SCIENTIFIC AMERICAN

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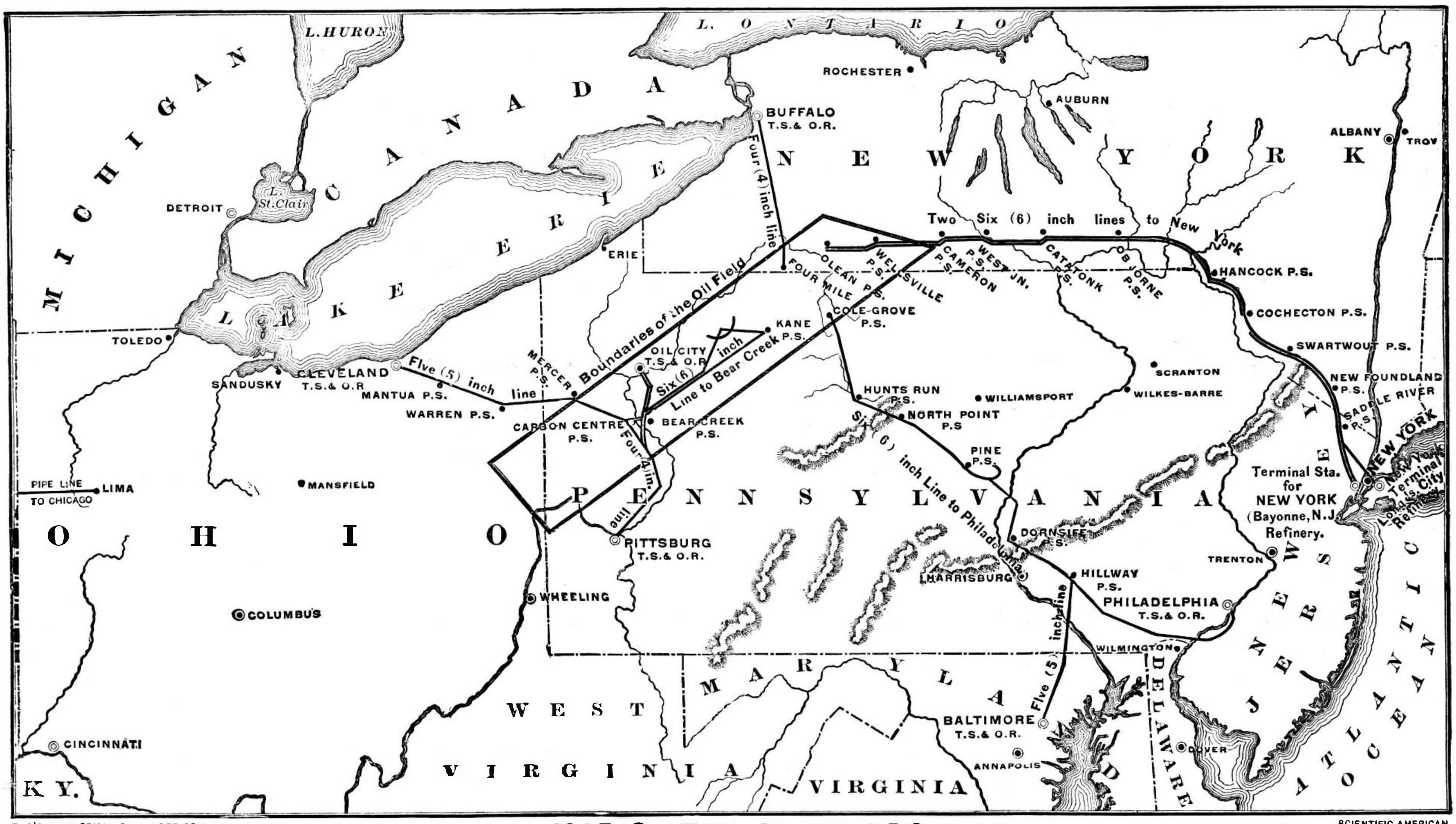
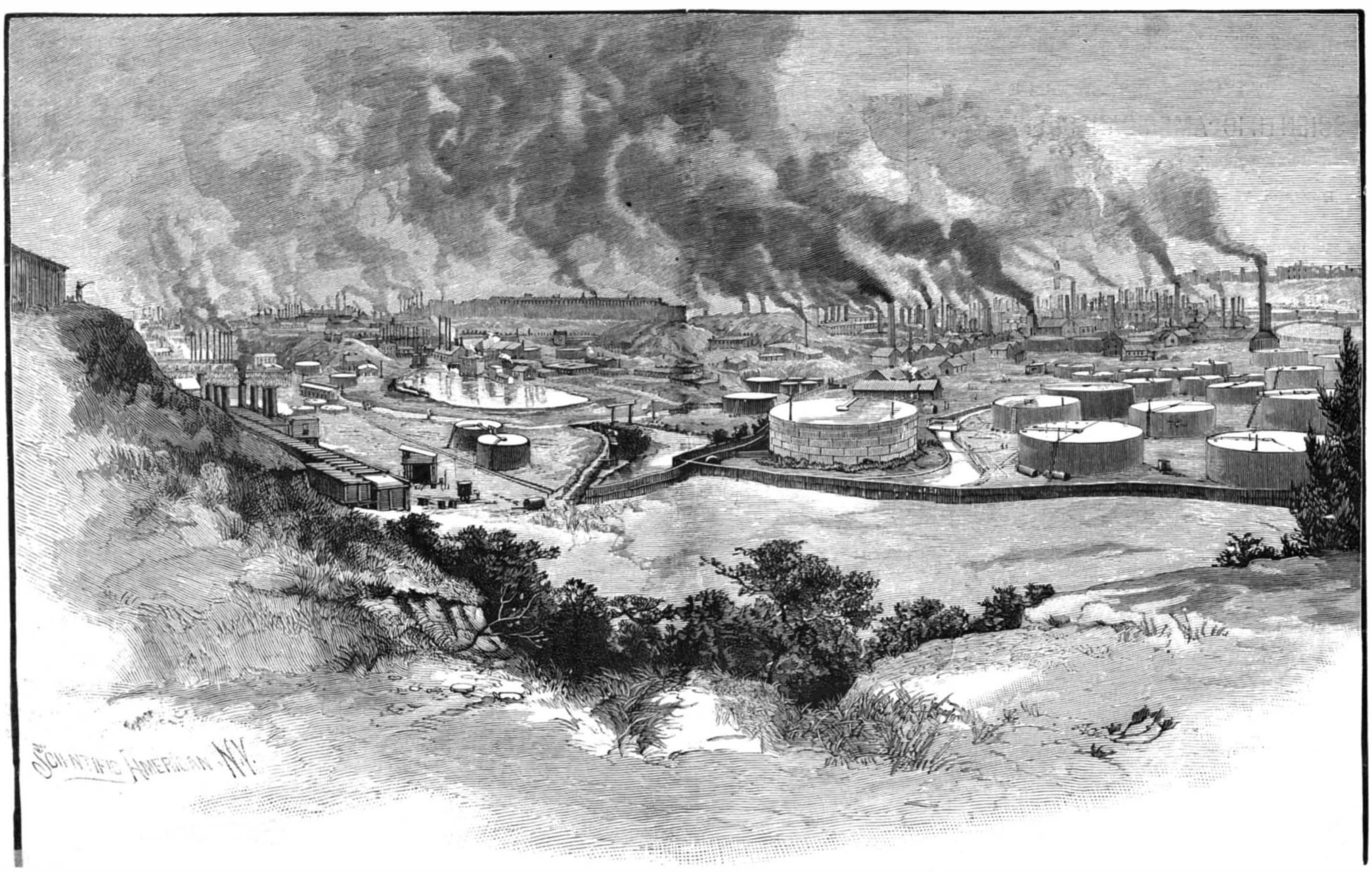


ENG'D BY AMERICAN BANK NOTE CO. N.Y. — SCIENTIFIC AMERICAN

MAP OF THE OIL FIELDS

ABBREVIATIONS.— T.S.— TERMINAL STATION O.R.— ORE REFINERIES P.S.— PUMP STATION



GENERAL VIEW OF CENTRAL REFINERY AT CLEVELAND.

THE TRANSFER OF OIL BY MAIN TRANSIT PIPE LINES FROM OIL REGIONS TO PRINCIPAL REFINERIES.—[See page 134.]

Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 27, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 843.

For the Week Ending February 27, 1892.

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ROAD IMPROVEMENT.

The importance of the wheel as a factor in civilized life has been well epitomized in the following extract: "Do you know that the wheel is the connecting link between barbarism and civilization, poverty and wealth; that by it the world moves, and upon it all great work depends? Do you know that the horse which staggers with 500 pounds upon his back trots off easily with 2,000 pounds loaded on wheels? Do you know that if you were chained to 500 pounds of iron in the form of a cube you would die if bread was but one-eighth of a mile off?—that in a cask you could roll 2,000 pounds around the earth? Do you know that every time you step you lift your weight (say 100 pounds) one inch, which, added up, makes a lot at the end of a day?—that on a bicycle you can go farther, faster, and easier in the same time? Take the wheel from the locomotive, and one-half the world's industry would die. Remove it from the car, carriage, and factory, and the wealth of the world would dwindle nine-tenths. You would hear of no Goulds, no Astors, no Vanderbilts. Wall Street would go down a tradition to future generations."

Like many other important facts, the above is very well known and is very imperfectly realized. But the wheel without a proper surface to roll upon is badly discounted. The railroad only attains its speed by having a smooth steel bed for its wheels to roll over. On a less perfect surface the speed of the slowest train would be unendurable for the passengers. The locomotive, that seems instinct with self-contained life, becomes the most helpless of organisms when its wheels leave the rails or when snow accumulates little by little on the track.

The road question is now one of the great issues of the day. Of all civilized countries, the United States probably hold the palm for bad roads. The annual messages of governors of States have taken cognizance of the need for better roads; the roads of a district have been made a subject for indictment by a grand jury. In the daily papers we read of a mud blockade, when farmers were confined to their houses because the roads were impassable. Their produce was locked up, money became scarce, the local merchants suffered in their business, so that a local financial crisis was the effect of bad roads. We read that a farmer in Pennsylvania, last spring, while using a six-horse team to haul a single load of hay, had one of his horses fall in the road, and the horse was drowned before he could be got out. The question, "How are the roads?" so frequently put in country places, tells a whole story of the dependence of farmers on roads for their prosperity, comfort, and even for social recreation and enlightenment. Without practicable transit, there can be no support for family gatherings, lectures or lyceums, and the very schooling of the children of the country depends on the same thing—good roads.

Occasionally it is found that people in a given district rise to the importance of this subject. In New Jersey, a group of adjoining counties have positively transformed the face of the country by constructing many miles of macadamized or telfordized roads. In Kentucky, in parts of New York, in the suburbs of Boston, and other places the same movement has progressed. In Parke County, Ind., a road enthusiast, out of his private purse, built one mile of good road. At this time the county in question was said to contain the muddiest road in the State. But the object lesson of the mile of roadbed had its effect, and now the same county is celebrated for its roads.

Without going into statistics as to the number of horses owned by the farmers of this country, it is plain that a condition of affairs which exacts the labor of two horses to do what should be the work of one is disastrous in the business sense. Good roads are the best possible investment for a State that cares for the prosperity of its greatest producing class. They are of the utmost importance to railroads. Good roads would easily double the width of the belt or zone of supply of railroad lines, and would maintain such supply winter and summer. This would avoid the troublesome glut of freight when the mud dried up, and the want of business when the frost, leaving the ground, produces impassable roads.

All this seems clear enough, but is hard to impress upon those most nearly concerned. How far State or federal aid should be devoted to the end of securing good roads is a question for political economists. It seems clear that, without some such aid, the end will never be reached. In Europe, the state is the road maker. The great carts of the French farmer with broad tires roll smoothly over splendid Telford surfaces, a tandem team drawing immense weights without painful effort. A parallel picture is presented in other countries, England and Italy among the rest.

The work of road improvement is being furthered by constant agitation, by publication of manuals on the subject, and by an excellently edited monthly magazine, published in this city. All this work will eventually have its effect. It has been found that roads can be laid under the bond system without overburdening the tax payers, and it seems probable that, fifty years from now, the people will contemplate with amazement the condition of things that permitted a whole region of farming industry to be paralyzed by a "mud blockade."

Naval and Seaboard Weakness of the United States.

The outbreak of war with Chile would have disclosed the weakness of the country. Before an army could have been transported from California to Valparaiso, a fleet of transports would have been required, and owing to the decline of the American commercial marine these would not have been available. No maritime nation can be considered in a proper state of preparation for war, offensive or defensive, unless it has a fleet of fast merchant steamers which can be converted into an auxiliary navy. If hostilities had arisen Chile would have employed the fine vessels of its national line as cruisers and transports, and the United States would have had no merchant vessels on the Pacific seaboard equal to them for war purposes. If there should be a similar emergency on the Atlantic side, there would be no merchant fleet under the American flag available in a war with any European maritime power.

If an army, moreover, had been sent to Chile and the American naval resources had been concentrated in that quarter for active operations and blockade duty, the California coast would have been defenseless, San Francisco exposed to attack from the most formidable Chilean war ships, and the Atlantic ports without adequate means of resisting long-range fire from such battle ships as the Prat. Coast defense would become an issue of paramount importance in any foreign war. It has seemed impracticable during the last decade to arouse public interest in this question or to secure wise and comprehensive action from Congress upon it.

A great nation, with unprotected cities on three seaboards, invites war by its lack of preparation for it. The United States not only ought to place its chief ports in a proper condition of defense, but it ought also to have a fleet of cruisers and battle ships large enough to meet any requirements of foreign warfare, a military system well ordered for sudden emergencies, and an auxiliary navy of requisite speed and tonnage in its merchant marine. With these preparations for national defense, the risks of war would be hardly worthy of serious consideration. Every one of these measures can be advocated in the interests of peace. The barbarism of war, which Americans justly hold in unspeakable abhorrence, cannot be averted by conditions of helplessness and insecurity produced by systematic neglect of comprehensive measures for national defense.—*N. Y. Tribune*.

Finishing Silver Prints.

BY HENRY STURMEY.

The following method of finishing silver prints, when intended to be kept unmounted, may be new to some readers of the Year Book, though I expect it to be an old idea to the majority. Still, as I have never seen it mentioned in print before, and as I chanced on the exact method myself, perhaps it may prove of interest. It is well known that to squeegee the wet print face down upon glass or polished vulcanite, and allow it there to dry, results sometimes in the total loss of the print by its sticking to the glass, and generally in a quickly drying print with a very high surface gloss. This gloss is all very well in its way, but I imagine, to most lovers of the beautiful, it is rather too much of a good thing. Now it struck me that I might obtain good results by squeegeeing the prints on to glass or vulcanite, and removing them while wet. I tried the experiment, and the results so fully answered my expectations that I have since adopted the system in all cases where I am dealing with prints for my unmounted portfolios.

My plan is to remove the print from the vulcanite directly I have pressed it on, and finish the drying under pressure between blotting paper. I find the squeegeeing presses the water out, and that the prints dry in less than half the time they take ordinarily, while they come out when dry with a much smoother and more even surface than can be obtained by ironing, which process is saved; and that while possessing this finer surface, they have not that high and inartistic gloss which is given them if left to dry upon the vulcanite.

Electric Motors Burned.

An accident occurred on the morning of January 19, at the Robinson electric street railway barns in Toledo, by which thirty-five electric motor cars were burned. A coal oil lamp had been left burning in a car which had been brought in but a short time before, and in some manner the lamp became overturned, the oil catching fire and the flames spreading and gaining such headway before being discovered that nothing could be done to save the car. The fire spread through the barns with such rapidity that by the time the fire department reached the spot, the fire was beyond control, resulting in a loss, it is estimated, of $150,000.

POSITION OF THE PLANETS IN MARCH.

SATURN

is morning star until the 16th, and then evening star. His opposition with the sun occurs on the 16th, at 4 h. 30 m. P. M. He then rises at sunset, is on the meridian at midnight, and sets at sunrise, being visible the entire night. He may be easily found in the eastern sky, as soon as it is dark enough for the stars to come out. He shines with a serene light and a leaden tint as he makes his way between Beta and Eta Virginis, two third-magnitude stars in Virgo. His motion is retrograde or westward, and, though he moves at a slow pace, careful observers will see that, at the close of the month, he is perceptibly nearer to Beta Virginis. The best period for the observation of Saturn extends from February to July. He is an interesting object when seen by the unaided eye, but in the telescope he is an object of surpassing loveliness even in his present aspect, for his rings are beginning to reappear, and his satellites gleam like points of gold as they circle around their great primary.

The moon is in conjunction with Saturn six hours after full moon, on the 13th, at 1 h. 48 m. P. M., being 1° 38′ north. The full-orbed moon and the radiant planet, not far away, will form a lovely celestial picture when they rise, soon after sunset, at nearly the same time.

The right ascension of Saturn on the 1st is 11 h. 56 m., his declination is 3° 6′ north, his diameter is 18″.4, and he is in the constellation Virgo.

Saturn rises on the 1st at 7 h. 1 m. P. M. On the 31st he sets at 5 h. 18 m. A. M.

MERCURY

is morning star until the 6th, and then evening star. He is in superior conjunction with the sun on the 6th, at 1 h. 18 m. A. M., when, appearing on the eastern side of the sun as evening star, he commences to oscillate eastward from the sun. On the way he meets Jupiter, apparently bound westward toward the sun. The planets meet on the 12th, at 3 h. 53 m. P. M., Mercury being 14 north of Jupiter. The conjunction is a close one, but will be invisible, both planets being so near the sun as to be entirely hidden in his light.

Mercury reaches his greatest eastern elongation on the 31st, at 7 h. 8 m. A. M., being 19° 3′ east of the sun. The conditions are favorable for a good view of the planet with the unaided eye, when at elongation and for nearly two weeks before. The observer must command a view of the western horizon, and note the point where the sun went down. He must commence the search about three-quarters of an hour after sunset, and, with the aid of an opera glass, sweep the sky about 9½° northeast of the sunset point. If he make diligent quest, he will surely be rewarded by finding the planet shining with a peculiar brilliancy on the still bright sky. This is his position at elongation when he sets an hour and a half later than the sun. Before that time, he is farther south, but shines with his greatest brilliancy. The present is the most favorable opportunity that the year affords for a view of Mercury as evening star.

The new moon of the 28th is in conjunction with Mercury on the 29th, at 1 h. 11 m. P. M., being 4° 25′ south.

The right ascension of Mercury on the 1st is 22 h. 40 m., his declination is 10° 33′ south, his diameter is 4″.8, and he is in the constellation Aquarius.

Mercury rises on the 1st at 6 h. 33 m. A. M. On the 31st he sets at 7 h. 57 m. P. M.

MARS

is morning star. He is in quadrature with the sun on the 29th, at 8 h. 28 m. A. M., being 90° west of him. His great southern declination, apparently slow progress toward the earth, and the inconvenient hour at which he makes his appearance above the horizon are difficulties in the way of northern observers. It is not until May that his movements begin to be of absorbing interest, but from that time until November he will be a target for all the telescopes in the civilized world, and no effort will be spared to increase our knowledge of what is going on in the comparatively small domain of our ruddy celestial neighbor.

The moon on the day of her last quarter is in conjunction with Mars on the 21st, at 6 h. 19 m. P. M., being 3° 32′ south.

The right ascension of Mars on the 1st is 17 h. 28 m., his declination is 23° 5′ south, his diameter is 7″.2, and he is in the constellation Ophiuchus.

Mars rises on the 1st at 2 h. 10 m. A. M. On the 31st he rises at 1 h. 31 m. A. M.

JUPITER

is evening star until the 20th, and then morning star. He closes his brilliant career as evening star on the 20th, at 11 h. 3 m. P. M., when he is in conjunction with the sun, passing beyond him and reappearing on his western side to play his part as morning star. He will be too near the sun to be visible for a few weeks, but will then become the radiant star in the east, attracting the attention of observers of the heavens when the morning light is breaking. This princely star will continue to increase in size and brilliancy as he treads his path across the celestial sphere until his opposition on October 12, when he will be visible under nearly the best conditions, not long after perihelion, and in northern declination. The lustrous light and majestic grace of Jupiter since his opposition last September have drawn forth tributes of admiration from all lovers of the stars. He will be larger and brighter at the coming opposition in October, and it is not impossible that something may be found out concerning the great red spot which is again deepening in color and becoming more distinct in outline. The close conjunction of Jupiter and Mercury, on the 12th, has been referred to.

