. She will have, in many respects, a wider field of usefulness than any other ship yet designed for the navy."

Small cruisers for police purposes, the Secretary says, can be quickly constructed. Their crews are small, they burn little fuel, and their cost, exclusive of armament, is only a trifle in excess of $300,000 each. "For ordinary police purposes," said Secretary Tracy, "they will be quite as effective as any of the heavier cruisers. They carry eight 4-inch rifles and a small subsidiary battery of rapid-fire guns. Where difficulties arise with small countries like Hayti, San Salvador, and Nicaragua, which have no navy, such vessels fill every requirement, while the expense of maintaining them afloat is trifling as compared with that of the larger ships. At this time, too, we could use them in China."

If the recommendations in Secretary of the Navy Tracy's forthcoming report are carried out, we are likely to expend a large sum of money on what we don't want and unnecessarily to postpone the building of the type of ship we shall be in most pressing need of when we need any. The great battleship of the Massachusetts type, in which he seems to repose so much confidence, would not, in all probability, have anything to battle with in case of war, unless the enemy should commit the folly of taking to the high seas to meet her. The best thing the enemy could do would be to leave her alone, for she could do no harm, unless coming up with something as slow and cumbersome as herself, in which case she would be only doing the enemy a service to sink it. And what would such enterprises avail if the enemy was plying his ocean trade unmolested? The purpose of deep-sea fighting heretofore was to prevent interference with commerce. But the most important commerce to-day is carried on in fast steamers, and in case of war would, in all probability, be confined to this character of craft, which, it may be said, is being more powerfully engined year by year. What hope would there be of intercepting it by such weighted-down and unwieldy warships as the coming Massachusetts, Indiana, and Oregon? As for depredations on an enemy's coast, the present superiority of the land gun over the marine target has rendered such impracticable. Thus the Secretary's declaration that these ships "can fight anything afloat," even if true, is without important significance.

Let us now consider the commerce destroyer New York, now building at Cramps' yard, and of which the Secretary says: "Four such ships distributed in various quarters would put an effectual stop to the depredations of as many fleets of ordinary cruisers." Perhaps they could. But how about the enemy's fast merchant fleet; could they overhaul it? There are at least four merchant steamers at present in the Atlantic trade that, even with heavy cargoes, are good for 21½ knots, and which with lighter cargoes can undoubtedly do better than this. The guaranteed speed at sea of the new Cunard steamers, contracts for which are reported as having been given, recently, to the Fairfield Co., is to be 22 knots per hour. Each boat 12,000 tons. Will the New York be up to this? We hope so, but the experience with our other new ships leaves room for serious doubt.

As to the "large number of small thousand ton craft with small batteries to do police duty and cost $300,000 each," which the Secretary would build, it is clear that they would be too weak to fight and too slow to run away. It is evident that our most pressing need is a fleet of commerce destroyers, fast enough to overhaul the fleetest craft afloat. During the civil war three swift steamers, the Alabama, Georgia and Florida, were the means of driving our great merchant fleet from the seas. These ships could come up to anything we had afloat, and in order successfully to play a similar role in a coming war, ships to do such work must have a like recommendation. The navy engineers, accounting for the lack of speed of those of our new ships that promised to be so swift, declare it impossible to get maximum speed out of engines unless they are constantly kept up to it, that is to say, constantly driven at full speed; the stokering maintained at maximum efficiency, the engineers experienced in meeting obstacles and correcting defects.

If this is the case, and no one can deny the reasonableness of it, the answer is that the thing should be done. Ships of the commerce destroyer class should, like the swift passenger vessels, be kept driving away at full speed in time of peace, to be prepared to perform their proper service with precision if war should come. Those who read the orders as they come from the navy office are aware that ships are constantly being sent to call at foreign stations, and it is a fact that in all the regular squadrons, North Atlantic, South Atlantic, Pacific, European, and Asiatic, the regular order is cruising over an extended track. Thus a long cruising ground could readily be selected for such craft as commerce destroyers, when they were not employed for emergency calls to far-away stations, and instead of burning 75 or 100 tons of coal per working day with two-thirds speed, they might be allowed 200 tons, or enough to drive them always at maximum speed.

Fast craft we want if we want any, and if the only means of keeping them fast is by constant pushing, let them be pushed for all that is in them.

ELECTRICAL TRANSMISSION OF 300 HORSE POWER.

If it is true, as cabled, that 300 h. p. gathered from the river Neckar is being delivered at the Frankfort exposition, 108 miles distant, in the form of electrical energy and with a loss of only 25 per cent, it is an event of uncommon importance and is likely to awaken as much interest in other parts of the world as at the chief city on the Main. It is more likely that there is some exaggeration in this statement, and yet the presence of many expert electricians and the remarkable care and cunning with which the transmitting apparatus has been set up and operated leaves room for the hope that an important advance in the science of transmitting large parcels of power has been attained. We are told that the power is obtained from a turbine placed in the channel of the Neckar at Lauffen, driving a rotation current dynamo which converts the energy into the form of a combination of alternating currents. These currents are next transformed into a current of high pressure and small strength. It is transmitted through three thin bare copper wires of no more than four mm. diameter. These are strung along ordinary telegraph poles. The line passes through Heilbronn, Jagstfeld, Eberbach, Erbach, Babenhausen, Hanau. At the exposition this current feeds 1,200 incandescent lights, runs a powerful rotation current motor, a number of smaller motors, a centrifugal pump supplying a waterfall 10 meters high and much other power-consuming apparatus.

We are not told how the operators have overcome the influence of that potent disturbance, the Foucault currents, which, from the time of Marcel Deprez's experiments at the railway shops of the Chemin de Fer du Nord in Paris down to the present time, have rendered futile all attempts at the economical transmission of large parcels of electricity over a long line. One hundred miles is a long distance to transmit 300 h. p. less 25 per cent, and if actually accomplished, it leaves a strong hope that both the load and distance may be gradually increased till finally the prophesy Sir William Thomson uttered at Niagara will have been fulfilled and vast quantities of power gathered at the great falls will be transmitted in the shape of electrical energy to operate mills and workshops and railways hundreds of miles away.

A NEW EDISON ELECTRO-MOTOR.

Mr. Edison, if correctly reported, has constructed a novel electro-motor or made important improvements in the present type—he is not yet prepared to say which—and because of this discovery declares that electrical traction will drive out all other forms, at least for city passenger traffic. Moreover, he says that the Broadway and the Third Avenue car companies will soon have cause to regret their enormous expenditures for cable roads, for that his new system could be installed by simple and readily accomplished changes in the roadbed. This will prove as melancholy news to Broadway merchants as to the companies, for if true, the long-continued and, indeed, not yet expired term of inconvenience and confusion might have been avoided.

Many who have watched the introduction and progress of the overhead trolley system were long since convinced that it would not prove a permanent form of traction. Too many parts of the apparatus are left exposed to the weather and other conditions unfavorable to reliable working, and though important improvements in economic apparatus are constantly being made, and running expenses have been declared by competent authority to be less per car mile than in any other now in practical usage, it was easily seen that the peculiar adaptability of electricity for operating motors was being utilized to only a small extent.

A self-contained motor without attendant wires and poles or charged rails or mains is the want of the day. Perhaps this is what the new Edison motor will prove to be. As it is declared to be easily applicable to Broadway and the Third Avenue it cannot need such accompaniments, for no one knows better than Edison how impractical such a system would be. As it would require but a slight and inexpensive change of the tracking, it evidently needs no pendent arms in a slot. Nor is it likely that so practical an inventor would resort to an exposed current transmitter with a metallic brush traversing it. Yet the fact that it will require a change in the tracking would seem to indicate that it is not to be operated by either a primary or secondary battery.

Whatever it may be, if it will run with speed and certainty in all weather, demanding neither poles nor overhanging wires, nor requiring an exposed conductor in the permanent way, it is urgently wanted and cannot come too soon.

Seed Farms of the United States.

According to Census Bulletin No. 111, the production of seeds as an industry has been for the first time made a subject of census investigation. This report is prepared by Mr. J. H. Hale, special agent, under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture. The material from which these statistics are compiled was obtained directly from the seed growers upon schedules prepared for that purpose and by personal visits of special agents to seed farms and dealers in all parts of the country.

This investigation included only such farms as were devoted to seed growing as a business, and did not consider the large amount of field and garden seeds grown as side crops on thousands of farms, which would greatly swell the aggregate yield of seeds, but would not fairly estimate seed growing as a special industry. It will be noted that seed growing has been carried on as a business in this country for more than a century, but that only within the past thirty years has it assumed large proportions. More than one-half the total number of establishments reported were started between 1870 and 1890. This report shows that there were in the United States in the census year 596 farms, with a total of 169,851 acres, devoted exclusively to seed growing, of which 96,567¼ acres were reported as producing seeds. Of these, 12,905 acres were devoted to beans, 1,268 to cabbage, 919 to beets, 10,219 to cucumbers, 71 to celery, 15,004 to sweet corn, 16,322 to field corn, 4,663 to squashes, 7,971 to peas, 5,149 to muskmelons, 662 to radishes, and 4,356 to tomatoes. The 596 seed farms reported represent a total value of farms, implements, and buildings of $18,325,935.86, and employed in the census year 13,500 men and 1,541 women. Two hundred and fifty-eight of these farms are in the North Atlantic divison, with an average of 185 acres per farm. In the North Central division there are 157 seed farms with an average of 555 acres per farm. The seed farms in Iowa and Nebraska average 695 acres, several being nearly 3,000 acres in extent.

Prior to 1850 all the seed farms of the country were in the few northeastern States of the Union, Connecticut and New York for more than half a century producing more seeds than all other States combined; and while each has at present more seed farms than any other State, the general westward tendency of all that pertains to agriculture has stimulated seed growing on a very extensive scale in the central West and on the Pacific coast. There has of late been a feeling of depression among the growers generally, who, previous to 1883, made exceptionally fine profits out of the business, and were thus stimulated to establish more seed farms than could profitably find market for their products during the past few years. The general feeling now is that prices must be advanced, or some method of production be discovered whereby a greater yield may be secured at less cost of labor.

A Dog Lives Twenty-seven Days without Food or Water.

On the night of September 27, 1891, the janitor of Parker Hall, Manasquan, N. J., went into the ticket office to put away some old tickets, and was much startled at feeling something crawling about his feet. Upon investigation, it proved to be a dog, which was in an extremely emaciated condition, and barely able to crawl.

The janitor alone has the keys of the place, and he is positive that the office had not been unlocked since September 1. As he could get in by no other way, the dog must have been shut up for twenty-seven days without food or water.

There were only some old tickets and a cigar box or two in the office, and these were chewed into bits by the famishing animal.

The janitor had been in the hall several times between the above dates, but heard no outcry, and was greatly astonished when he found the office occupied. The dog was given a good drink of water and a loaf of bread, which latter was eagerly devoured, and at a subsequent date the dog was doing well, being apparently little the worse for his fast. O. D.

Can We Make It Rain?

I am not going to maintain that we can never make it rain. But I do maintain two propositions. If we are going to make it rain, or produce any other result hitherto unattainable, we must employ adequate means. And if any proposed means or agency is already familiar to science, we may be able to decide beforehand whether it is adequate. Let us grant that out of a thousand seemingly visionary projects one is really sound. Must we try the entire thousand to find the one? By no means. The chances are that nine hundred of them will involve no agency that is not already fully understood, and may, therefore, be set aside without even being tried. To this class belongs the project of producing rain by sound. As I write, the daily journals are announcing the brilliant success of experiments in this direction; yet I unhesitatingly maintain that sound cannot make rain, and propose to adduce all necessary proof of my thesis. The nature of sound is fully understood, and so are the conditions under which the aqueous vapor in the atmosphere may be condensed. Let us see how the case stands. A room of average size, at ordinary temperature and under usual conditions, contains about a quart of water in the form of invisible vapor. The whole atmosphere is impregnated with vapor in about the same proportion We must, however, distinguish between this invisible vapor and the clouds or other visible masses to which the same term is often applied. Clouds are not formed of true vapor, but consist of impalpable particles of liquid water floating or suspended in the air. But we all know that clouds do not always fall as rain. In order that rain may fall, the impalpable particles of water which form the cloud must collect into sensible drops large enough to fall to the earth.

Two steps are therefore necessary to the formation of rain; the transparent aqueous vapor in the air must be condensed into clouds, and the material of the clouds must agglomerate into raindrops. No physical fact is better established than that, under the conditions which prevail in the atmosphere, the aqueous vapor of the air cannot be condensed into clouds except by cooling. It is true that in our laboratories it can be condensed by compression. But, for reasons which I need not explain, condensation by compression cannot take place in the air. The cooling which results in the formation of clouds and rain may come in two ways. Rains which last for several hours or days are generally produced by the intermixture of currents of air of different temperatures. A current of cold air meeting a current of warm, moist air in its course may condense a considerable portion of the moisture into clouds and rain, and this condensation will go on as long as the currents continue to meet. In a hot spring day a mass of air which has been warmed by the sun, and moistened by evaporation near the surface of the earth, may rise up and cool by expansion near the freezing point. The resulting condensation of the moisture may then produce a shower or thunder squall. But the formation of clouds in a clear sky without motion of the air or change in the temperature of the vapor is simply impossible. We know by abundant experiments that a mass of true aqueous vapor will never condense into clouds or drops so long as its temperature and the pressure of the air upon it remain unchanged. Now let us consider sound as an agent for changing the state of things in the air. It is one of the commonest and simplest agencies in the world, which we can experiment upon without difficulty. It is purely mechanical in its action. When a bomb explodes, a certain quantity of gas, say five or six cubic yards, is suddenly produced. It pushes aside and compresses the surrounding air in all directions, and this motion and compression are transmitted from one portion of the air to another. The amount of motion diminishes as the square of the distance; a simple calculation shows that at a quarter of a mile from the point of explosion it would not be one ten-thousandth of an inch. The condensation is only momentary; it may last the hundredth or the thousandth of a second, according to the suddenness and violence of the explosion; then elasticity restores the air to its original condition, and everything is just as it was before the explosion. A thousand detonations can produce no more effect upon the air, or upon the watery vapor in it, than a thousand rebounds of a small boy's rubber ball would produce upon a stone wall.

So far as the compression of the air could produce even a momentary effect, it would be to prevent rather than to cause condensation of its vapor, because it is productive of heat, which produces evaporation, not condensation. The popular notion that sound may produce rain is founded principally upon the supposed fact that great battles have been followed by heavy rains. This notion, I believe, is not confirmed by statistics; but, whether it is or not, we can say with confidence that it was not the sound of the cannon that produced the rain. That sound as a physical factor is quite insignificant would be evident were it not for our fallacious way of measuring it. The human ear is an instrument of wonderful delicacy, and when its tympanum is agitated by a sound we call it a "concussion," when, in fact, all that takes place is a sudden motion back and forth of a tenth, a hundredth, or a thousandth of an inch, accompanied by a slight momentary condensation. After these motions are completed the air is exactly in the same condition as it was before. It is neither hotter nor colder; no current has been produced, no moisture added. It must, however, be added that the laws under which the impalpable particles of water in clouds agglomerate into drops of rain are not yet understood, and that opinions differ on this subject. Experiments to decide the question are needed, and it is to be hoped that the Weather Bureau will undertake them. For anything we know to the contrary, the agglomeration may be facilitated by smoke in the air. If it be really true that rains have been produced by great battles, we may say with confidence that they were produced by the smoke from the burning powder rising into the clouds and forming nuclei for the agglomeration into drops, and not by the mere explosion.—*Prof. Simon Newcomb, in the North American Review for October.*

Horses, Mules, and Asses on Farms.

Census Bulletin 103, prepared by Mr. Mortimer Whitehead, special agent of the Census Office, gives statistics of horses, mules, and asses on farms of three or more acres, but not including this kind of stock on ranges, kept on holdings of less than three acres, or in cities and villages.

The figures of the tables show that in the States and Territories there were on hand June 1, 1890, 14,976,017 horses, 2,246,936 mules, and 49,109 asses; that in 1889 there were foaled 1,814,404 horses, 157,105 mules, and 7,957 asses; that there were sold in the same year 1,309,557 horses, 329,995 mules, and 7,271 asses, and that there died from all causes 765,211 horses, mules, and asses during the same period.

Taking the whole country into consideration, the mule is not keeping pace with the horse as a farm animal; but the mule grows in favor and use in several of the Southern States faster than the horse. One reason for the change in the Eastern, Northern, Central, and Western States is probably the falling off in the profits of agriculture during the past decade, causing the farmer to economize in many ways. The price of horses has held up better than of most classes of farm stock during the past ten years. A team of mares can do the farm work and raise a pair of colts each year, so mares have taken the place of mules on tens of thousands of farms.

Still the breeding of mules is a great industry, found largely in Missouri, Kentucky, Tennessee, and Texas, with a considerable development in Kansas, California, Illinois, Arkansas, Mississippi, Alabama, and North Carolina. Under the diversified system of agriculture rapidly spreading in the South the breeding of horses and mules is growing in favor, and cannot fail to add largely to the material wealth of that section.

The hardy little burro has advantages over both horse and mule, and in some sections count up into the thousands, notably in New Mexico, California, and Colorado. Census figures show that on the ranges of New Mexico, in 1890, there were 13,074 of these useful creatures employed as pack animals for transportation.

The breeders of "jack stock" are mainly located in Tennessee, Kentucky, Illinois, Colorado, Missouri, Texas, Louisiana, and Alabama.

The jack stock imported into this country comes mainly from Spain, France, Italy, and the islands of Malta and Majorca. The best animals sell as high as $2,000 and $3,000 each. In the Poiteau district of France, not larger than most of our counties, statistics show that in a single year 50,000 mares were bred to jacks, and the yearly export of young mules amounted in value to between two and three millions of dollars.

Cheap Reservoirs.

Mr. C. D. Durban says that the cheapest reservoir that a man can build on his land for retaining water for irrigation purposes is a tunnel run into a hill. An open reservoir in a cañon or other suitable place will lose one-third of its water during the summer from evaporation, while in a tunnel there is no loss. A small spring will supply a tunnel with sufficient water for many purposes. He has illustrated this in a practical manner. On his own land at Mesilla Valley he ran a tunnel thirty-five feet long into a hill, in so doing tapping a spring; this tunnel he dammed up, leaving a space thirty-five feet long and the size of the tunnel, which is about five by six feet, to be filled with water. The water he carried to his house in pipes and we observed that it supplied his dwelling, another near by, his barn and drying house for raisins, as well as irrigated quite a space devoted to flowers for a garden. He says that the tunnel is the cheapest and best form, and that for each dollar expended one can obtain a space equal to twenty-five cubic feet.

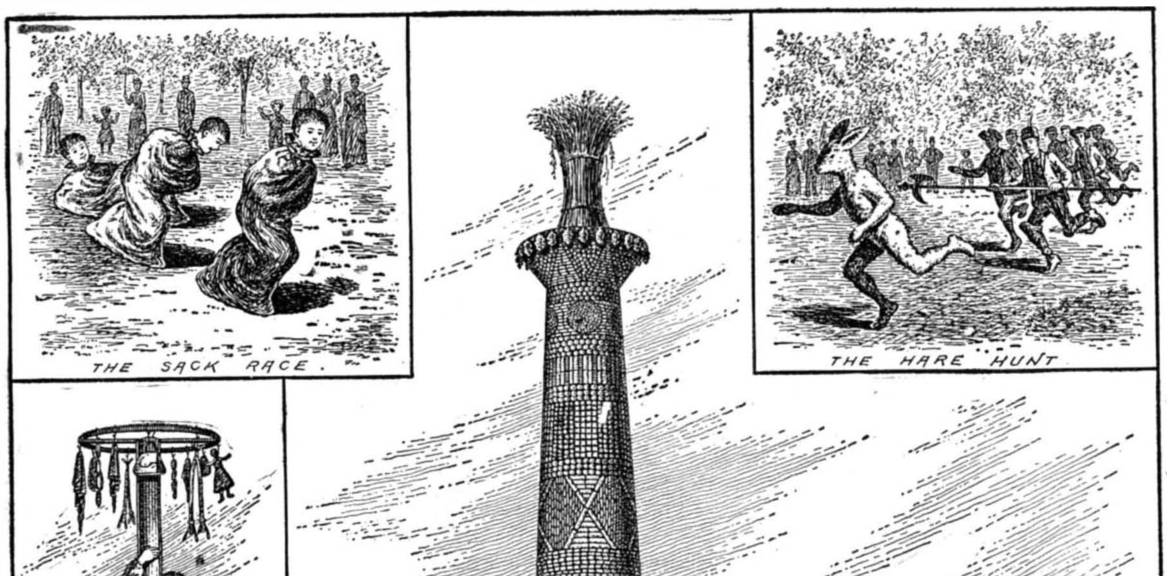
THE SUABIAN HARVEST FESTIVAL.

The Suabian harvest festivals take place in America during the latter part of September, and are similar to those held by the Suabians in Germany. Suabia, or the kingdom of Wurtemberg, lies in the southwest angle of the German empire and is a great agricultural country. About 100 years ago the king of Wurtemberg ordered a day in each year to be set aside for these festivals, and the 26th of September was chosen. Vegetables and fruits from all parts of the country are brought in and made into columns and arches, the different designs and colors made of the vegetables and fruits giving them a beautiful appearance. They also have numerous games, such as the hare hunt, climbing the pole, sack races, etc.

The Suabians in this country have formed themselves into mutual benefit societies, and also hold these festivals in the various parks in the large cities. Our sketches illustrate the Suabian harvest monuments as erected in Caledonia Park, Jersey City, N. J., in September last. The vegetable monuments erected were from 30 to 40 feet in height. A pole, about 8 inches in diameter, runs from the ground to the top, and around this is built a circular shaft. The base of the monument is about 14 feet square, and is made into four steps, tapering up to the top, where a box, 6 feet square, made of heavy material is fastened. The pole running through the circular shaft projects down below the base about 10 feet. An 8 inch hole running through the top and bottom of the box, through the base to the ground, through which the pole runs, keeps the shaft in position. The shaft is 2 feet in diameter at the top and 4 feet in diameter at the bottom, and the entire column is made of wood. The designs are first laid out with chalk, and, beginning at the top, the vegetables are nailed on, covering up the woodwork from view, and giving the appearance of a solid vegetable column. Six, eight, and ten penny nails are used to the number of three kegs, and twenty-five barrels of vegetables and fruits will barely cover one of these monuments, melons, pumpkins, and the larger vegetables being placed about the steps or base of the column. The designs and colors are beautiful to look at. The time consumed in nailing on the vegetables is about three days.

These festivals last three or four days, there being each day numerous games, such as climbing the pole, the schoolmaster, sack races, and a hare hunt. There is an old story in connection with the hare hunt, which runs as follows: A simple Swab went out into the woods one day, and, being very much frightened by a strange animal, he ran back and told a great story to his six companions about the animal he had seen. He described it as being something terrible, and greatly frightened them all. They finally decided to go out and see what it was, each one urging the other to go first. One of the number happened to have a big pair of boots on, and the others induced him to go first, providing him with a big spear. The animal, when found and killed, proved to be only a hare.

These monuments cost between $400 and $500 each. After the festival is over the column is put up at auction to the hightest bidder, but the nails spoil most of the fruit, and the receipts from such a sale are usually only from $8 to $10.



THE SUABIAN HARVEST FESTIVAL—MONUMENT OF VEGETABLES.

TO remove rust stains from nickel plate, grease the rust stains with oil, and after a few days rub thoroughly with a cloth moistened with ammonia. If any spots still remain, remove them with dilute hydrochloric acid and polish with tripoli.

The "Faure" Patent in Germany.

The following extract is taken from the Berlin *Borsen Courier* of September 11: A case which for some time past has aroused much interest in the electrical world came up for decision before the Nullity Department of the Imperial Patent Office. The Joint Stock Accumulator Company, of Hagen, in Westphalia, is the holder of a license in respect of the patent granted in 1881 to Camille Faure for the production of accumulators. The extraordinary success attained by this industry, both in this country and abroad, led last year to the conversion of the original company into a large joint stock undertaking, in which, among others, the Allegemeine Elektricitats Gesellschaft and the firm of Siemens & Halske became interested to a very considerable extent. On the other hand, this very success led, especially in Germany, to attempts at evasion of the rights patented by Faure, and the Accumulator Company found themselves obliged to defend actions both in the civil and criminal courts against the firms of the Berlin Accumulator Company, Correns & Co., De Khotinsky, Gelnhausen, and Gottfried Hagen, of Cologne on Rhine. These firms in turn combined together with a view to obtaining the right to employ Faure's patent without charge, and instituted a suit for the nullification of the rights secured by Faure's patent. This suit came on for decision before the Imperial Patent Office. All motions made by the petitioners for annulment, in order to obtain a postponement of the case, the institution of experiments, hearing of witnesses both in this country and abroad, were disallowed by the Imperial Patent Office, it being decided that sufficient material was already before the court on which to give a decision. The assertion advanced by counsel for the petitioner, Dr. Haberlain, patent attorney of Berlin, namely, that accumulators similar to those patented by Faure were already perfectly familiar to experts in consequence of published writings of Plante, Kirchhoff, De la Rive and Brush, and from a combination of publications of the published writings of Prof. Stockhardt and Dr. List, and the experiments of Dr. Aron, of Berlin, previous to the announcement of Faure's patent, was shown by the counsel for the defendants, engineer and patent attorney Pieper, of Berlin, to be in each separate instance inaccurate. In like manner, the alternative plea advanced by the plaintiffs, to the effect that the only point which could be held to be protected by the patent was a layer supplied by means of a brush in connection with partition walls, was shown to be quite unsupported; it was, on the contrary, proved that neither the specification nor the claims of the patent contained anything which was not capable of practical realization, proof being advanced in support of this view to the effect that over twenty millions worth of accumulators constructed on Faure's system are at this moment employed for purposes of lighting and transport, and attention being drawn to the fact that the only motive which could be suggested for the desire of the petitioners to annul the patent must be to their wish to share in the advantages secured by it. Indeed, the circumstance that they follow Faure's above mentioned specification by applying the layer for the collection of electricity on the electrodes, proves conclusively that Faure had given clear and precise instructions for the production of accumulators. The fact that the form of the conductor employed for the reception of the active layer used to store the electricity was a new one did not in any way justify the petitioners in the previous application of such a layer of active material to plates other than those first of all employed by Faure in the case of such active layers. The Imperial Patent Office admitted the force of these arguments by granting the demand of defendant's counsel that the appeal lodged by the petitioners should be disallowed, thereby declaring the validity of Faure's 1881 patent to be unconditional.

Stopping Horses by Electricity.

A successful trial of stopping a runaway team was witnessed by a large crowd on Michigan Avenue, Chicago, recently. The experiment was undertaken by Mr. Halson, of the Halson Electric Harness and Supply Company, of Chicago. After placing a set of his patent harness on a span of high-spirited horses, he hitched them to a new top buggy and connected the lines to wires running from under the seat. He then took a seat in the buggy and gave the horses two slashing cuts with the whip. They immediately started down the street with every appearance of a genuine runaway. Suddenly both animals reared in the air, danced frantically for a moment, throwing their heads viciously, and came to a dead standstill.

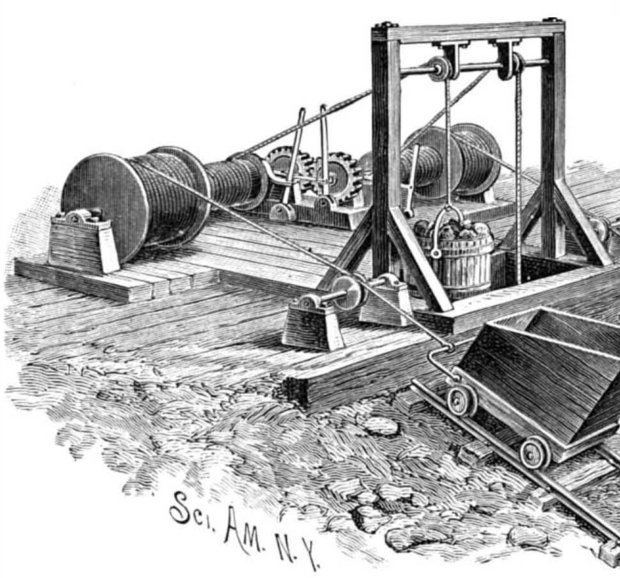
Mr. Halson then jumped out and described the manner in which the horses were stopped. By means of a small battery and coil in the carriage, a system of wiring through the harness, and the pressure of a conveniently located button, a mild shock is given the horses from the bit. The strange sensation induces them to back away from a seeming attack in front, and thereby causes them to immediately stop. The shock is not of sufficient strength to injure the animal in the least, but it is enough to check any horse.—*Electricity.*

New Cunard Steamers.

Referring to the progress of Clyde shipbuilders, *The Engineer*, London, states that the most important of recent orders is that reported to have been booked by the Fairfield Company, Govan, for the construction of two new steamers for the Cunard Company, to run between New York and Liverpool. It is stated these boats are to be of 12,000 tons capacity, speed at sea to be guaranteed at 22 knots per hour. Such vessels, on a spurt, could probably make 24 knots.

A SIMPLE AND EFFICIENT GRAVITY HOIST.

The apparatus shown in the illustration is especially adapted for use in sinking deep wells and shafts, and may be employed in elevating and disposing of material taken from mines, and for many similar uses. It has been patented by Mr. William J. C. Doyle (box 874), Aspen, Col. The drums or windlasses of the apparatus are carried by two shafts geared together at their inner ends, each shaft carrying two drums, one of

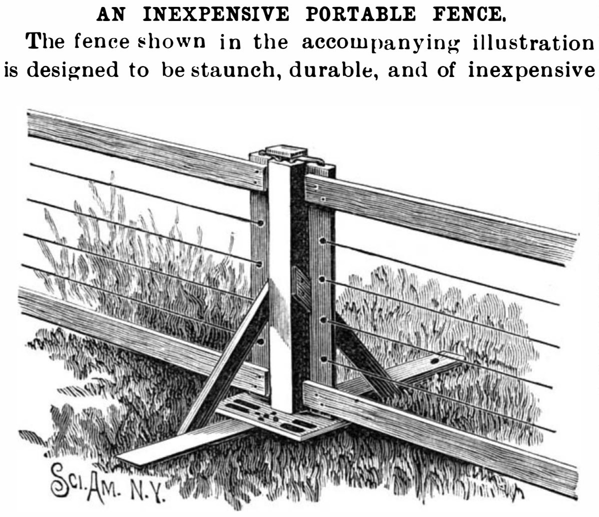


DOYLE'S GRAVITY HOISTING APPARATUS.

which is larger than the other. On the smaller drums are wound the hoisting ropes, which pass over pulleys on a shaft in a suitably constructed frame, and are connected with the buckets traveling in the well or shaft, the arrangement being such that when one bucket descends the other one rises, and *vice versa*. On the larger drums are wound cables connected with cars traveling in opposite directions on inclined tracks, the cables and the hoisting ropes being so arranged, relatively to each other, that when an empty car is at the upper end of the incline a filled bucket will also be at the top of the shaft, in position to be conveniently emptied into the car, the downward travel of each filled car along the inclined road exerting a pull on one of the ropes on the large drums to cause a filled bucket to be raised, while at the same time an empty car is drawn up and an empty bucket let down. A brake band is provided for each shaft, operated by a lever conveniently arranged, and, that the two shafts may be readily disconnected, for lengthening or shortening the cables or other purposes, their inner bearings are fitted to slide, and are each connected by a link with a lever pivoted on the frame, by means of which the bearings may be moved to disengage the gear wheels. The construction is very simple, and the hoisting work is all the time under the control of the operator.

AN INEXPENSIVE PORTABLE FENCE.

The fence shown in the accompanying illustration is designed to be staunch, durable, and of inexpensive



HARRIS' PORTABLE FENCE.

construction, and capable of being quickly and easily set up on even or uneven ground. It has been patented by Mr. Charles E. Harris, of Brandon, Manitoba, Canada. The post from which the fence sections are supported is secured to a block or plate attached to a bed-beam, beveled under at each end, and having end apertures in which a hook may be inserted for convenience in moving the beam over the ground. The block or plate on the bed-beam has near each end a series of slots and central apertures, each adapted to receive a tongue on the lower end of a post of a rail section. The body section and the bed-beam section of the post are connected by braces, and the top of the post has three or more triangularly arranged recesses, and is covered by a metal plate with apertures corresponding to the recesses, there being arranged upon the plate an angular cap mounted to swing horizontally. The fence sections may be made in any approved manner, but the end posts of each section have recesses in their upper ends, and their lower ends are provided with integral or attached tongues. In erecting a fence, the tongue on the lower end of a section post is placed in one of the slots of the plate on the bed-beam nearest the main post, and the upper end of the post is connected with the top of the main post by a staple, the cap being first swung to one side, and when the staples have been forced down into place the cap is carried over them, preventing their withdrawal. If the ground is slanting or uneven, the end post of the section may be placed in one of the other slots of the bed-plate, and where another fence intersects the first one at an angle the end post of the diverging fence will be placed in one of the other apertures. It will be seen that a section of this fence can be easily removed to make an opening to an inclosure, while the whole fence can be quickly taken down and set up again.

Concrete Buildings.

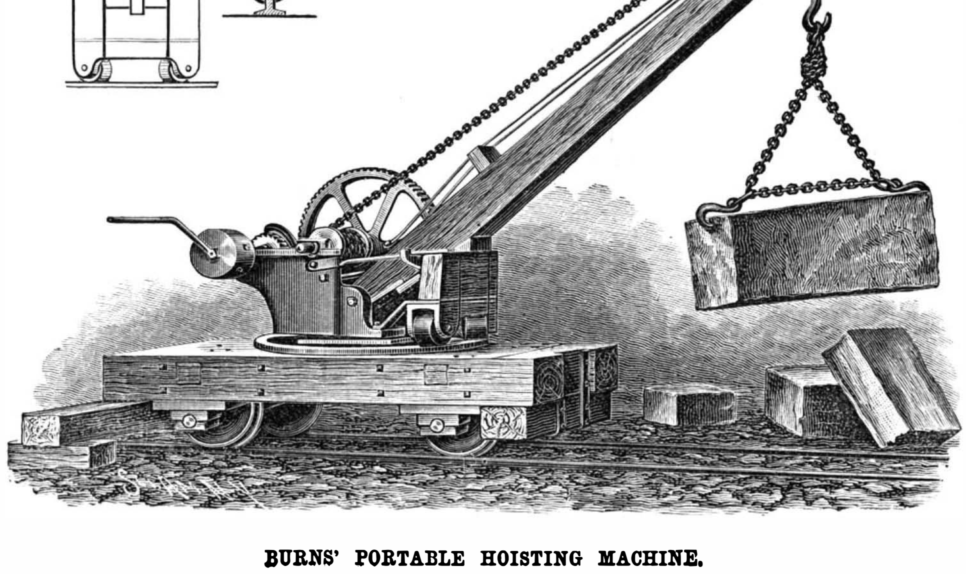
The members of the Technical Society of the Pacific Coast lately went to Palo Alto on the invitation of E. L. Ransome, who has nearly completed two large concrete buildings for the Leland Stanford, Jr., University. One of these is the girls' dormitory. The larger one is the museum building, and is the finest piece of building concrete work yet done in this vicinity. The structure is absolutely fireproof, and intended also to be earthquake-proof. It is built on the system patented by Mr. Ransome, so as to be a homogeneous structure as to walls and partitions, there being no joints. Twisted iron rods are used for additional strength where necessary. The cement is mixed in the Ransome patent mixer and elevated to points where used. A large force of men has been at work on this building for some time and it is now almost complete. Even the interior arches and ceilings are of concrete.

The stairways are made of concrete, and these will be covered with marble steps. The hallways will be finished in marble over the concrete. There is no wood anywhere in the building, the window frames, etc., being of metal. The exterior is furnished with a smooth coat of cement to resemble brownstone. The heavy columns of the entrances are, like the main structure, of concrete, and the statuary to surmount the building is moulded of the same material.

There are two concrete buildings now and others are to follow. They were built by contract by Messrs. Ransome & Cushing in an exceedingly short space of time. Stone buildings of equal dimensions would have taken three or four times longer to construct.

A PORTABLE HOIST FOR HEAVY ARTICLES.

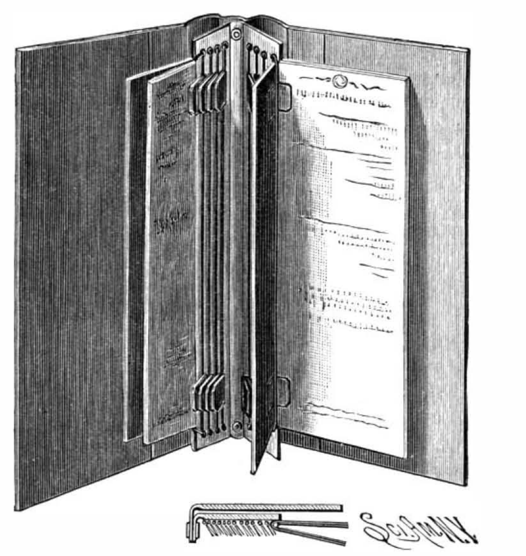
A hoisting machine designed to travel on rails, for conveniently lifting heavy articles to and from cars, ships, warehouses, yards, etc., is shown in the accompanying illustration, and has been patented by Mr. Ed. Burns, Superintendent of the Berlin and Montello Granite Co., works at Montello, Wis. The machine is employed in handling all sizes of stone to and from the stone cutters, and is said to have proved its superiority to any kind of traveler hoist or previous means employed in this kind of work. Centrally on a platform car is a plate on which turns the base of the hoist, the base having a downwardly extending pivot passing through the plate and having a nut at its lower end abutting against the under side of the platform. On the base are lugs in which is pivoted the lower end of the boom, as shown also in one of the small views, the boom having, just in advance of its pivotal point, a short foot or bracket in which are journaled rollers adapted to travel on a circular track. The hoisting chain, passing over the pulley on the outer end of the boom, is wound or unwound from a hoisting drum of any approved construction on the base of the hoist. On the under side of the platform, near each end, are guideways adapted to support a beam, which may be drawn out to rest on blocks, the beam being extended to that side of the car on which the boom projects, to prevent the car from upsetting or leaving the rails, when a heavy article is being lifted. One of the small figures represents a special device to hold the car to the rails. It consists of an arm fastened by a key to the car timbers, the lower end of the arm being formed into a hook to engage one side of the head of the rail, the other side being engaged by a hook pivoted to the arm and locked in place by a wedge. The boom and hoisting drum can, with this improvement, be readily turned in any direction, carrying the load with ease and perfect security, while the construction is simple and durable.



BURNS' PORTABLE HOISTING MACHINE.

A BINDER FOR PAPERS, MAGAZINES, ETC.

This binder, which has been patented by Messrs. James Fitzpatrick and John Ring, is designed to provide a convenient means for removably securing papers, pamphlets, etc., within permanent covers, the device being of very simple and durable construction. The cover has a flexible back, centrally in which an auxiliary back is secured by means of rivets, the auxiliary back comprising two rigid side board sections and an intermediate section, united by any approved form of hinge. When the sides are of pasteboard or similar material, covered with canvas, the fabric may be continued from one side to the other, thus forming a flexible intermediate portion. In each side of the auxiliary cover, at the ends, is a series of eyeleted openings, through which cords are run longi-



FITZPATRICK AND RING'S BINDER.

tudinally across the inner face of each side, the cords being simply looped upon the under face of the sides of the cover at both ends. Wire may be used instead of an ordinary cord if preferred, and attached to each strand or cord, at top and bottom, is a two-leaved tab, a sleeve uniting the leaves, whereby the tabs may be slid up and down on the cords, to accommodate pamphlets or papers of different lengths. The leaves of the tabs are covered on their outer faces with mucilage or other adhesive, and the paper or pamphlet to be introduced into the binder is opened in the center and passed half way under one of the cords, when the tabs are cemented to the central leaves, the paper being thereby re-enforced at the top and bottom edges, while the inserted publication is held in the position in which it is placed.

Further particulars with reference to this improvement may be obtained of Mr John Cassidy, Nos. 221 to 225 Fulton Street, New York City.

To make a good sticky fly paper, mix by heat 3½ ounces raw linseed oil, 1 pound resin, and add 3½ ounces molasses. Apply to paper while warm.

DR. J. W. CLOWES' IMPROVEMENTS IN DENTISTRY.

Our present engravings illustrate a notable improvement in the art of dentistry, of which Dr. J. W. Clowes, of 667 Fifth Avenue, New York City, is the author.

The object of the invention is to provide a simple and effective means by which missing teeth may be artificially restored, and broken, loose, and dilapidated natural teeth may be preserved from decay and helped to become mutually supporting to each other.

The invention consists in fillings inserted in cavities in approximate faces of contiguous teeth, said fillings resting directly upon the gums, and being formed of a single body of material connecting the teeth so that they mutually support each other. It also consists in fillings of plastic material inserted in cavities in approximate faces of the teeth and extending between and across the teeth and down upon and closely contacting with the gums.

The plastic material which the author has so far found to be best adapted for the purpose of his invention is the ordinary dental amalgam; but he does not limit himself to this material, as any other suitable plastic material may be used which sufficiently hardens and solidifies after it is put in place.

Our engravings are taken from a recent case that occurred in Dr. Clowes' practice. Fig. 1 shows the condition of the patient's upper teeth prior to treatment. It will be noticed several of the most important teeth are gone, and the task Dr. Clowes sets for himself, in such cases, is to restore to the gums the missing dentures, the use of plates being avoided.

Cavities in the contiguous teeth, shown at the left in Fig. 2, are excavated and prepared for receiving fillings in the usual way with undercuts and anchorages to insure a firm hold of the filling in the teeth, and the plastic material, such as amalgam, is inserted in the teeth, so as to fill the cavities and the space between the teeth, which amalgam is also moulded upon the surface of the gum between the teeth, so as to press firmly thereon between the teeth, and the plastic material of the filling is shaped to conform to the natural contour of the teeth, but without actual division of the filling material between the teeth, the filling when completed appearing as shown in dotted lines at the left of Fig. 2. When the material of the filling solidifies and hardens, the teeth will be rigidly connected and locked together, so that they cannot spread apart, and the filling will be in close contact with the gums and will completely close the space between the teeth, so that food cannot enter between the teeth or between the filling and the gum. By this method of locking the teeth together, if before treatment one of the teeth should be loose, as is frequently the case, it becomes locked to the sound tooth and is held firmly in its proper place.

When the natural teeth are absent between two decayed teeth, having cavities in adjacent places, as shown at the right in Fig. 2, the said cavities are prepared for receiving plastic fillings in the usual way and the fillings are inserted, and the body of plastic material of which the fillings are formed is extended in one body across the space between the two teeth and moulded and firmly pressed upon the face of the gum, connecting the teeth, as shown in Fig. 2, and forming a rigid body of material, which, in addition to this use as a support and connection for the teeth, may be used for the purpose of mastication, and this material may be moulded or carved in imitation of natural teeth, as shown by the dotted lines in Fig. 2. This body of material is firmly locked to the teeth, and forms, not a bridge, but a causeway between the said teeth.

In forming the fillings care is taken to mould them firmly upon the gums, so as to form a perfect contact therewith. The gum is thus made partly to support and to carry the prolongations of the fillings of the teeth, while the close contact of the teeth with the gum and the naturally elastic or expansive quality of the gum operate to exclude and expel particles of food or deleterious matter from between the gums and the plastic fillings that are kept in contact with the gums.

In the example of three adjoining decayed teeth, which it is desired to fill and lock firmly together, the cavities are excavated in the form of grooves extending through the teeth and the cavities are prepared in the usual manner, and the plastic filling is inserted, so as to close the cavities and conform to the contour of the natural teeth, and the material of the filling is, as before described, moulded firmly upon the gum between the teeth and is made to close the spaces between the teeth and form a body of the filling material which extends continuously through the teeth and along and upon the gum between the teeth, thus locking the teeth firmly together. For the further strengthening of the teeth and to further assist in locking them together, a hooked bar, similar to that already described, is inserted in the outer teeth of the series, and the filling is pressed upon and around the bar as in the other case, which thus becomes inclosed within the filling and adds strength thereto, as before described.

In the case of absent front teeth, grooves are made in the backs of the adjacent natural teeth, and a bar is inserted therein, extending from tooth to tooth. Artificial teeth, grooved at the back, are fitted to the bar, and the grooves are closed with the plastic filling, which thus incloses the bar and locks both the natural and the artificial teeth together in the firmest manner. This is illustrated in Fig. 3, which is an inverted interior view of the patient's mouth, after the entire work has been completed, the dark, shaded portions representing the improved fillings. Fig. 4 illustrates the external appearance of the patient's teeth after treatment by the Clowes method. The contrast between Fig. 1, which shows the original condition of the patient's dentures, and Fig. 4, showing the completed work, is very striking.