The moon is in conjunction with Jupiter the day before new moon on the 27th, at 9 h. 36 m. P. M., being 2° 52′ south.

The right ascension of Jupiter on the 1st is 23 h. 48 m., his declination is 2° 29′ south, his diameter is 32″.0, and he is in the constellation Pisces.

Jupiter sets on the 1st at 6 h. 56 m. P. M. On the 31st he rises at 5 h. 28 m. A. M.

VENUS

is evening star. Words are powerless to give expression to the fascinating grace with which she wields her starry scepter, and, holding her court in the west, shines with peerless luster on the twilight sky, and then among the myriad hosts that spangle the firmament. She reigns alone, for Jupiter, her rival, has disappeared, eclipsed in the sunlight, and, on moonless nights, she is the glory of the evening sky. Her greatest elongation from the sun is the first goal in her path, as she advances rejoicing in her course, and when the month closes she sets nearly four hours later than the sun.

The moon makes two conjunctions with Venus during the month. The three-days-old moon is in conjunction with the bright planet, on the 1st, at 2 h. 41 m. P. M., being 2° 54′ south. She makes a closer conjunction on the 31st, at 9 h. 30 m. A. M., being 1° 27′ south.

The right ascension of Venus on the 1st is 1 h. 14 m., her declination is 7° 58′ north, her diameter is 14″.8, and she is in the constellation Pisces.

Venus sets on the 1st at 8 h. 58 m. P. M. On the 31st she sets at 10 h. 3 m. P. M.

URANUS

is morning star. He is visible to the naked eye, and may be easily found not far from Lambda Virginis, a star of the fourth magnitude in Virgo.

The moon makes a close conjunction with Uranus on the 16th at 8 h. 53 m. P. M., being 35′ north of the planet and serving as a guide to point out his position.

The right ascension of Uranus on the 1st is 14 h. 15 m., his declination is 13°.0 south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus rises on the 1st at 10 h. 14 m. P. M. On the 31st he rises at 8 h. 12 m. P. M.

NEPTUNE

is evening star. His right ascension on the 1st is 4 h. 19 m., his declination is 19° 49′ north, his diameter is 2″.5, and he is in the constellation Taurus.

Neptune sets on the 1st at 0 h. 47 m. A. M. On the 31st he sets at 10 h. 53 m. P. M.

Mercury, Venus, Saturn, and Neptune are evening stars at the close of the month. Mars, Jupiter, and Uranus are morning stars.

Speech in the Lower Animals.

A meeting of the Nineteenth Century Club was held in the assembly rooms of the Madison Square Garden on Tuesday, February 16. The occasion of the meeting was an address by Mr. R. L. Garner on "Speech in the Lower Animals."

The president, Mr. Brander Matthews, in introducing the lecturer of the evening, made some brief references to Darwinism, in which he said that Darwin's "Descent of Man" was the most important scientific work since the "Principia" of Newton, and that Mr. Garner's brilliant researches were well calculated to sustain the views introduced by Darwin.

Mr. Garner in opening his address gave an interesting account of his early experiments which commenced some eight or nine years ago. His experiments have been to a large extent among the monkeys, though other classes of animals were also experimented on. The first principle to be understood in beginning the study of the speech of animals is to associate the act with the sound, when the notes indicating anger, desire and fear may be understood. All researches of this nature must necessarily be crude, but about two years ago Mr. Garner conceived the idea of using the phonograph to record and analyze the sounds. The phonograph affords an unquestionable proof that certain sounds are accompanied by a definite act or gesture, as when the phonograph gives the note of fear, the monkey gives unmistakable signs of fear. The phonograph thus relieves the difficulty of having no standard or phonetic base upon which to work. The analysis of sounds on the phonograph is accomplished by the differences in speed of rotation of the cylinder, which may be increased or decreased from 40 or 50 to 225 revolutions per minute. Human laughter on the phonograph cylinder by proper manipulation easily deceives animals.

Mr. Garner's description of his method of obtaining a record of the sounds was very interesting. A mirror was hung on the horn of the phonograph, which induced the monkey to believe that another monkey was present, when the phonograph began to utter sounds. When anything suspicious occurred, the monkey warned his friend in the mirror, of whom he seemed very fond, lavishing caresses upon him, monkey fashion. A point of great value in Mr. Garner's researches is that monkeys have three or four inflections of the same sound, each with a meaning of its own. If the value of the sounds are considered as Mr. Garner states, it is true speech. Mr. Garner makes no claim that monkeys or other animals have definite sounds for the kinds of food, as bananas, but that they divide food into sweet food, etc. This speech of animals is a marked contrast to the redundancy of human speech. Monkeys speak, if the term may be allowed, in syllables, the word for food having five or six syllables.

Mr. Garner states on the authority of Frank Cushing, the celebrated white Zuni chief, that the Zuni Indians not only know the language of animals, but put this knowledge to practical use. In conclusion the lecturer gave a brief outline of his projected trip to Africa. Special cages are being made, which will not only afford protection for the impedimenta, but serve also to carry home the captured monkeys. An ingenious arrow has been devised by Mr. Garner, which is fired from an air gun. The tip of the arrow on striking the animal drops the shaft, and being charged with anhydrous prussic acid, produces instant death. The cages are provided with electrical fittings, which will give shocks to the thief whether animal or human. A fine phonograph with telephone attachment is being constructed specially by Mr. Edison for Mr. Garner. Some specimens of the monkey speech were given on the phonograph, including a love duet, which, though interesting, did not entirely resemble the love duet of Tristan and Isolde.

The paper was ably discussed by Dr. Daniel G. Brinton, of the University of Pennsylvania, who took the view of an anthropologist, and Prof. E. D. Perry, of Columbia, who viewed the subject from a philological point of view.

Electrotechnics.

Examples are not wanting of the scientific isolation that is caused by not possessing that familiarity with foreign languages which is a characteristic of diplomatists and hotel waiters. Take, for instance, the fact that, whereas manganin was manufactured on a commercial scale in Germany, and German resistance coils have for the last three years been constructed of this material with a temperature coefficient of nearly zero, the very existence of this alloy was unknown to many English electrical instrument makers a few weeks ago; and even now most of them are still un acquainted with the composition of manganin, and its peculiar properties, as well as with the results of the extensive and striking experiments that have been carried out at the Reichsanstalt at Charlottenburg on the temperature coefficient and specific resistance of all sorts of manganin-copper-zinc-nickel-iron alloys.

This Physikalisch-Technischen Reichsanstalt, I may mention, is an establishment totally distinct from the Technical High School in Charlottenburg, some photographs of which I showed you this evening. The Reichsanstalt is not an institution with students, but a vast series of imperial laboratories, presided over by Prof. Von Helmholtz, solely used for carrying out researches in pure and technical physics. The investigations are conducted under the direction of Dr. Loewenherz, aided by forty-six assistants.

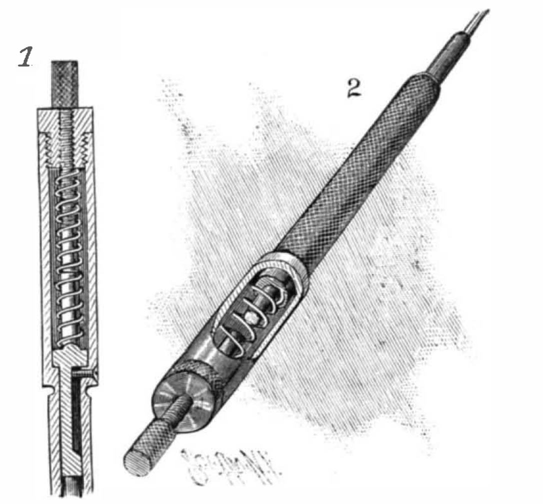
We have no establishment in Great Britain at all comparable with this Reichsanstalt. The original work turned out there in electrotechnics alone is considerable. Here are some of the published accounts of researches immediately bearing on your profession which Dr. St. Lindeck has been so kind as to send me: "Hardening Steel Magnets," "Standard Resistance Coils for Large Currents," "Tests of Commercial Ammeters and Voltmeters," "Mercury Standard of Resistance," "Photometric Investigations," "Compensation Apparatus for Use in P. D. Measurements," "Alloys for Resistance Coils," and so on.

Surely it is part of the technical education of the electrical engineer to be taught how to read such pamphlets as these with comparative ease?

A working knowledge of French and German can be obtained without the necessity of learning to express oneself fluently in epigrammatic French, or to imitate with facility the word-building of a native German; and with such a working knowledge the average technical student may rest content. But as regards his own language he should aim at something higher, and, therefore, the electrical engineering students of our country should be, I urge, practiced in writing—yes, and also speaking—vigorous English.—*Prof. W. E. Ayrton.*

AN IMPROVED DENTAL PLUGGER.

This is a dental instrument capable of use as a hand and mallet plugging implement, the device being also adapted for use as a handle for various instruments. It has been patented by Mr. George W. Geitz, of No. 127 Water Street (room 14), New York City. The tubular casing of the instrument is preferably made in one piece, its upper and lower portions of two diameters, and the bore also has two diameters, forming thereby a shoulder at the bottom of the upper section, as shown in Fig. 1. A plunger rod held to slide in the casing has at its lower end a threaded or other suitable



GEITZ'S DENTAL PLUGGER.

socket to receive the shank of a tool, and the upper portion of the rod, in the upper section of the casing, has a collar normally resting on the shoulder, while one side of the rod, below the collar, has a longitudinal slot into which a screw is passed through the casing to prevent the turning of the rod. A cap having a threaded bore screws into the upper end of the casing, and a spiral or coil spring resting at one end on the collar of the plunger rod bears at its other end against the bottom surface of the cap. An adjusting screw, passing through the threaded bore of the cap, is adapted at times for engagement with the upper end of the plunger rod. When the instrument is to be used for hand plugging, the adjusting screw is carried out, as shown in Fig. 2, and then, as the instrument is reciprocated, the upper end of the plunger rod is carried up, against the tension of the spring, into violent engagement with the lower end of the screw, at every downward or inward stroke of the casing, when the screw acts as a hammer, the spring also re-enforcing such action and returning the plunger rod to its normal position, with its collar in engagement with the internal shoulder of the casing. When the device is to be employed as a tool handle, or as a mallet-plugging implement, the screw is carried down into positive engagement with the plunger rod, as shown in Fig. 1, whereby all the parts are held in fixed position.

A New Blowpipe.

At a recent meeting of the *Academie des Sciences*, M. Paquelin exhibited a new blowpipe of a single tube, connected by an India rubber tube with a carburetor. A cylinder of wire gauze prevented the flame from reaching the carburetor. The air of a bellows regulated by stop cocks fed the flame, part of it going through the carburetor, which contained a mineral essence. The maximum heat of the flame was obtained when it was of an indigo-blue color, showing a complete combustion of the carbon, and its temperature was then sufficient to fuse platinum, that is to say 1,800° C.

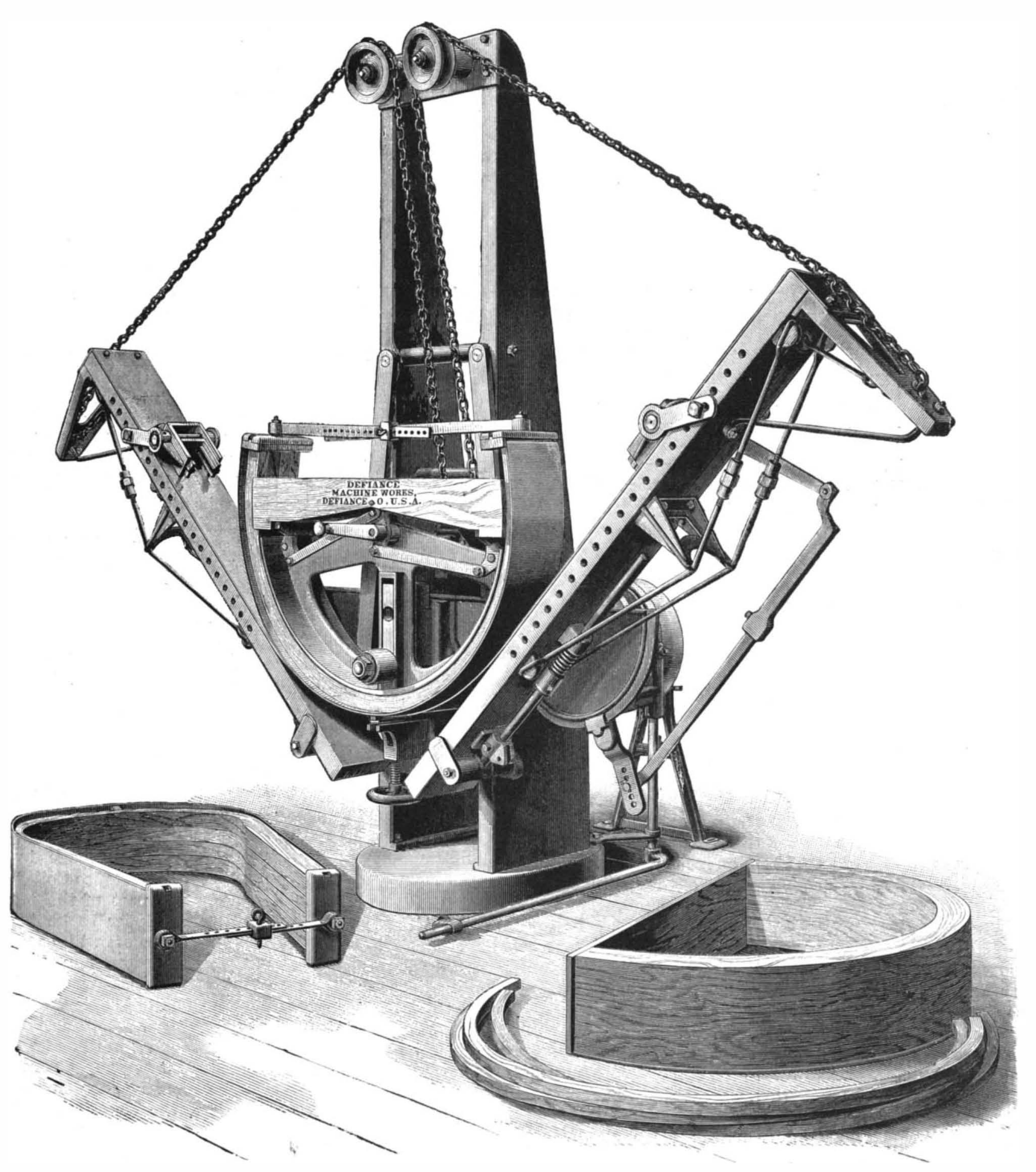
AN IMPROVED WOOD BENDING MACHINE.

The demand for wood bent into shapes to suit structural requirements has steadily increased of late years, and ingenuity has been taxed to fill it. Pieces for ornamental furniture, in infinite variety of form, carriage seats and carriage bodies, car finishings, ship building, wagon making, and innumerable other departments make demands on the art of bending woods for effects of utility and beauty which seem to have no end.

The accompanying engraving represents a machine capable of bending wood of every description, from the size of the most delicate stick to that of the heavier piece of oak, 4 by 9 inches, shown in the illustration. Of course it must be understood that the timber, of whatever size, is required to be steamed to perfect saturation before the operation of bending; but a person unacquainted with the bending of woods can have very little idea of the enormous energy required to bend such a stick as the larger one represented in the engraving. Some of the most refractory woods, such as Australian iron bark and Tasmanian black wood, have been successfully bent in this machine, and while woods of a more cellular character are better for the purposes of bending, it is believed that wood of nearly every variety can be satisfactorily bent.

The outside arc of the larger piece of bent timber shown in the engraving is forty inches in diameter. The lighter pieces and those shown in the form on the machine are forty-eight inches in diameter, and are such as are used for carriage fellies. The bundle lying down and shackled in the inclosing steel strap contains wagon hounds.

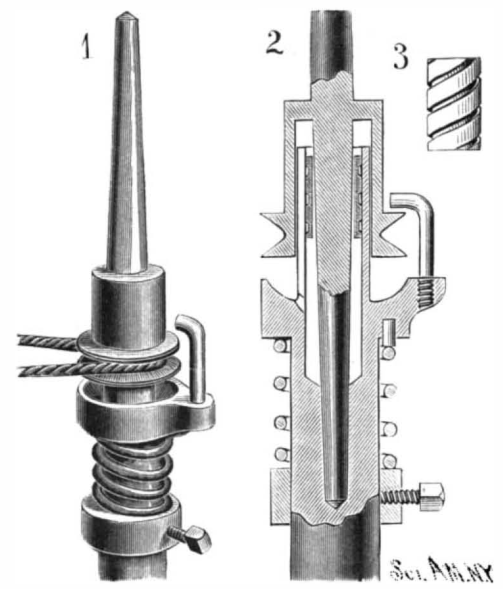
The machine is composed entirely of iron and steel, is automatic in its movements, weighs about four thousand pounds, and has several valuable features recently patented by the Defiance Machine Works, the manufacturers, Defiance, Ohio.



AN IMPROVED WOOD BENDING MACHINE.

A SILK SPINNING SPINDLE SUPPORT.

The device shown in the illustration provides for the perfect lubrication of the spindle in its supporting box, while thoroughly preventing the escape of any oil to the possible injury of the delicate material operated upon. It has been patented by Mr. Robert Atherton, of the Franklin Mill, Mill Street, Paterson, N. J. The spindle box is of the usual form, and is adjusted in place upon the spinning frame in the ordinary way,



ATHERTON'S SPINDLE SUPPORT.

and formed upon the box near its lower end is an oil cup having an annular recess in its upper surface, around a vertical extension, as shown in Fig. 2. This vertical extension is cylindrical, and has an oil chamber above an axially formed step socket, in which the spindle is supported, a small perforation or oil passage for the introduction of the lubricator extending from the bottom of an annular recess into the oil chamber. The spindle has an enlarged portion to form a seat for spun yarn, and near its lower end is a grooved whirl for the band, by which the spindle is rotated. The enlarged portion of the spindle is hollow, and has a central leg, whose lower end is formed as a conical step, seated in the step socket near the bottom of the box. Around this central leg is an annular channel, against the outer walls of which loosely fits the vertical extension, while within the extension, just below its upper edge, and around the central leg, closely fits a bushing sleeve, shown in Fig. 3. On the exterior of the sleeve are spiral grooves forming channels for the lubricating material, which, as the spindle revolves, works upwardly around the spindle leg and lubricates the portion of the latter which has contact with the bore of the bushing sleeve. As the upper end of the sleeve is below the edge of the vertical extension of the box, no oil can work over the latter, but the oil is conducted downwardly into the oil chamber below the sleeve.

To remove a wart, cover the skin around the wart with lard, apply over the surface of the growth one or two drops of strong hydrochloric or nitric acid; then keep the part covered up until the scab separates.

INDOOR CURLING.

The illustrations of this subject are taken from the Thistle Association club house, Hoboken, N. J. Indoor curling is a new idea in this country. Formerly the curling clubs played their games at the different parks around New York and vicinity. The accommodations being so poor at these places, the different clubs formed themselves into an organization known as the Thistle Association and built a large club house where they could have their games day and night all winter long. The floor of the curling hall is 100 feet in width and 150 feet in length, and is the largest floor for that purpose in the United States. The floor is raised from the ground about 4 feet and is made of narrow strips of yellow pine about 1 inch in thickness. The floor is sprayed to facilitate coating it with ice. The attendant in charge of the building on every freezing night starts in one corner and sprays the whole surface, the process taking about one hour. This practice is continued all through the winter. The spray falling on the ice freezes instantly. Under each window, on a level with the floor, are 4 feet by 2 feet swinging traps, which are opened on freezing nights to let in the cold air. The ice during the latter part of the winter, after repeated sprayings, becomes about 2 to 3 inches thick.