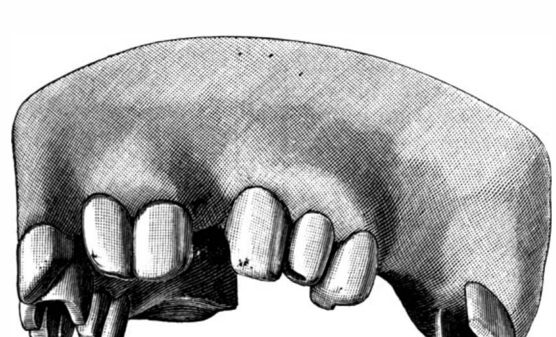


Fig. 1.

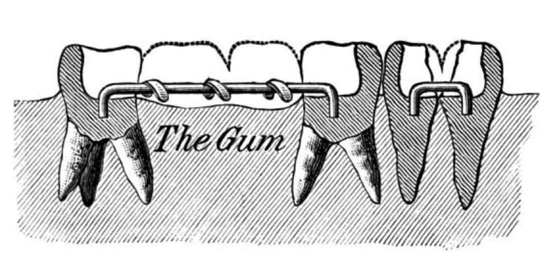


Fig. 2.

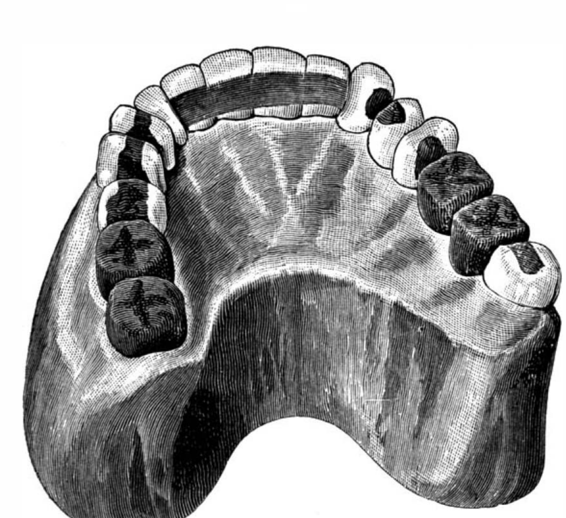


Fig. 3.

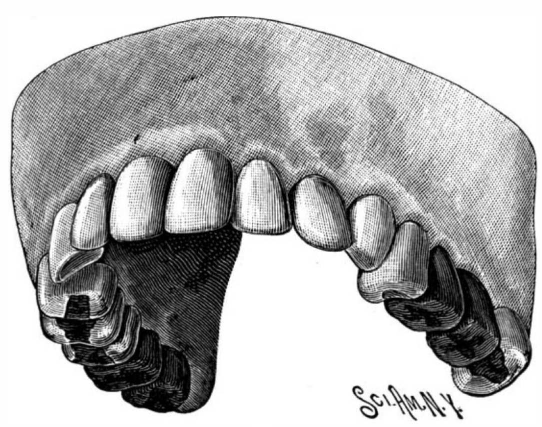


Fig. 4.

DR. J. W. CLOWES' IMPROVEMENTS IN DENTISTRY.

In discovering the peculiar use and application of amalgam, as herein set forth, a grand stride has been made in dental science. That any foreign substance could be pressed and immovably fixed without irritation upon so delicate a tissue as the human gum has heretofore been considered impossible and unworthy of professional consideration; but thorough and long-continued tests have proved the practice to be highly beneficial and preservative. We may add that Dr. Clowes is one of our ablest and most experienced dental practitioners, and that further information respecting the subject we have presented may be obtained from him.

The Edible Passion Flower.

(Passiflora edulis).

Considering the merits of this excellent fruit, the ease with which it can be grown, its ornamental properties in leaf, flower, and fruit, its adaptability for planting in almost any aspect—in sun or shade—and its freedom from insect pests, it is astonishing that it is not much more extensively cultivated for the sake of its fruit, which makes a valuable addition to a dessert. We have been for years growing it here for this purpose, and have it planted on the back walls of the vineries, which, in most instances, unfortunately, are left unfurnished with anything either ornamental or useful—bare, glaring, whitewashed walls. When planted in moderately light and not overrich, well-drained soil, with the roots confined within reasonable limits to check over-luxuriance of growth, we find that this passion flower thrives and crops well, even in such unfavorable positions; but our demand far exceeding the supply from these, we have devoted, in addition, a house (an old pine stove) entirely to several plants, and full well do they repay us for such accommodation, by bearing enormous crops of fine, luscious fruit. These specimens are trained vine-like up the rafters, and the bearing shoots allowed freedom to festoon and hang down—a grand picture in green and purple. We find a kind of long spur-pruning answer well for them. Fertilizing the blooms is also necessary to secure a crop, and we shade lightly when in bloom (if planted in a sunny aspect), to prevent the reproductive organs from burning and drying up before fructification takes place. Moderate heat is suitable, and water rather sparingly until a full set is insured, when, if the soil is well drained, ample supplies of both liquid manure and clear water alternately must be given them unstintingly to swell up heavy crops. The only insect pest that we find at all troublesome is thrip, fumigating being the antidote. To summarize the mode of culture: 1. Plant in light, well drained soil. 2. Grow on in moderate heat. 3. Confine the roots within reasonable limits. 4. Fertilize the blooms for a crop. By so doing, success is a certainty I believe. I may add that several American gentlemen who visited here last spring and others have commenced experimenting in cultivation of the edible passion flower out of doors in the Southern States and elsewhere, with a view of growing it for export, etc.—*J. Roberts, The Gardeners' Magazine.*

Recent Tests of Nickel Steel Armor Plates.

Experiments made on October 12 at the Annapolis proving ground have again confirmed the superiority of nickel steel over ordinary steel for armor plates. The tests were made to determine the value of nickel steel for a protective deck. The targets were made of two superposed 1½ inch plates, placed almost horizontally, presenting angle of only 2° to the line of fire. A 6 inch rifle was used, with a 100 lb. armor-piercing projectile.

When fired at the target of ordinary steel, the target was perforated, and the projectile, which was broken, passed through both plates and through two feet of wood and eight feet of earth composing the backing. The velocity of the projectile was 1,780 feet per second. When fired at the nickel steel target, the velocity of projectile was 1,873 feet, but it glanced off the target without rupturing either plate, but was itself smashed to pieces. Its effect on the target was a small crack 5 inches long in one plate and an indentation between 3 inches and 5 inches deep.

The demonstration of the superiority of nickel steel over ordinary steel for armor plate suggests that it may have other valuable uses in the arts. A wide field for metallurgical research is here afforded. In this connection it seems strange that the world has waited so long for the discovery of the qualities of nickel steel to be made. For more than twenty years the open hearth steel process has been in successful use, producing the purest known varieties of carbon steel, and during all this time it would have been an easy matter to make experiments on alloying this steel with other elements, and to determine the physical qualities of these alloys; yet it has been only within a year or so that such experiments have been seriously attempted. During these twenty years, millions of money have been spent in Europe in the manufacture of compound armor plate, viz., wrought iron with a steel face, all of which has now to be abandoned in view of the superiority of nickel steel, while the much simpler method of making a steel plate with a simple alloy has remained undiscovered. The time is ripe for further researches into the qualities of other alloys of steel. There are unlimited possibilities of the discovery of valuable qualities in numerous alloys yet untried; and it should be a matter neither of great difficulty nor of great expense for any open hearth steel works to make the experiments which may result in such discoveries.—*Eng. and Min. Jour.*

A Stoker's Explanation of the Steam Engine.

"This 'ere furnace, gen'lmen, heats that 'ere water, and that 'ere water is in this 'ere biler; and that there pistern rod is moved up and down by the steam from this 'ere biler; and them 'ere pisterns acts upon them rods, which turns the axles of the paddles, and the paddles their selves in consequence."—*From Pickwick Abroad, by G. W. M. Reynolds.*

Correspondence.

Alleged Power of Mental Impressions.

To the Editor of the Scientific American:

Being a constant reader of your journal, I wish to state that your item in issue of August 15, "Power of Mental Impressions," is totally wrong. The patient noted was anæsthetized by rapid inhalation. I am a dentist, and hundreds of times I have drawn teeth absolutely without pain, sometimes by putting the inhaler to the mouth and sometimes simply directing the patient to breathe rapidly for one minute while the tooth is extracted.

More frequently I saturate a small bit of cotton or paper with a drop of cologne and direct the patient to breathe as rapidly as possible, when extraction is entirely without pain. Also applied to opening and extracting nerves in teeth for immediate filling.

The period of insensibility is usually very short, but many times a kind of spasmodic breathing is kept up for several minutes, requiring a command to cease breathing and wake up. IRA G. LEEK.

San Francisco, Cal.

[We are obliged to our correspondent for calling attention to the above. It reminds us that in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 275, is an interesting and valuable paper on "Rapid Breathing as a Pain Obtender," by Dr. W. G. A. Bonwill, in which the history of operation by the method is fully explained. The subject deserves the careful consideration of medical men.—ED]

Proposed Metric System.

We have never been enthusiasts over the French metric system, says the *Travelers' Record*. Its original unit is as purely arbitrary as the foot itself; and all its secondary units are so violently out of gear with everything existent that the enormous labor and loss of the change can hardly be made good by any service. It is possible to pay too high a price even for a decimal system with interchangeable parts. But a system is proposed (and detailed in the *Chemical News*) by a Danish engineer named Hanssen, which is so wonderfully simple and easy that we hope to see it speedily adopted through all the world except those committed by pride or interest to the French scheme; it has almost all the merits of the other system and almost none of its immense drawbacks. Nobody seems before to have noticed the very close approach to interchangeability between our principal units of weights and measures. Mr. Hanssen proposes to increase the inch and foot to 1·000403 times their present length, or about $\frac{1}{2500}$, less than $\frac{1}{200}$ of an inch to the foot, which for ordinary purposes is no change at all; and the ounce, pound, and imperial gallon will need no change. A cubic foot contains 436,971·78 grains of distilled water; the new cubic foot would contain 437,500 grains, or just 1,000 ounces avoirdupois. Sixteen cubic feet would equal exactly imperial 100 gallons, or one hektogallon, which will weigh just 1,000 pounds. The foot will be divided, like the meter, into decifoot, centifoot, millifoot; there will be hektogallon, dekagallon, gallon, decigallon, centigallon, milligallon; and so on with others. Of course governments must first agree on the basis; but it could quickly be made what the French metric system never will become—a really popular utility, displacing the old standards.

Ninety Miles an Hour by Rail.

Recently we gave accounts of three very remarkable runs. The Philadelphia & Reading run was made with one of the class "D" 33 engines with four 68½ inch driving wheels, the total train load being about 169 tons. The fastest time made was 90½ miles per hour for about one mile, on a level immediately following a descending grade of 37 feet per mile. The fast run on the New York Central, with a Schenectady engine, was more difficult, owing to the long time and distance from start to final stop. In that run 436⅓ miles was made in an actual running time of 425 minutes and 14 seconds, giving an average speed, excluding stops, of 61·56 miles per hour.

The maximum speed between stations on the Central run is unknown. It is said that the fastest mile was made in 47 seconds, or at the rate of 76·6 miles per hour. It is to be regretted that in such cases as this, and the fast run on the Reading, a speed recorder was not used on the engine or one of the cars. An analysis of a diagram made by a recorder on these runs would have permitted an extremely satisfactory investigation to be made of the detail of the velocities and rates of acceleration and retardation. Such a diagram taken in connection with the profile of the road would solve one or two perplexing questions which inevitably arise when reports are made of fast runs. However, this much is certain: A speed of 90 miles an hour has been attained, and the possibility of it is proved beyond question. This will settle once for all the argument of those who have heretofore held that speeds above 70 miles an hour were not only impracticable, but impossible, in spite of the fact that trains run short distances at over 70 miles an hour every day in the year. While there are conditions which would prevent the common adoption of a 90-mile an hour speed, yet it is possible to so improve the permanent way and the coupled locomotive as to make such a speed perfectly feasible.

It will be noted that this fast time was made with locomotives having parallel rods, and as this is essentially a feature of American locomotives, it would appear that our engines are well adapted for high speeds, and we shall not be compelled to resort in the future to single pairs of drivers with the necessary loss of traction. Our locomotives stand to-day as the most powerful in the world, as the most economical under equal conditions, and last, but not least, capable of making the highest maximum and average speed. These two instances of high velocities were not with light train loads; the loads were not equal to our heavy passenger traffic loads, but compared to English and foreign train loads for high speed they are certainly not to be termed "light loads." The New York Central train weighed about 230 tons; the Reading train weighed about 169 tons.

During the past two years we have reviewed at different times some of the necessary changes that must be made in locomotives to adapt them for extremely high speed. Of all of these changes the most important ones are in the counterbalances and reciprocating parts, the steam ports and valve travel, and the arrangement of the exhaust. Radical changes are probably unnecessary, but decided modifications must be made to adapt the average locomotive for fast runs.

It is well understood what will have to be done with the reciprocating parts, and a great improvement is noticeable in the most recent designs. The pistons are now made of less than one-half their former weight, and of cast steel or wrought iron. The reduction in the crosshead is not as great, but a further reduction is at hand. The main rods, which largely affect the counterbalancing, have been reduced one-half in several instances. The parallel rods, which do not affect the accuracy of the counterbalancing, and hence produce no detrimental effect on the track when counterbalanced, have been supposed to be one of the limitations of speed, but the rapid introduction of solid ends and "I" sections, as well as the use of an extremely fine grade of steel having a high tensile strength and great ductility, have so improved the strength, and at the same time decreased the strain by reason of a decrease in weight, that the limit of safety in increasing speed, as determined by side rods, has been raised considerably. If 60 miles an hour was a safe speed with the parallel rods of five years ago, then 90 miles an hour is a safe speed with the most improved form and kind of rod. The reciprocating parts of our best engines to-day, when perfectly balanced, have less detrimental effect upon the roadbed than the best single-driver engines. Hence, so far as counterbalancing is concerned, we may consider that the best locomotive designs in this country are such as to remove the limit of speed to a point above the highest practicable speed with permanent way as it is.

The other two necessary changes in design to adapt the present locomotives to high speed have not received the attention they should have. It is only now that we can say that any efforts which promise success have been made to determine what is the proper form of an exhaust pipe and smokestack to give the least back pressure in the cylinders. The Master Mechanics' Association committee reported this year a few general facts which will assist in a solution of the problem; but we expect the most conclusive results from the experimental work being carried on by two railroad companies with old engines jacked up in the shop, on which a large variety of exhaust apparatus will be tried. Within another year one will probably know how to construct a locomotive blast apparatus so as to give approximately the least back pressure to the cylinders.

It is the mean effective pressure on the piston at high speeds that must be increased before we can hope to haul heavy trains at a higher rate of speed than is now common. This average pressure on the pistons is to be increased by decreasing the back pressure, as just shown, and further by so increasing the opening of the steam ports at short cut-offs, and prolonging the period of exhaust, that the wire drawing at admission and the loss by compression shall be materially reduced. There are those who have proposed, and will continue to propose, radical changes in the valve motion, such as a substitution of a new gear in place of the Stephenson link. While in a general way this is to be encouraged, yet the most advisable and desirable thing to do is to improve the plain "D" valve and the Stephenson link as much as it can be improved before we give it up. This gear we know all about in service. It is reliable and positive, and gives little or no trouble. There is no substitute yet proposed which does not promise trouble from the start when operated at high speed. As we have before shown in the *Railroad Gazette*, there are ways of increasing the port opening at short cut-offs and prolonging the period of exhaust which are perfectly practicable, and are being used with good success on several roads, notably the Reading, where the high speed was made which has called forth these comments. The engine which made this fast time had the following dimensions of ports, outside lap, and valve travel: Cylinders, 18½ inches in diameter by 22 inches stroke; steam ports, 1¼ inches by 16¾ inches; exhaust ports, 16¾ by 3¼ inches; travel of valve, 7 inches; outside lap, 1⅛ inches; inside lap, zero; diameter of drivers, 68½ inches; weight on drivers, 64,400 pounds; weight on truck, 31,800 pounds; total weight, 96,200 pounds.

Undoubtedly, the area of port opening was much more than common with this engine at short cut-offs, and was 25 or 30 per cent greater than with the ordinary engines used on express trains. The indicator cards which we have seen from this class of locomotives have the least compression and the best admission line of any that have been put before us. The engines were built in 1886, and have been operated since that time with perfect success with these foregoing dimensions of valve and valve travel. Hence the feasibility of the arrangement is proved beyond question.—*Railroad Gazette.*

Table of Seconds per Mile at Various Speeds in Miles per Hour.

When traveling by rail it is often convenient to know, when one wishes to determine the speed of the train, just how many seconds are taken to go one mile at any speed in miles per hour. The accompanying table gives the number of seconds required to go one mile at any speed in miles per hour from 1 to 100. In using this table one may take the time required to travel from one mile post to the next, and then look in the table for the speed in miles per hour corresponding to the number of seconds.

TABLE OF SECONDS PER MILE AT GIVEN MILES PER HOUR.

Miles per hour.	Seconds per mile.	Miles per hour.	Seconds per mile.	Miles per hour.	Seconds per mile.
1	3,600	34	106	67	53·7
2	1,800	35	103	68	52·9
3	1,200	36	100	69	52 2
4	900	37	97	70	51·4
5	720	38	95	71	50 7
6	600	39	92	72	50
7	514	40	90	73	49·3
8	450	41	87·8	74	48·7
9	400	42	85·7	75	48
10	360	43	83·7	76	47·4
11	327	44	81·8	77	46·7
12	300	45	80	78	46·2
13	277	46	78 3	79	45·5
14	257	47	76·6	80	45
15	240	48	75	81	44·4
16	225	49	73·5	82	43·9
17	212	50	72	83	43·4
18	200	51	70·5	84	42 9
19	189	52	69·2	85	42·4
20	180	53	67 9	86	41·9
21	171	54	66·7	87	41·4
22	164	55	65·5	88	40 9
23	157	56	64·3	89	40·4
24	150	57	63·2	90	40
25	144	58	62·1	91	39·6
26	138	59	61	92	39·1
27	133	60	60	93	38·7
28	129	61	59	94	38 3
29	124	62	58·1	95	37·9
30	120	63	57·1	96	37·5
31	116	64	56·2	97	37·1
32	113	65	55·4	98	36·7
33	109	66	54·5	99	36·4
				100	36

Almost every one knows the following rule, which gives the result with sufficient accuracy for ordinary purposes: The number of rails passed in 20 seconds equals the number of miles per hour. If all rails were 30 feet long, we should add about 2¼ per cent to the speed in miles per hour as given by this rule, but as there are some short rails, the result will be very close without correction. Up to pretty high speeds, say to 60 miles an hour, one can ordinarily count the click of the joints.—*Railroad Gazette.*

Lead and Zinc.

A valuable report upon the lead and zinc industries of this country, by Charles Kirchhoff, is contained in Census Bulletin No. 80. According to this report the totals are as follows for the respective ores:

LEAD ORE.

	Short tons.
Colorado	70,788
Missouri	44,482
Idaho	23,172
Utah	16,675
Montana	10,183
New Mexico	4,764
Kansas	3,617
Arizona	3,158

ZINC ORE.

Missouri	93,131
New Jersey and Pennsylvania	63,339
Kansas	39,575
Wisconsin	24,832
Virginia and Tennessee	12,906
Iowa	450

AT the little village of Wellsburg, N. Y., six miles below Elmira, on the Erie road, gas has been discovered issuing from a well which was originally put down to secure good water. A stream of gas was flowing from the pipe sunk in the ground which an expert says would illuminate the whole county. The citizens of the village are enthusiastic.

BROADWAY AND SEVENTH AVENUE CABLE ROAD.

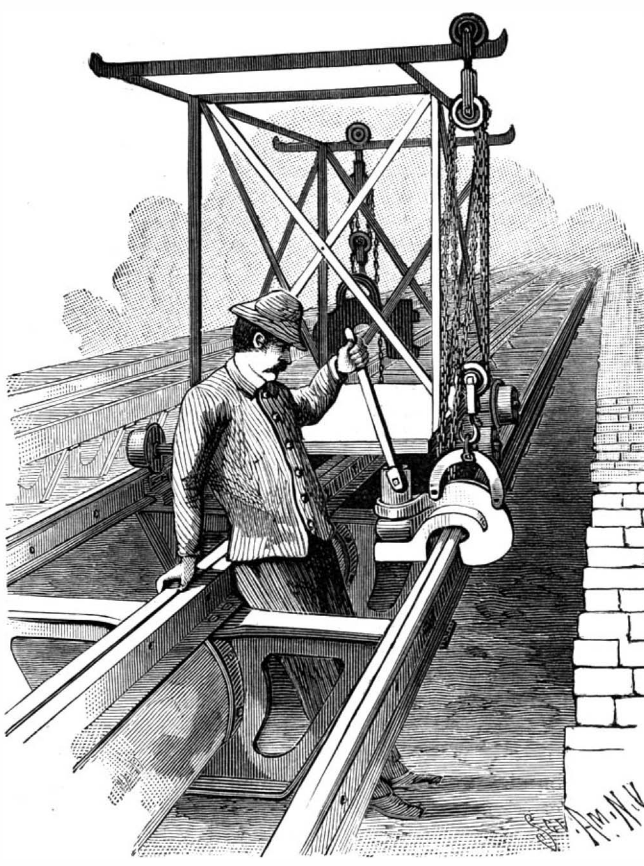
(*Continued from first page.*)

Houston Street there will be a cable loop, which will extend to the Battery and back, a distance of 4·24 miles, and another extending to a sheave pit between 36th and 37th Streets and back to the power station, a distance of 3·86 miles. There will be another power station at 51st Street, from which a single loop will extend southward to the sheave pit below 37th Street, and north to a sheave pit at 59th Street, returning to the power station, a total distance of 2·24 miles. The power required to drive this amount of cable will be about 2,000 horse power, but the machinery will be able to exert three times that amount of power in case of an emergency. The strain on each cable when in use will average about 12,000 pounds.

The construction of the road was shown in one of its stages in our issue of May 16, 1891. In our present issue we give illustrations of the work as it appears at Franklin Street and Broadway, opposite the offices of the SCIENTIFIC AMERICAN. As will be seen by reference to the engraving, the track is set upon cast iron yokes, which also hold the slot rails and encircle the ends of the sections of the sheet steel cable conduit. The yokes are 27½ inches high to top of lugs and 23 inches to rail seat, and weigh about 550 pounds each. The distance between the yokes is 4 feet 6 inches. They rest upon separate foundations of concrete, which are 45 inches long, 18 inches wide, and 6 inches deep. The conduit in which the cable runs is formed of sheet steel sections, with a backing of concrete. The pits in which the carrier sheaves are located are 42 inches deep and 31½ feet apart. The slot rail is formed of two like but oppositely arranged Z-shaped parts, leaving between them a groove, through which the grip extends from the car down into the conduit, where it engages the cable. The slot rails are braced at frequent intervals by wrought iron rods passing through the tram rails and through the slot rails. The entire construction is designed to be permanent, and everything relating to it is carefully and thoroughly done. In fact, this road is intended to be a masterpiece of its kind.

In carrying forward this great work, much of the labor has been performed at night by means of artificial light. Modern appliances have been used wherever they tend to facilitate the construction. For example, a steam concrete mixer, mounted upon wheels, so that it may be moved along the track as required, is used for preparing the concrete used in the foundations, and in filling in around the conduits. It not only does the work of a great number of men, but it does it more thoroughly and evenly. The materials are shoveled into one end of the machine, and thoroughly prepared concrete is delivered at the opposite end.

The concrete mixer is simply a heavy iron cylinder, containing a shaft carrying a series of wings or vanes, arranged spirally. These wings form, practically, an endless screw, which stirs the ingredients thoroughly while the necessary amount of water is added. At the same time it propels the concrete toward the discharge end of the machine, where it is delivered ready for use. The mixer is driven by a 6 h. p. vertical steam engine, mounted on the same platform. The capacity of the mixer is 150 cubic yards per day of ten hours. The holes for the bolts which connect the manhole curbs to the slot and tram rails are punched in the rails by means of hydraulic punches, which are supported on a car, so that they can be moved along the track as required. These simple machines readily punch 1 inch holes in the ½ inch web of the slot rail, requiring the application of hand power for about half a minute only.



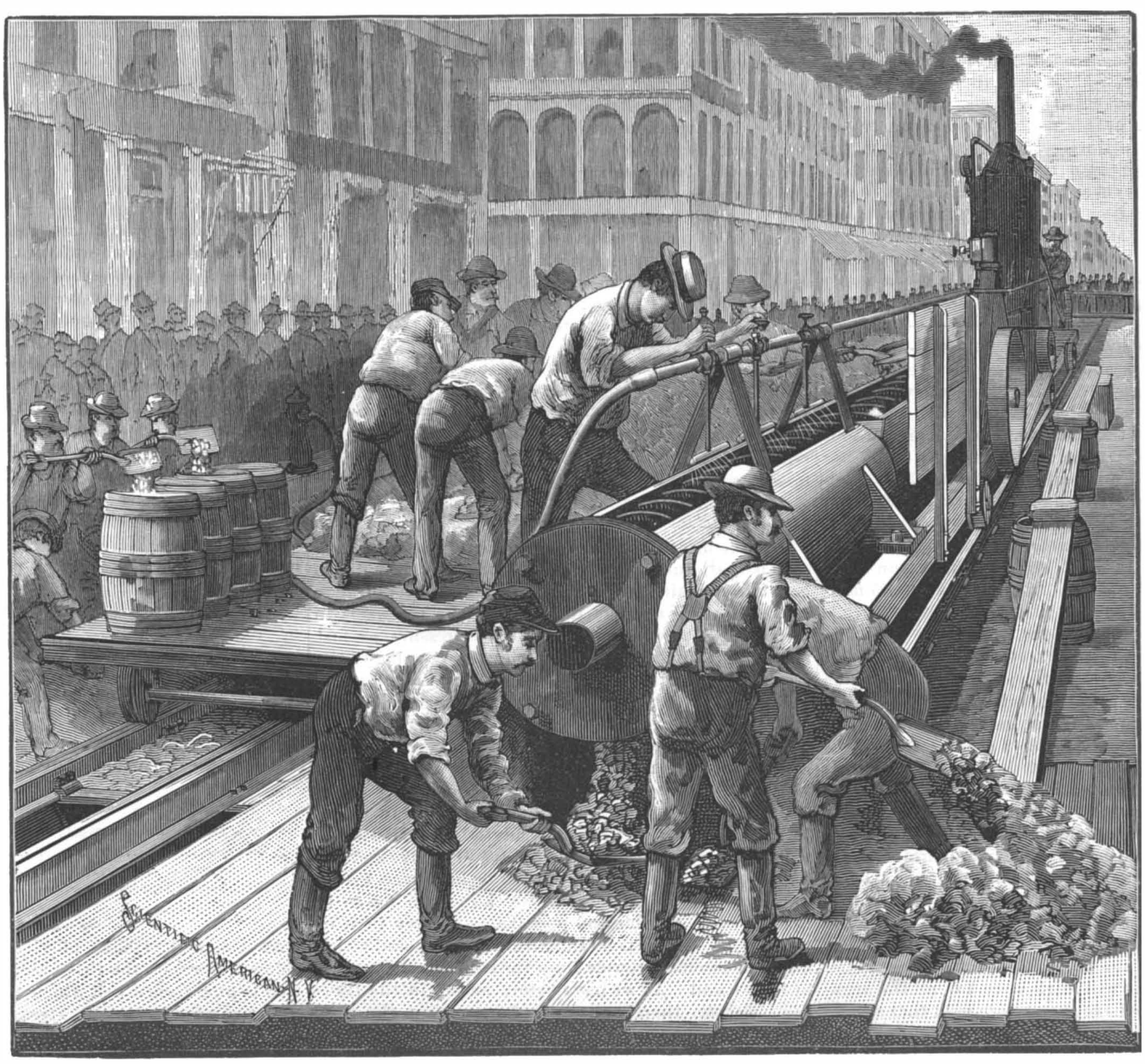
PORTABLE HYDRAULIC PUNCH.

The difficulties encountered in preparing the excavations for the road were enormous. Some of the obstructions at Fulton Street were described in our issue of May 16. Another example occurs at Broadway and 14th Street. These are not by any means the only places where obstructions of this kind are met. Something of the same nature is found at almost every block. Water and gas mains have to be moved, sometimes laterally and sometimes by dropping them down below their original level, the electrical conduits require shifting, and the pueumatic tubes of the Western Union Telegraph Company are being replaced by a complete new set laid in the space between the two tracks about on a level with the foundations of the yokes, and all this is accomplished with practically no interruption of the use of the various pipes and conduits.

The yokes which support the tracks weigh, as stated, about 550 pounds each; the tram rails weigh 91 pounds per yard, and the slot rails weigh 67 pounds per yard. Each was specially designed for this work. The gauge of the track is 4 feet 8½ inches, and the distance from center to center of the tracks below 35th Street is 9 feet; above 35th Street it is 10 feet.

The diameter of the cables will be 1¼ inches; the cable drums will be 12 feet in diameter; the large rope-driving drums will be 32 feet in diameter and the small ones 10 feet and 7 feet 6 inches. The engines driving these drums will have cylinders 36 and 38 inches in diameter, with a piston stroke of 60 inches.

Some of the interesting features of the road are necessarily omitted from the present article, but we expect to give full details of them at some future time. Among these features are the curves, the switches, the cars, and the grip.



POWER CONCRETE MIXER—CAPACITY, 15 CUBIC YARDS PER HOUR.

Rules and Suggestions for Transplanting Trees.

A general rule that will hold good in transplanting trees, shrubs, and grape vines, says *Farmer's Call*, is to shorten and severely prune the parts that are to remain above ground. In taking up plants that have attained any considerable size, it is unavoidable that the roots will be broken more or less and large portions of them left in the ground. This makes it necessary to preserve a proper balance between the two parts by pruning the tops accordingly. In transplanting, whether in spring or fall, the roots should be spread out as well as possible without cramping them unnaturally, and spring-planted trees in case of protracted drought may often be saved by watering them evenings, when without it they would die.

The following practical hints on this subject are from an address by Mr. Samuel Edwards before the Illinois Horticultural Society:

Deciduous trees, the roots of which have become dry in transit, can in many instances be saved by burying the entire tree in moist earth for a few days.

The prolific cause of loss is the failure to properly pack and firm soil among the roots of the newly set trees. Fine dirt should be packed in by hand and all roots covered several inches with it. Pour on a pail or two of water to wash dirt into all possible crevices. After ground settles fill in again, tramp and pound dirt firmly about the roots. Leave the surface soil loose, mulch with prairie hay, straw or other coarse litter to depth of six inches, extending a foot beyond ends of roots.

Neglect to mulch or frequent stirring surface soil kills many trees, especially if they are daily deluged by water. In a season of protracted drought, watering may be necessary. Dig a hole near the tree, water bountifully, then return the earth after water settles.

Wrap bodies of new-set trees with burlaps of any cheap material to shade from hot sun. In a hot summer, if this is not done, bark is often killed in spots on south or southwest side.

WILLIAM FERREL.

The National Academy of Sciences has met with serious losses since its April meeting in Washington. Its deliberations had scarcely terminated when the news of the death of John Le Conte, who for so many years filled the chair of physics in the University of California, was announced. Also in the last days of April Joseph Leidy, the distinguished biologist and president of the Philadelphia Academy of Natural Sciences, passed away. The long illness of Julius G. Hilgard, who from 1845 till 1885 was connected with the U. S. Coast Survey in many capacities, including that of superintendent, terminated fatally on May 8, and now the Academy mourns the loss of William Ferrel, who has long been one of its most eminent members.

William Ferrel was born of humble parentage in Bedford (now Fulton) County, Pa., on January 29, 1817. The facilities for education were inferior in those days and were confined mostly to winter schools in log cabins. But such as they were, young Ferrel made the most of them until, at the age of fourteen, he "had mastered everything taught then in the schools of the country, and so my school education ended."*

Meanwhile, at the age of twelve, he removed with his parents into Berkeley County, now West Virginia, which, though only fifteen miles from his birthplace, was entirely across the State of Maryland, as at that point it was only two miles wide. Here he continued to aid his parents in the work on the farm, but did not neglect his books, for he continued to read and study everything that came into his hands, which, however, were very few.

Of his early fondness for science he has left a distinct account, and he says, "On the morning of July 29, 1832, as I was going to the field to work, I observed that the sun was eclipsed. I was not aware that there was to be an eclipse, and I had never read or thought on anything pertaining to astronomy." The eclipse excited an interest in such matters, and he at once began to study its cause. The only available text books on the subject were a copy of Adam's Geography, with an appendix containing various problems to be solved by means of globes, and a series of almanacs extending back for several years. From the latter he studied the motions of the sun and moon, and discovered that, although the motions of the moon are very irregular, they repeat themselves somewhat in each cycle of 15 revolutions of the moon and about 42 degrees, and that counting from any previous conjunction or opposition of the sun and moon, there is another conjunction or opposition occurring very nearly at the end of the time of the preceding cycle. Hence, by reckoning from some previous conjunction or opposition, he knew approximately the place of the moon at the end of the cycle, and so very nearly at the time of any new or full moon or time of any eclipse.

By similar means he determined the sun's place, and by applying the information he worked out he was able to predict future eclipses, so that at the age of sixteen he ventured to predict and put upon record the times and other circumstances of three eclipses for the year 1832. Concerning which he writes, "the greatest error in the times, according to the next almanac, when it appeared, was only nine minutes."

A year later he tried to procure a trigonometry, but on making inquiry for one was given a treatise on surveying, which he studied "mostly during winter evenings, by the light of a dim candle or the blaze of light wood, and mastered it very nearly all in about three months."

He was successful in obtaining a few other text books on mathematics, which he carefully studied until, at the age of twenty-two, having made a little money by teaching, and having the promise of some aid from his father, he entered Marshall, now Marshall and Franklin, College. For two years he continued at college, but at the close of 1841, no longer willing to burden his friends with the expense of his education, he left, and taught in Virginia. After several years' experience in this occupation, he entered Bethany College, and was graduated there in 1844.

Resuming his vocation as a teacher, he settled in Liberty, Mo., near where Kansas City now is, and also devoted much of his time to study, especially in the higher branches of mathematics. From Liberty he went to Nashville, Tenn., where he taught for several years in a commercial college, and at the same time studied the works of Newton, La Place, and such books as Maury's "Physical Geography of the Sea" and Mrs. Sommerville's "Physical Geography."

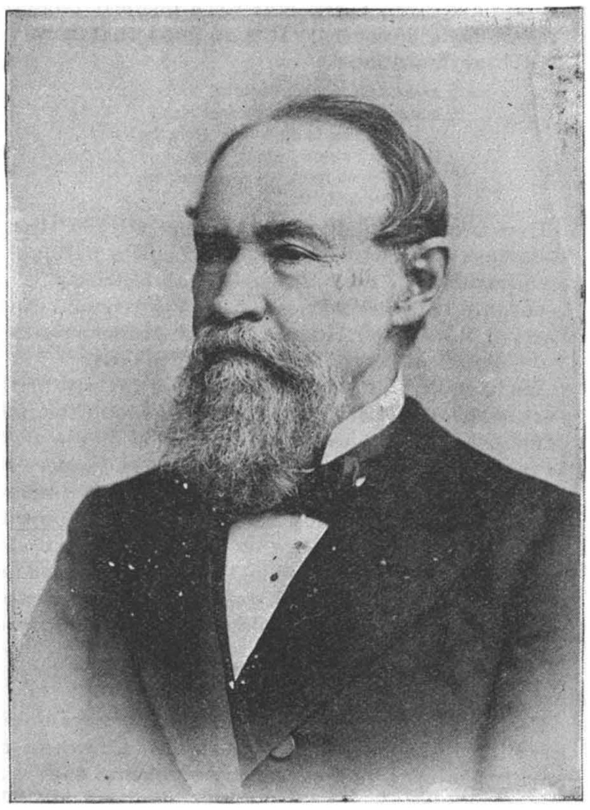
He had now acquired a sufficient fund of knowledge to impart his ideas to others, and in 1856 he published in the Nashville *Journal of Medicine and Surgery* a popular essay on the "Winds and Currents of the Ocean," and later contributed to Dr. Benjamin A. Gould's *Astronomical Journal*, then issued in Cambridge, Mass. These led to his acquaintance with men of science, and early in 1857 he received an appointment as assistant in the office of the *American Ephemeris and Nautical Almanac*, then published in Cambridge, under the supervision of Professor Joseph Winlock. This place he held for ten years.

*Personal letter to the writer.

When Benjamin Peirce was called to succeed Alexander Dallas Bache as superintendent of the United States Coast Survey in 1867, he invited Professor Ferrel to accept an appointment in that service, with special charge of the consideration and discussion of tidal relations. In the annual report of the survey for 1874 there was published his "Tidal Researches," and subsequently in the annual volumes appeared contributions on this specialty by him. During his connection with the Coast Survey he invented a maxima and minima tide-predicting machine, which was constructed at a cost of $2,500, of which a full description is given in Appendix 10 of the "Report of the United States Coast and Geodetic Survey" for the year 1883.

In 1882 he was invited to accept an office in the United States Signal Service as professor of meteorology, which place he then continued to hold until October, 1886, when he resigned, to devote his entire attention to his private researches. While in the Signal Service he prepared a volume of 440 pages, entitled "On the Recent Advances in Meteorology," which is used as a text book in signal service schools and as a hand book in the office of the chief signal officer. It is said to be "a work of rare ability, and for a good while to come will be the chief authority at Washington in theoretical meteorology."

His leisure after retiring from government service was spent in the preparation of "A Popular Treatise on the Winds," which was published in New York during 1889. It is a volume of some 500 pages, and added materially to his reputation. A reviewer, in writing of him, says: "It places the author in company with Professor Peirce and a few others in this country on the plane still occupied by La Place in France and Europe."



THE LATE WILLIAM FERREL.

There is not space in which to refer to the theories and newly discovered laws of Professor Ferrel in regard to the winds, tides and currents of the ocean. Such discussion belongs more properly to more strictly technical journals than this, but we are sure that the progress which he has inaugurated in the science of the ocean and of our atmosphere will prove to be both enduring and substantial.

His professional papers are more than fifty in number, and include, besides those published in the official reports of the departments with which he was connected, special contributions to the *American Journal of Science*, *Van Nostrand's Engineering Magazine*, *Science* and similar journals, and also to the transactions of various scientific bodies of which he was a member.

Among the more important titles of his papers are: "Motions of Fluids and Solids Relative to the Earth's Surface" (1859); "Determinations of the Moon's Mass from Tidal Observations" (1871); "Converging Series expressing the Ratio between the Diameter and the Circumference of a Circle" (1871); "Meteorological Researches. Part I. On the Mechanics and the General Motions of the Atmosphere" (1877); Part II. "On Cyclones, Tornadoes, and Waterspouts" (1880); Part III. "On Barometric Hypsometry and the Reduction of the Barometer to Sea Level" (1882); and "Temperature of the Atmosphere and the Earth's Surface" (1884).

Besides the degree of A. M., he had received the honorary conferment of that of doctor of philosophy. He was an honorary member of the Austrian, English, and German Meteorological Societies and an associate fellow of the American Academy of Arts and Sciences. In 1868 he was chosen to the National Academy of Sciences, and as at that time the membership was restricted to fifty persons, the honor was a most valuable one.

Professor Ferrel was never married, and made his home with relatives and friends in Kansas City, Mo., and there, at the ripe age of seventy-four, on September 18, 1891, he passed away. M. B.

The Clark University, Worcester, Mass.

One of the leading courses of study is that of original research relating to psychology. Moreover, this university is presided over by one of our own members as president, and another as trustee. It has a *Psychological Journal* of its own, which certainly is an honor to its founder, to ourselves, and to our specialty in this country. Here then, within our own ranks, there exist the very means by which we may anticipate a larger measure of progress in psychology, and incidentally also in psychiatry, than would be probable if sought in almost any other way.

Here can be trained a class of students for original investigation and experimental research in accordance with the strict requirements of science. Here are already, or hereafter are likely to be, gathered the requisite means of such research, in the way of special journals and books from the centers of the medical world; also laboratories, experimental and chemical, with their various needful appliances, together with facilities for ascertaining the physiological effects of drugs.

Already there are established scholarships by means of which a higher attainment in all that may conduce toward a more differentiated knowledge of comparative and human anatomy and physiology may be had. Pathological research may also be prosecuted under conditions which can be had only in thoroughly equipped laboratories; studies relating to those physiological changes which occur in the sensory system during the different seasons of the year, day and night, morning, noon, and evening; tests in the capacity of endurance in motor and psychic centers of the brain; the length of time required by different portions of the nervous and muscular systems to energize and to expend their store of energy; the rapidity of movement in the nervous system attending the physiological elements of sight, hearing, and general sensation; the periods requisite for peripheral irritations to pass through the afferent nerves to the sensory ganglia, thence to the cortex, and again through the efferent nerves, eventuating in motion or speech; a study of the anatomical arrangements of all the organs of the special senses, and their co-ordinating activities in connection with sensation, ideation, and motion; in short, all those physiological activities which are associated in the formation and exhibition of thought.

I hardly need to suggest that the stimulus of such investigations, such a library, laboratories, instruments, and opportunities for study, will tend greatly to enlarge the boundaries of our specialty beyond our present vision. It will lift the status and broaden the culture of our association.

It indicates the possibility of passing beyond the routine of that care and anxiety which ever attends the practical management of the insane into a higher sphere of research relating to the nature and treatment of their maladies. Here may be gathered those who, by virtue of their special attainments, may be able to sift the chaff from the wheat, and sit in judgment upon the merits of the work and its results which may be prosecuted by teachers and students in the laboratories. Is it too much to anticipate that in the future such study and experiment will reflect rays of light upon the physiological activities of the brain and nervous system, which will render more clear and definite the indications for scientific treatment?

May we not also anticipate that at no distant date there will be discovered in chemical laboratories some remedy which will act with increased efficiency in modifying and restoring nerve energy?—*H. P. Stearns, M.D.*

Eruptive Geysers.

Bunsen has explained the periodical eruption of geysers in such a satisfactory manner that doubt is no longer possible. A cavern filled with water lies deep in the earth, under the geyser, and the water in this cavern is heated by the earth's internal heat far above 212°, since there is a heavy hydrostatic pressure upon it arising from the weight of water in the passage or natural standpipe that leads from the subterranean chamber to the surface of the earth. After a certain time the temperature of the water below rises, so that steam is given off in spite of the pressure, and the column in the exit tube is gradually forced upward. The release of pressure and the disturbance of the water then cause the contents of the subterranean chamber to flash into steam and expel the contents of the exit pipe violently. These eruptions may also be provoked by throwing stones or clods of turf into the basin of the geyser. The water in the cavern below is disturbed by this means.

Some Electrical Words.

A very fair idea of the rise and progress of a science may be gathered from a study of the technical terms which have been used from time to time to explain the various phenomena or for the purpose of setting forth new theories. Should any one be disposed to make such an attempt in regard to electricity, he will find the material ready to his hand in the recently issued part (E—Every) of the "New English Dictionary on Historical Principles," a monumental work now in course of publication by the Oxford University Press. As there may be some who are unacquainted with this modern "Johnson," it is perhaps necessary to say that it is based, as the title sets forth, on strictly "historical principles." It is true that the definitions are generally in the editor's own words, but they are little more than a summing up of the evidence furnished by quotations from authors of acknowledged repute, and as full references are always given, the reader can verify them for himself and obtain further information if he wishes for it.

The word "electricity" and the various compounds under "electro" occupy more than ten closely printed columns of small type, enough to more than fill an entire number of the *Electrical Engineer.* We do not advocate any radical reform in scientific nomenclature, but it is curious to observe what a vast superstructure has been built upon a foundation which is, logically speaking, utterly insecure. Every text book tells us that "electric" is derived from a Greek word signifying "amber," that substance when rubbed developing electricity. But who thinks of amber in connection with the electrical science of the present day? The modern Latin word seems to have been first used by Gilbert, in 1600, in his treatise "De Magnete," and the earliest instance of its use in English is in Sir Thomas Browne's "Vulgar Errours" (1646). For "electrical" there is an earlier authority in Carpenter's "Geography Delineated" (1635). The editor notices the somewhat arbitrary uses of the words "electric" and "electrical," which are precisely synonymous, although we should not expect to be asked, "Have you bought any electric books lately?" nor do we usually speak of the "electrical light."