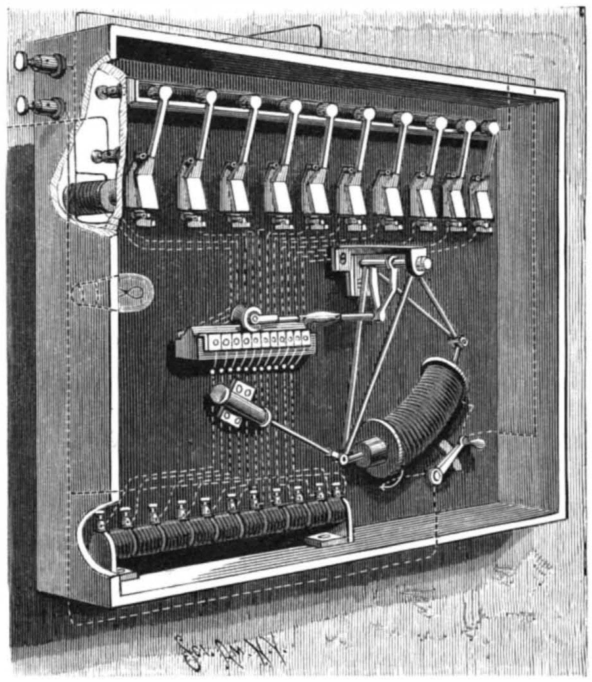
The circles at each end are painted in black on the bare floor, and can be seen through the ice. The rink from tee to tee is 38 yards in length. The circles around the tees are 2, 8 and 14 feet in diameter. Seven yards from each tee is a "hog line," every stone not clearing this line being called a "hog." There is also a line running at right angles to the rink half way between the tees, called the middle line.

The game is simple at first. The leader first tries to get as near the tee as possible, and his opponent has a similar object. During the game, if two or more stones have been well planted, the supporters of those who placed them are directed by their skips or captain to guard the winning stones rather then venture too near them, which may injure their position. The opposite players then try to knock off the guards and drive the well-planted stones away, so that they can get their own in a good position. Sometimes the stone nearest the tee is so well protected that it cannot be touched directly, and will take a master stroke to remove it. To do this, inringing is resorted to, which drives the stone in an oblique direction after striking the well-placed stone and becoming the winner instead. When the ice is blocked up so the tee caunot be seen, rebutting is resorted to. The player is told by his skip to put plenty of muscle into his arm, and the stone is sent with tremendous force, and goes crashing through the guards, sometimes changing the complexion of the game. Brooms are used by the players to sweep the ice dust which is scratched up by moving stones. By sweeping in front of a moving stone it gives it more power to move forward.

The curling stones weigh about 40 pounds each and are 12 inches in diameter across and about 5 inches in thickness. The best stones are made of Ailsa Craig granite. The best and hardest stone is taken from under the water. They are now being made by machinery, and cost $15 per pair. They are very highly polished. Formerly they were made by hand, at a cost of from $20 to $30 each, according to finish. The club house is built on piling, and cost about $18,000.

NEW ELECTRICAL GOVERNOR.

We give an engraving of an electrical governor for controlling the current on a circuit, by introducing resistance into the circuit or removing it therefrom, or by changing the exciting current in the field magnet of the electrical generator.



O'BRIAN'S ELECTRICAL GOVERNOR.

This instrument, as will be seen by reference to the drawing, is operated by a curved solenoid, in which is suspended a curved armature, so that it may swing freely in the solenoid. The armature is made tapering, to secure regular action, and its movement is damped by means of a dash pot. The arms which support the curved solenoid are attached to a rock shaft, which carries a shorter arm, connected with a double roller by an adjustable rod. The double roller rolls on two series of electric contacts, one set of which is connected with wires leading to resistance coils and the other set to a switch mechanism, which sends the current into storage batteries or other translating devices, when it is not required on the main line; that is to say, whenever the current in the main circuit is above the normal, the armature is drawn into the solenoid, moving forward the contact roller upon the contacts, cutting out one or more of the resistance coils and cutting in one or more of the switch magnets, thus shifting the circuit so as to allow the surplus current to go through storage batteries or other translating devices when it is not needed in the main circuit. When the current in the main circuit diminishes, the roller is returned by the armature, and in so doing cuts out one or more of the switch magnets, thus cutting out one or more storage batteries or other translating devices, and at the same time cuts in one or more of the resistance coils seen in the lower part of the apparatus, thus keeping the resistance of the governor constant.

This invention has recently been patented by Mr. John T. O'Brian, of Kearney, Nebraska.

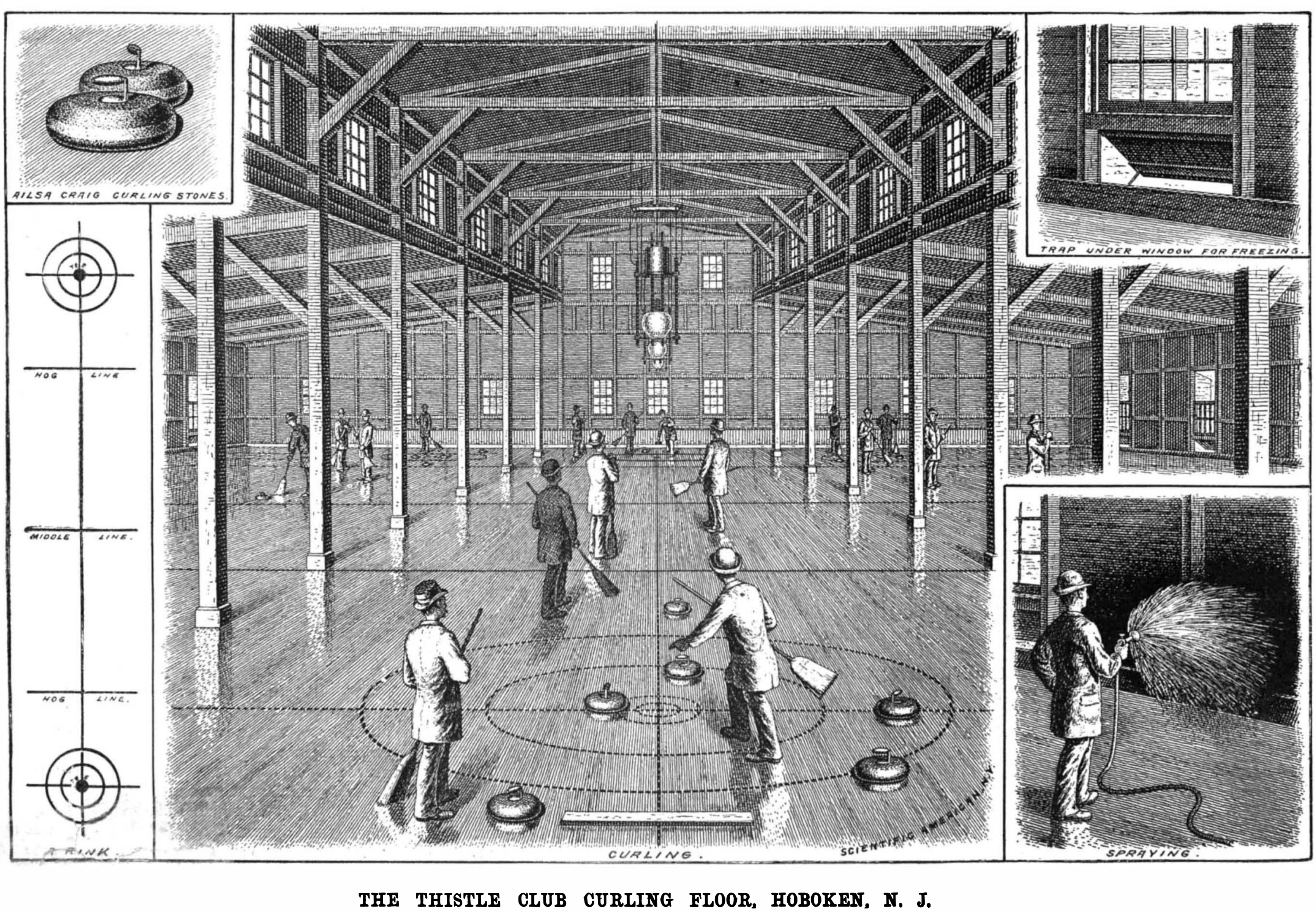
Purification of Water by Metallic Iron.

Metallic iron, in the form of either cast iron borings or steel punchings, is placed in a cylinder so arranged that by a slow rotation the iron may be continuously showered through the water, which is being passed at a moderate speed through the same cylinder. The chemical action consists in great part in the conversion of the iron into ferrous carbonate, through the agency of the carbonic acid, which partly dissolves in the water and partly remains suspended in the form of dark green turbidity. On exposure to air the iron is converted into ferric hydroxide, which, settling rapidly, carries down with it and oxidizes the organic matter. The flocculent sediment permits of rapid and perfect filtration through a simple sand filter. For evidence of its success and efficiency it is only necessary to point to the continued successful use of the process at Antwerp, Dordrecht, Paris, Nancy, and other places.

Mounting Paste for Lantern Slides.

For attaching lantern slide bindings to the glass nothing is better than bichromated paste, which is used for attaching paper to glass in the manufacture of electric machines, and which is a most useful paste for many purposes in damp climates. It is made as follows: Flour, 2 teaspoonfuls; water, 4 ounces; bichromate of potash, 5 grains. The flour must be rubbed to a smooth batter with the water, then placed in a saucepan over a fire, and kept stirred till it boils. Add the bichromate slowly, stirring all the time. Then stand to cool. *This paste must be kept in the dark;* and used as soon as possible.

Soak the paper in it, attach to the glass, and then place in direct sunlight for a day. This sets up a chemical change in the bichromate and renders the paste insoluble.—*M. V. Portman, Jour. Photo. Society of India.*



THE THISTLE CLUB CURLING FLOOR, HOBOKEN, N. J.

Tesla's Wonderful Electrical Experiments.

Mr. Nicolas Tesla, of New York, has lately repeated in London, at the Royal Institution, the remarkable electrical experiments first shown in this city. The lecturer was received with great enthusiasm in London. The proceedings are described by *Engineering* as follows: Wednesday, Feb. 3, saw another of those successful meetings for which the Royal Institution is famed. This time, however, the audience were not able to congratulate themselves that they were the first to view in public the striking experiments which were performed before them, as it is the custom of Royal Institution audiences to do, for on one occasion before, in America, Mr. Tesla, the lecturer of the evening, had been over the same ground. This was probably no disadvantage either to him or to the numerous members and associates of the Institution of Electrical Engineers who crowded to hear him, for the fame of his researches had had time to spread, and their significance to become more or less appreciated. Not that Mr. Tesla needed this to render him welcome in this country, for the man who shares with Professor Ferraris the honor of having invented the self-starting alternate current motor requires no introduction in England, nor, indeed, in any country where scientific ability is appreciated.

Our account of the previous lecture will have rendered our readers familiar with the line of Mr. Tesla's researches. We may, however, briefly state that he has devoted himself for the last year or two to the investigation of the effects attending the use of alternate currents of very high frequency and of high potential. This matter of the frequency of alternation seems to have been neglected by former experimenters with vacuum tubes. They took great pains to get immense potentials, but paid little attention to the rate at which the current vibrated to and fro. It now appears, however, that the rate of alternation is as important as potential in evolving certain phenomena, and by increasing it to a very great extent perfectly new and unexpected results can be obtained. This can be done in various ways, of which Mr. Tesla employs two. He has an alternate current dynamo, the armature of which consists of a steel disk, having arrayed on its rim 380 poles. This runs within a ring of magnets of corresponding number, and with the machine rotating at 2,000 revolutions, gives 13,000 complete alternations per second. The current thus produced is sent through the primary wire of an induction coil, and its potential raised from 50,000 volts to more than a million, although, of course, the exact amount is a matter of conjecture. In another method of obtaining currents of high frequency there was employed an alternator lent by Messrs. Siemens Brothers. The current was sent through the primary of a large induction coil, in the circuit of which a special break was interposed. This consisted of two balls, between which the current sparked, and two powerful magnet poles, which blew out the spark as fast as it was formed, and thus greatly multiplied the effect. The current from the secondary coil was then sent through the primary coil of one of Mr. Tesla's oil-insulated induction coils; in the circuit of the secondary coil there was interposed a battery of Leyden jars, which was constantly charged and discharged, the discharge being of an alternating character, with a frequency of immense rapidity.

Mr. Tesla's coils are of peculiar form. The primary coil is on the outside, and is separated from the secondary by some little space. The whole is immersed in oil, and the inventor insists most strongly that a solid dielectric can never be used successfully in this position. If this be damaged, it is spoiled irretrievably, while the oil may be struck through time after time, and instantly repairs itself. Any bubbles of air that the oil may contain are soon warmed and rise, and thus the defects are rapidly expelled—an event which cannot occur in a solid substance, in which defects tend to aggravate and not to eliminate themselves.

Mr. Tesla began his lecture with a tribute to the work of Professor Crookes, which, he said, had fired his imagination when at college, and had given a bent to his studies. He then turned to his own researches, and in a second revealed to his audience the immense distance which separates himself from his predecessors, by taking in one hand an exhausted tube, 4 ft. long, while the other hand was connected to one terminal of a coil. Instantly the tube glowed with a brilliant lambent flame from end to end, and recalled to every one the idea of the magician's enchanted wand. When the gas was turned out, the light was sufficient to reveal the lecturer and his assistants, and would have been enough to enable him to read newspaper print. It was a most striking experiment; the old ideas of electric circuits, metallic electrodes, and all the rest of time-honored notions, seemed to be flatly contradicted. From a single terminal of the coil the electro-magnetic radiations were conducted through the body of the lecturer to the tube, and entering through the glass, they put the few molecules of air that it contained into such active oscillation that they glowed in their mutual bombardment.

It was a breach of the dramatic canons to begin with an experiment of such brilliancy, and then to descend to others of less importance, but it was an indication of the power of the lecturer, and evoked rounds of applause. Indeed, the reception accorded to Mr. Tesla was one that must have raised feelings of pride in any breast. Both seats and standing room were filled, and on the front benches were to be seen most of our leading electricians and electrical engineers. All through the evening there was rapt attention, which never flagged, even during the less striking experiments.

Putting down the tube, Mr. Tesla attached an exhausted bulb to one terminal of a coil, and showed that phosphorescence was immediately set up in it. When he placed his hand near to it this phosphorescence was immensely increased, and the lamp filled with a vivid glow. This was repeated in other ways with different bulbs, and then two plates were attached to the terminals of a coil, with a sheet of vulcanite between them. The current then endeavored to spark across, and beat itself in purple rays on the sheet, branching out in streaming brushes to make its way round the edges of the plate. Turning to his audience, Mr. Tesla exclaimed: "Is there anything more fascinating than the study of alternating currents?" It was evident to all in the room that use had not rendered the lecturer insusceptible to the beauties of the experiments that he showed, and that his mind was as completely filled with wonder and enthusiasm as that of the merest novice present, and probably far more so, as he saw further into the inner nature of the phenomena which he displayed, and grasped more of their significance.

The next experiment was the passage of sparks between two balls, to simulate the discharge from a Wimshurst machine. This was done most successfully, and it was difficult to believe that the well known disks were not being turned in the ante-room. At first a 2 inch spark was shown, and then one of 6 inches, the balls being changed, for the size of the balls appears to have a distinct effect on the appearance of the arc set up between them. Next came another of those brilliant sights which are always so effective with an audience, especially when it is in a cordial mood. Two wires were stretched across the wall of the theater, about a foot apart, and were connected to the poles of a coil. When the current was turned on they glowed for their entire length with a blue light, which streamed from one to the other, and was of sufficient intensity to reveal the faces of the audience. Here there was no case of exhausted globes; the light was given off in the open air, and if not enough for the ordinary domestic purposes, was at any rate of very appreciable intensity. In this case the alternations were obtained by aid of the Leyden jars. The same idea was developed in another way in the next experiment. A wire ring, 3 feet in diameter, was connected to one terminal of a coil, and a second ring, 6 inches in diameter, was connected to the other, the two being concentric. The light streamed radially from one to the other, making a palpitating purple disk of great beauty.

Speaking on this subject of phosphorescence, Mr. Tesla stated his belief that it could be excited in all substances, if currents of sufficient frequency and potential were employed. He was also of opinion that exhaustion of the air was not necessary. Hitherto it has not been possible to drive the molecules on to the substance unless a fairly clear road were prepared for them, by removing all but an infinitesimal number. They could not get through the *melee*. But with sufficient initial velocity they will be able to proceed in straight lines, just as a cannon shot will pierce a crowd that would stop or deflect a cricket ball. All that is wanted is that the atoms shall fly fast enough and often enough to raise the surface, even of metal, to the phosphorescing or at least to the glowing stage. With extremely rapid alternation, also, the molecules never get far away from the substance they bombard, and so their heat is not diffused. Crookes' phosphorescent tubes give a magnificent glow if only held in the hand, while the other hand is applied to a coil working with sufficient frequency and potential.

Visible light and heat are not necessary to prove the existence of the electric radiation, and Crookes' radiometer placed near a ball connected to one pole of a coil rotates very briskly—curiously, however, in the opposite direction to that which it follows under the influence of light. This is explained as being due to the streams from the glass. In a second instance an unexhausted radiometer was made to rotate; the fans were covered on one side with mica, and the spindle was connected to the coil. The effect of the mica was to prevent the molecules heating one side of the vanes. As the current was increased, the speed diminished on account of the electrostatic action between the mica and the glass.

In a certain sense the most interesting part of the lecture was that dealing with lamps, because here we seem to get nearer to some practical result. Mr. Tesla's lamps mostly consist of a bulb inclosing a button of carbon resting on the end of a wire or a filament. This wire is screened by being surrounded by a tube of aluminum, which forces the radiation to follow it to the button, and not stream off sideways. When the single conductor, which this lamp contains, is connected to one terminal of a coil, the carbon glows with a light the intensity of which varies with the character of the current. On Wednesday the light seemed to be about equal to 5 candle power. When a metal screen was put over the lamp, and the radiations that fell on it were deflected back on to the sphere, the light was doubled, and reached a perfectly useful limit. Wonderful as this was, a greater marvel appeared when two zinc plates, one at a height of 10 feet and one on the floor, were connected respectively to the poles of the coil. Then it only needed that a lamp of this construction should be brought into the intervening space to glow brilliantly without any electrical connection whatever. The radiation between plate and plate was so active that, in passing through the attenuated atmosphere in the globe, it evolved the molecular bombardment which made the carbon glow.

The practical man asked as the lecturer finished, "What is the use of it all?" Nearly fifty years ago he was present when Faraday explained the laws of electro-magnetic induction, and then he also asked the same question. It was not till the Paris Exhibition of 1878 that he got his answer, but we shall be much mistaken if he has to wait so long this time. Wait he must, and in the mean time he cannot do better than join in honoring such men as Mr. Tesla, who engage in researches which promise no immediate pecuniary benefit. He must, however, be dull if he cannot discern in the few experiments we have described, out of the many shown to the audience, a clew tending toward a great discovery that would entirely revolutionize our methods of artificial illumination. If a space measuring several feet in each direction can be brought into such a condition that an attenuated atmosphere introduced into it instantly becomes self-luminous, it does not call for any great stretch of imagination to see the whole of the atmosphere of our rooms in the same condition, and filled with the same clear light which bathes our planetary system. Just as the sun puts the ether into vibration of the kind revealed to our senses as light, so does electric energy also put it into vibration of the same kind, but of a different degree. Wednesday's lecture marks one step in the progress toward luminous electric radiations; possibly some of us may live to see the remaining stages covered.

Experiments on the Solubility of Metals.

The insolubility of pure metals in acids has been investigated by Dr. Weeren, a German chemist, who states that chemically pure zinc, as well as many other metals in a state of purity, are insoluble or only very slightly soluble in acids, because at the moment of their introduction into the acid they become surrounded by an atmosphere of condensed hydrogen, which, under normal circumstances, effectually protects the metal from further attacks on the part of the acid. In the experiments which established this conclusion, the amount of chemically pure zinc dissolved by the acid was first determined; it was next sought to ascertain what difference would follow by performing the experiment in vacuo, when, of course, the escape of hydrogen would be greatly facilitated; and under these circumstances the solubility was found to be increased sevenfold. In the final experiment, namely, to learn the effect of introducing into the acid a small quantity of an oxidizing agent capable of converting the hydrogen film to water, it was found that when a little chromic acid was thus introduced, the solubility was increased one hundred and seventy-five times, and when hydrogen peroxide was employed, the solubility was increased three hundredfold.

How to Take Silver Stains Out of a Gelatine Negative.

BY J. V. DRAKE.

Soak the plate for five minutes in clean water; meanwhile, make a solution of iodide of potassium, 20 grains to an ounce of water; now put the plate in this solution, and let it stay for ten minutes. If the stain is very old, keep it in for half an hour. Now dissolve half drachm of cyanide of potassium in one ounce of water. Take the plate and put it into this, and gently rub the stains with a tuft of cotton wool, free from grit, until they are quite gone. If the stains are very old, make the solutions stronger, and soak for a longer time.

ACCORDING to Herren Lubbert and Roscher, aluminum cannot be used for articles which have to withstand the action of water at its boiling point, and consequently is not suitable for vessels intended to hold preserved foods, as these have commonly to be heated in order to sterilize their contents. The same experimenters also find that such mildly corrosive liquids as claret, tea, coffee, and herring brine act on it appreciably. As it is also attacked by phenol salicylic acid, and boric acid, it is unavailable for many surgical purposes.

Correspondence.

The Great Sewers of St. Joseph, Mo.

To the Editor of the Scientific American:

In your issue of January 30, in the description of the Brooklyn sewer, you mention it as probably the third largest sewer in the world. We have a sewer here which will place it fourth if not fifth or sixth in the list. I send you blue print of "Blacksnake sewer," in this city, commenced in 1884. We have this last season extended it 1,766 feet, and have now a total length of 2,486 feet. The blue print shows sections at different points as constructed this last season. It is egg-shaped and the same size, 17 feet high by 14 feet 6 inches wide internal diameter, is carried through its length. It has two curves, one of 573 feet and one of 192 feet radius, the angles being each about 70 degrees.

We have another sewer here, 14 feet diameter, circular, changed to egg shape in its extension, with a height of 15 feet and width of 13. This sewer we expect this season to extend 700 feet and then reduce to 14 by 12 feet for 2,000 feet further. I have always claimed for this Blacksnake sewer especially that it was the largest *brick sewer* in the world. If wrong, would like to know where its superior is. F. FANNING.

Saint Joseph, Mo., Feb. 8, 1892.

How to Extract Burs from Wool.

To the Editor of the Scientific American:

I read an article in the last number of the SCIENTIFIC AMERICAN (February 6) on "Carbonization of Wool." The object is to rid wool of burs. The process seems to be tedious and not likely to leave the wool either clean or uninjured. Forty years ago I lived near an old farmer cotton planter, who owned a small flock of sheep from whose wool he had manufactured the clothing and bed covering for the family. On his farm there grew an immense quanty of cockle burs.

The sheeps' wool was perfectly matted with them every year. He told me that he ginned them out as he did the seed from cotton. The breast of the gin must be raised, so as to let the teeth of the saws just come through the ribs. In this way they would catch a few fibers of the wool at a time and draw them away from the burs, when the revolving brush would flirt them into the "lint room." When the burs were thus relieved they would fall under the gin as cotton seed does. The wool thus freed from the burs was in the best possible condition for carding.

WILLIAMS RUTHERFORD.

Athens, Ga.. Feb. 8, 1892.

"Scientific American" versus Encyclopedia.

To the Editor of the Scientific American:

Run to an encyclopedia for information! and then—well, close the "ponderous tome" in disappointment, for that is almost sure to be the result of your quest if the object be to clear up a mooted point in scientific inquiry. Most of us are willing to concede that, with regard to historical matters, a reference to an encyclopedia will lead to conclusive results. But much confidence even in that field is hazardous in these days of "rich leads" in archæological diggings. About a year ago the SCIENTIFIC AMERICAN published the report of a discovery of a Babylonian cylinder, in the Palmyrian plains. An inscription on the cylinder cleared a point in history upon which Herodotus and Thucydides were at variance, and credit accrued to the latter, to whom it had been adverse for more than two thousand years. "What then, what rests!" Consult the cyclopedia less? No! but read the scientific journal more. It seems, in many views, that—

"Science moves, but slowly, slowly,
Creeping on from point to point."

On the other hand, a little incident, in a twinkling, turns out of doors the theories of ages.

Although unknown to the SCIENTIFIC AMERICAN as a subscriber, having taken it through newsdealers, I have taken and read it, with the best care at my command, for thirty-five years. All the volumes have been promptly bound and kept where they are as easy of access as is my dictionary; and I know them to be a treasure house of the richest treats. All three of the publications, the BUILDER'S EDITION, the SUPPLEMENT, and SCIENTIFIC AMERICAN proper, are thus kept bound and convenient. I know of nothing else to which I would so strenuously recommend the young as to do likewise with these valuable journals.

A few days ago, within my hearing, a group of young people were eagerly seeking information about the conjunction of the planets Jupiter and Venus when one of them, the youngest of the party, said, "Here is the SCIENTIFIC AMERICAN. It always has everything." And their wishes were quickly satisfied.

A scientific journal, with its columns freely open for controversy, for the number of years with which the SCIENTIFIC AMERICAN has been favored, winnows and assays, with an almost unerring precision, every current topic until the truth is reached. Controversy directs the blasts of that adversity by which alone science may be sublimated. For that reason text-books of science, so called, cyclopedias and the like should be very charily regarded, and a journal like the SCIENTIFIC AMERICAN should be in every household as a check and counter check. That which is considered science to-day may be held quite otherwise the next week or the next year. AUGLAIZE.

Defiance, Ohio.

A Needed Invention.

To the Editor of the Scientific American:

It is, probably, not generally known how injurious the electric street lights are to accurate work in astronomical observatories situated in or near cities where this system of lighting is adopted. No new nebulæ or faint comets can be discovered, and the sky illumination fogs the plates in photographic work.

If the top half of the globes could be painted, a large percentage of the trouble would be obviated, and this could easily be done were it not for the varying height of the light as the carbon is consumed, reaching nearly to the top of the globe at ignition, and sinking almost to its base at the time of extinguishment.

The invention desired is one that will maintain the light at one level, and that near the bottom of the globe, during the entire night. Could this be done and the upper half of the globe be painted white, it would benefit the street not only, but would also prevent nine-tenths of the light from ascending skyward.

The inventive genius who shall accomplish this feat will go down to posterity with honor, while astronomers and photographers of celestial scenery will, in particular, have cause to bless his name.

LEWIS SWIFT.

Warner Observatory, Rochester, N. Y., Feb. 11, 1892.

Wind Power for Electrical Purposes.

To the Editor of the Scientific American:

Talking of powers, why may not the winds that forever blow over these vast plains be used to develop and store electricity? At every point from an elevation of some fifteen hundred feet it may be said there is never an hour of the day when the winds are not blowing. Think what an enormous force could be created by some twenty large windmills co-operating. The cost would be nominal only. It has always seemed to me that if the winds blew with as much regularity in the Eastern States as they do where I mention, great use would be made of their power. From the Missouri River west for five hundred miles the winds are incessant, day and night, every hour and minute, no let-up, at the altitude I mention up to five thousand feet and higher. I make the suggestion. You may see objections, but I think none that are insuperable.

HOLT.

[Our correspondent's suggestion is practical. In the SCIENTIFIC AMERICAN of December 20, 1890, he will find illustrations showing the use of the windmill for driving electrical machines for lighting dwellings. Our engravings show all the mechanism and details as actually employed.—ED.]

Sugar in Mortar.

To the Editor of the Scientific American:

I wrote to you some time ago for a paper giving information about using sugar in plastering mortar; you sent me one, but the article in it did not suit our case, so we determined to experiment on it. Thinking the result of our experiment may be of some use to you or your readers, we will send it. We use the cheapest grade of beet sugar, costing here four cents a pound, and all lumps must be mashed up before putting in the mortar. The mortar must be dry or "stiff" when the sugar is put in, as it makes it very soft when mixed thoroughly. We put the sugar in when we temper it for putting on the walls, and put it in the hair mortar only, or first coat, and use about forty pounds sugar to the hundred yards. It is a little harder to put on than without sugar. But the result is we have a wall that cannot be easily damaged. We can draw a trowel corner over it, and bearing on hard can merely mark it. It does not crack by pounding on it, nor can the clinches be easily broken off. It does not color the white coat any, and we can find no fault with it, while on the other hand it is far superior to the unsweetened. Would like to know of some one else's experiments. We figure the extra cost at four cents per yard. Our sand here is very poor and loamy. C. E. SPALDING.

Big Stone Gap, Va., February 10, 1892.

The Architect of the Great Mormon Temple—Honor to whom Honor is Due.

To the Editor of the Scientific American:

In your issue of February 6, 1892, is an illustrated article relating to "The 'Temple Block,' Salt Lake City," in which mention is made of the men who superintended the construction of the Tabernacle and its world-famed organ, but the architect of the temple, which when finished will be one of the most beautiful and costly structures in the world, and is famed for the unique features of its architecture, is not given. It was Truman O. Angell, the father of the writer, and his work in connection with this structure proves him to have been possessed of rare genius as a designer of buildings. He died Oct. 16, 1887. C. E. ANGELL.

Salt Lake City, Utah, Feb. 13, 1892.

Magnitude of Molecules and Light Waves.

BY PRESIDENT MORTON.

When we hear that the successive vibrations in a light ray of average wave length number about 600 million of millions in a second the natural impression is that they must be submicroscopic in dimensions.

This, however, is far from being the case. The actual length of the waves in such a ray is about one fifty-thousandth of an inch. The parallel rulings on the glass plates known as Nobert's test plates, which are employed to test the defining powers of lenses, have been not only "resolved" but photographed when only one one hundred and fifty thousandth of an inch apart (*i. e.*, 150,000 to the inch). In other words, four such lines, spaced as in these rulings, could be drawn within the length of an average wave of light. This shows that the size of the ultimate particles or molecules of the glass must be very much smaller than the waves of light, since several furrows may be plowed through them within the width of an average wave.

All these magnitudes are, however, far beyond our direct perception or powers of realizing, but we may at least get at some sense of our shortcomings in power of conception from the following:

A maker of these "test plates," named Webb, many years ago, made for the Army Medical Museum at Washington a specimen of microscopic writing on glass. This writing consists of the words of the Lord's Prayer, and occupies a rectangular space measuring $\frac{1}{294}$ by $\frac{1}{441}$ of an inch, or an area of $\frac{1}{129654}$ of a square inch.

The lines of this writing are about as broad as those on the test plates, which are $\frac{1}{50000}$ of an inch apart. They are, therefore, about as wide as average light waves. Now then to get some idea of the magnitude or minuteness of this writing.

There are in the Lord's Prayer 227 letters, and if, as here, this number occupies the $\frac{1}{129654}$ of an inch, there would be room in an entire square inch for 29,431,458 such letters, similarly spaced.

Now the entire Bible, Old and New Testaments, contains but 3,566,480 letters, and there would, therefore, be room enough to write *the entire Bible eight times over on one square inch of glass*, in the same manner as the words of the Lord's Prayer have been written on this specimen.

Such a statement, without doubt, staggers the imagination, but the figures are easily verified and are certainly correct, and the whole statement at least serves to bring home to us the limited nature of our mental capacities as compared with the facts of the universe.

It also furnishes an interesting suggestion in a very different subject.

It has been often stated that a physical basis of memory may exist in permanent structural modification of the brain matter constituting the surface of the furrows. In a highly developed brain this surface amounts to 340 square inches, and it would, therefore, appear that the entire memories of a lifetime might be written out in the English language on such a surface, in characters capable of mechanical execution, such as those of the Webb plate at Washington. See *The Lens*, December, 1873, p. 225 (Chicago). Also Trans. of Micro. Soc. (London), 1862, III., Vol. X., p. 69.—*The Stevens Indicator*.

A Soiling Experiment.

The indications from this experiment are:

The average cow will eat about seventy-five pounds of green feed a day, kept in the stable with grain ration added.

That cows fed on oats and peas, clover and corn, fed green in the stable, in midsummer, will give more milk than when feeding on a good blue grass pasture.

That a cow fed on green feed in a stable darkened and ventilated will gain in weight more than she will in a well shaded pasture.

That the cow responds as promptly to a well balanced ration of grain while eating green feed as she does on dry feed.

An acre of peas cut green weighed 13·5 tons.

An acre of peas and oats cut green weighed 24 tons.

An acre of corn cut green weighed 33·6 tons.

The second cut of clover in a drought was 3·1 tons.

It is not necessary to cut green feed oftener than twice a week, if it is spread to avoid heating.

Articles on "Time of sowing grass seeds, winter wheat and oats."—*James Wilson, Director Iowa Experiment Station.*

Manganin.

Manganin is an alloy of copper, nickel and manganese, and has remarkable electrical properties. Its resistance hardly varies at all. Even at a range of temperature varying from 15° to 97° C. the mean variation of resistance is only from 20 to 30 millionths of the original value. The resistance slightly decreases with the rise of temperature. Its specific resistance is very high, as much as 0·42 ohm per centimeter. These properties render manganin a superior material for the construction of artificial resistances, for which purposes it is now extensively used.

THE TRANSPORTATION OF PETROLEUM.

Petroleum was discovered at a very early date in the United States. In western Pennsylvania oil had long been observed floating as a film upon the surface of some of the streams. The Indians and the early settlers used to collect it by placing blankets in the streams, which absorbed the oil, which subsequently was wrung out of them by hand. Even remains of excavations made by the aborigines have been taken to indicate crude "oil wells" made to collect the surface oil. The oil thus collected was used by the settlers to mix with paint, as an illuminant and medicinally. As a medicament it was sold as Seneca oil, and can still be procured in the drug stores.

Prof. Benjamin Silliman, the elder, described in 1833 what he termed a "fountain of petroleum" in western New York. It was a muddy, dirty pool of 18 ft. diameter, without outlet. On the surface of the stagnant water the oil collected, and was removed by skimming somewhat as cream is removed from milk. A board was used as skimmer, and when coated with the thick adhesive oil was freed from it by scraping. It was collected for use as a liniment or ointment. In the beginning of the present century oil had been collected from the West Virginia salt wells, and in 1849, or thereabout, an enterprising person named Kier bottled petroleum and sold it as a "natural remedy," sometimes selling as much as three barrels a day. In 1852 he distilled the oil and made a lamp oil, but one of very bad odor, and his efforts were entirely experimental.

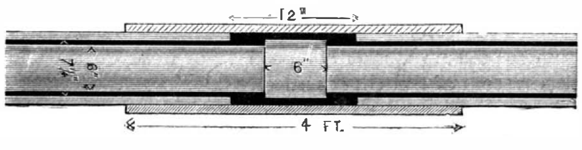
Meanwhile coal oil was being introduced into commerce. This was prepared by the distillation of cannel coal and bituminous shales. From 1840 to 1850 the industry was developed until it had attained considerable dimensions, there being fifty or sixty refineries at work. The name of kerosene was given to their product by the Downer Company, at Boston, Mass. In 1853 Mr. George H. Bissel saw a bottle of petroleum in the office of Prof. Crosby, of Dartmouth College. The oil had been sent to Prof. Crosby as a curiosity by Dr. Brewer, of Titusville, Pa. Mr. Bissel induced his partner, Mr. J. E. Eveleth, to prospect the ground whence the oil came, and they purchased one hundred acres and rented for ninety-nine years another tract of about the same size, all for the consideration of five thousand dollars. They organized the "Pennsylvania Rock Oil Co.," with $500,000 capital, notable as the first petroleum oil company, and the actual predecessor of the great Standard Oil Co. of to-day. They dug shallow wells and trenches for collecting the oil, and had it analyzed by Prof. Silliman. By accident Mr. Bissel came across one of Kier's show bills. Kier advertised his specific as coming from a well 400 ft. deep, and gave a picture of the derrick. At once Mr. Bissel conceived the idea of drilling artesian wells. After much trouble and a delay of two years the arrangements for drilling were completed, and the work was put in charge of Mr. E. L. Drake, known now to fame as Col. Drake. The well was drilled, and on Saturday, August 28, 1859, the workmen quit for the day, the drill having penetrated a cavity. The total depth was 69 ft. 6 in.

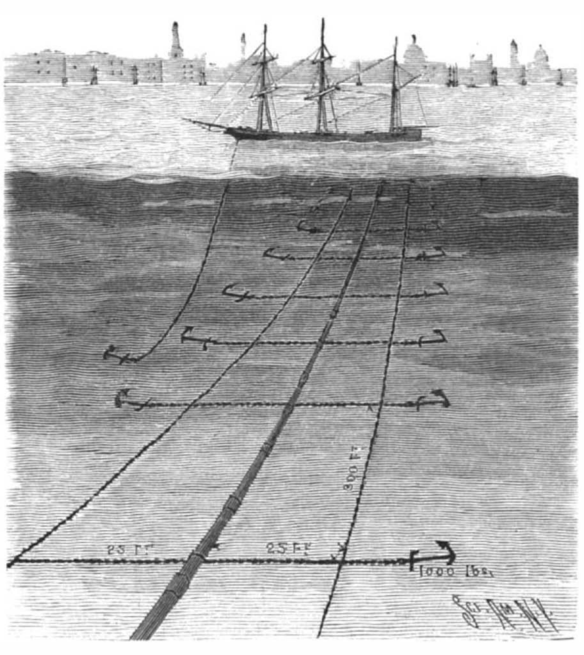
On Sunday one of their number, looking into the well, found it filled with fluid within 8 or 10 ft. of the surface. With an improvised tin dipper he drew up a sample and found it was petroleum. On Monday a pump was adjusted and some twenty-five barrels a day of oil was obtained.

The news spread far and wide, and occasioned intense excitement. Mr. Bissel, who was notified by telegraph, bought up all the stock he could get at in his own company, and the petroleum epoch was inaugurated. To-day the petroleum industry represents one of the greatest industries of the world. With gas and the electric light to compete against as illuminants, it is every year acquiring more importance, and holds a position as one of the three great sources of artificial light.

The present article is principally concerned with the transportation of the crude oil to the seaboard. The process of carrying petroleum from the wells to the distant refineries has been greatly modified within recent years, and new engineering methods have been devised to effect the transportation in question.

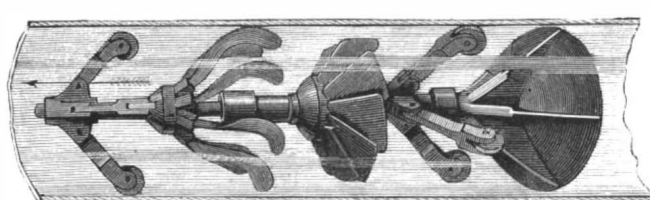
LEAD JACKETED PIPE CROSSING THE EAST RIVER.





METHOD OF LAYING PIPE LINE UNDER THE HUDSON RIVER AT NEW YORK.

The transferal of petroleum from the wells to the local refineries and depots was, originally, very laborious, and had to be carried on by teams and wagons, over the very bad roads and wagon tracks of the sparsely settled region. From the oil regions to the seaboard or to the large cities of the interior, the oil was originally shipped by rail, in barrels or on tank cars, or on boats, by a species of slack water navigation, down Oil Creek to the Alleghany River. In 1862 it cost about eight dollars to send one barrel of oil to New York, while oil, at the same time, was selling at the wells for fifty cents a barrel. The original tank cars carried two circular wooden vats. These were replaced by horizontal cylindrical iron tanks, 26 ft. long and 5 ft. 6 in. in diameter, holding about 2,000 gallons each. A number of these cars are still in use. In 1862 and 1864 the first suggestions toward transporting oil by lines of pipe were made, and in 1865 a pipe, 3,200 ft. long, was laid from Pithole toward Oil Creek, at Miller Farm. It could pass 81 barrels a day. It was often cut and damaged by the teamsters, who regarded it as a deadly rival, and had eventually to be guarded by a patrol of armed watchmen. At this period it cost between five and six dollars to send a barrel of oil to New York.



GO-DEVIL FOR CLEANING PIPES AUTOMATICALLY.

At the present day the entire oil region is covered by pipe lines. Small pipes, often of two inches diameter, do local service for wells, and collect the oil for shipment to the distant cities. To effect the latter, transportation trunk lines have been laid to New York, Philadelphia, Baltimore, Cleveland, and other points. These lines are for the most part owned by the National Transit Co., which is, really, a branch of the Standard Oil Company, which controls practically all of the refineries, as well as the oil business of the United States. The map which we publish shows the trunk lines and their size as operated by the company in question.