Proceeding in alphabetical order we come upon "electricalness," a word we never met with before. The only authority for it is Bailey's Dictionary (1736), but we doubt if the word was ever actually used. We were rather surprised to learn that "electrician" dates as far back as 1751, when we find Franklin saying in the *Philosophical Transactions,* "I have not heard that any of your European electricians have been able to . . . do it"—words which somehow or other have a familiar sound, as if we had heard them only the other day. "Electricity" is a long article, the earliest quotation being again from Sir Thomas Browne's "Vulgar Errours" (1646). The *Philosophical Transactions* furnish many examples, and the editor points out that the term "electric fluid" survives in popular language, and that "positive" and "negative," which we also inherit from Franklin's theory, are still in scientific use.

"Electric light," in its modern restricted sense, makes its first appearance in 1843, as the heading of a paragraph in the *Mechanic's Magazine,* "Electric Light a Substitute for Gas." The *Daily News* is responsible for "a beautiful electric-lighted clock." We come next upon the uncouth word "electricology," which is the title of a work on electricity, written in 1746 by one R. Turner. Bennet, a well known electrician of the last century, is credited with a proposal for "an electrico-meteorological diary." "Electrify" seems to be Franklin's word, and dates from 1747.

The compounds of "electro" number about a hundred, and although we are not disposed to set up as purists, we cannot avoid the observation that many of them are nothing better than base coin. This remark, however, must not be understood as attributing blame to the editor for retaining them. This is no "Dictionnaire de l'Academie" which is to serve as a standard of propriety of language, but it includes everything, whether good, bad or indifferent. Faraday's words are generally referred to their original source, and we should have thought that "electrolysis" was due to him, but Todd's "Cyclopædia of Anatomy" is the earliest authority given. The word is said to have two meanings: (1) chemical decomposition by galvanic action, and (2) the name of a branch of science. This seems to us to be unnecessary. The word "electromagnet" only goes back to 1831, which is the date of a paper in *Silliman's Journal.* "Electro-magnetic" dates from 1823, and "electro-magnetism" from 1828. We have to note some deficiencies here, and Œrsted's papers in the *Annals of Philosophy* for October and November, 1820, would have furnished an earlier quotation for "electro-magnetic," while Faraday's "Historical Sketch of Electro-magnetism" in the *Annals* for September, 1821, shows that the word is at least seven years older than stated in the dictionary. It might also have been worth noting that "electro-magnet" meant originally a solenoid, such as the little apparatus known as De la Rive's "floating battery."

As the dictionary takes account of words only, some confusion occasionally arises by reason of the same word being used to denote different things. For instance, under "Electrometer" we have a reference to Lane's apparatus known by this name described in the *Philosophical Transactions* for 1766, where the contriver suggests that his instrument "may not improperly be called an electrometer." Under the same heading there are other quotations which obviously refer to "electroscopes," as we now call them, such as Bennet's gold leaf electroscope. One has to bear this change of name in mind to account for the fact that no authority earlier than 1824 has been found for the word "electroscope."

Under "electro-motive" our contemporary the *Engineer* is quoted in support of the use of this word as a substantive, in the sense of a locomotive engine worked by electricity. This is very sad, and should be rigorously put down along with "electrolier," though we have endured "gaselier" for so long that we fear this last abortion cannot be refused admission into our vocabulary.

The striking character of electrical phenomena seems to have taken firm hold on the popular imagination, and we find accordingly that the technical terms of the science have been largely adopted by general writers in a figurative or metaphorical sense. As early as 1752 Lord Chesterfield writes to his son, "You will not be so agreeably electrified as you were at Manheim." Coleridge (1793) has these lines:

> The electric flash that from the melting eye
> Darts the fond question or the soft reply.

The editors do not often "drop into poetry," or they might have given Clerk Maxwell's poetical rendering of Faraday's discovery. It is so good that it will always bear quotation:

> Around the magnet Faraday
> Is sure that Volta's lightnings play;
> But how to draw them from the wire!
> He takes a lesson from the heart.
> 'Tis when we meet, 'tis when we part,
> Breaks forth th' electric fire!

Here is a striking quotation from Carlyle's "Sartor Resartus:" "Wait a little till the entire nation is in an electric state; till your whole vital electricity . . . is cut into two isolated portions of Positive and Negative; of Money and Hunger." Max Muller speaks of "the electric light of Comparative Philology."

We have by no means exhausted the interest of this part of the dictionary; and those who are in the habit of occasionally thinking of the words they use daily, as they sometimes scrutinize the image and superscription of a current coin, will find much that is suggestive. As we have already remarked, theories now discarded have left their mark on the language of to-day, and it is more than probable that the words we now invent, and which we think are altogether admirable, will in turn become meaningless.—*Elec. Engineer, London.*

The Pressure of Gas in Coal.

Cool in the bituminous mine seams is always more or less subjected to bleeding. This is well known to the practical miner; he is constantly observing the sweating of the coal, accompanied with a hissing sound. The sweating undoubtedly is produced by the pressure of the gas stored up in miniature cavities and fissures of the seam.

The pressure of the gas is a subject of increasing interest; it has been found in some cases to be nearly equal to the pressure of the steam in the boilers of steamships. Pressures of 200 pounds and upward have been found to be common in deep seams newly opened out. What is interesting about the matter is the corelationship of the pressure of the gas to the pressure due to a vertical column of water, measured from the seam to the drainage level of the rocks overlying the seam.

To make this clear, let us suppose a seam to be 250 fathoms from the surface; again, let us suppose the drainage level is about 50 fathoms from the surface. Now by these data we may, with considerable accuracy, calculate the pressure of the gas stored up in the cavities of the seam.

Suppose the seam has not been wrought, but has been pierced by a bore hole. If a long iron tube was inserted in this bore hole and made gas tight, that is to say, made to fit the hole so closely by some system of packing that no gas could escape, and a pressure gauge was screwed on the upper end of this pipe and allowed sufficient time for gas to accumulate in the bore hole, the pressure ultimately observed might first be calculated as follows: Vertical height of water being 200 fathoms, then—

$$\frac{200 \times 6 \times 62{\cdot}5}{144} = 520 \text{ pounds pressure on the square inch.}$$

This calculation might, however, have been made by a simpler process, which we highly recommend: a square inch column of water having a vertical length or rise of 6 feet weighs nearly 2·6 pounds, therefore $200 \times 2{\cdot}6 = 520$, or is equal to a pressure of 520 pounds on the square inch, as before.

Often, as faults and dislocations, water and gas are met with in unusual quantities. Sometimes on cutting a fault, gas is given off, generally at the bottom of the seam, and this gas often consists of sulphureted hydrogen. Water is often met with at faults, and it generally comes off at the fault at the top of the seam, and after the water has expended itself, it is followed by gas, which also consists of sulphureted hydrogen. Now, why gas should be found at the bottom of the seam and water at the top of the seam is a matter full of interest. Water is sometimes given off at the bottom of the seam, and when that is the case, the reason why requires observation and investigation.

Now when water is given off at the bottom of the seam, some cavity in the neighborhood of the fault contains gas at a high pressure, but is situated above another cavity filled with water, so that while the gas is pressing on the water, water flows from the bottom of the seam, through some vent or parting in the fault; but as water is heavier than gas, if the water and gas are found in one cavity in the bottom stratum of rock communicating with the fault or fissure, then gas only is given off, and sometimes at a high pressure. But it will be noticed that after a while the gas is all spent off, and the air in the neighborhood of the fault resumes its normal condition. The gas is expelled by the operation of Boyle's law; it exists in this bottom cavity at a pressure considerably above that of the atmosphere, and if the pressure of the gas in the cavity was three times that of the atmosphere, on that pressure being removed it would expand into three times its original volume, or every cubic foot in the cavity would expand into three cubic feet, two of which would be expelled.

When the water is given off at a fault at the top of the seam, we may certainly expect this water to be followed by gas, because, being lighter than water, it is pent up at a high pressure above it, and the high pressure of the gas causes a rapid or violent outflow of water. Now as the gas cannot sink in the water, being lighter, if the bottom of the cavity communicates with the fault, then no gas will spend off until the water has all been expelled.

These facts correspond with every-day experience, and happy is the man that takes a pleasurable interest in these matters, because it is out of such observations that knowledge and experience are matured, and men are made useful and profitable to themselves and others.—*American Gas Light Journal.*

The Manufacture of Caustic Soda and Chlorine by Electrolysis.

An improvement which has recently been introduced in the production of chlorine gas and caustic soda electrolytically exhibits the following essential features.

The vessel in which the electrolysis takes place is made either of iron or of carbon; in the latter case it is jacketed with an adherent coating of electrolytically deposited copper. This vessel forms the cathode.

The anode consists of a cylinder made of any suitable metal and coated with a layer of carbon; this cylinder is placed in the center of the vessel which forms the cathode.

Between the two electrodes there is a porous diaphragm consisting of a number of V-shaped troughs made of porcelain; these are built up inside each other, and the intermediate spaces are packed with asbestos fiber or powdered steatite. This curious diaphragm is a special feature of the apparatus, and it is stated that it offers much less resistance than does the usual form of porous earthenware. Another advantage claimed for this arrangement is that it prevents the diffusion of the chlorine evolved in the anode section into the caustic soda formed in the cathode section.

The electrolyzing vessels may be arranged together in series or used separately.

The raw material is brine. This is supplied from separate tanks to the anode and cathode of the first vessel when a number are arranged in series, and the brine gravitating along the entire series through the respective sections of the cells flows ultimately into separate catch vessels from whence it is delivered back into the respective tanks.

This circulation is maintained until the solutions are sufficiently decomposed.

The chlorine escapes from the electrolyzing vessel through an outlet pipe, in a porcelain cover, which latter seals the vessel.

There is another combination in which an oblong vessel is divided, by a number of parallel plates (representing the poles) and diaphragms, into anode and cathode sections, through which the respective liquids circulate; but in this arrangement the cathodes are not coated with a layer of carbon.

THE Wheeler Condenser and Engineering Company has recently filed articles of incorporation with the Secretary of State at Trenton, N. J. The company has bought out the entire plant and business of the Colwell Iron Works, of Carteret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans and special machinery for sugar refineries, salt works, condensed milk factories, etc. The Wheeler Company will continue to manufacture Wheeler's patent surface condensers and other of his specialties.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

DRAW BAR AND SPRING.—Ferdinand E. Canda, New York City. This invention provides a spring casing permanently attached to the car timbers, with a removable bottom plate, while a mortised tail bolt is adapted to receive the pulling strain and a follower with key guides prevents the tail bolt from turning. The casing is designed to have the greatest possible strength and be of such form as to have the firmest anchorage to the draught timbers, while being easily accessible for the renewal of springs, followers, etc., the improvement providing increased strength in all parts connected with the draught rigging, as called for by the heavy tonnage cars now used on the various railroads.

SPIKE.—John S. Van Leer and John T. Redmon, Sedalia, Mo. This spike is especially designed for securing rails on ties, and has its shank square near the head, from which there is a laterally projecting wedge-shaped flange, there being a boss on the head directly above the shank, which is triangular below the square portion, each side of the triangular part being longitudinally grooved to afford channels and intervening ribs, all sides being sloped to form a triangular point coincident with the axis of the shank. This spike is designed to be economically made and to seal the puncture formed by its insertion in the wood, while it is readily guided to drive in a straight line vertically or at any desired degree of inclination.

DUMPING CAR.—Christian Schmalzrid, Donaldsonville, La. Tilting cars which dump their load at the side from the top of the body of the car may be made of improved construction by means of this invention, which consists in a raising and lowering car body in connection with a truck on the wheel frame of which it rests when not to be tilted. Special means are provided for raising and lowering the car body and for tilting it laterally to dump when needed. The improvement, although applicable to hauling and dumping coal and other materials, is more especially designed for the hauling of sugar cane from the field to the mill, and dumping it quickly on a suitable carrier.

Electrical.

INSULATOR. — Frank A. Ross, Livingston, Montana. This insulator is threaded internally to receive a supporting pin, and has a water shed at its lower end, while its upper end has a screw-threaded transversely slotted part to receive the wire. At the bottom of the transverse slot the insulator is concaved or corrugated to antagonize a screw having a similar surface, and a screw adapted to the threaded portion of the insulator for clamping the wire on its corrugated surface. With this device the use of binding wires will be avoided, and the conductor may be securely clamped without injury to the insulation or the wire itself.

Agricultural.

CULTIVATOR.—Parrott M. Hardy and Thomas R. Boyd, Edwards' Mill, N. C. The frame of this machine has a series of offsets, with inclined faces and recesses opposite the offsets, cultivator blades being secured to the inclined faces and cultivator teeth located in the recesses, while there is a fastening device for securing the cultivator teeth and blades adjustably to the frame. The implement is designed to be conveniently adjusted laterally to work upon rows of different widths, while the harrow teeth and cultivator blades carried by it may be readily and quickly adjusted vertically to and from the ground.

GRAIN AND COCKLE SEPARATOR. — Thomas F. Gray, Monroeville, Ohio. This is a simple and durable machine, that is inexpensive to manufacture, in which a vibrating frame is mounted in the main frame, and parallel inclined rollers are mounted in the vibrating frame, an endless belt provided with pockets passing around the rollers, and the belt being operated by the vibration of the frame, which is effected by a cam on the drive shaft. The machine also provides means whereby the cockle and wheat kernels are separately delivered, each being passed into a receptacle provided therefor.

Mechanical Appliances.

REAMER. — William W. McGregory, Pasadena, Cal. This invention relates to drilling tools for boring wells, providing a simple and durable reamer which expands to ream out the hole made by the drilling tool to facilitate the lowering of the well pipes or casing. Two opposed reaming blades are pivoted on a head, below which they extend, and a longitudinal plate spring is secured on the inner side of each blade, the springs being bowed inward into contact with each other and holding the blades normally apart at their lower ends. The reamer is attached to the drill rod in the same manner as the drilling tools.

SECTIONAL CORE. — Marshall J. Hughes, New York City. This is a core for the foundation of stereotypes, electrotypes, printers' furniture, etc., and is formed of sections of varying width, to replace type metal with cast iron or other cheap material which will support the cast and give it the required rigidity and strength. The invention provides apertured core sections of hard metal with apertured sections of soft material disposed intermediate of the hard sections, whereby the cast may be separated into sections without trouble, in combination with a core support adapted to enter the apertured sections.

SHOE TURNING MACHINE.—Jason H. Edgerly, Chicago. A hollow form adapted to approximately fit inside the heel of a shoe, and bear upon the sole near its edges, is secured to a slide, by which it is held in position on a suitable work bench, and a plunger, worked by a treadle, has a vertical movement from above down into the form. When the shoe is placed, bottom up, upon the form, and the plunger is moved downward by pressing on the treadle, the sole is pressed down within the form, and the operator completes the operation of turning by lifting the edges of the upper by hand.

AXLE GAUGE. — Henry F. C. Feus, Savannah, Ga. This gauge consists of a bar on which is held to slide a series of sets having equidistant set screws projecting from three sides, and a thumb screw in the fourth side adapted to impinge on the bar. It is a simple and convenient device to accurately test an axle to indicate whether it is properly turned and the wheels properly set, and it may also be used as a straight edge and rule.

CIGAR BUNCHING MACHINE. — Bernhard Wertheimer, Carlsruhe, Germany. This machine has a plurality of parallel independent bunching aprons arranged side by side and secured at one to independent rollers, in combination with a form plate provided with a series of transverse forms or moulds. There are other novel features, and the machine is specially adapted to roll the wrappers upon the fillers and automatically deliver the completed cigar into a form. While not entirely making a cigar, the machine is designed to greatly facilitate the work, forming the cigar in such shape that the tobacco will be evenly distributed and the bunch will be rolled symmetrically.

WRENCH. — Albert Cincade, Jersey City, N. J. This invention is for an improvement in that class of ratchet wrenches having pivoted spring dogs for locking a pivoted head or block that carries adjustable jaws for holding a nut or other object to be turned. The improvement relates to the construction and combination of the pivoted block and the jaws and the means for adjusting the latter, the construction being such that either of the jaws may be quickly carried into engagement with the block or disengaged therefrom to convert the wrench into a right or left hand ratchet wrench, according to the character of the work and the place in which it is to be used.

COMBINATION WRENCH TOOL.—Aaron C. Haunty, Pott's Grove, Pa. This invention provides in one tool of simple construction an alligator burr wrench, a pipe wrench, a hammer, a tack puller, and a screw driver, while special means of adjustment are applied to the wrench portion of the tool, forming an implement adapted for service in a great variety of work.

Miscellaneous.

SOLAR CAMERA. — Frank T. Wilson, Stillwater, Minn. The frame which supports this solar camera is to be fitted to a door or window or a suitable opening in the wall, and, in connection with the projecting lenses, there is a fixed inclined mirror for directing the sun's rays into the projecting apparatus, and an adjustable mirror mounted on a revoluble support and adapted to receive the light from the sun and reflect it upon the fixed mirror. The revoluble mirror may be readily turned and adjusted to any desired angle, and the entire camera is conveniently adjustable.

PROTRACTOR AND BEVEL.—George E. Allen, Hartford, Conn. This is a combination implement of simple and durable construction, capable of ready adjustment for measuring angles, bevels, etc. The pointer is pivoted in the center of the protractor, and a slotted bar is fitted to slide on the pointer, and be secured with it on the protractor. The bar can be moved inward or outward as desired and is held in fixed position by a thumb screw.

LIQUID MEASURING DEVICE.—George M. Bellasis, Lakefield, Canada. A scale beam adapted to support a vessel is, according to this invention, pivoted on a post, and a weight sliding on the post is supported on an arm or tongue of the scale beam, while a device is connected with the weight and with the faucet discharging into the vessel, so that when the proper quantity of liquid has been measured out the scale beam is actuated and its arm or tongue is disconnected from the weight, when the latter actuates the device to turn off the faucet. By this means all overflow and loss of liquid is prevented, while only the desired amount of liquid is passed into the vessel.

ENVELOPE BOOK.—Marcellus M. Hitt, Sheffield, Ala. This book is more especially designed for envelopes to be distributed in which contributions are to be collected, as for church purposes, etc. The envelopes are detachable from stubs held in the book, the envelopes having mouths at their inner ends, on which they are provided with closing flaps, while the stubs from which the envelopes are detached remain in the book, and are inscribed with the record of the particulars of each envelope, as the name of the donor, amount subscribed, object of contribution, etc.

SEWING MACHINE SPOOL RACK. — Eduard Kolber, New York City. This is a frame supporting a rack designed to hold a number of spools and guide the thread of any of them to the proper mechanism of the machine on or near which the rack is employed, the rack being simple and durable in construction and securely locking the several spools in place. The frame of the device is adapted to be readily fastened to the arm of a sewing machine, to a table, or in other desired position.

WINDOW. — Valentine Schirmer, Nos. 334 and 336 West Fifty-sixth Street, New York City. This is an inexpensive improvement for windows, designed to afford means to open the window by swinging the sash within the apartment, and also enable the sash to slide vertically and independently, as usual, the swinging adjustment being provided to facilitate the cleansing of each side of the upper and lower sash in a safe and convenient manner. The improvement may be readily applied to any window of the ordinary description where the sash is counterbalanced by weights and suspended with ropes or cords. The construction is simple and practical, and involves no loss of light or air, windows being really made more thoroughly air tight by the employment of this improvement.

CHEESE COVER. — Strother J. Lynn, Hope, Kansas. This is a double cover, the inner casing of which only comes entirely down to the base board, while the compartment between the inner and outer casings is designed to afford a channel for ample ventilation, having many openings at the top. The inner casing is also provided with many top and side apertures, too small to prevent the entrance of insects, and in the side wall of the inner casing is a small pocket to receive a wet sponge and thus supply a proper degree of moisture. The ventilation and protection afforded by the casing is designed to prevent mould and keep the cheese in good condition.

HOUSE DOOR LETTER BOX. — Henry K. Day, Elyria, Ohio. Combined with a frame to which a door is hinged are latch levers and a sliding trip bar pivotally connected with the levers, with other novel features, forming a box of simple and durable construction which can be easily opened by the postman and locked after the mail has been placed in it. An alarm is sounded on a gong on both the upward and downward movement of the trip bar, and on the front of the box a name plate may be placed, while a paper or package receptacle can be conveniently attached to the box, and when not required may be practically hidden.

EXTENSION LADDER. — George Albee, Susquehanna, Pa. The movable part of this ladder is adapted to be raised or lowered by means of a lifting rope. The fixed and movable parts are provided with clips and arranged to slide one on the other, in combination with one or more weighted catches adapted to engage the rungs of the ladder, a latch being pivoted to the catch to close its hook, when desired, to allow the movable part of the ladder to descend without engagement of the catch.

VENTILATOR FOR MATTRESSES.—George H. Hildreth, Cincinnati, Ohio. This device consists of a perforated rubber tube having a metallic top and a perforated cover, the tube being designed for insertion in the body of the mattress from opposite sides at the points where mattresses are usually tufted, the ventilators being held in place by the twine used in tufting the mattress. The tubes, being flexible, do not interfere in any way with the efficiency of the mattress, while they insure the constant thorough airing of its interior.

ICE CUTTING MACHINE. — Thomas F. Lynch, Philadelphia, Pa. A frame carrying a motor and main driving shaft has vertically sliding racks in which a saw shaft is journaled so as to permit the raising and lowering of the saws without interfering with their rotary motion, the shaft being provided with two or more saws placed at a distance apart according to the width of the cakes of ice to be cut. The machine is designed to be easily operated to cut ice from the surface of ponds, lakes, etc., for storage, rapidly dividing it into strips and cakes of the desired size.

HARNESS FLY NET CLIP. — Lyman Rosenberger, Harleysville, Pa. This is a simple device for clamping a fly net to a harness, and is made in two sections—a keeper or box-like section, open at one end and having at the other extremity an inturned clip, and a detachable latch section, made of a single piece of spring metal. The clip can be conveniently and easily applied to hold the net securely in engagement with the straps of a harness.

BREAST STRAP SLIDE. — James A. Macrae, Regina, Canada. This slide consists of a hollow case having opposite side openings, with a snap hook projecting from one side and a keeper rigidly secured to the opposite side. The improvement forms a simple, durable and efficient device by which the breast strap of a harness may be quickly secured to the ring of a neck yoke.

SADDLE JACK. — Eugene E. Bateman, Marquez, Texas. A frame is mounted to turn on a pivoted arm having transversely extending brackets connected together at the top by a beam with which clamping plates are adjustably and detachably connected, with other novel features, forming a jack which is simple and durable in construction, and which can be readily adjusted to hold the saddle tree in any desired position for the convenience of the workman engaged upon it.

ADJUSTABLE SINGLETREE.—Sosthenes Moeschler, Riceville, Va. This invention consists of a pair of rods pivoted together and connected by the pivotal bolt with the clevis, being attached at their outer ends to an adjustable bar, thus forming a single tree which may be lengthened or shortened to suit the animal attached to it and the work to be done.

TRUCK. — William H. Gohring, Binghamton, N. Y. This is a hand truck for moving freight or baggage, etc., and is designed for use ordinarily as a two-wheeled truck, but it is so constructed that, when a heavy or a large load is to be carried, another axle and pair of wheels may be swung into position, converting the truck into a four-wheeled vehicle on which a large load may be piled, and having a handle by which it may be drawn.

DINNER PAIL.—Robert Dickinson, Sr., Millgrove, N. Y. This pail is of sheet metal, and is divided into several compartments adapted to hold a variety of liquid and solid food, while it is also provided with a lamp and appliances whereby the liquid and solid food may be simultaneously heated. The device also affords a drinking cup and a platter to eat from, the whole being arranged in simple, compact, and convenient form.

HAIR PIN EXHIBITOR. — Louis D. Nessler, New York City. This is a box having an inclined bottom, above which, at different distances, two strips of coarse netting are held in horizontal position, the prongs of the pins dropping easily through the netting, so that the pins may be readily arranged in rows one above another in a manner well calculated to display them.

GAME APPARATUS.—Albert Cromwell, Philadelphia, Pa. The game board provided by this invention has a central concave portion and a flange around its outer edge, while upon the board are placed concentric rows of pins in shallow sockets. A top having facets on its sides is used in playing the game, the player holding the board with one hand and with the other spinning the top, at the same time tilting the board to guide the top from a central position out through the rows of pins and back again.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HANDBUCH DER PHOTOGRAPHIE FUR AMATEURE UND TOURISTEN. Von G. Pizzighelli. II. Edition. Volume I. Photographic Apparatus. 485 pages and 531 illustrations. 1891. Halle a. S.: Wilhelm Knapp Publisher.

The first volume of this handsomely illustrated handbook for amateurs and tourists treats in an exhaustive manner in six chapters, objectives, cameras, selection of objectives and cameras, stereoscopic apparatus, apparatus for enlarging and reducing, and magnesium flash light apparatus.

DIE PHOTOGRAPHISCHEN OBJECTIVE, IHRE EIGENSCHAFTEN UND PRUFUNG. By Dr. J. M. Eder, Director of the School for Photography and Reproduction, etc., in Vienna. 273 pages, 197 woodcuts and 3 plates. 1891. Halle a. S.: Wilhelm Knapp Publisher. Price $2.

This publication forms the fourth number of Vol. I. of Handbook of Photography by the same author. This number contains three plates with fine portraits of Dr. Steinheil, Voigtlander and Joseph Petzval. The book is divided in 16 chapters, and treats objectives in a very systematic and exhaustive manner, showing the author's thorough knowledge of the various forms and construction of lenses. A chapter on the history of camera and objectives furnishes very interesting reading for the student.

1. The chapters in their order treat on photographic optics.
2. History of camera and objectives.
3. The lensless camera.
4. The single lens as a photographic objective.
5. Aplanatic, euryscopic, rectilinear, and similar symmetric aplanatic lenses.
6. The anti-planatic objectives.
7. Portrait objectives according to Petzval's system.
8. Anastigmatic and triplet objectives.
9. Petzval's orthoscope, Sutton's water lens, sphere lens, pantoscope, periscope, etc.
10. Combination objectives.
11. Mirror objectives.
12. Mirrors and prisms for inverting pictures.
13. Diaphragms.
14. Fastening of the objectives.
15. Selections and trials of lenses.
16. Calculating the time for exposure from the nature of the lens and the subject.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3447) D. E. S. asks: 1. I have commenced to build the electric motor described in SUPPLEMENT, No. 641, and is the wire of the armature core 16 or 18? A. It is immaterial whether you use No. 16 or No. 18 iron wire in the core of your armature. Probably you would find No. 18 or 20 easier to wind. 2. Is all copper wire magnet? A. Magnet wire is copper wire wound with one or two wrappings of cotton or silk. 3. Will it make any difference if the wire in the armature core is in more than one piece? If not, must the ends be abutted or fastened together? A. If you refer to the armature core, it will make no difference whether the cores of the wire are abutted or fastened together. 4. Is the wire on the field magnets copper or iron, covered or bare? A. It is magnet wire. (See answer to No. 2.) 5. What does a one horse power Shipman engine weigh, and would it be practical to run a buggy? Are there any other small engines made that would be better adapted? A. We do not know the exact weight of a Shipman one horse power engine, but we think it must weigh about 150 pounds. It might possibly be adapted to running buggies. We do not know of any regularly made engines for this purpose, but probably one could be designed that would be better adapted to running carriages. 6. Would the above motor be practical to get the power from a dynamo? And how should it be arranged? A. These motors are successfully used for running dynamos. The dynamo is driven by a belt from the fly wheel of the engine. 7. How can I make a positive jet black writing ink that will show as soon as written and not dry for a couple of hours, and that will take a good copy by simply rubbing a sheet of dry tissue paper over the writing with the fingers? A. It is almost impossible to find an ink which fulfills all your conditions, but the following from the new "Scientific American Cyclopedia of Receipts, Notes and Queries" (in press) gives a copy without the use of a press: Nigrosine (aniline black) C. P. fine, 10 oz.; glucose "A," 1½ oz.; hot water, 13¼ pints; glycerine, 1¼ oz. Dissolve the nigrosine by trituration in the hot water, then add the other ingredients and strain through a piece of silk. If too thick when cold, dilute with water. In preparing this ink, it is imperative that the water should be quite hot until all the dye has been taken up by the water. 8. If a fair question, how are you able to so correctly answer the 1,001 questions asked every month? A. We employ a corps of writers who are able to answer many of the questions offhand, while other queries require a great deal of research, and sometimes intricate calculations and experiments. The "Scientific American Cyclopedia of Receipts, Notes and Queries," now in press, is designed to meet the wants of those who seek information of this kind. It is a digest of notes and queries published in the SCIENTIFIC AMERICAN, and contains over 12,000 valuable receipts.

(3448) W. J. M. asks: 1. What would the voltage of a single cell of the dry copper-zinc battery described in query 3271 on page 123 of the issue of August 22, 1891, be, if the blotting paper was 2×3 inches? A. The E.M.F. of the battery referred to is about 1 volt. 2. Does the size or thickness of the plates affect the strength of the current? Also, is it necessary to put each element in a separate jar, or could I put a number of elements together in an air tight box? A. The current is dependent upon the size of the plates. It would be better to put the elements in separate cells, but undoubtedly you could get very good results from a number of elements arranged in the form of a pile. 3. How many 24 volt 32 candle power lamps could I light with 30 elements connected in series, the lamps being arranged in parallel? A. This battery is not at all adapted to running electric lamps, in fact it would be practically impossible to use it for this purpose, on account of the great resistance of the battery. 4. What is the amperage of a single cell of this battery? A. Probably from one-fourth to one-eighth of an ampere. 5. What is the voltage and amperage of a single cell of Daniell battery? Also, does the size affect the E.M.F., and could I put the bluestone in the bottom of the cell instead of having a pocket? A. About one-third of an ampere. The size of a Daniell battery has no effect upon the E. M. F. The only effect of putting the bluestone in the bottom of the jar around the porous cell would be to impede the action of the porous cell. 6. If I had a battery giving 30 volts at 20 amperes, could I light five 24 volt lamps arranged in parallel, if each lamp requires 4 amperes? If not, why? A. If your battery will yield a 20 ampere current having an E. M. F. of 30 volts, with the 24 volt lamps in circuit, you can undoubtedly run the lamps, but the resistance of your lamps will cut down your current so as to render this impracticable. 7. Which is the best way to connect up the eight light dynamo—series or shunt? If series, how many pounds of No. 12 wire should be wound on each leg of field magnet? A. For arc lighting, connect up the 8 light dynamo as a series machine; for incandescent lighting it would be better to arrange it as a shunt machine. It will require about 17 pounds of No. 12 wire for the field magnet. 8. Would a medical coil made as follows be very powerful? If not have you any description of how to make one? A piece of ⅛ inch iron pipe 7 in. long. On this at each end are fitted two pieces of wood 1 inch thick to confine the wire. Then four layers of No. 23 cotton-covered magnet wire is put on for the primary coil. Then 17 layers of No. 30 cotton-covered wire for the secondary. When the winding is finished, a brass tube is fitted on the coil. The inside of the iron pipe is filled with No. 18 iron wire. I would like to know if a current of from 2 to 4 volts were used, whether this would make a good coil. Also would you feel the current stronger if a person had hold of handles than from simply a bare wire? A. Your proposed induction coil would be defective, first on account of using the gas pipe as a portion of the core. The core should be formed entirely of soft iron wire to insure a rapid magnetization and demagnetization. Your primary wire is too fine. You should use two layers of No. 16 instead of four layers of No. 23. Two cells of bichromate battery should give you a strong current. Handles are more effective, as they give a greater surface for the distribution of the current. 9. What is the best wire to use on an outdoor electric bell line? A. Common telegraph or telephone wire will answer if supported upon insulators, or you can use office wire or any of the various insulated wires in the market. 10. What is the price of the Edison dynamo described in SCIENTIFIC AMERICAN of July 25, 1891? A. For prices we must refer you to the Edison General Manufacturing Company, Broad Street, N. Y. 11. Is the electric light line wire that is used out doors iron or copper? A. Electric light wires are generally made of copper.

(3449) W. M. writes: 1. I have made a Faradic instrument with battery to operate it, and have made the connections as I have been instructed from a work on induction coils, that is, I have connected a wire from the pillar carrying the platinum screw to the battery, then one end of the primary wire to the pillar carrying the spring, then the other end of the primary wire to the battery. The battery I use is the bichromate of potash. The solution I have made as follows, according to instructions: To 1 pint of water 2 ounces of finely powdered bichromate of potash; this I have boiled when cold. I added to this 1 ounce of sulphuric acid when it was cold; the instructions claimed it was ready for use. The elements are composed of 1 zinc to 2 carbons. I have tried the battery on the machine, and for about 15 minutes it kept up a very powerful and steady shock; then it gradually decreased in power till at last there was no perceptible shock. Thinking that it ought to maintain its power for a longer time than that, I would ask you to be kind enough to tell me where the trouble lies? A. Your battery solution is too weak, and probably your zincs are not thoroughly amalgamated. Make a solution as follows: Make a saturated solution of bichromate of potash or soda in water; to this add one-fifth its bulk of commercial sulphuric acid. It is well also to add a small percentage of sulphate of mercury to keep the zincs amalgamated. If the solution boils at the zincs, you will need to remove them and amalgamate them by sprinkling on a little mercury and spreading it around by means of a brush or swab. 2. Give me a receipt for a cheap solution, dip or process for blacking or bluing brass work, something that will hold good for some length of time. A. Lustrous black on brass.—Mix equal parts of copper sulphate and sodium carbonate; these solutions must be hot. Wash the precipitate as it lies on the filter paper and dissolve immediately in an excess of ammonia. Dilute the solution with water and add a small quantity of plumbago, 20 to 50 grains, depending on the amount of solution used, then heat to 100° Fah. The brass articles must be thoroughly cleaned and left in this bath until they are black. Wash well in water and dry in sawdust. Prepare only as much solution as is wanted for immediate use.

(3450) W. D. K. asks how impression wax is made. A. Temper paraffine wax with olive oil to suit conditions. Mix a little whiting with it while hot.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3451) W. P. H. asks: 1. From what and how is oxygen made for commercial purposes, also hydrogen? A. Oxygen is made by heating a mixture of chlorate of potassium and binoxide of manganese. By Brin's process, which has been introduced in England on the large scale, it is made with barium oxide as a base from the air. See our SUPPLEMENT, No. 623. 2. Please refer me to engravings and details of construction of the calcium light. A. We refer you to manuals on the magic lantern, such as Hepworth's "Book of the Lantern," price $2. "The Magic Lantern, its Construction and Management," price $1 by mail postpaid. An annular burner is described also in "Experimental Science."

(3452) B. A. W. asks how insects, flowers, etc., and their elements may be preserved so as to look as if they were in their natural state. A. Place the specimens on a bed of fine dry sand in a vessel having sufficient depth to extend above the specimens. Carefully sift fine sand over the objects until they are completely buried. Set the vessel in a warm dry place, and allow it to remain there until the objects are thoroughly dry. Remove the sand carefully, and where gloss is no objection, the articles may be dipped in melted paraffine which is just warm enough to be limpid.

(3453) F. J. F. writes: Can you give me a receipt or process for bluing over a gun barrel where it has been scratched? A. The barrel should be repolished with the finest flour emery cloth, and evenly heated until the blue color is produced, then cooled in water, dried, and varnished or oiled. It is a difficult job for an amateur. We recommend you to employ a gunsmith.

(3454) E. E. asks: What are the approximate composition and the properties of the principal fire-resisting materials used in furnace construction? A. Alumina is the fire-resisting element. Fire bricks are made of clay, hydrosilicate of alumina, colored slightly buff by admixture of oxide of iron. 2. What is the most suitable non-conducting material for covering pipes, boilers, etc., to prevent loss of heat? A. Magnesia felting and boiler covering.

(3455) W. asks: Will whitewood boards shrink lengthwise? For example: A counter is made of two whitewood boards, tightly matched together, and bolted. There is now a crack between them about ¼ inch wide. Did the boards shrink? A. The soft woods shrink slightly endwise in seasoning.

(3456) J. D. writes: I am making small dynamo, described in SUPPLEMENT, No. 161, and would like to know if I could shellac the bore of the field magnet also the outside of armature (Siemens) to prevent rusting. Would it detract from the power of the dynamo by so doing? A. There is no objection to shellacking the field magnet and armature of your dynamo.

(3457) W. C. W. asks: Has copper or brass ever been hardened and at what time and by what nation or nations, and have they by such hardening lost any of their properties or not? By hardening, I mean tempering, in the ordinary sense of the word, as steel is tempered. A. Pure copper cannot be hardened like steel. The hard copper tools of the ancients were made of an alloy of copper and tin. Such tools can be made now that will cut stone or wood. The proportion is 72 parts copper, 28 parts tin. It must be cast in the shape required and ground sharp. It cannot be hardened by tempering.

(3458) R. H. S. asks for directions for making "P. and B. electrical compound" for coating wood storage battery cells, acid, water, and alkali proof, applied with a brush the same as ordinary paint. A. We have not the formula for the compound referred to. The following has been recommended: Stockholm tar 10 parts, rosin 10 parts, gutta percha 30 parts. Coal tar pitch answers very well. See next query.

(3459) R. H. S. asks (1) how to make a varnish for the inside of a wooden battery cell that would not be affected by acid or alkali. A. For this purpose a mixture of gutta percha, Burgundy pitch and ground pumice stone with a little boiled linseed oil is recommended. Melt it in with a hot iron. 2. Please reply about the sample of salt sent. A. The white salt said to be used for the inner cell or porous cup of a sulphuric acid battery is nitrate of potassium.

(3460) G. V. asks as to the correctness of the statement of the Johnstown flood in A. S. Barnes & Co.'s brief history of the United States, latest edition. This book says that the waters rushed down the valley at the rate of 2½ miles in one minute. A. This rate is somewhat conjectural, and we cannot find a really satisfactory basis for an opinion.

(3461) J. F. D. asks whether there are any chemicals that will resemble fire after dark. A. Try a solution of common phosphorus in olive oil, or Balmain's luminous paint, described in our SUPPLEMENTS, and sold by large dealers in paints.

(3462) N. W. writes: I want to get some instructions to repair mercurial barometers. Can you put me on track of any work published for that business? A. Read "How to make a Barometer," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 309, illustrated.

(3463) A. U. asks: Will you be kind enough to inform me how to prepare barrels in order to keep spirits put in them perfectly white? I have a very fine well of water 72 ft. deep, 8 ft. square; the sand coming in with the stream of water gives me a great deal of trouble. Could you advise me how to overcome it? A. The method of preparing barrels for pure spirits as practiced by our rectifiers is to steam the barrels by placing them bung down over a small steam pipe projecting into the barrel. Continue this for an hour or more, according to the condition of the barrel. Then fill the barrel with clean water in which a half pound of sal soda is dissolved. Soak for 2 or 3 hours and thoroughly wash out with fresh water.—The only remedy for sand coming into your well that can be applied easily is to drive several pipes of large size, made like the points of drive well pipes, down to a lower stratum, leaving their tops below the low water surface. This will relieve the pressure that lifts the sand and tend to increase the flow of the well.

(3464) F. V. Y. writes: Will you please publish an article in your SCIENTIFIC AMERICAN or SUPPLEMENT on the construction of a transit strong enough to see the rings of Saturn, or if you have published such, will you please tell me what in, and send price? A. You will find interesting details of telescope construction in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582, 583, and eyepieces for telescopes in SCIENTIFIC AMERICAN SUPPLEMENT, No. 399. 10 cents each. You will also find the transit illustrated and its use defined in "General Astronomy," by Young, $3 mailed.

(3465) A. C. O. asks: How can absolutely pure air be obtained for the purpose of aerating milk? How would air be affected by passing it successively through hot and cold tubes and thus exposing it to great extremes of temperature? A. Pump the air in small streams through a perforated plate, immersed in solution of permanganate of potassium. The other method you give would answer excellently if the air was finally passed through solution of caustic soda.

(3466) "Argentum Purificatum" asks: 1. Is there a better way of reclaiming the silver from photographic clippings than burning the clippings, and reducing the resulting ash to metallic silver, in a crucible, using carbonate soda and carbonate potash (2 to 1) as a flux? A. The method you describe is the surest and simplest. 2. How much nitrate silver can be produced from 1 oz. pure silver? A. About one and one half ounces.

(3467) H. S. writes: I have imported a glass filter for the household, and would like to know whether its efficiency is thoroughly reliable. A. No filter is thoroughly reliable. If properly used and cleaned, a good filter will do good, but cannot be depended on in all cases, as many injurious ingredients will pass through the finest pores.

(3468) F. A. F. asks for some ingredients he could mix with wax to harden it for use, to make perfectly firm. A. Try paraffin or lead oleate (lead plaster).

(3469) E. H. K. asks how to waterproof boots. The following methods are from the new "Scientific American Cyclopedia of Receipts, Notes and Queries." A. A coat of gum copal varnish applied to the soles of boots and shoes and repeated as it dries until the pores are filled and the surface shines. Or try the following mixture: 100 oz. best white wax; 6 oz. Burgundy pitch; 8 oz. ground nut oil; 5 oz. iron sulphate; 2 oz. essence of thyme.

(3470) J. S. W. writes: 1. I have 4 oz. of No. 36 copper wire, and want to make an induction coil. What number wire shall I use for the primary coil, and how many layers of wire? A. Use two layers of No. 18 wire for your primary coil. 2. How long should I make the core, and how large should the heads be? A. Make the core about 3 inches long and ⅜ inch in diameter; the heads might be 1¼ inches in diameter. 3. How is carbon made, such as used in batteries? A. For directions for making carbons see SCIENTIFIC AMERICAN, vol. 60, page 307. Also consult "Experimental Science." 4. Why is it that electric conduits are not used in New York for the cars? Is it because it is against the law or too expensive? A. Electrical conduits are not in use in New York City. It seems a difficult problem to apply them successfully. 5. How is it that an induction coil has as many as 50,000 volts and it does not kill a man, when a dynamo of 1,000 is enough to kill a man? A. A current from an induction coil has an exceedingly low amperage or quantity; still we do not think it safe to take a shock from a large induction coil.

(3471) G. M. B. asks for a receipt for mending porcelain. A. Milk is coagulated with acetic acid, and the caseine thus formed is thoroughly washed in water and dissolved in a cold saturated solution of borax. The clear solution thus formed is superior to gum arabic; for porcelain, mix with finely powdered quicklime. Apply to the ware immediately. Bind up with cord and expose to gentle heat.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." (In press.)

(3472) A. K. B. asks: 1. What chemicals are used in taking tintypes, and how to use them? A. Collodion, a nitrate of silver bath, sulphate of iron, acetic acid and cyanide of potassium. We refer you to Estabrook's "Ferrotyper's Guide," price $1. 2. Can a camera be constructed for taking tintypes without a lens? Can the aperture be a small pin hole instead? A. Yes; but it will take too long. The plate would spoil. It must be exposed while wet. You may be able to obtain sensitized dry ferrotype plates from E. & H. T. Anthony & Co., 591 Broadway, New York. But they will not give as satisfactory results as by the wet plate process.

(3473) E. H. asks how to take fatty stains out of bones. A. Much may be removed by soaking in naphtha. As a final bleach, mix 1 part bleaching powder, 2 parts washing soda and 16 parts boiling water, and soak the bones therein, after it has cooled. Wash thoroughly, best with some dilute sulphuric acid.

(3474) F. G. C. asks: 1. What will take peach stains out of white table napkins without injuring the fabric? A. Try Javelle water or weak solution of oxalic acid. Wash out thoroughly. It is well to follow Javelle water with a weak solution of sulphurous acid. 2. What is the specific gravity of erbium, caesium, yttrium, and glucinum? A. Caesium, 1·88; glucinum, 2·1. The others are not known.

(3475) A. C. D. asks for a receipt for making a polish for cleaning glass, composed of whiting, etc., formed into a ball. A. Mix the whiting with soft soap, kneaded well, form into balls and dry in the sun. Or make the balls of pure whiting by hydraulic pressure.

(3476) J. C. M. asks: 1. Will a tube of hard rubber hold mercury for any length of time? A. It will hold it for an indefinite period. There is a possibility of its contaminating the mercury, but if its inner surface is polished, it will not do so. 2. What other materials, besides iron, could be used for the purpose? A. Nothing is superior to glass. Platinum also will answer, as it only amalgamates under special conditions.

(3477) H. W. asks what natural gas consists of? If it is of same substance as coal gas, or can coal gas be used for the same purpose as natural gas? I am trying to find out if I can use coal gas for welding iron on a small scale. A. Natural gas contains hydrogen, nitrogen, marsh gas and other hydrocarbons, carbon monoxide, etc. Coal gas is inferior to it for welding, because it contains too high a percentage of carbon. It can be used with a hot blast with some success. Water gas made by passing steam through white hot coal is superior to either for welding iron.