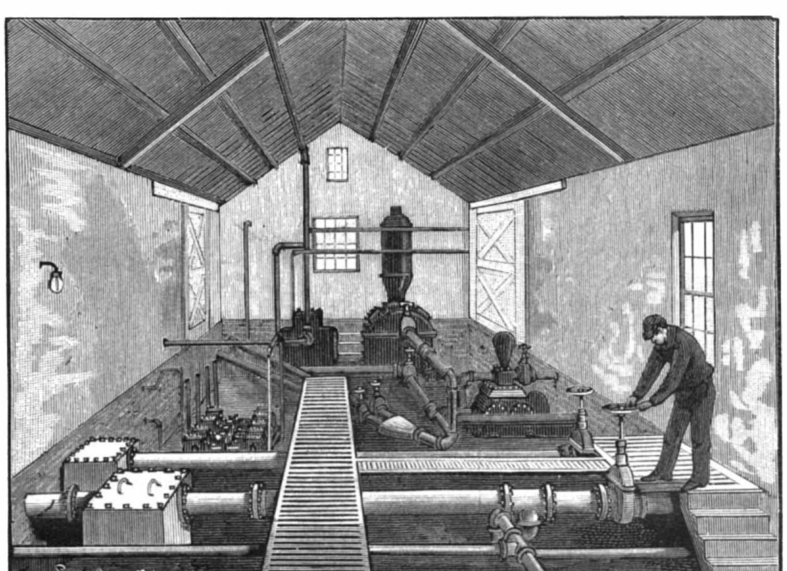
The New York City line may be taken as typical. It is about 300 miles long, and consists for most of its length of two parallel lines of six inch lap-welded, taper screw jointed pipe. This pipe is made for the purpose and is sold as pipe line tubing. To force the oil through the pipe powerful pumps are used, and pumping stations are established all along the line, at about 28 miles apart. The plant at each of these stations comprises one or more receiving tanks, 90 ft. diameter and 30 ft. height being standard dimensions for them. Boilers and Worthington pumps sufficient for the work complete the equipment. The work of a pumping station consists in forcing the oil through the pipe to the next station. Although this is the usual practice, loops have been laid around stations and the oil has been pumped through 110 miles of consecutive pipe line.

At the station hourly readings, day and night, are taken of the levels of oil in the tanks. To enable this to be done at night a reflector and distant lamp are employed, so that no light need be carried over the tank's roof.

The Worthington high service pump, which we illustrate, was designed especially for this work. It has four steam cylinders, two high and two low pressure, steam jacketed, each set working tandem, and is direct acting. Each pair of cylinders actuates two single stroke rams of the exterior packed type. This brings the only possible source of plunger leakage under the eyes of the engineer. Between the high and low pressure cylinders the steam passes through a receiver, where the steam from the high pressure cylinder is heated before admission to the low pressure cylinder. The general dimensions of one of these pumps are as follows: Diameter of low pressure steam cylinder, 66 in.; of high pressure ditto, 33 in.; of plungers, 9¼ in.; stroke, 37¾ in. Horse power, 440; average duty 105,000,000 foot pounds per 100 lb. of coal. The rated capacity is one and one-half millions of gallons, against a pressure equivalent to 2,000 feet head of water.

The extraordinarily high duty record is the most striking feature of these engines. The great disproportion of diameter between the steam pistons and pump plungers indicates the nature of the service they are called on to perform. The delivery of oil at pressures of 900 lb. to the square inch was one of the early difficulties in the way of pipe transit, and the problem has been completely solved by the Worthington pumping engine.

For such high pressures it was found disadvantageous to use an air vessel, and to take its place and maintain an even pressure a pair of compensating cylinders and plungers are connected at the outer end of the rams. As shown in the drawing, these appear as two vertical cylinders, their position being the one occupied at half stroke. Each cylinder is mounted on trunnions near its center. A heavy pressure is maintained by an accumulator, and fluid on the rear of the plungers tending to thrust them out. As the rams of the main pump move outward from the center position, the compensating cylinders swing on their trunnions and take increasingly oblique positions.



VALVE PIT OF PUMPING STATION.

SOUNDING OIL TANKS AT NIGHT.

the pump gets nearer the end of its stroke. The compensating rams are forced out during this period, and re-enforce the action of the steam, whose pressure is getting lower, owing to expansion. On the return stroke the compensating rams are pushed back against the accumulator pressure, their cylinders swinging back to the vertical position. In this period, therefore, the action of the steam at a high pressure in the steam cylinder is resisted by the rams. As the stroke returns from center in the other direction, the compensating rams act as in the other half stroke. By thus opposing the action of the unexpanded and re-enforcing the action of the expanded steam, an almost even action is preserved at all periods of the stroke, and a nearly constant pressure is exerted on the liquid pumped. Thus there is no need for a fly wheel or air vessel. The spring accumulator and compensating cylinders effect all the regulating.

Eight horizontal return tubular boilers, 5×14 ft., with one high power and another often low power pump for use in emergencies, or when the main pump is being repaired or adjusted, represent the main plant of a station. Six boilers are fired at once, and a single pump is kept at work. A usual practice is to have one low and one high service pump, and to use the latter for most of the work, the low service pump serving as an alternative in case of repairs or accidents.

The distribution of the oil is effected by valve connections contained in a cellar called the valve pit.

Where the pipe crosses the Hudson River, a system of chain protection is employed to prevent damage from anchors. Two lines of chain are laid across the river parallel with the pipe and about twenty-five feet distant from it. Lateral chains and anchors hold these in place Any vessel which anchors near enough the pipe to be in danger of fouling with it, were it unprotected, can only catch the chain with her anchor. A diver is kept on the New York shore by the Transport Co., who, when a vessel catches her anchor, goes out and arranges with the captain to cut his vessel loose and provide a new anchor. This done and the old anchor being buoyed, it is dived for if necessary, and is raised and kept in exchange for the other one. The pipe runs across the city and passes under the East River to Long Island City, where the refineries are situated. This portion of the pipe has a second pipe outside it with tight-fitting sleeve joints. The jacket pipe has its ends separated by a space of twelve inches, to permit the inner pipe to be screwed home. The sleeve is pushed over the twelve inch gap and the whole space between the pipes is filled with lead, run in while melted. The object of this lead jacket is to protect the pipe from corrosion.

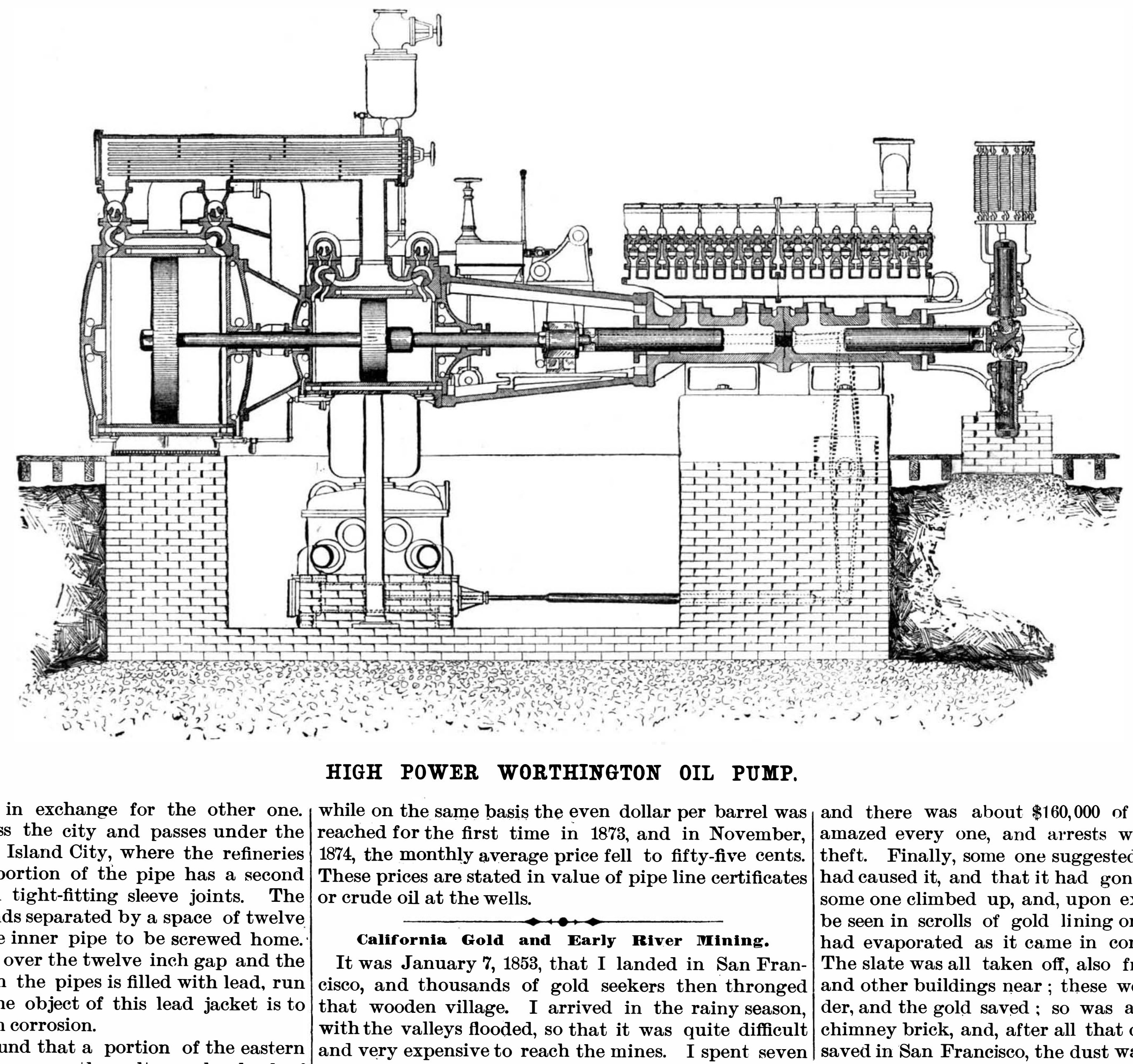
Recently it was found that a portion of the eastern end of the line which crosses the salt marshes back of Jersey City was being corroded by the action of the salt water. This portion is being gradually replaced by a single eight inch pipe laid in a rectangular wooden box, which is filled with hydraulic cement.

To clean the interior of the pipes an instrument which we illustrate and which is called the scraper or "go-devil" is employed. A spindle with ball and socket joint near its center carries steel blades set radially. In front and rear are three arms with guide wheels to keep keep the spindle co-axial with the pipe into which it is inserted. A set of oblique vanes serves to rotate the blades and a piston in the rear approximately fits the pipe in which it is used. To clean the pipe it is inserted at a pumping station into the line. As the oil is pumped in it forces it forward at about three miles an hour, the blades turning as it goes and scraping the interior of the pipe. A catch box is provided at the other end of the line, at the next pumping station, to catch it in as it reaches that point. Formerly when a "scraper" was started its course was followed by the pipe patrol, the sound it produced being audible above ground. It was reported that it went faster up hill than down, but this was probably a subjective phenomenon of the patrollers. The present practice is to let it go unaccompanied, and to time its arrival by the hours it normally consumes in its journey.

The entire pipe line is patrolled to watch for leaks, which show very soon at the surface. A footpath worn by the feet of the patrollers extends over hundreds of miles of the lines that stretch across the eastern territory.

It sometimes happens that the oil tanks are struck by lightning, and the oil catches fire. In such cases the oil may be pumped out from the bottom of the tank, so as to be saved as far as possible. Sometimes water is pumped in to keep the level of combustion at the top, so that only the upper segment of the iron of the tank is injured by the heat.

The statistics of the production of oil indicate an increasing production. For 1891 an average monthly production of over 93,000 barrels was recorded. The nearest approach to this was in 1882, when the monthly average was 82,303 barrels. Over 3,300 new wells were completed in the past year—a rather low showing, as in 1890 6,358 wells and in 1889 5,489 wells were completed. The prices of crude oil have now attained a comparatively steady basis, compared to the old times of fierce speculation. For the past year a difference of twenty cents a barrel would cover the general range, the price fluctuating from fifty-eight to seventy-four cents a barrel. With these figures the average of former years may be contrasted. In 1865 the range was from $4.62½ to $8.25 per barrel, monthly average, while on the same basis the even dollar per barrel was reached for the first time in 1873, and in November, 1874, the monthly average price fell to fifty-five cents. These prices are stated in value of pipe line certificates or crude oil at the wells.



HIGH POWER WORTHINGTON OIL PUMP.

California Gold and Early River Mining.

It was January 7, 1853, that I landed in San Francisco, and thousands of gold seekers then thronged that wooden village. I arrived in the rainy season, with the valleys flooded, so that it was quite difficult and very expensive to reach the mines. I spent seven years, lacking one day, in these wonderful regions, and witnessed the most heroic enterprises ever engaged in by mortal man.

Hydraulic mining was infantile, as compared with fluming the rivers. I soon engaged in the saw mill business, in Grass Valley, Nevada County, and being near the Eaubar River, a stream of considerable size, winding its crooked way down among the golden hills. During the dry season, this and Feather River became very low, so that prospectors and miners could pan out considerable of the yellow metal along the edges of the rivers by digging out the ore from the crevices in the slate rock, and would follow it into the water sometimes two or three feet in depth. This soon led to the idea of constructing a wooden flume, made of lumber of sufficient size to carry all of the running water of the river, sometimes for miles along the bank and sometimes for many miles in length. Companies were formed for this purpose, and they would order often millions of feet of lumber sawed to special dimensions, and delivered along the banks, and the lower portions of the flumes would be built during high water, or, as we used to say, during the rainy season. This would leave a short piece to be put in at or near the bed of some waterfall, when the rivers fell to a size that the flume could convey. As a rule, they would buy their lumber and provisions, to be paid for out of the first gold taken out, so that we, who trusted them, took part of their risk. But with all of their peculiarities, a more honest set of men never lived on earth than the California gold miners, nor a set of harder workers. At one time—I forget the year now, but I had furnished a large amount of lumber for a flume above Oroville, and was quite well acquainted with one of the managers—I took my wife and clambered down over rocks and ledges, among rockers and sluices, to one of the richest spots, of about four miles of river bed. The gentleman took his pan, and after a short search, said: "Here, I think, is a rich crevice." So, with his narrow-pointed pick, he dug out a panful of dirt from a seam in the ledge; the naked eye could see the gold all through the gravel. He then washed it out, and there was a full half pint of the yellow metal; from this he selected a beautiful specimen, which I had soldered to the head of a gold pin that my wife wore. The gentleman then scraped up a pan of dirt, and gave it to my wife, which she panned out, and the contents we kept; and one of my daughters still has it. Before the rainy season came that year, more than $300,000 in gold had been taken from opposite this one flume. It was contrary to all mining laws then to wear a "biled shirt," as they called it, but physicians, lawyers, preachers, doctors of divinity, who lived in the mining regions, wore gray shirts, and worked with pick and shovel, played cards, and some of them gambled; and if a miner had bad luck and got dead broke, go to a lucky miner, or even a gambler, and he would give him a lift, as they then called it.

DANGERS OF LOSS IN GOLD MELTING.

Gold melts at from 2016° to 2590° Fahrenheit, so it is stated by good authority. But it evaporates and passes off at much less than a melting heat, and also if held in a molten state for any considerable time before it is cast into an ingot.

Soon after the San Francisco mint went into operation, the United States inspector visited it to take stock, and there was about $160,000 of a shortage. This amazed every one, and arrests were threatened for theft. Finally, some one suggested that evaporation had caused it, and that it had gone up chimney. So some one climbed up, and, upon examination, it could be seen in scrolls of gold lining on the slate, where it had evaporated as it came in contact with the air. The slate was all taken off, also from a church roof and other buildings near; these were ground to powder, and the gold saved; so was also the furnace and chimney brick, and, after all that could be profitably saved in San Francisco, the dust was sent to the Philadelphia mint, and worked over more closely, and then the dust was all sold to French chemists and shipped to Paris and worked over again. I think, now, that more than one-half the deficiency was saved. I was in San Francisco when the loss was discovered, and the excitement was next to that of the Vigilance Committee when Casey and Corey were hung.

J. E. EMERSON.

Railroad in the Holy Land.

The first railway to Jerusalem will, it is reported, be opened in the spring of the coming year. It is a short line, running only from Joppa, the nearest port on the Mediterranean, and intended to accommodate the growing passenger and other traffic between that place and the Holy City. The work of construction is being carried out by a French company, who began laying down the line in April, 1890. It is stated that over eight hundred vessels of various kinds annually land 40,000 persons at Joppa whose destination is Jerusalem. On the completion of the railroad, tourists will be able to buy a return ticket from the port to Jerusalem for twenty francs.

PROFESSOR JOSEPH LOVERING.

Death has again invaded the ranks of the National Academy of Sciences, and now claims for its own Professor Joseph Lovering, of Harvard University, who fell a victim to the prevalent influenza at his home in Cambridge, Mass., on January 18, 1892.

This eminent scientist was the son of Robert Lovering, a surveyor by profession, and his wife, Elizabeth Simonds, and was born in Charlestown, now a part of Boston, Mass., on December 25, 1813. He studied in the public schools and under the direction of his pastor, Rev. James Walker, afterward president of Harvard College, who fitted him to enter the sophomore class at Harvard in 1830. Three years later he was graduated, standing fourth in his class, and at commencement delivered the Latin salutatory oration. Two years later he took the degree of A.M., and on that occasion delivered a valedictory oration in Latin. Among his classmates in college were Francis Bowen, Henry W. Warren, Jeffries Wyman, and Morrill Wyman, all of whom subsequently became professors in Harvard, and Robert T. S. Lowell, the elder brother of James Russell Lowell.

After graduation he taught for a year in Charlestown, but his inclinations were toward theology, and he spent two years in the Harvard Divinity School. He had early shown a fondness for mathematics, and while in the divinity school continued to pursue studies in that science during his leisure. Accordingly in 1836, on the illness of Professor John Farrar, he was appointed tutor in mathematics and physics, and two years later, on the retirement of Professor Farrar, he was succeeded in the possession of the Hollis chair of mathematics and natural philosophy by Mr. Lovering, who then continued in the active occupancy of this chair until 1888, when, having completed fifty years' service as professor, he retired and was made emeritus.

Professor Lovering was the first member of the faculty at Harvard to have passed half a century in the service of his alma mater and the second in the length of his service to the university, Henry Flynt having in the earlier history of Harvard been connected as tutor to the university for the period of fifty-five years. In other ways Prof. Lovering served his college. In 1853-4 he was a regent, during the absence of Prof. Cornelius C. Felton, and when that scholar was advanced to the presidency of Harvard, Prof. Lovering succeeded him permanently as a regent, which post he then held until 1870. Also in 1884 he became director of the Jefferson Physical Laboratory, which office he retained for four years.

The growth of the Harvard Astronomical Observatory was largely due to Prof. Lovering. He was associated with Prof. William C. Bond, in 1840, when, with but few instruments and indifferent facilities, a beginning of the astronomical work was made in the Dana house in Cambridge. From this small effort the present astronomical observatory has been developed. It was at this time that the great scientist, Alexander Von Humboldt, induced the Royal Society of London to make simultaneous observations on terrestrial magnetism in Great Britain and the colonies. The co-operation of the United States was sought, and one of the three stations in America was located in Cambridge, where the making of the observations was under the direction of Profs. Bond and Lovering. Several of the undergraduates of the university lent their aid to this work, and among these was Thomas Hill, who subsequently became president of Harvard, and Benjamin A. Gould, the famous astronomer.

Prof. Lovering was associated with Benjamin Peirce in the publication of the "Cambridge Miscellany of Mathematics and Physics," to which he contributed articles on "The Internal Equilibrium of Bodies," "The Application of Mathematical Analysis to Physical Research," "The Divisibility of Matter," and similar subjects, which attracted wide attention throughout this country and the scientific world. In 1867, when Prof. Peirce was called to the superintendency of the U. S. Coast and Geodetic Survey, he intrusted the computations for determining transatlantic longitudes from telegraphic observations on cable lines to his colleague, who then had charge of this work until 1876.

As a lecturer, Prof. Lovering was well known. He gave nine courses, each of twelve lectures, on astronomy or physics, before the Lowell Institute of Boston. Five of these courses were repeated on the days following those of their original delivery, to another audience, according to the original practice of that institution. He delivered shorter courses of lectures at the Smithsonian Institution in Washington, D. C., at the Peabody Institute in Baltimore, Md., and at the Charitable Mechanics' Institution of Boston, and one or more lectures in many towns and cities of New England.