(3478) E. D. H. asks: 1. What is the best formula for making dry hop yeast? What is the best mode of drying it? If dried by heat, about what should the temperature be? A. Mix 3½ ounces of hops with 15 quarts hot water and 3¾ pounds rye flour. When it has cooled to a lukewarm temperature only add ½ pint of beer yeast, and allow it to ferment. After standing over night add 7¾ pounds of corn or barley meal, knead into dough, and roll out to a thickness of ½ inch. Cut this into small cakes and dry in a warm room or in the sun, turning from time to time. To use, a piece is soaked in warm water left to stand 12 hours in a warm place, when it is ready for use. 2. Is there any cold air process by which it can be dried by evaporation? A. It can be dried by being placed in a tight jar in which a lump of quicklime is placed. The yeast must of course be in its own proper receptacle, and not in contact with the lime.

(3479) L. S. says: We send inclosed two worms found in a piece of plush. Would you kindly tell me what they are and whether they are liable to injure goods? The darker worm was found in a substance resembling silk and which adhered pretty firmly to the plush. A. Reply by Prof. C. V. Riley.—One of the larvæ forwarded had transformed to pupa in transit, but the other is still active. It is the larva of a beetle of the family Cleridæ and the genus *Corynetis*. This family of beetles is, as a rule, carnivorous or predaceous in the early stages. It is therefore probable that the larvæ were attracted to the goods by the presence of other larvæ, the latter probably of some of the common "clothes moths." I hope to rear the imago and should much like to have other specimens. If it turns out, as seems probable, that this larva will prey upon the various clothes moths that so trouble the housekeeper, it is well to know the fact, as possibly it may be encouraged and utilized to advantage. On the other hand, one of the species of the genus, namely, *Corynetis rufipes*, is known to be injurious to preserved meat and has been found particularly bad in hams. An account of its injuries has been published by me in my Sixth Report on the Insects of Missouri, page 96. The species sent by your correspondent is smaller, yet all the species of the genus in the larva state, so far as known, feed on dead rather than live animal matter, and the presumption is that in this case the two specimens had left some such matter and got on the plush accidentally, or they may have fed on the exuviæ of the clothes moths. The substance resembling silk may have been the cocoon of the clothes moth larvæ or else a cocoon made by the *Corynetis* larva itself, preparatory to pupation.

(3480) W. R. B. asks how to make beef, iron and wine. A. Liebig's extract of beef ½ ounce avoirdupois, ammonio-citrate of iron 256 grains, spirits of orange ¼ fluid ounce, distilled water 1½ fluid ounces, sherry wine sufficient to make 16 fluid ounces. Dissolve the ammonio citrate of iron in the water, dissolve the extract of beef in the sherry wine, add the spirit of orange and mix the solutions.—Beef, iron, and wine for soda fountains: Beef, iron, and wine 1 ounce, vanilla sirup 3 ounces.—For dispensing: For 2 quarts, concentrated extract of beef, 2 ounces; pyrophosphate iron, ½ grain. Dissolve in ½ pint boiling water. Add tincture curacoa, 2 ounces; tincture orange peel, 2 ounces; sirup, 12½ ounces; alcohol, 12½ ounces; solution citrate of ammonia, 2 ounces; sherry wine, 23 ounces. The information given above is taken from "The Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3481) G. L. B. asks how to make bluing for laundry use. A. 1. Dissolve good cotton blue (aniline blue 6 B) in cold water. 2. Dissolve fine Prussian or Berlin blue with ⅛ part of oxalic acid in water, or use ferrocyanide of potassium (1-12 part) in place of oxalic acid. 3 A disinfective laundry blue.—Mix together 16 parts of Prussian blue, 2 parts of carbolic acid, 1 part of borax, and 1 part of gum arabic into a stiff dough. Roll it out into balls as large as hazel nuts, and coat them with gelatin or gum, to prevent the carbolic acid from escaping. 4. Water 15 parts; dissolve in this 1½ parts indigo carmine, add ¾ part gum arabic. From "The Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3482) K. F. asks: 1. What will cement thin ivory pads on nickel-plated steel triangles without coloring the ivory or injuring the triangle and that will set in 48 hours or less? A. Mastic varnish 1 part, isinglass 2 parts. Dissolve the isinglass in as little water as possible with a little alcohol, and mix with the varnish. The latter is prepared by making a strong solution of gum mastic in alcohol and benzine. 2. What is the best book on surveying, more especially with the transit? A. We recommend and can supply Johnson's "Theory and Practice of Surveying," price $3.50 by mail, also Gillespie's "Practical Treatise on Surveying," price $3.50. 3. What is the best book on mining surveying? A. We recommend Brough's "Mine Surveying," price $2.50 mailed.

(3483) H. G. J. asks: What is the velocity of light and of the electric current? A. The velocity of light is 185,420 miles per second. Wheatstone gives the velocity of static electricity as 288,000 miles per second, which is greater than that of light. Current electricity, where it meets with no resistance, has about the same velocity as light. The velocity of electricity on an iron wire is variously estimated at from 18,400 to 62,100 miles per second, and on a copper wire 111,780 miles per second. The nature of the conductor and its environment has an influence on the velocity.

(3484) C. A. W. asks: Which travels the faster—light or electricity? Please state also the rate of each. A. See reply above.

(3485) I. E. asks: 1. Is alumina manufactured in the United States anywhere. If so, where and by whom? A. Address the Pennsylvania Salt Company, Philadelphia. It is a dyer's chemical. 2. Could gas be compressed in tank and carried any distance and used to drive an Otto gas engine, and would the tanks empty themselves through the engine without any pressure above atmospheric pressure? A. Yes. 3. Where could I get a cheap work on the use of gas or its manufacture? A. We can supply you with works on this subject such as "A Treatise on the Manufacture of Illuminating and Heating Gas," by Burns, price $1.50, also Richard's "Practical Treatise on the Manufacture and Distribution of Coal Gas," price $12 by mail post paid.

(3486) J. C. writes: 1. In speaking of the resistance of fields in a shunt dynamo as being 14 times that of the armature, do you mean all the wire on armature or only half between the brushes, or as some say only a quarter of the armature wire is taken as the resistance of armature when comparing it with fields. A. The resistance of the armature is meant. This is one quarter of the resistance of the total length of wire on the armature, for the reason that the current goes through the two halves of the wire in parallel, thus reducing the length of the conductor one-half, and at the same time doubling its sectional area, thus reducing the resistance as above stated. 2. Does the same resistance do for motor shunt-wound? Yes.

(3487) R. N. asks: During an argument in this city a few days ago, as to the component parts of glass, one party asserted that glass could be manufactured from straw. Immediately a bet was made that he was mistaken, and the parties to the wager agreed to leave it to the SCIENTIFIC AMERICAN for decision. A. The ashes of straw might be fused into a species of glass. To this extent the assertion is true.

(3488) F. F. writes: Can you tell me of a glue or cement, for the purpose of attaching cloth or felt to garments, that is absolutely waterproof, and will resist 140° Fah. of heat, also dry quickly? What is the best method of using same? A. We know of nothing better than the sheet gutta percha used by tailors for the purpose you mention. It answers to all the qualities you call for except the heat. It softens under heat. In use place a sheet of the percha between the two surfaces of fabric to be joined, and press the same with a hot flat iron. The operation is quick and effective, provided the heat is maintained long enough to penetrate the fabric and melt the percha.

(3489) E. G. H. asks (1) for some preparations that will render cane pole fireproof. I refer to the "fishing pole" grown in the South. In working the material I have considerable waste and propose to make pipes, for smoking tobacco in, so want to "get on to" a treatment not expensive, that will admit of using them in that way. Would like a chemical that they could be soaked in, and that would not give off any unpleasant odor or taste. A. Soak the cane in a solution of phosphate of soda. 2. A good formula for marking ink to be used in laundry for marking clothes, that will not require to be (the goods) prepared in any way before or after marking, but be ready to go into the wash. A. For ink formulæ in general we refer you to our SUPPLEMENT, No. 157. 3. Can you give me an idea of some preparation for bleaching, in laundry work, better than chloride of lime? A. For real bleaching we cannot. For laundry work in general we refer you to SCIENTIFIC AMERICAN, No. 9, vol. 61; SUPPLEMENT, No. 577.

(3490) G.—A machine that will always keep itself in motion without exterior aid, and without consuming fuel, might be termed a perpetual motion. No reward offered.

(3491) M. S. P. asks: What can I coat tin battery cells with to make them acid proof? A. Try a coating of coal tar pitch.

(3492) E. B. C. asks: 1. Where can I obtain paramidophenol to be used for a developer as described in your paper of August 29? A. From the principal dealers in photographic materials in New York. 2. How much does it cost? A. $8 per ounce. 3. In what proportions should I use it in developing? A. In the proportions given in SCIENTIFIC AMERICAN. 4. Is it poisonous, and if so, what forms a good antidote for it? A. Yes, to take internally. Antidote, a strong emetic. 5. Is hydroquinone poisonous, and if so, what is a good antidote? A. Yes. Antidote, a strong emetic. 6. What is the formula of paramidophenol? A. The chemical formula is $C_6H_4(NH_2)OH$. 7. How much did the Philadelphia cost? A. $1,350,000. 8. What is her type? A. See SCIENTIFIC AMERICAN, vol. 61, Nos. 6 and 11, for illustrations of her. 9. Is there any good book published exclusively on the new American navy? And if so, how much does it cost? A. Consult the back numbers of the SCIENTIFIC AMERICAN. There is no book on the subject. 10. I have a room, size 25 x 30 feet, in which there is a fireplace that is 6 feet long, and whenever a fire is lighted it will always smoke unless a window is opened, and no matter how little the window is opened, the fire stops smoking. Now, how can I fix it so that I can have the windows all shut, and have the fire not to smoke? A. Conduct a special air flue under the floor from the outside of the house to the fireplace, having the aperture at the grate closed with a register. This will supply a constant current of air when the room is closed. 11. How much about per night would it cost to run a lime light in a Marcy sciopticon, for say about two hours at a time? A. The cost for gas will be about $3.50, for lime 10 cents. 12. Would it be safe to use a lime light, and what good book can I get on the subject, and how much does it cost? A. It will be safe to use the lime light if the gases are compressed in iron cylinders. We refer you to the "Book of the Lantern," by T. C. Hepworth, which we can send by mail. Price $2.

(3493) J. M. L. writes: I have a well about 105 feet deep. When the well digger got down some 85 feet, the solid rock was struck. Then a hole was drilled 15 feet, water was found in either slate or soapstone, judging from the appearance of the material that stuck to the drill. The water rose within 3 feet of the top of the rock. I have a windmill which pumps the water out faster than it comes in, although two men say that they can hear the water rushing through the bottom of the well. I want to know what I ought to have done to increase the supply of water. I have been told if I drop into the hole 2 pounds of quicksilver, it will cause the water to come in more freely. I am told of a man in Quincy who wanted to dry up his well; he was told to put quicksilver in it; he did so, but it had the contrary effect. The water rose in the well, flooded his cellar, and he had no relief until he connected with the sewer. Can you give me any information if the quicksilver will have the desired effect? I have built small fish pond, and I want to keep it supplied with water from the well. A. We have no confidence in the quicksilver yarn. Drill the hole deeper to get more water.

(3494) R. W. S. asks: 1. If a rifle ball be fired perpendicularly into the air, what velocity will it have when it returns to the earth? 2. If at close range it will penetrate 5 inches into a piece of wood, how far will it penetrate the same piece of wood after falling from a perpendicular shot? A. The return velocity depends upon the initial. The greater difference with the greater height that the ball reaches before returning. The friction of the air retarding the velocity both ways. We cannot give definite figures on account of the uncertainty of muzzle velocity and height of projection, as well as relative densities of bullet and air. An elongated and globular ball having different frictional exponents. Under all circumstances the return will have a greatly lessened penetration.

(3495) E. P. G. says: Kindly inform me through the inquiries column in your paper what is the cheapest way of dressing the surface of a grindstone which has worn unevenly, to produce an even and true surface again? It is not valuable enough to warrant purchasing a diamond tool, and I am not in or near a town where such a tool is owned, the use of which could be hired for this one occasion. A. Nail or fasten a block of wood across the frame as close as possible to the stone; use a piece of ¾ or 1 inch gas pipe, with the end resting on the block, and the edge against the stone; by rolling the gas pipe back and forth along the face of the stone it can be turned off true. Use no water.

(3496) P. W. K. asks: Will it make any difference which way you jump (while in a car moving at the rate of 60 miles per hour), either against or with the motion of the train? By the difference I mean difference in distance jumped, measuring from a certain spot in the car floor. A. It will make no difference which way you jump; the distance jumped will be the same, as you are moving with the same motion as the car.

TO INVENTORS.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 6, 1891.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Loom, narrow ware, O. W. Schaum...... 460,662
Loom shuttle tension device, J. W. Eisenhart.... 460,723
Lubricator. See Axle lubricator.
Mail pouch deliverer, A. Kimber...... 460,932
Mailing case, E. J. Kraetzer...... 460,918
Main or crank pins, device for truing up, R. C. Nugent...... 460,884
Mat. See Picture mat.
Mattress, woven wire, T. Burdick...... 460,712
Measurer and bagger, grain, G. J. Johnson...... 460,580
Measurer, grain, J. Hallahan...... 460,577
Mechanical movement, Williams & Lash...... 460,736
Medical compound, G. W. White...... 460,611
Message recording instrument, A. Storer...... 460,676
Metal cutting machine, W. B. Hammond...... 460,679
Meter. See Millampere meter.
Middlings purifier, H. W. Stone, Jr...... 460,731
Mill. See Rolling mill.
Millampere meter, L. D. McIntosh...... 460,850
Mop holder and wringer, L. Pelton...... 460,656
Motor. See Spring motor. Wave power motor.
Musical instrument, W. M. Jewell...... 460,688
Nail making machine, wire, J. R. Hoskin...... 460,720
Net for horses, fly, E. V. Stryker...... 460,605
Nut making machine, J. H. Burdick...... 460,553
Nuts, manufacture of, J. H. Burdick...... 460,554
Oil burner, R. Winkler...... 460,902
Oiler, loose pulley, C. T. Brandon...... 460,908
Ore feeder, J. Tulloch...... 460,733
Ore separator, H. H. Taylor...... 460,732
Padlock, I. Goldfain...... 460,636
Pan. See Evaporating pan.
Paper box, angular, D. S. Clark...... 460,817
Paper fixture, toilet, Grosvenor & Holmes...... 460,775
Paper weight and envelope cutter, combined, F. O. Paige...... 460,756
Parcel carrier, A. Edgar...... 460,772
Passenger registers, gate for use in connection with, A. Gajardo...... 460,719
Pattern. See Shoe pattern.
Peanuts from the vine, device for picking or stripping, J. T. Stewart...... 460,667
Pencil sharpener, H. J. Miller...... 460,753
Pencil sharpener, B. Pickering...... 460,658
Permutation lock, J. H. Christie...... 460,559
Photographic films, manufacture of, B. J. Edwards...... 460,570
Photographs, giving a matte surface to albumenized silver paper, Wrigglesworth & Binns...... 460,621
Picker. See Fruit picker.
Picture mat, J. Searvogle...... 460,663
Pipe supporting device, Crawford & Young...... 460,631
Pipe wrench, E. Murphy...... 460,591
Pipes, method of and apparatus for connecting branches to, P. Eley...... 460,773
Planter and fertilizer distributer, combined, P. Montecino...... 460,880
Planter and fertilizer distributer, seed, J. M. Crout...... 460,818
Planter attachment, corn, S. M. Bowman...... 460,739
Planter, corn, H. C. Lohff...... 460,588
Platform adjustment, J. F. R. Holmes...... 460,824
Pliers, P. Meyer...... 460,590
Plug, safety, H. P. Ball...... 460,548
Pole, J. W. Knause...... 460,826
Pole tip, J. O. Hebert...... 460,578
Post. See Fence post. Telegraph or other post.
Preserving compound, J. M. & T. J. Gillihan...... 460,861
Printing surfaces, producing copper or other like, J. G. Garrison...... 460,635
Printing wood signs, press for, Beach & Palm...... 460,929
Pump, duplex steam, L. F. Volsard...... 460,900
Pump valve, steam, Cook & Willers...... 460,562
Pumping apparatus, oil well, G. Allen...... 460,807
Puzzle, A. N. Burbank...... 460,552
Rail joint, R. J. Colvin...... 460,848
Railway conduit, underground, E. E. Keller...... 460,780
Railway driving mechanism, cable, J. Walker...... 460,794
Railway, electric, I. Robbins...... 460,887
Railway rail, B. F. Curtis...... 460,742
Railway splice bars, making, M. W. Thomson...... 460,899
Railway switches, mechanism for operating and controlling, J. N. Strong...... 460,668
Railway tanks, water elevator for, D. P. Burdon...... 460,844
Railway traffic control, telegraph block system of, Coombes & Rowe...... 460,771
Railway trolley, electric, E. E. Keller...... 460,781
Railways, girder rail track for street, W. C. Wood 460,927
Railways, rail connection for electric, M. J. Wightman...... 460,615
Railways, system of electrical signaling for, De Jager & Zoutman...... 460,779
Rake. See Hay rake.
Reamer, C. B. Kohlard...... 460,802
Refrigerator, W. Campell...... 460,808
Register. See Camera roll holder register.
Rein holder, Shaw & Atwood...... 460,664
Rein holder, T. H. Watson...... 460,734
Ring. See Curtain pole ring.
Rolling mill and flattening and edging rolls therefor, metal, F. Nevegold...... 460,882
Rubber, J. B. Sargent...... 460,600
Sad iron, G. Heftiel...... 460,868
Safe, W. H. Reynolds...... 460,660
Sand conveyer attachment, C. G. Cohen...... 460,630
Sash cord fastener, J. P. Gardner...... 460,859
Sash holder, G. W. Morstatt...... 460,690
Saw machine, swing, E. F. Autenrieth...... 460,599
Scaffold horse, G. Kautz...... 460,583
Scales, poise and price scale attachment for weighing, J. H. Milburn...... 460,689
Seat. See Carriage seat.
Separator. See Egg separator. Grain separator. Ore separator.
Sewing machine, book, F. R. Kahnes...... 460,582
Sewing machine feeding mechanism, W. J. Stewart...... 460,730
Sewing machine welt guide, C. Hatch, Jr...... 460,776
Shafts register and recorder for revolving, Pomeroy & White...... 460,886
Shears, C. W. Hansen...... 460,704, 460,705
Sheet metal, drawing, J. W. Bodge...... 460,550
Sheet metal drawing die, J. W. Bodge...... 460,551
Sheet metal drawing die, E. Norton...... 460,594
Shelf, pastry, M. S. C. Hartmann...... 460,748
Shoe, A. Barrows...... 460,770
Shoe fastening, J. Dickson, Jr...... 460,743
Shoe pattern, J. P. Eaton...... 460,569
Shoe shank making machine, J. Hyslop, Jr...... 460,813
Shoes, etc., composition of matter for soles of, Brown & Blackwell...... 460,842
Shutter spring, A. P. Merrill...... 460,646
Silk, apparatus for making artificial, H. De Chardonnet...... 460,629
Sink trap, J. B. Carroll...... 460,557
Skein lacer, R. Simon...... 460,665
Sliding gate, A. E. Bright...... 460,711
Slip, label, card, or letter file, J. L. Gilman...... 460,862
Snow from road beds, apparatus for removing, J. F. Seery...... 460,893
Snow plow, H. A. Ruggles...... 460,761
Sole cutting die, R. R. Gibbs...... 460,774
Spectacles, O. J. Halbe...... 460,576
Spike extractor, J. E. Stout...... 460,897
Spring. See Bell spring. Shutter spring.
Spring motor, I. S. Patton...... 460,655
Stalk cutter, R. N. Brownlee...... 460,843
Stamp, time and calendar, E. W. Morton...... 460,881
Stand. See Display stand.
Steam boiler, J. Baird...... 460,838, 460,906
Steamer or heater for tempering wheat or other grain, Zimmerman & Beall...... 460,624
Steering apparatus, rudder lock for, S. H. Le Fevre...... 460,706
Steno-telegraphic apparatus, A. Wood...... 460,619
Stone gutters, device for rounding and smoothing the edges of artificial, M. Maurer...... 460,645
Stone pavements, apparatus for cutting or marking artificial, G. F. Gray...... 460,821
Stone pavements, device for blocking off artificial, M. Maurer...... 460,644
Stove boards, machine for making paper lined, J. J. Sweeney...... 460,764
Stove or furnace grate, Walker & Harlow...... 460,710
Stoves, water heater for gas or vapor, Edmonds & Mason...... 460,703
Straw stacker, A. A. Russell...... 460,889
Stringed instrument, C. Gumbel...... 460,863
Suppository machine, Wood & Howarth...... 460,620
Surcingle, H. Ellsworth...... 460,746
Surveyer's transit, J. A. Brown...... 460,909
Switch. See Electric switch.
Switch indicator, automatic electric, E. W. Hadley...... 460,864
Table. See Billiard table.
Tag, key, E. W. Hall...... 460,865
Tank. See Fish tank.
Telegraph or other post, iron or steel, W. E. Pedley...... 460,831
Telegraph, printing, M. G. Farmer...... 460,572
Tent and knapsack, combined shelter, H. Stiter...... 460,896
Thill coupling, F. M. Mitchell...... 460,830
Thill coupling, D. Murray...... 460,785
Thill couplings, anti-rattler for, W. H. Bodfish...... 460,549
Ticket holder, W. J. Barron...... 460,769
Tin, apparatus for coating plates with, Taylor & Struve...... 460,685
Tongs, roofing, H. Beirwirth, Jr...... 460,627
Tool handle fastening, D. Lumbert...... 460,829
Trace coupling, R. C. Williamson...... 460,806
Tramway, aerial, A. H. De Camp...... 460,567
Trap. See Grease trap. Sink trap.
Trolley wire support, T. Fricker...... 460,634
Trolley wire support, N. Weeks, Jr...... 460,735
Trolley wires, turn-out or switch for, D. W. Edwards...... 460,571
Truck, G. L. Chadborn...... 460,741
Trunk, convertible, Ripple & Williams...... 460,759
Tubing, sheet metal, W. H. Noble...... 460,651
Twist drills, marking, G. L. Holt...... 460,639
Typewriter copy holder, J. Chase...... 460,847
Typewriting machine, D. C. Way...... 460,901
Umbrella or parasol, C. E. Metzger...... 460,791
Valve for compound engines, starting, F. W. Johnstone...... 460,581
Valve for inflatable wheel tires, air, E. R. De Wolfe...... 460,714
Valve gear, engine, S. T. Bruce...... 460,628
Valve operating device, elevator, H. A. Beidler...... 460,934
Valve, steam-actuated, W. Franks...... 460,858
Vehicle brake, N. Cunningham...... 460,564
Vehicle brake, J. T. & G. Schuetz, Jr...... 460,890
Vehicle brake, automatic, J. N. Schwalen...... 460,892
Vehicle wheel, J. B. Lott...... 460,681
Velocipede, T. B. Jeffery...... 460,641
Vent, automatic, M. Anthony...... 460,671
Vise, C. Wies...... 460,613
Wagon, dumping, T. Hill...... 460,869, 460,879
Wagon, fire department, C. T. Holloway...... 460,777
Wagon, platform, T. Hill...... 460,870
Wall paper exhibiting machine, T. M. Robertson. 460,727
Wash boiler, C. F. Haussler...... 460,796
Washer. See Dish washer.
Washing machine, A. J. Stasey...... 460,835
Watch bow fastener, J. J. Hogan...... 460,872
Watch bow fastener, F. Mink...... 460,879
Water elevator, vacuum, D. P. Burdon...... 460,845
Water wheel, J. B. Pitchford...... 460,758, 460,815
Wave power motor, H. P. Holland...... 460,812
Wheel. See Vehicle wheel. Water wheel.
Whiffletree attachment, vehicle, W. F. Henry...... 460,823
Whiffletree hook, A. B. Neiman...... 460,755
Windmill tower, H. C. Addis...... 460,837
Wire, drawing, S. L. Mershon...... 460,726
Wire looping tool, L. S. Flatau...... 460,916
Wire, plated, G. E. A. Knight...... 460,750
Wire stretcher, J. W. Peterson...... 460,885
Wire swaging machine, W. H. Dayton...... 460,566
Wire, trundler for spooled, C. R. Smith...... 460,894
Wool washing apparatus, Eastwood & Ambler...... 460,852
Wrench. See Pipe wrench.
Wrench, T. F. Vandegrift...... 460,694
Writing and moistening device, combined, A. H. Stevens...... 460,602

DESIGNS.

Badge, J. D. Perry...... 21,095
Dish, E. M. Pearson...... 21,102
Monument, F. S. Ingoldsby...... 21,093
Paper fastener, G. W. McGill...... 21,098, 21,099
Photographic card, C. A. Wright...... 21,096
Powder sprinkler, C. F. Redlich...... 21,103, 21,104
Spoon, C. G. Willson...... 21,092
Spoon, H. M. Wilson...... 21,105
Stamp handle and base, rubber, W. E. Banning...... 21,091
Stove, J. S. Van Buren...... 21,100
Tassel, W. E. Oehrle...... 21,094
Tobacco plug, D. Harris...... 21,097
Type, font of printing, H. Ihlenburg...... 21,101

TRADE MARKS.

Antiseptic and detergent compound, Reed & Carnrick...... 20,193
Brandy, J. Robin & Co...... 20,184
Cheese, A. Ethridge & Co...... 20,183
Cigarettes and cut tobacco, P. Rabell...... 20,203, 20,204
Cigars, D. Mendia & Co...... 20,202
Cotton goods, such as lawns, cambrics, etc., King Philip Mills...... 20,196
Dextrine, P. Bauer & Co...... 20,200
Gelatine, C. B. Knox...... 20,191
Lamp and gas fixtures, shades for, W. Foerster & Co...... 20,190
Liniment for sprains, lumbago, lameness, etc., Weinberg & Mann...... 20,198
Medical appliances, hygienic, R. B. Duty...... 20,189
Photographic plates or films, G. Cramer...... 20,185, 20,186
Powder for the prevention of odors from perspiring feet, L. A. Kimberly...... 20,192
Remedy for catarrhal affections and other mucous diseases. J. H. Sumser...... 20,195
Remedy for rheumatism and gouty diathesis, Reed & Carnrick...... 20,194
Shampoo cream, E. Butch...... 20,199
Soap, laundry, Detroit Electric Soap Company...... 20,188
Tin plates and roofing tin, W. Gilbertson & Company...... 20,201
Tonic, liniment, cough sirup, pills, mineral bath, and hair restorative, Wolfe Chemical Company 20,197
Toothache drops, liniment, and cough sirup, W. L. Dodge...... 20,187
Whisky, T. E. Pepper...... 20,205

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

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

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

[In press, to be issued about December 1, 1891.]

The Scientific American Cyclopedia of Receipts, NOTES AND QUERIES.

650 pages. Price $5.

This splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the **Scientific American** during nearly half a century past; together with many valuable and important additions.

Over Twelve Thousand selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use.

Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Instructions for working many different processes in the arts are given. How to make and prepare many different articles and goods is set forth.

Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings.

Those who are in search of independent business or employment, relating to the manufacture and sale of useful articles, will find in it hundreds of most excellent suggestions.

MUNN & CO., Publishers,
Scientific American Office,
361 Broadway, New York.

RECEIVER'S SALE.

Axe Patents, etc., at Public Auction.

By order of the Superior Court for Hartford County, Connecticut, in the case of Vail vs. Hammond, the undersigned, as Receiver, will sell at public auction, at 2 o'clock on Wednesday afternoon, November 18, 1891, at Number 75 Court Street, New Haven, Conn., the following American and Foreign Letters Patent, granted and issued to Henry Hammond, of said New Haven, as inventor, the legal title to said patents having been conveyed to the undersigned pursuant to order of Court, To wit:

PATENTS GRANTED BY THE UNITED STATES.

For "**IMPROVEMENT IN THE MANUFACTURE OF AXES;**" April 28, 1885, No. 316,617; July 7, 1885, No. 321,494; and July 23, 1889, No. 407,591. For "**AXE BLANK;**" April 28, 1885, No. 316,618; and January 26, 1886 No. 334,948. For "**FORGING MACHINE;**" July 28, 1885, No. 322,928; July 28, 1885, No. 322,929; July 28, 1885, No. 322,930; and April 2, 1889, No. 400,670. For "**SHEARING DIE;**" September 22, 1885, No. 326,644. For "**PROCESS OF FORMING EDGE OF AXES;**" September 22, 1885, No. 326,645. For "**NIPPERS;**" August 16, 1887, No. 368,470.

PATENTS GRANTED BY THE GOVERNMENT OF GREAT BRITAIN.

For "**IMPROVEMENT IN THE MANUFACTURE OF AXES;**" July 9, 1885, No. 8,311; and January 29, 1889, No. 1,560. For "**AXE BLANK;**" February 5, 1886, No. 1,714. For "**FORGING MACHINE;**" April 2, 1889, No. 5,571.

PATENTS GRANTED BY THE DOMINION OF CANADA.

For "**IMPROVEMENT IN THE MANUFACTURE OF AXES;**" October 23, 1885, No. 22,676; November 21, 1885, No. 22,866; and November 24, 1885, No. 22,872.

After selling the Letters Patent, there will also be sold large Machines, Dies, Tools, Patterns, Models, and material used in work performed under said patents.

This sale affords opportunity for obtaining exclusive control of a valuable system and associated improvements for the economical manufacture of Axes and other Tools. Terms and conditions announced at sale.

JAMES P. ANDREWS, Receiver.

Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.

Industrial Publishers, Booksellers, and Importers, 810 Walnut St., Philadelphia, Pa., U. S. A.

Our new and Revised Catalogue of Practical and Scientific Books, 86 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

OVER 16 TONS

—OF—

"Experimental Science"

SOLD.

We do not refer to science in the abstract, but to our new book by Mr. Geo. M. Hopkins, having the above title.

This book has proved itself to be the most popular scientific book ever printed. Every scientific person, and any person desiring to become scientific, should have it. It will pay to look over the illustrated table of contents, which we send gratis. 740 pages, over 680 first-class illustrations. Price by mail, $4.

Munn & Co., 361 Broadway, N.Y.

OCT. ENGINEERING MAGAZINE.

PROGRESS IN AERIAL NAVIGATION. Illus. O. Chanute, President Am. Soc. C. E.
ONE VIEW OF THE KEELY MOTOR. T. Carpenter Smith, M. E.
POSSIBILITIES OF LANDSCAPE GARDENING. John De Wolf, L. A.
RAILROAD BUILDING ON THE TEXAS FRONTIER. Illus. George W. Rafter, C. E.
MARBLE QUARRYING IN THE UNITED STATES. E. R. Morse.
MODERN TYPES OF GOLD AND SILVER MINERS. Illus. Albert Williams, Jr., E. M.
THE CONDITIONS CAUSING A TORNADO. Illus. Prof. H. A. Hazen, U. S. Weather Bureau.
THE FUTURE OF OUR WAGON ROADS. William Claypoole, C. E.
A SOLUTION OF THE BLOCK SIGNAL PROBLEM. Illus. H. Ward Leonard, E. E.
THE NEW ART, DECORATIVE ELECTRICITY. Illus. N. G. Wall.
Editorial Dep'ts. Index to Engineering Press. Popular Miscellany.

"In a field of literature that commands wide and increasing interest, because it deals with problems of a vital and practical nature."—*Denver News.*

News stands or by mail; 25 cents a number, $3 a year. Sample copy, 10 cents. Mention the *Sci. American.*

The Engineering Magazine Co., World Building, N. Y.

HARPER'S PERIODICALS

HARPER'S MAGAZINE, One Year - - $4.00
HARPER'S WEEKLY, One Year - - - - 4.00
HARPER'S BAZAR, One Year - - - - 4.00
HARPER'S YOUNG PEOPLE, One Year - 2.00

Postage free to all subscribers in the United States, Canada, and Mexico.

The volumes of the WEEKLY and BAZAR begin with the first numbers for January, the volumes of the YOUNG PEOPLE with the first number for November, and the volumes of the MAGAZINE with the numbers for June and December of each year.

Booksellers and Postmasters usually receive Subscriptions. Subscriptions sent direct to the publishers should be accompanied by Post Office Money Order or Draft. When no time is specified, subscriptions will begin with the current Number.

The MAGAZINE is an overflowing store of good literature and exquisite art—a delightful production deserving all the fame and all the material success which have been won by it. The WEEKLY is a rarely illustrated chronicle of the year's events. There is no end of pleasure and profit in its pages. . . . The BAZAR is a repository of fashion, and a gallery of some of the finest engravings of the time. . . . The YOUNG PEOPLE is a treasure-house, fascinating to every boy and girl as well as to plenty of persons older. A remarkable and valuable, an instructive and delightful line of publications, indeed.—*N. Y. Sun.*

Address

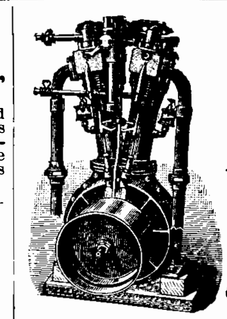
HARPER & BROTHERS, NEW YORK.

A Machine Shop and Laboratory

Where inventors may be helped out of their mechanical troubles. Will send a primer that is itself a help.

THE JONES BROTHERS ELECTRIC CO. CIN'TI, O.

DEAFNESS & HEAD NOISES CURED by Peck's Invisible Tubular Ear Cushions. Whispers heard. Successful when all remedies fail. Sold **FREE** only by F. Hiscox, 853 B'way, N.Y. Write for book of proofs



AMERICAN INSTITUTE FAIR.

DAIMLER MOTOR CO.,

MANUFACTURERS OF

GAS ENGINES,

Adapted to STATIONARY, LOCOMOTIVE, AND BOAT PURPOSES.

DAIMLER MOTOR LAUNCHES, {18 to 35 feet, 1 to 10 horse power.

Safe, Speedy, Clean, Reliable, Convenient. No Steam. No Coal. No Ashes.

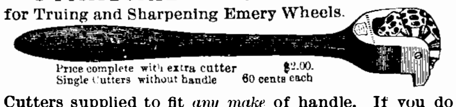
Office, 111 East Fourteenth Street, New York,

Next door to Steinway Hall.

These Motors are now on exhibition at the American Institute Fair, New York.

"STANDARD" EMERY WHEEL DRESSER

for Truing and Sharpening Emery Wheels.



Price complete with extra cutter $2.00. Single Cutters without handle 60 cents each

Cutters supplied to fit *any make* of handle. If you do not wish to buy complete tool, send 60c. with name of the make of handle you have, and we will send cutter to fit. Will last *three times* as long as any other make.

STANDARD TOOL CO., Cleveland, Ohio.

Our Twist Drills and Tools are sold by all dealers in Hardware and Supplies. *Send for Catalogue.*

AIR BRUSH Highest gold medal award by Franklin Institute as a legitimate Art Tool. Invaluable to crayon and water color portrait artists and draughtsmen. Saves time, gives finest technical effects. Send for circular. AIR BRUSH MFG. CO., 67 Nassau St., Rockford, Ill.

ALANSON CARY MANUFACTURER OF FLAT STEEL SPRINGS OF EVERY DESCRIPTION 240 & 242 W. 29TH ST. NEW YORK.

2nd MACHINERY Lists Sent.

N. Y. Mach'y Depot, Bridge Store 16, Frankfort St., N.Y.

Cheap Printing Do it yourself. Circular press $8. Size for small newspaper, $44. Everything easy, printed rules. Send two stamps for Catalogue to factory. KELSEY & CO., Meriden, Conn.

—FOR—

FREE SITES TO SUBSTANTIAL MANUFACTURING ENTERPRISES

in the rapidly growing towns of Virginia and West Virginia, possessing CHEAP IRON, CHEAP LUMBER, CHEAP FUEL, and RAILROAD FACILITIES, address J. H. DINGEE, 330 Walnut Street, Philadelphia, Pa., President and General Manager of numerous Land Companies situated along the lines of the Norfolk & Western Railroad.

FOR SALE, or to manufacture on royalty, patent No. 440,048, issued November 4, 1890. Device for attaching horse shoes without the use of nails. Highly indorsed by those who have used them. For particulars address MAYOW & CASTLE, Mount Sylvan, Texas.

WANTED.

A first-class Blacksmith and Wrought Iron Worker—one that can take charge of works employing seventy-five men. Must be capable of making drawings, calculating strengths, and do estimating. State salary required. Address Blacksmith, care *Scientific Am.*, N. Y.

A MAN OF SENSE will always buy the best. In wire Door Mats, that state of mind means a customer for the "Hartman Flexible." "Proof," did you say? We have made over half a million Mats, and annually sell 90 per cent of the total output in this line. HARTMAN MFG. CO. works, Beaver Falls, Pa. *Branches:* 102 *Chambers St., New York;* 508 *State St., Chicago;* 51 *and* 53 *S. Forsyth St., Atlanta, Ga.* Catalogue and testimonials mailed free. **Our Mats have brass tag attached stamped "Hartman."**

ROCK BREAKERS AND ORE CRUSHERS

We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers, containing the invention described in Letters Patent issued to Eli W. Blake, June 15, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11 and July 20, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under these patents.

FARREL FOUNDRY & MACHINE CO., Manufacturers, ANSONIA, CONN. COPELAND & BACON, Agents, NEW YORK and PHILADELPHIA.

PURE TEMPERED COPPER THE SAFEST, MOST DURABLE & ECONOMICAL METAL EVER OFFERED FOR VARIOUS MECHANICAL USES. HIGHEST ANTI-FRICTIONAL QUALITIES. INDISPENSIBLE FOR ELECTRICAL WORK. EUREKA TEMPERED COPPER CO. NORTH EAST, PA.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal 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. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page or address MUNN & CO., Publishers,

361 Broadway, New York.

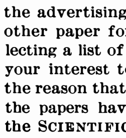
The most Successful Lubricator for Loose Pulleys in use.

VAN DUZEN'S PATENT LOOSE PULLEY OILER

Highly recommended by those who have used them for the past four years. Prices very reasonable. Every user of machinery should have our "Catalogue No. 56," sent free. Mention this paper.

VAN DUZEN & TIFT, Cincinnati, Ohio.

FERTILIZERS. AN OUTLINE OF the history of commercial fertilizers. A valuable and instructive paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 806. Price 10 cents. To be had at this office and from all newsdealers.



JENKINS' UPRIGHT CUSHIONED

POWER HAMMER.

Users of this hammer sustain us in saying that it has no equal in all good working qualities. *Perfect cushion* and a *perfect blow,* with *perfect control.* For particulars, L. & R. WISTER & Co., 257 So. 4th St., Philadelphia, Pa., U.S.A.

THE MODERN ICE YACHT. — BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 624. Price 10 cents. To be had at this office and of all newsdealers.

The Sebastian-May Co.

Improved Screw Cutting

Foot & Power LATHES $60

Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.

165 to 167 Highland Ave., SIDNEY, OHIO.

THE PENNA. DIAMOND DRILL & MFG. CO. BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drills, Power and Hand Cranes, and General Machinery.

ARTIFICIAL INCUBATION.—A DEscription of the French process of raising chickens. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 778. Price 10 cents. To be had at this office and from all newsdealers.

PAINT YOUR ROOFS WITH

DIXON'S SILICA GRAPHITE PAINT

Water will run from it pure and clean. It covers double the surface of any other paint, and will *last four or five times longer.* Equally useful for any iron work. Send for circulars. JOS. DIXON CRUCIBLE CO., Jersey City, N.J.

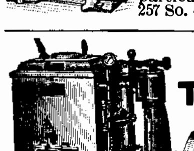
Scientific Book Catalogue

RECENTLY PUBLISHED.

Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.

MUNN & CO., Publishers Scientific American.

361 Broadway, New York.



NO SKILLED ENGINEER.

The Shipman Automatic Steam Engine

STATIONARY AND MARINE.

Petroleum, Kerosene Oil, and Natural Gas Fuel.

1, 2, 4, 6, and 8 Horse Power, Single.

8 and 22 Horse Power, Compound

For Elevating Water, Creameries, and all Manufacturing Purposes.

SHIPMAN ENGINE CO. 210 Summer St BOSTON.

STEAM ROAD ROLLERS.

IDE AND IDEAL AUTOMATIC ENGINES. WHITNEY PATENT FURNACE. TANDEM AND CROSS COMPOUND ENGINES. BOILERS OF EVERY DESCRIPTION.

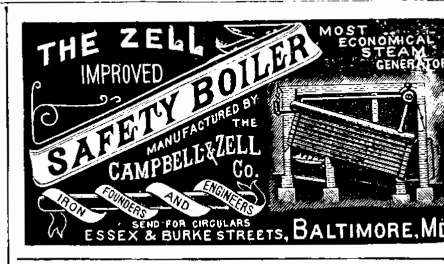
Manufactured by HARRISBURG FOUNDRY AND MACHINE WORKS, Harrisburg, Pa., U. S. A.

PERFORATED METALS for MINING SCREENS

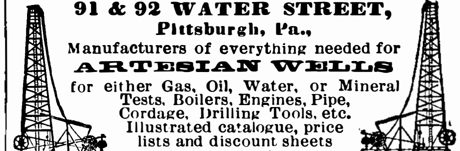
COAL AND ORE SEPARATORS, REVOLVING AND SHAKING SCREENS, JIGS & STAMP BATTERIES, FOR ALL KINDS OF MILLING & MINING MACHINERY, ETC.

HARRINGTON & KING PERFORATING CO. CHICAGO.

NEW YORK OFFICE, 284 PEARL STREET.



OIL WELL SUPPLY CO.



91 & 92 WATER STREET, Pittsburgh, Pa.,

Manufacturers of everything needed for

ARTESIAN WELLS

for either Gas, Oil, Water, or Mineral Tests. Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.

GATES ROCK & ORE BREAKER

Capacity up to 200 tons per hour.

Has produced more ballast, road metal, and broken more ore than all other Breakers combined. Builders of High Grade Mining Machinery. Send for Catalogues.

GATES IRON WORKS, 50 C So. Clinton St., Chicago

215 Franklin St., Boston, Mass.

INVENTIONS PRACTICALLY DEVELOPED

Drawings, Pattern Making, Experimental and Fine Machine Work of all kinds. MILLIKEN & D'AMOUR, 151-153 Cedar Street, near West Street, New York.

CLARK'S

WOOL WASHERS, WARP DYEING AND SIZING MACHINES, PATENT RUBBER COVERED SQUEEZE ROLLS, POWER WRINGERS FOR HOSIERY AND YARN DYEING, DRYING AND VENTILATING FANS, WOOL AND COTTON DRYERS, Etc.

Catalogues free.

GEO. P. CLARK,

Box L. Windsor Locks, Conn.

Useful Books!

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,

MUNN & CO., 361 Broadway, New York.

CHUCKS.

Catalogue No. 12, just issued, with over 40 new illustrations, sent free. Address, The Cushman Chuck Co., Hartford, Conn.

ARTESIAN

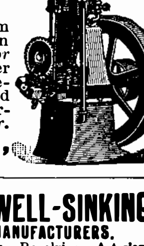
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. Pierce Artesian and Oil Well Supply Co., 80 Beaver Street, New York.

OILS AND FATS—SOME PRACTICAL notes on the oils and fats used for industrial purposes. A valuable and interesting paper, contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 800. Price 10 cents. To be had at this office and from all newsdealers.

"THE SINTZ"

GAS AND GASOLINE ENGINES

Stationary and Marine.



Makes its own supply of gas from gasoline, and at less expense than any other engine. *No boiler, coal, or fireman required.* Runs with either manufactured or natural gas. Specially adapted for small boats and launches and electric light work. Circulars free. *Mention this paper.*

CLARK SINTZ, MFR., Springfield, Ohio.

LIGHTNING WELL-SINKING

MACHINERY MANUFACTURERS.

Hydraulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. Encyclopedia, 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c. The American Well Works, Aurora, Ill. 11 & 13 S. Canal St., Chicago, Ill. Dallas, Texas.

Works and General Office AURORA. Branches

LITTLE HERCULES DRILL CHUCK

Has eccentric rotating, self-gripping jaws, which hold strongest when working hardest. The larger the drill, the more powerful the leverage. All working parts of best steel, hardened. The most powerful, accurate, and durable chuck in the market. Oneida Mfg. Chuck Co., Oneida, N. Y., U. S. A.

BARNES'

New Friction Disk Drill.

FOR LIGHT WORK.

Has these Great Advantages: The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.

W. F. & JNO. BARNES CO., 1999 Ruby St., - Rockford, Ill.

CHANDLER & TAYLOR CO'S SELF-CONTAINED STEAM ENGINES

Are tested under full load before shipment.

12 to 80 H.P. in Stock

ALSO SUITABLE

BOILERS

on hand for immediate delivery. For Circulars address

CHANDLER & TAYLOR CO. INDIANAPOLIS, IND.

THE SCIENTIFIC AMERICAN

ESTABLISHED 1846.
The Most Popular Scientific Paper in the World

Only $3.00 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, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. 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., 361 Broadway, New York.

THE
Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.