He was an indefatigable contributor of scientific articles to contemporary literature, and his papers, more than one hundred in number, may be found in the files of the "Proceedings of the American Academy of Arts and Sciences," the "Proceedings of the American Association for the Advancement of Science," the *American Journal of Science*, the *Journal* of the Franklin Institute, the *American Almanac*, the *North American Review*, the *Old and New*, and the *Popular Science Monthly*. His most important researches are included in several papers on the aurora, terrestrial magnetism, and the determination of transatlantic longitudes, which appeared in Volumes II. and IX. of the "Memoirs of the American Academy of Arts and Sciences;" also Volume X. consists of his results on "Aurora Borealis" (Boston, 1873). Besides the foregoing he edited a new edition of John Farrar's "Electricity and Magnetism" (1842).

The degree of LL.D. was conferred on him by Harvard University in 1879, and in 1873 he was chosen a member of the National Academy of Sciences. In 1839 he was elected to the American Academy of Arts and Sciences, of which he was corresponding secretary from 1869 to 1873, its vice-president from 1873 to 1880, and president thereafter until 1888. He joined the American Association for the Advancement of Science at its Cambridge meeting in 1849, and from 1854 till 1873 he was its permanent secretary, during which time he edited fifteen volumes of its proceedings. This abundant service to the greatest of our American scientific associations was then rewarded by his elevation to its presidency, and at the Hartford meeting, in 1874, he delivered his retiring address, in which he reviewed the development of the physical sciences. He was also a member of the American Philosophical Society and of the Buffalo Historical Society.

His long life was mostly spent in Cambridge, but during 1868-9 he was given leave of absence by the university for a year, and he spent the great portion of that time in Europe with Prof. William W. Goodwin, the well known occupant of the Eliot chair of Greek

PROFESSOR JOSEPH LOVERING.

literature at Harvard. Prof. Lovering was an active member of the Cambridge Thursday Club, and one of the trustees of the Peabody Museum of Archæology and Ethnology.

Soon after his retirement from the active duties of his university work, his colleagues, classmates, and many friends sought in some way to express their appreciation of his distinguished services. At first it was proposed to give him some valuable token of this esteem, but this plan gave way to one of his own suggesting, in the proposition to sit for a portrait to be hung in Memorial Hall. The incident was commemorated in an elaborate banquet held at the Hotel Vendome on January 15, 1889, at which President Charles W. Eliot, Rev. Phillips Brooks, Thomas W. Higginson, Charles Devens, Augustus Lowell, and other distinguished men were speakers. A few weeks later the Harvard Club, of New York, entertained him in a similar manner. Since then he lived at his home on Kirtland Street in retirement, although maintaining to the last his keen interest in the affairs of his alma mater.

His wife and four children still survive him. The funeral services were held in Appleton Chapel, in Cambridge, on January 20, and the day following his remains were interred in Mount Auburn Cemetery.

It has been well said that: "In his death Harvard has met a serious loss, as has the scientific world, which benefited so much by his investigations. Behind him, however, he has left the results so well organized that the students of the present day can press forward to a consummation of the results which their teacher and exemplar did an incalculable amount to bring about and for the perfection of which he had given the vitality of his mind and body." M. B.

THE highest railroad bridge in the United States is the Kinzua viaduct on the Erie road—305 feet high.

New York to Chicago in Eighteen Hours.

A mail train to run from New York to Chicago in about 18 hours, over the New York Central & Hudson River and the Lake Shore & Michigan Southern, has been discussed in the newspapers during the past week, though nothing seems to have been decided upon, and the post office authorities at Washington on one side and the officers of the New York Central on the other seem to be each inclined to throw upon the other the responsibility of having first suggested the idea. Such a train is doubtless practicable, and the only question, as Vice-President Webb says, is whether the government is willing to pay the necessary cost. The speed would be practically the same as that made by the Empire State Express, and that train has made a very creditable record thus far. A summary of the train sheets for the 58 days from October 26 to December 31 shows that it arrived in Buffalo on time on 40 days and not over five minutes late on 7 other days. There were 5 days on which delays of over half an hour occurred, slight mishaps to freight trains having occasioned these in each case. On December 25, 28 minutes lost time was made up between Albany and Buffalo, and considerable losses have been made up on other days. The schedule of this train is 8 h. 40 m. for 439½ miles, equal to 50·75 miles an hour, including the four stops. The distance through to Chicago is 965 miles (calling the Lake Shore via the Sandusky and Air Line divisions 525½), and the Empire State's route would make the schedule through 19 hours, equal to 18 hours apparent time, and 30 minutes longer than the time mentioned by the newspapers.

As regards track and grades, the Lake Shore is doubtless as good as the New York Central for fast trains, and in freedom from curves even better; but it has not three extra tracks on which to run the other trains, and some of the way it has not even one; that is, it is a single track road. But there are two separate roads most of the way where there is not a double track, so that the conditions can be made quite favorable everywhere. It is, of course, incumbent upon a manager to make them as favorable as possible in such a case, even for a mail train, for to kill six mail clerks, as at Kipton last April, is as bad either ethically or in a business sense as to slaughter the same number of passengers. The use of the absolute block system, on both double and single track, at least for this train, and the equipment of all facing points on double track and of all switches on single track with distant signals, should, therefore, be regarded as imperative prerequisites to making this further attempt to beat the world.

But after safety comes the question of cost; and though the government may conclude to pay a very liberal price, the question with the road is whether the real cost can be determined at all. To make very high speed with regularity, other trains, especially freight trains, must be run so as to clear the fast train by a large margin—more than 10 minutes in many cases—and the losses, direct and indirect, by the delays caused in this way are not easy to calculate. A train of this kind would be of value to people sending letters through between New York and the Missouri River and places west of there, but it is still a somewhat questionable improvement for business between New York and Chicago proper, as letters must be mailed in New York about three o'clock and cannot be delivered in Chicago until about 11 or 12 the next morning. To really cover the 965 miles "between two business days" would require a decided advance on the "Empire State" schedule.—*Railroad Gazette.*

Process for the Manufacture of Metallic Nickel.

Mons. J. Garnier, Paris, France, has recently patented a new process for the manufacture of metallic nickel. It consists in purifying the crude nickel resulting from the reducing fusion of nickel oxide or roasted nickel mattes by charging the crude nickel with the addition of coke and lime, magnesia or baryta, together with fluorspar or sea salt, in a water-jacketed furnace having a basic lining or a lining of chrome iron ore, the bed of fusion being so prepared that the bases enter into the slag formed in the proportion of 75 per cent to 25 per cent of silica and fluorspar or silica and sea salt, the product obtained consisting only of nickel and the metals of the bed of fusion, viz., iron, and sometimes copper, from which the sulphur, arsenic, silicon, and phosphorus have been eliminated. The product thus formed may be energetically oxidized and deoxidizing agents added to get rid of the iron, so as to obtain pure nickel or nickel alloyed with copper, or it may be employed in the manufacture of alloys of nickel and iron.

"I HAVE lots of fun in a quiet way," said an ex-telegraph operator to an *Electrical Review* representative. "I was dining at the Murray Hill Hotel the other night, and while waiting to be served I began to tick on a plate with my knife. In a few minutes I got an answer in the same way from the other side of the room. Conversation was maintained for some time, and finally names were exchanged. I stood up and, looking across the room, saw an old side partner of mine whom I had not met for years."

A BAMBOO BRIDGE IN SIKKIM, INDIA.

This picturesque but frail structure is one of those extraordinary feats of native engineering to be seen spanning the mountain streams in all parts of the Himalayas. More commonly they are made of cane work, but where bamboos are to be had in plenty and the engineer has genius, their form takes the bolder outline to be seen in the picture. During our autumn holiday last year we one day reached this spot after a long but very enjoyable ride over the road that skirts the lower reaches of the River Teesta. The day had been indeed one succession of lovely vistas of winding sunlit river and dark forest-clad hill, and this bridge and its wooded surroundings seemed a fitting end to our morning ride; so we dismounted on a turf-clad rock overhanging the stream, and, having seen to our jaded ponies, proceeded with keen appetite to discuss the contents of our tiffin basket. The scene was a lovely one. Up stream the waters leapt suddenly and noisily into view at a sharp bend, and with a crest of white foam, raised in many a tussle with the glistening bowlders that strewed the banks, rippled into a sober-er calm as they flowed through the deep pool under the bridge. Below this it disappeared into the dark over-hanging foliage of the lower reach. Our afternoon journey was upward, and we could see afar off, through the tangle of foliage, the hill we had still to climb, beginning, even then, to lose the strong coloring lent it by the midday sun, for those softer violet tints that betoken the declining day in the Himalayas. But we dawdled over our tiffin and then over our camera until our syces, who saw only a long march in the dusk before them, aroused us into action. So we picked our way with cautious steps over the ricketty bridge to our fresh ponies awaiting us on the other side and got safely over. But hardly a day too soon, for we subsequently learnt that it had come down with a crash about a week after, its remains disappearing in a sudden rise of the waters below.—*Jour. Photo. Soc. of India.*

A BAMBOO BRIDGE IN SIKKIM, INDIA.—PLATE BY THE PAPYROTINT PROCESS.

A New Submarine Boat.

A submarine boat has been designed by a Portuguese engineer, Don Fontes Pereira de Mello, and it possesses several novel features. The boat has a length of 72 feet, a diameter of 11 feet 2 inches, and a displacement when submerged of 100 tons. Power is furnished by a motor working from accumulators, which drive a pair of screws and give a speed of six knots, maintainable for 14 hours. The boat is submerged by introducing water ballast into reservoirs, and by horizontal propellers, its perfect stability under all conditions being insured by a special arrangement. When submerged, direct communication is kept up with the outer air by means of a long hose, which admits of 40 cubic meters of air per hour, and allows of the free respiration of natural air. The dome is furnished with an optical tube 16½ feet long, and slightly over 4 inches in diameter, within which a set of mirrors reflect the image of the object to be observed and magnify it before it meets the eye of the observer. The special advantages claimed for the new boat over all others are its absolute stability, even when submerged in a strong current; free respiration, without the necessity for reservoirs of compressed air, and consequent ability to remain under water for lengthened periods; and finally the special optical apparatus which permits of a good lookout being kept when the boat is under water, and of distances being accurately measured. The boat is intended solely for coast defense, and is armed with torpedoes.—*The Steamship.*

Astronomy Graphically Portrayed.

At the Carnegie Music Hall, in New York, there was recently given the first of a series of illustrated astronomical lectures on an entirely novel plan. The spectators saw a realistic display of lunar and solar eclipses from the standpoint of observers on the earth, then on the moon, and again from space. This is the first time that the effort has been made in this country to depict these astronomical phenomena by scenic and mechanical means. Similar representations have been given in Berlin by the Urania Society, which was organized for the purpose of spreading astronomical knowledge among the people. Andrew Carnegie is reponsible for the reproduction of this unique form of entertainment in America, and he has imported all the necessary theatrical properties from Berlin to establish the enterprise here on a similar basis, it being intended, if this kind of educational amusement is appreciated, to have it repeated in the leading cities. The first scene shown to the spectators was one of the most interesting of the whole evening. It represented a landscape near Berlin, with a lake in the background. It was darkened at first, and then the clouds in the sky began to take on a rosy hue. It was a very good simulation of an approaching sunrise. The sun appears above the horizon as a blood-red crescent. It is being eclipsed, and as it ascends less and less of the crescent is seen, until the sun is totally eclipsed. It appears then simply as a black disk with the corona about it. The landscape is involved in the curious darkness which results from an eclipse. The sun's reappearance is faithfully depicted, until it becomes a full round ball of pure white light, a very good counterpart of the original.

In the next scene the spectators are viewing the same solar eclipse from a point in space supposed to be 80,000 miles away. They see the earth hanging in space, a large globe, with stars shining about it. The rays of the sun coming from the right illuminate half of its surface. The moon is seen to come into the sun's rays and its shadow falls upon the earth and advances across its surface. The phenomenon of a solar eclipse is thus graphically explained.

The next scene depicts an eclipse of the moon in space, and in the fourth scene the spectators are looking from a distance of 4,800 miles at the moon suspended in space. From behind the scenes the sun's rays fall upon the moon, and the shortening shadows of the mountains on the moon indicate sunrise.

In the next act, for the representation is divided into acts, the observers are supposed to be actually on different portions of the moon's surface, looking on its mountains and craters. The barrenness of the moon's surface is sharply defined in the sunlight striking across it.

In another scene the earth is seen hanging over the moon and casting its reflected light upon it. The sun rises on the horizon of the landscape, and is eclipsed by the earth itself, the strange red glow cast upon the moon's surface being very well reproduced. The last act has scenes upon the earth again, one a lunar landscape in the highlands and another a sunset in the Indian Ocean.

H. G. KETCHUM, engineer of the Chignecto ship railway, is credited as the author of a scheme by which vessels drawing upward of 20 feet of water can be pushed through the present St. Lawrence canals from Port Arthur to Quebec, and through the Soo Canal now being excavated, without deepening the canals or enlarging the locks, thus obviating the expenditure of millions of dollars upon canal deepening. Mr. Ketchum proposes that large vessels be placed upon steel rafts or pontoons, and thus floated through the canals and over river shallows, the vessels to be placed upon the pontoons by means of hydraulic lifts established at the entrance of each canal. He says $500,000 would provide pontoons and lifts for all the existing canals; but these lifts could be used as graving docks; but little time would be lost in placing the vessels upon the floats, and the plan has been successful elsewhere.

THE new 12 inch naval gun made a successful trip across the continent in eleven days, arriving at San Francisco January 23. The attendants who accompanied it state that the gun has attracted great attention on its tour across the continent, crowds of people gathering at the stations along the line to view it, and in many places school children were given a half holiday for the purpose.

RECENTLY PATENTED INVENTIONS.

Engineering.

"GLORY HOLE" GLASS FURNACE.—Henry Hagerling, St. Louis, Mo. An improvement in glass bottle finishing furnaces is provided by this invention, whereby the entire bottle may be evenly heated, to prepare it nicely for the tempering oven, instead of the neck of the bottle only being heated, causing breakage, as has been frequently the case heretofore. The furnace has a main combustion chamber from which leads a horizontal flue extending around within the furnace walls, there being a series of working holes in the furnace walls above the horizontal flue, and flues leading from the horizontal flue to the working holes, in which are sliding dampers, with means for supporting and evening the bottles.

PULLING OR LIFTING MACHINE. — John Cornelius, Oakland, Md. In this machine a base or bed supports a pulling mechanism in which, combined with a main wheel provided with a worm wheel, is a main worm meshing with the wheel and provided with a worm wheel with which meshes a drive worm, a worm wheel formed of sections being arranged on opposite sides of a chain wheel, and the invention including various other novel features. The machine is adapted to be easily convertible to either an elevated wrecking machine or a flat pulling machine, and arranged for extraordinary power or a medium power, and a higher or lower speed, and may be advantageously used to remove wrecked cars from a track, in pulling stumps, in quarries, in bridge building, etc.

FEED WATER FILTER AND SEPARATOR.—Elwood P. Mandigo, Brooklyn, N. Y. This is an apparatus for purifying feed water, more especially the water of condensation from the condenser of a condensing engine, to remove the oil and other deleterious matter. It consists mainly of a vessel having a series of compartments connected by pipes, which have openings at their lower ends near the bottom of one compartment and their outlets extending into the adjacent compartment at about the water level. The water progresses from one chamber to another in being separated from the oil, the latter being left entirely in the separator when the water passes to the boiler.

Railway Appliances.

CAR COUPLING.—Frederick H. Brown, West Pittston, Pa. This invention relates to an improvement in car couplings of a kind in which a hinged jaw interlocks by a lateral movement with a similar jaw on another coupling, the invention providing an improved locking pin and means to retain the pin in elevated adjustment until the vibratile coupling jaw is rocked by the impact of a mating coupling jaw with which it becomes interlocked automatically, improved means being also provided to lock the jaw in a coupled condition. There is a joint leaf on the swinging jaw, with a cam slope on its inner edge to sustain the locking pin, which is adapted to drop through a notch in the cam slope at its lowest point.

CAR DOOR.—John Smith, Pooler, Ga. This is a ventilating door in which the frame has a series of slats with trunnion ends near one longitudinal edge of each slat and a shouldered projection on one slat end of each slat joining the base of the trunnion, a slide bar being notched edgewise in series to receive the shouldered projections, with means to move the slide bar longitudinally. It is a freight car door designed to afford free ventilation to the interior of the car while the ventilator may be close sealed when necessary, avoiding the use of a special door to ventilate the car.

Electrical.

ELECTRIC MOTOR. — James T. Wilson, Tyrone, Pa. In this motor a continuous rotary motion is converted into an effective reciprocating motion, applicable to bicycles, cars, tricycles, drilling machines, the driving of saws, and other uses. The motor is mounted on a reciprocating frame and has its armature journaled in side bearings, there being cranks on the ends of the armature shafts, pitmen connecting both cranks with a fixed frame, and a transmitting rod connecting with the reciprocating frame.

MAGNETIC EXTRACTOR. — Horatio W. Southworth, New York City. This improvement is specially designed to facilitate the removal of particles of iron and steel from paper pulp, and is also adapted for similar use in various industries. The pulp or other material is flowed through a helical channel or sluice in which is arranged a series of magnets past which the pulp flows, so that the magnets may take up any contained particles of steel or iron and hold them until the end of the run, when the apparatus is cleared of the pulp and the magnets are discharged of the adhering particles.

ANNUNCIATORS. — Ralph A. Schoenberg, New York City. This invention provides an attachment whereby the annunciator may be pneumatically reset without jarring and the annunciator may be placed upon any desired support without interfering with its proper manipulation. The attachment may be operated from a distance, and means are provided whereby, before ringing and causing a drop finger to disclose the number of the room or floor, the operator may be assured that every drop finger is elevated and concealed from view in front of the annunciator window. The attachment is very simple and inexpensive, and can be readily applied.

Mechanical Appliances.

VALVE SEAT GRINDER. — Hiram H. Swallow and Mathew T. Jones, Carbondale, Kansas. In connection with a frame on which a clamping plate is adjustably held is a shaft mounted to turn and slide in the frame, a chuck on the shaft carrying the valve, with means for imparting a rotary motion and a sliding motion to the shaft. The device is very simple and durable, can be readily applied to the valve, and permits of examining the grinding of the seat at any time during the progress of the work, while the several parts are held in perfect alignment, so that the seat is ground in proper relation to the valve.

DRAWING FRAME.—Junius A. Murphy, New Orleans, La. According to this invention a combing belt is arranged above a supporting apron, and has a forward movement beyond the apron, drawing rolls being arranged in advance of the apron and beneath the forward end of the combing belt. The improvement provides a means for effectively and economically combing animal fibers, particularly horse hair, which has a peculiar tendency to entwine itself in and follow the combing fingers in ordinarily arranged drawing frames, instead of leaving the fingers in obedience to the action of the drawing rolls. By this improvement provision is made for releasing the hair by gravitation in the clearance space beyond the apron and beneath the combing belt.

WRENCH. — Thomas A. Ferguson, Lyons, Neb. This is a simple form of wrench adapted for use as a pipe wrench or a nut wrench, and which adapts itself to a variety of sizes of nuts or pipes. It has a slotted shank with one end inclined and terminating in a fixed jaw, the shank also having teeth on one edge in which interlock the teeth of a movable slide block. Means are provided for securing the block in the shank, and a movable jaw is connected with the block by a ball joint, the jaw having its free end curved and provided with teeth. The curvature of the movable jaw is such that the distance between the outer portions of the two jaws is greater than the distance between their inner portions, so that the wrench may be instantly applied to objects of very dissimilar sizes.

Agricultural.

POISON DUST DISTRIBUTER. — Enoch B. Norton, Hartford, N. Y. This is a device to be carried along rows of potatoes, corn, or other plants to be powdered, and an upward jolting movement given to the powder-holding chamber, causing a dust guard to protect over each hill successively, so that the dust thrown out will be confined and directed upon the leaves and stalks of the plants operated upon, to kill bugs or similar insect pests. The dust holder is cylindrical and has a foraminated conical bottom, in combination with a concentric air escape tube attached to the bottom and terminating above within the chamber, while a downwardly projecting dust guard envelops the plant when being dusted.

Miscellaneous.

CENTER SUPPORT OR HANGER. — Thomas W. Snell, Chicago, Ill. This is a device for supporting centers for masonry, arches, floors, etc., adapted for ready application and adjustment to support the center at the proper place. It consists of a chain adapted to engage the center, a bolt provided with a hook to be engaged by the chain, and a cross beam adapted to carry the bolt. The hanger always passes through the center of the arch in the tile course, and a hole is always left from nine to eighteen inches long by six to nine inches wide, this hole being filled up after the centers are dropped.

HEATING, COOLING AND VENTILATING APPARATUS. — William M. Decker, Kingston, N. Y. This invention provides an improved system adapted for use in all architectural structures having intercellular spaces in side walls and between floors. Pipe coils connected with the steam or hot water pipes are located in the intercellular spaces, and in the outer side walls are registers for the graduated introduction of cold air from the outer atmosphere, there being also registers to afford exit passages for foul air or any excess of heat in the upper part of the rooms. Rods projecting through perforations in the inner side walls are adapted to move slide gates to regulate the flow of hot or cold air in the intercellular spaces, the system affording a continuous envelope of properly heated air for a building, and giving a uniform heat and pure air as well as ventilation.

RADIATOR LOOP. — George H. Burley, Tyrone, Pa. This is an improvement for conveniently controlling the steam and water of condensation so that the entire radiator or only a part of it may be used as desired to regulate the heat of a room. Two members are separated from each other on top and bottom and have inlet openings on opposite sides, with valves in the lower ends of the legs, plugs held in the lower ends of the radiator loop in communication with outlet openings and discharging into a common pipe, while valves connected with a water return pipe are arranged on the inner ends of the plugs.

WEIGHT LIFTING ATTACHMENT. — James W. McHenry, Aspen, Col. This is a device to be applied to express and delivery wagons for lifting and dropping the weight attached to the halter and reins for temporarily holding the horse. It consists of a conical frame attached to the axle by means of the king bolt, for receiving and holding the weight when drawn up, with an angled lever fulcrumed on the wagon body and connected by a cord with the halter or rein-holding weight, while a releasing lever pivoted to the wagon body is adapted to retain the weight-holding lever. If desired, the reins may be so connected that, when the horse starts, the weight will be released and fall to the ground, to act as a backward pull on the reins.

HOLDBACK FOR VEHICLES. — Patrick Mullane, Moline, Ill. A simple, strong, secure, and easily manipulated holdback is provided by this invention. It consists of a metal band attached to a vehicle shaft and having a lateral keeper for the breeching strap and a hinged tongue which serves to secure the strap detachably. The looped free end of the strap passes beneath the keeper and the hinged tongue drops through the loop, thus holding the strap securely while in use, yet permitting it to be easily and quickly detached.

COMBINED TRUNK AND BED.—George W. Snaman, Jr., Allegheny, Pa. This invention provides an improvement on a former patented invention of the same inventor. The combination device comprises two sections hinged together at one end, each section having a removable wall at the hinged end, and one of the walls having binding hooks engaging the side walls of the section. The sections are provided with staple loops, into which enter the tenons of legs that also have shoulders extending under the bottom. A tray having a hinge cover is hinged to one end.

FLOUR CABINET. — Albert A. Tinker, Madison, Wis. This cabinet is of simple and novel construction, designed to be neat in appearance, and afford ample ventilation to the flour or other materials kept in its bins. A moulding board or leaf is pivoted to the framing in a manner to facilitate ready use, and all the parts are so arranged as to afford easy access to the flour and prevent waste.

OIL CAN AND LAMP FILLER.—Charles W. Proctor, Lake Forest, Ill. This invention is designed to afford a convenient receptacle in which oil may be kept, and which may also be used to fill lamps without danger of spilling the oil. It consists of a closed tank or can, in the inside of which, near the top, is an open basin adapted to hold about the necessary quantity of oil to fill a lamp. Leading from this basin is a pipe which connects by a swinging joint with a swinging pipe through which oil is delivered to the lamp. This pipe has a faucet near its free end, and is adapted to lie flat on the face of the tank when the latter is laid on its back, so that there will be no leakage of the oil.

BICYCLE. — Felix Clément, Salins, France. This invention provides for bicycles, velocipedes and similar machines a yielding or flexible frame that is designed to be durable and also easy to the rider, so that, if desired, the saddle springs may be dispensed with. It is a two-part frame with members of essentially triangular shape, hinged together near the bottom, one member being mounted on the rear wheel and the other on the steering fork, while sockets are formed in the upper adjacent portions of the members and a spring extends from socket to socket, the location of the spring being such that it receives directly the shock transmitted by either of the wheels.

CASH CARRIER. — Charles Frederick, Columbiana, Ohio. This is a carrier of the type wherein a wire track is used to support a traveling carriage, and improved means are provided to removably hold the carriage at a station, with novel mechanism to actuate the carriage in propelling it from one station to another, improvements being also effected in the means for removably attaching the cash receptacle to the carriage proper. The entire device at each station is suspended on a depending hanger arm reaching a point accessible from the floor, to permit the convenient manipulation of the mechanism.

CLASP. — Antenor Assorati, New York City. A simple and inexpensive article capable of use wherever a button is required, and especially adapted for closing and locking the pockets of garments, is provided by this invention. It is made in two sections, one having a locking contact with the other, the keeper section having a trip and a keeper post, and the latch section having apertures to receive the posts and a spring. It is impossible for a pocket to be opened when locked by the device without warning or notification to the person wearing the garment.

PENCIL ATTACHMENT. — Joseph H. Hamill, Globe, Arizona Ter. This is a little device to be attached to pencils to prevent them from accidentally escaping from the pocket. It consists of a rod attached to the end of the pencil, a funnel-shaped rubber cup on the rod opening toward the end of the pencil, and a metallic slide for closing the cup. A socket is also provided for receiving the end of the pencil and supporting the attachment.

NURSING BOTTLE.—Gabriel A. Bobrick, New York City. This bottle has projecting lugs on its neck, over which is adapted to slip a rubber nipple having perforations to receive the lugs, the material being re-enforced around the perforations, and the arrangement making accidental displacement impossible. The nipple may be easily placed in position upon or removed from the bottle.

SIGN.—William R. Garner, Galveston, Texas. This invention provides an improvement in signs for street railroad cars. The sign is made triangular in cross section, having at its top an opening with movable cover and being conformed at its base to the top of the car to which it is to be fitted, there being fastening devices by which the sign is secured directly to the car. The sash signs held in the main frame or casing are arranged so that the front sign can be read as the car approaches, while the side signs can be read by persons in the rear or on the sides of the car.

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.

PERFUMES AND THEIR PREPARATION. By George William Askinson, Dr. Chem. Translated from the third German edition by Isidor Furst. Illustrated. New York: Norman W. Henley & Co. 1892. Pp. viii, 312. Price $3.

The subject of the manufacture of all classes of perfumes is the topic of this attractively printed volume. Its opening chapters treat of the history of the art and tell about the nature and properties of the original substances in the animal and vegetable kingdoms as prepared by the chemist for the manufacture of perfumes. Next the extraction of odors, giving materials, their special characteristics, their adulteration, and the special extracts and essences used in the arts are treated. Adulteration of the valuable essences and extracts receives proper consideration, and directions for making them follow. All kinds of finished perfumes, for the handkerchief, sachets, fumigators, etc., are given. The hair and skin and preparations for application to them are given liberal space, including cosmetics of all kinds, hair dyes and depilatories. The work has, it will be seen, a wide scope and will be of general as well as professional interest, meeting the wants not only of the druggist and perfume manufacturer, but also of the general public. It has been revised by Dr. Charles Rice of this city, a recognized authority in pharmacy and allied topics. The book should be warmly received by the public as well as by the technical manufacturer.

A MANUAL OF THE STEAM ENGINE. Part II. Design, construction and operation for engineers and technical schools. By Robert H. Thurston, A.M., LL.D., Dr. Eng. New York: John Wiley & Sons. Pp. xxiii, 934. Price $7.50.

All that is necessary to say of this second volume of Professor Thurston's great work is that it upholds fully the promises of the first volume. Design, regulation of speed, construction and erection, operation, care and management, engine and boiler trials, specifications and contracts, and finance of steam engineering are the topics more particularly covered. The work is too large and ample for us to pretend to review it within the limits of the space at our command. Its size, style and author are enough to make it a *sine qua non* for every engineer who wishes to keep abreast of the present day. It is excellently indexed, and while containing many calculations and formulæ, does not by any means miss the practical side of the topics, showing and explaining accepted structures and designs.

EVOLUTION IN SCIENCE, PHILOSOPHY, AND ART. New York: D. Appleton & Co. 1891. Pp. ix, 475.

This book contains a series of popular lectures before the Brooklyn Ethical Association. It includes fifteen papers on all kinds of evolution, in many cases the modern fashionable name for what used to be called progress. In it we find evolution of chemistry, electric and magnetic physics, botany, zoology, optics, art, etc. It is to be hoped that the picturesque process of evolution is still going on, as there is much yet to learn. Among the authors are Prof. John Fiske, Arthur E. Kenelly, Prof. Edward D. Cope, and others more or less known in their respective capacities.

SHORT HAND AND TYPE WRITING. By D. McKillop. New York: Fowler & Wells Co. Pp. 123. Price 40 cents.

This little pamphlet is one of a series to be called the Self-Culture Library. It seems to be well written and to present its subject very graphically and practically. It has a number of cuts illustrating different type writers, etc.

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.

(4050) H. W. G. asks: 1. Is there any preparation in existence which will produce oxygen gas? If so, what? A. No preparation known gives off oxygen gas without the application of heat to some extent in any practically useful way. 2. Also is there any preparation that will absorb carbonic acid gas, such as we eject from our lungs in breathing? A. Caustic soda, potash, or lime will do this. To absorb injurious organic matter, potassium permanganate is useful. Simple absorption of carbonic acid gas will not suffice for purification of air which contains products of respiration.

(4051) W. A. S. asks: Can you tell me what the actuating element is in the common form of metallic thermometer, and how used? A. A compound spiral of steel and brass. The differential expansion causes the rotation of the needle connected with it. It is the principle of the Breguet thermometer, described in text books on physics.

(4052) O. P. asks: Will kerosene oil penetrate and rot rubber? And if so, is there any that can be prepared so it will not penetrate or rot it? A. Kerosene oil will have some effect upon India rubber, which will be more perceptible in proportion to the time of action. It cannot be prevented. A good quality of vulcanized rubber will be least affected.

(4053) J. M. U. de G. asks (1) for a cheap method of making hydrogen gas. A. Pass steam over white hot iron or copper contained in a tube. 2. How many cubic inches of pure hydrogen gas will it take to lift one pound avoirdupois weight? A. Allow for pure gas, 70 pounds to 1,000 cubic feet, or 14 feet to one pound avoirdupois.

(4054) O. S. E. says: I have laid some pressed brick which some white substance comes out of. I would like to know what causes it, and what will remove it and other stains from pressed brick. A. The white stains are chiefly due to the presence of salts of magnesia, and no satisfactory cure has as yet been discovered.

(4055) F. W. asks: 1. Does a cubic foot of lead weigh less at a depth of 10,000 feet than it does at a depth of 10 feet under the surface of the sea? A. The lead would weigh slightly less by the decreased gravity at great depths. 2. Which will reach bottom first of two balls, one weighing 100 lb., the other 1 lb.? A. The 100 lb. ball will get to the bottom first, because its weight is greater in proportion to its surface exposed to the friction of the water. 3. Is water harder to penetrate at the bottom or surface of the sea? A. The density of the water at the bottom of the deep seas is but very slightly greater than at the surface. At one mile in depth it is 1-130 more dense than at the surface. 4. Will a small stone or sand sink to a depth of three miles? A. All substances that will sink at all will go to the bottom of the deep sea. Sand, mud and shells are found there.

(4056) C. J. B. asks: 1. To what use is the metal palladium put? A. It has been used for graduated scales. It has very little use outside of the laboratory except as a constituent of alloys used for hair springs of watches. It is the base of a useful reagent and is used in gas analysis to absorb hydrogen. 2. What is its market value? A. It is quoted at $2 per grain. 3. To what extent is it used? A. In very small amounts. 4. Where is it found? And how extracted from the ore? A. In Russia, North and South America, native or as an alloy. It is extracted by solution in acid and precipitation and ignition. 5. Is the process cheap or costly? A. It is not very costly. An excellent article on the subject is given in Appleton's American Encyclopedia.

(4057) H. G. M. asks: Will loadstone hold its power of attraction if not interfered with? A. Yes.

(4058) O. W. asks: 1. Is the flickering in arc lamps caused by impure carbon or unsteady feeding apparatus, or if neither of them, what causes this trouble? A. Both; and also to variations of E.M. F. and current. 2. Is it necessary to connect arc lamps in series as in the Brush system? What size iron wire would be best for a resistance coil in a line where high voltage is used? A. Arc lamps are generally connected in series. The size of wire depends on the current. Iron has about six times the resistance of copper. 3. Did Wilde (the inventor of the well known Wilde dynamo-electric machine) ever take out a patent on his arc lamp, known as Wilde's candle, in the United States of America? A. We think not. 4. In his apparatus, while burning, the carbons stood side by side, and I should think the current would have jumped across the space near the metal carbon holders instead of going to the points of the carbons, which would throw in additional resistance in the circuit. What is the reason it did not? A. The carbons stand at an angle, the points being nearer together than the clamped ends, hence the resistance of the increased air space prevented the arc from running along the carbons.

(4059) E. S. F. asks: 1. How large a storage battery would be required to light one 10 candle power incandescent lamp for two hours? A. Supposing the lamp to be a 20 volt lamp, 10 or 11 cells of storage battery will be required to secure the necessary voltage; but this number is sufficient to run 10 such lamps. 2. How much would such a battery cost, and would you tell me how I could make one? A. For cost of storage batteries, address the manufacturers and dealers. For directions for making, consult SCIENTIFIC AMERICAN, vol. 61, page 22. 3. How much power can I obtain from a steam engine with piston 1¼ inch diameter, 2¾ stroke, with 50 and also 100 lb. steam? A. If the engine is well made, you would realize respectively ¼ and ½ h. p. approximately at a speed of 300 revolutions per minute.

(4060) B. I. T. asks whether there is any advantage or gain in wetting down the coal. Some claim the dry coal produces more heat, while others claim the wet coal produces most heat. A. The wetting of coal dust is for the purpose of holding it together and preventing waste by dropping through the grate. In this way more heat is obtained.

(4061) M. L. writes: I received your book "Experimental Science," and am well pleased with it. I am making the simple motor described in its pages, and would like to ask a few questions through Notes and Queries about it: 1. How many pounds of wire will be required for motor, when used either as a motor or dynamo with cast iron field magnets, using No. 18 for fields and No. 20 for armature? A. It requires about 2 lb. No. 18 and ½ lb. No. 20. 2. Should the wire be single or double covered? A. Double covered. 3. Will the above sizes of wire be light to be used on a dynamo circuit when placed in a shunt? A. It depends on the kind of current used. It would be right for a current of low voltage. 4. How many cells of the secondary battery described on page 418 in "Experimental Science" will be required to run the motor? A. Four. 5. If it requires a stronger current to charge the storage cell than it gives out, what advantage is gained by using it? A. Convenience and constancy. It can be charged at night and used during the daytime, and a stronger current taken from it for a shorter period than was used in charging it.

(4062) G. D. writes: I have taken the liberty of forwarding a sample of brown animal grease, which I am desirous of bleaching. A. Try following processes on it for purifying tallow: 1. Agitate with 5 parts good vinegar. 2. Agitate 50 parts tallow with 80 parts water and 12 parts salt. 3. Agitate 50 parts with 1 part calcined magnesia. 4. Agitate with weak solution of caustic alkali, or with strong solution of an alkaline carbonate. 5. Prolonged agitation with water. 6. Agitate 10 gallons with ⅛ gallon H_2SO_4 and ½ gallon water. In all cases apply heat during process and then wash, steam well, and remove last traces of chemicals.

(4063) J. W. C. asks where the gelatine-like composition used instead of glass for holding the film for plates is manufactured. Also is it a patented article? A. The compound is a mixture of guncotton and camphor, and is called celluloid. It is made by the Celluloid Company, Newark, N. J., under patents.

(4064) J. L. F. asks: What number cotton-covered magnet wire should I use to make a magnet of about 20 ohms resistance? Also how much of it? A. 4865 feet of No. 16, 1924·2 feet of No. 20, 761 feet of No. 24, 189·32 feet of No. 30, or 47 feet of No. 36. The size of the wire must be in proportion to the current to be carried.

(4065) L. A. P. asks: Is sewer gas odorless? By what chemical process can you detect sewer gas in a room? A. It generally has a depressing odor and usually contains sulphureted hydrogen. In the latter case it can be detected by paper dipped in lead acetate solution. It turns the paper brown. This is not at all infallible. It should be tried in the night.

(4066) A. J. O. writes: I desire to paint my roof with a coat of lead color instead of the customary red mineral paint. Some of my neighbors maintain that there would be danger of lead poisoning from such a roof. Will you kindly inform me if there would be any such danger? A. We should advise the use of ochers, graphite, or similar colors for roof painting.

(4067) J. D. H. writes: In relation to the induction coil described on page 548, "Experimental Science," allow me to ask the following questions: 1. Is it any advantage to varnish the layers of the secondary coil? A. Yes; but the advantage will hardly compensate for the trouble. 2. About how much more than one pound of No. 36 wire is called for? A. It requires nearly 2 lb. 3. Can I purchase platinum-pointed screws of electrical supply dealers? A. Yes; or you can easily insert the point yourself. 4. Are the contact points of the ordinary call bells protected with this metal, platinum? A. Usually. In the cheaper kinds, however, makers are apt to substitute silver or German silver, which are, of course, not so good. 5. Why does a condenser of a capacity of 75 square feet command such a high price, $20? A. They are carefully made and well mounted and protected, and besides this, the dealer must necessarily make a profit. 6. Should the sheets of tin foil in condenser for above mentioned coil be large or small? Does the size of sheet make any difference? A. The size makes no material difference, but they should not be too small. Make them of a size suited to the base of your instrument.

(4068) C. E. W. writes: 1. I made an induction coil *a la* Hopkins. Used two one gallon bichromates, made interrupter with platinum points, burnt out fast, made mercury breaker, worse than platinum, mercury vaporized, made condenser, 50 square feet tin foil, bunched together and wired as per directions; this made one-half; run a wire to neighboring tin roof for the other, thus electrically separating the two sections. Sparked as much as before, thought surface must be deficient, so run wire to water pipe, hoping all creation would furnish at least one-half the necessary amount, mercury kept burning up all the same. The books say the mercury breaker prevents the spark, at least decreases it, and the condenser helps considerably, and if I have two large metallic surfaces insulated from each other, why is not that sufficient? A. Try connecting your battery in parallel. Use kerosene oil or alcohol on the surface of the mercury in the contact breaker. Have it deep enough to always cover the platinum point. 2. Is it absolutely necessary that sheets of foil should be piled together in order to secure the best effect? If so, why? A. Yes; in order that they may act inductively on each other.

(4069) G. A. M. asks: 1. Does it hurt the meter or converter on an incandescent system to short circuit the wires? A. It depends upon the way the meter is connected in the circuit. 2. What is the current that is used to execute criminals at Sing Sing? A. A circuit including an E.M.F. of 1500 to 1700 volts. 3. Could an induction coil be made with No. 36 double-wound cotton-covered? If so, how much should be used for the secondary coil? A. Yes; it would take two pounds.

(4070) H. K. asks: How many cells of storage battery (such as described in "Experimental Science) will it take to run the motor in SUPPLEMENT, No. 641, also how many cells of gravity battery required to charge the same? A. It takes four cells of storage battery to run the motor, and four cells of gravity battery are required for each storage cell for charging.

(4071) A. C. W. writes: I have been trying to connect two buildings, about 1,300 feet apart, by two bells over one outside wire (No. 18 copper), using the ground as a return wire, so they will reply to each other. I have used three closed circuit, Crowfoot batteries at each end (5 x 7 inches), using 1 pound of blue vitriol to each jar. Used double contact buttons. The grounds are: One pipe about 4 feet long driven into moist ground filled with water, the other is a well pipe about 25 feet long. Can you tell me where I have made my mistake? A. You have probably failed in your grounds; they should have a much larger surface. We think a better plan would be to connect all the batteries together at one end of the line and keep the whole line normally closed, simply opening the circuit for signals. If the bells are of the vibrating style, you might make the bell ring by connecting it up on an independent local circuit with one cell. Then when the main line is open, the hammer will fall back and the bell will be operated by the local battery.

(4072) R. A. W. asks: 1. What is the best and quickest mode of polishing ornamental wood turning? Is it possible to mix a color with shellac to make the turned wood appear like mahogany and polish at same time? What process is used to put color on and polish articles such as lead pencils and ladies' toilet brushes and work boxes, such as appear enameled? A. For mahogany stain on light woods use an extract of cam wood. The stain is to be applied to the work while it is in the lathe. It is then removed and allowed to dry. Polish with shellac varnish to which has been added 50 per cent of boiled linseed oil, or better, use French spirit varnish in the same way. Apply with a cloth. For pencils and boxes a logwood stain is often used. The varnish is flowed on and often not polished. 2. Is there any book published which treats on polishing, wood turning, staining, and graining, etc.? A. You will find a great deal on wood stains and polishes in the "Scientific American Cyclopedia of Receipts, Notes and Queries," which we can mail you for $5.

(4073) A. S. asks (1) how to prepare the cloth for a small balloon intended to contain hydrogen. A. For preparing cloth for balloons see the SCIENTIFIC AMERICAN SUPPLEMENT, No. 726. 2. Can hydrogen be used in a balloon of India rubber? A. Yes; but hydrogen will always rapidly escape. 3. How many pounds will a balloon filled with hydrogen, and with a capacity of 1,000 cubic feet, lift? A. For 1,000 cubic feet pure hydrogen allow 70 pounds of lifting power; from this subtract the weight of your balloon and accessories. A liberal allowance should also be made for impurities, diffusion of gas, etc.

(4074) G. H. L. asks: 1. How can I make a cheap reliable air pump for experimental purposes, with a bell about eight inches high? A. For this we refer you to Hopkins' "Experimental Science," $4 by mail. 2. Have carbons been made to show different colors of light? Is it possible, owing to the great heat which they must undergo while carbonizing? A. To the eye the white rays will always predominate, although they have been caused in spectrum analysis to volatilize metals to give the characteristic flame. 4. Would colored carbons be in demand? A. We doubt if any demand would exist for such as could be made.

(4075) C. B. asks: 1. A formula reads "solution chloride zinc" (U. S. Ph.), 1 quart. What quantity of zinc chloride granulated does it require to make proper strength to quart of water, so as to be like above U. S. Ph.? A. For one quart of solution allow about 1 pound of the solid salt. 2. Solution chloride sodium (℥ vj to O j), 2 pints. Does this mean 6 ounces sodium chloride to 1 pint water? A. We suppose so; it is not very explicitly stated. 3. Will arsenious acid 1 part, dissolved by using carbonate potassa, 6 parts, remain colorless or turn brown after standing? A. It should remain colorless. 4. What is the best way to make alum mix with arsenious acid solution and remain clear? A. Acidify if necessary with hydrochloric acid. 5. In making solution of bichloride mercury with muriate ammonia, should they be dissolved together in cold water or hot, or separately in hot or cold water? A. Dissolve both together, or the ammonia salt first. Warm the water, do not boil it.

(4076) H. J. S. asks: 1. Will you please explain the latest theory in reference to ventilation? A. The best method of ventilation is that in which the foul air is drawn from the upper and lower portions of the room and in which fresh air enters around the windows, doors, and other openings or through a number of small openings distributed around the room, but not located near the ventilating ducts. 2. Should rooms be ventilated at top or bottom of room or at both points? A. See answer above. 3. Can a school room be properly ventilated (that is not cooled off) by lowering the top of window only? A. Not properly; but this method, when draughts are not created, is better than no method. 4. Does carbonic acid gas settle to bottom of room or rise to top or is it diffused through the room generally when heated to ordinary living temperature, and are there any other gases deleterious to health, and how best to ventilate for them? A. Carbonic acid rises to the top of a room because it is always evolved in a heated condition. It then diffuses all through it. There are other gases and emanations from the body, as well as dust and disease germs, which are carried off by ventilation.

(4077) S. T. C. asks the difference between a square foot and a foot square. A. A square foot is any shaped surface that contains a square foot of area. A foot square is a square surface of the length of one foot on each of its four sides.

S. C. M. I. asks for a waterproof cement.—J. C. says: Will you please tell me how to repair the back of a mirror where the silvering has scaled off?—A. G. H. asks for a receipt for a good hard washing soap.—F. H. W. S. says: I wish a paint mixture for outdoor work on statues, that will stand weather and will neither fade nor turn yellow.—J. J. M. says: Do you know of any way I can get a formula for making a dressing for ladies' shoes?

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 16, 1892.

AND EACH BEARING THAT DATE.

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

Acid, apparatus for concentrating sulphuric, C. Negrier.......... 468,891
Adjustable handle for taps, reamers, etc., T. E. Avery.......... 469,035
Advertiser, photoscopic, P. Ortega.......... 469,171
Air brake, E. G. Shortt.......... 469,176
Air cooling and purifying apparatus, I. F. Good.......... 469,207
Arm, artificial, W. Boardman.......... 469,115
Armature for dynamo electric machines, M. Deprez.......... 469,080
Asphaltum, manufacturing, J. A. Dubbs.......... 468,867
Atomizer, A. Howard.......... 469,144

Auger, post hole, Mendenhall & Hite 468,812
Awning, F. P. Kirk 468,942
Axle lubricator, W. W. Smith 469,100
Bag. See Mail bag.
Bag holder, Henning & Pigott 469,061
Ballots, device for facilitating the counting of, I. S. Pear 468,972
Barrel rack, J. A. Browning 469,119
Batteries, electrolytes or depolarizing solution for galvanic, S. Miller 468,887
Battery. See Storage battery.
Bearing, adjustable, B. V. Nordberg 468,822
Bedstead brace, E. S. Elliott 469,081
Bedstead, metallic, B. R. Barklow 468,862
Beehive, S. F. Brewer 468,783
Beer, method of and apparatus for the manufacture of, C. F. Lawton 468,809
Bicycle, W. A. Hance 468,994
Bicycle seat spring, P. R. Walsh 469,192
Bicycle support, W. L. Ross 468,920
Bit. See Overcheck bit.
Block. See Building block. Paving block. Pulley block.
Board. See Ironing board. Multiple switch board.
Boat detaching apparatus, H. Ashford 469,034
Boat seat, adjustable folding, E. Hardendorf 468,873
Boiler. See Steam boiler. Water or steam boiler.
Boiler cleaner, D. N. Baxter 468,863
Book, blank, F. Bowman 468,780, 469,054
Book rest and writing slab, C. K. Gaines 469,133
Booth, portable wooden, C. F. Hodsdon 469,017
Boots or shoes, machine for polishing, R. Kunstman 469,087
Bottle stopper, F. Schmidt 469,085
Bowling alley, A. Warth 469,071
Box. See Letter box. Measuring box. Miter box. Wagon box. Work box.
Box bottoms, machine for tonguing and cutting, C. H. Fuchs 469,059
Brace. See Bedstead brace. Ratchet brace.
Bracket. See Tool bracket.
Braiding machine, W. Mundt 468,997
Brake. See Air brake. Vehicle brake.
Brake beams, core for hollow, T. Fielden 468,910
Brake beams, strut for, C. T. Schoen 468,830
Brewing, C. F. Lawton 468,808
Brick, building, J. Rapp 468,990
Brick, building, L. A. Steiger 468,838
Brick handling implement, C. & C. Hansen 468,872
Brick, interlocking, L. A. Steiger 468,840
Brick kiln, C. Klose 469,151
Brick mould sander, E. O. Leach 468,810
Bucket, lunch, A. Miller 469,162
Buckle plate, H. J. Lewis 469,063
Building block, W. R. Forbush 469,083
Building, portable, W. E. Brock 468,785
Buildings, construction of fireproof, R. Guastavino, Jr 468,871
Burial apparatus, F. Haug 468,995
Burner. See Hydrocarbon burner. Oil burner.
Cake cutter, L. W. Snell 468,836
Can. See Oil can.
Can filling machine, J. S. Moore 468,888
Can float, creaming, P. L. Kimball 469,149
Candle holder and shade holder, combined, Kent & Ashby 469,189
Caps and fuses for giant powder, coupler for, K. McFarland 468,890
Car buffer, W. H. Wild 469,051
Car coupling, J. G. Brady 469,055
Car coupling, P. H. Murphy 469,166
Car coupling, J. L. Randolph 469,197
Car coupling, Reynolds & Pittman 468,828
Car coupling, R. M. Tucker 468,846
Car coupling, E. A. Yeaton 469,110
Car door, grain, J. Pearson 468,894
Car, electrically propelled, H. E. Dey 468,948
Car motor, street, A. J. Painter 468,824
Car step, M. B. Ryan 468,899
Car trolley, electric, J. W. Beebe 468,779
Cars, traction device for tram, W. B. Wright 468,860
Card case, coin operated playing, M. Prior 468,827
Carding engine, T. S. Whitworth 468,854, 468,855
Carding engine feeder, J. F. Geb 469,206
Carriage step, E. Post 469,031
Carrier, W. C. Hall 469,137
Carrousel, G. Baum 468,962
Cart, road, W. L. Pike 469,090
Case. See Card case. Toothpick case.
Cash register, E. N. Foote 469,012
Cash register, Foote & Range 469,194
Cash register, J. F. Pfeffer 468,944
Cash register and indicator, J. F. Pfeffer 468,945
Cash register and indicator, E. Rector 468,967
Cash register and indicator, C. W. Weiss 469,003
Cattle guard, F. C. Seymour 469,049
Ceiling, fireproof, P. M. Bruner 469,121
Ceiling, metallic, E. C. Ewing 469,183
Ceiling, metallic, Ewing & Packer 469,182
Ceiling, metallic, J. H. Packer 469,186
Chalk holder, J. W. Klapperich 469,150
Cheese cutter, O. W. Smith 468,902
Chest. See Tea chest.
Chest protector, W. S. Heinemann 469,195
Chimney cap or cowl, Stubbs & Harden 469,069
Chopper. See Cotton chopper.
Chopping knife, F. M. Palmiter 468,893
Churn, J. W. Sullins 468,844
Clamp. See Rope clamp. Saw filling clamp.
Cleaner. See Boiler cleaner. Track cleaner.
Cloth cutting machine, A. Warth .... 469,072 to 469,074
Cloth press, rotary, G. W. Miller 468,815
Clothes drier, W. J. Kayser 469,018
Clothes line and clothes holder, wire, W. C. Baker 469,113
Coal bucket and stool, combined, W. E. Weatherly 469,107
Coat adjuster, J. J. & W. H. Giesler 469,134
Coin freed apparatus, J. G. Cumming 469,127
Collar, harness, A. T. Rutter 468,898
Commutator brush for electric motors and dynamos, T. A. Edison 468,950
Composition of matter, P. H. Holmes 469,142
Conveyer, pneumatic, Schutte & Ladd 469,175
Copying written or printed documents executed in carbonaceous inks, G. H. Ball 468,777
Cotton chopper, Kent & Hargett 469,027
Countersink, L. K. & C. A. Williams 468,857
Coupling. See Car coupling. Thill coupling.
Cover, extension, C. F. Shaw 468,833
Cradle and chair, combined, C. T. Freid 469,131
Crusher. See Ore crusher.
Cultivator, W. T. & J. D. Calton 468,907
Cultivator, G. W. Forbes 468,986
Cultivator, C. H. Hilbert 469,140
Cultivator, W. E. Williams 469,109
Cultivator, wheel, A. Lindgren 469,154
Curling iron, electric, A. F. Godefroy 469,135
Curtain attachment, J. C. Moore *et al* 469,164
Curtain rod, H. A. Fowler *et al* 468,987
Curtain stick and guide, Bailey & Cole 468,861
Cutter. See Cake cutter. Cheese cutter. Feed cutter.
Dental tool, R. G. Stanbrough 468,923
Dye. See Type die.
Digger. See Potato digger.
Disintegrating machine, J. M. Holmes 469,141
Distilling apparatus, N. Hunting 468,913
Door hanger, F. C. Hammond 469,043
Draught equalizer, P. A. Thrasher 468,978
Draught regulator, automatic, C. D. Howard 469,185
Drawing table or desk, adjustable, W. Cochrane 468,929
Drier. See Clothes drier.
Drying kiln, H. S. Servoss 469,067
Dust collector, W. A. Cockrell 468,964
Dust collector, O. M. Morse 468,935
Dynamometer, E. J. Wood 468,947
Dynamos and motors, field magnet for, R. Lundell 468,953
Earring, C. L. Marsters 468,883
Earth boring apparatus, J. H. Stokesbary 469,219
Egg crate, J. P. Berger 469,114
Electric cut-out, V. A. Thomas 469,220
Electric elevator, R. C. Smith 468,903
Electric machine or motor, dynamo, H. M. Byllesby 469,193
Electric search light, N. Weeks, Jr 469,050
Electric shocks, coin-freed machine for giving, J. Mason 468,955
Electrical conduit, E. T. Greenfield 469,208
Electrical heating currents, system of distribution of, G. D. Burton 468,938
Electrolytic cell, E. A. Le Sueur 468,880
Elevator. See Electric elevator.
Elevator controlling device, J. M. Locke 469,196
Elevators, electric brake mechanism for, C. E. Moore 468,917
Engine. See Carding engine.
Engine or machinery stop, J. Nesbitt 469,213
Engineer's leveling rod, civil, J. Beers 468,864
Engraving in relievo, machine for, P. Otto 469,047
Envelope gumming mechanism, J. Ball 468,925
Envelope or case, P. J. Fish 469,204
Extension table, C. Oberlander 469,214
Eyeglasses, B. E. Gregory 468,951
Fatty compound, viscid, A. Sommer 468,937
Feed cutter and corn husker, combined, Morton & Rowan 468,817
Felt boots, machine for forming, J. Brandy 469,007
Fences, wire tightener for, W. M. Skelton 469,218
Fencing, wire, T. J. Ingraham 469,062
Fertilizer distributer, G. E. Sparks 468,837
Fifth wheel, vehicle, Williams & Capps 468,905
File, newspaper, J. L. Deming 468,795
Filter, E. Boeing 468,984
Filtering apparatus, centrifugal, D. Williamson 468,858
Fire kindling, composition of matter for, H. W. Kling 469,086
Fish plate, H. W. Libbey 468,881
Fishing leader, G. C. Hemenway 469,015
Fishing purposes, snell and gauge for, G. C. Hemenway 469,016
Flask. See Pocket flask.
Floor thimble, A. G. Anderson .... 46 ,005
Flooring, fireproof, W. R. Forbush 469,082
Flower stand, J. W. Quinn 469,216
Fluids, apparatus for cooling, B. Rettenmeyer 468,919
Flushing apparatus, automatic, F. Walker 468,979
Fly paper, sticky, J. H. Smith 469,021
Folding table, T. Crane 468,791
Fork. See Mail bag catching fork.
Fruit picker, J. W. Cain 469,125
Furnace. See Gas furnace. Heating furnace. Zinc furnace.
Furnace, J. Hinstin 468,875
Furnace, S. J. Miles 468,814
Furnace for burning garbage, G. H. Warner 468,851
Furnace for burning garbage, etc., G. H. Warner 468,852
Game apparatus, G. S. Parker 469,089
Garbage receptacle, P. Scanlan 469,000
Gas apparatus, G. R. Waite 469,180
Gas furnace and producer, regenerative, F. Siemens 468,834
Gas furnaces and gas producers, working regenerative, F. Siemens 468,835
Gases, producing inflammable, A. Noteman 468,956
Gate. See Sewer gate.
Generator. See Steam generator.
Glassware, device for grinding and polishing, H. C. Wood 469,052
Glassware, manufacture of, G. Beatty 469,053
Governor, engine, Tompkins & Bigelow 469,105
Grate, W. & J. C. Swindell 469,070
Grease and stains, compound for removing, Cox & Lewis 468,866
Grinding mill, S. Hughes 469,145
Guano distributer, C. J. Peterson 468,826
Guard. See Cattle guard.
Gun lock, G. W. Werner 468,853
Gun sight, W. W. Harris 468,803
Hair dressing device, J. M. Sooshny 469,191
Hammer, granite, P. Denham 469,040
Hammer handles, locking means for, H. A. Brinton 468,784
Handle. See Adjustable handle. Tool handle.
Hanger. See Door hanger.
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Harness loop, H. H. Baker, Jr 468,932
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Heating system, J. H. Griffith 469,209
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Holder. See Bag holder. Candle holder. Chalk holder. Clothes line and clothes holder. Soap holder.
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Hydrant, fire, S. Brentano 468,781, 468,782
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Jar cap spanner, H. P. Hobbs 468,804
Joint. See Rail joint.
Joint for furniture, etc., J. W. Campbell 468,963
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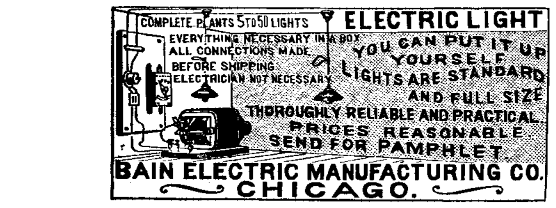

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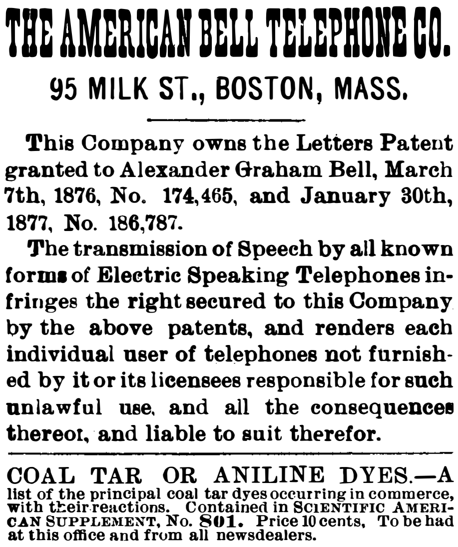

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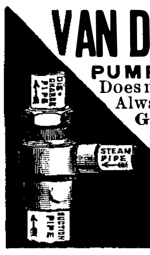

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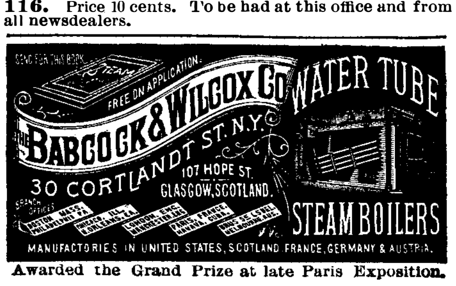

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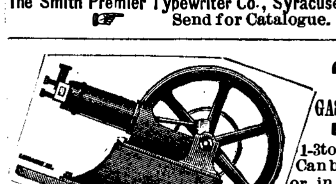

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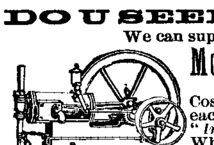

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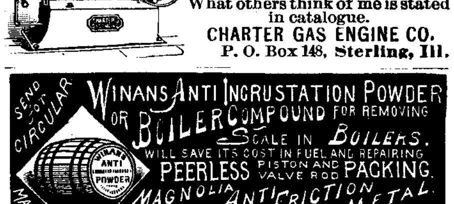

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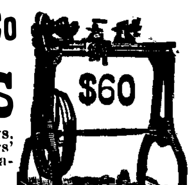

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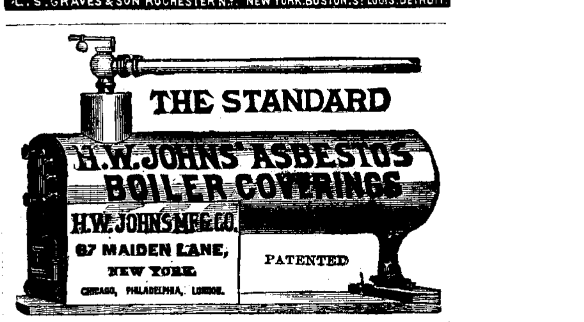

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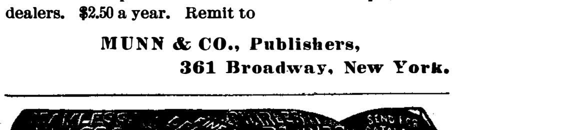

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