SCIENTIFIC AMERICAN

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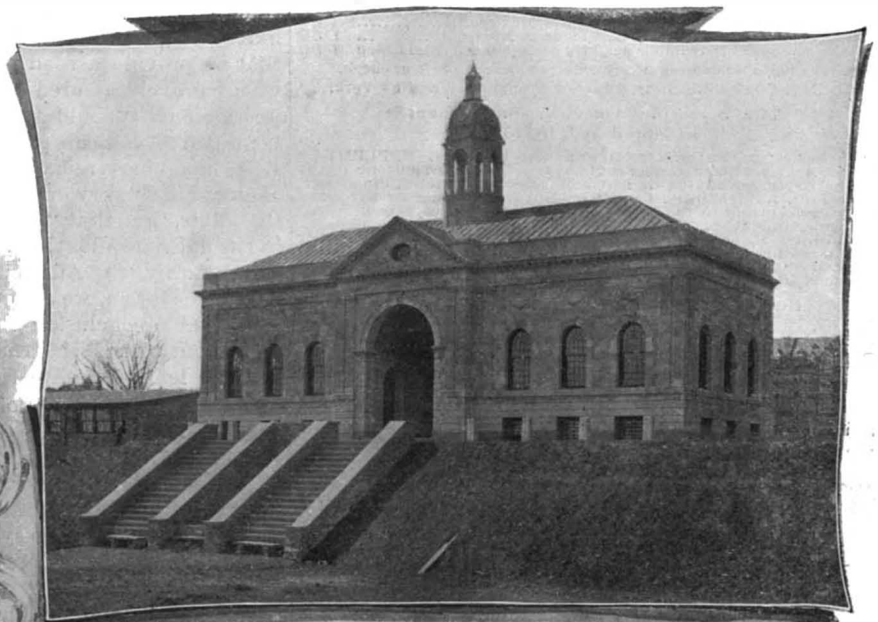
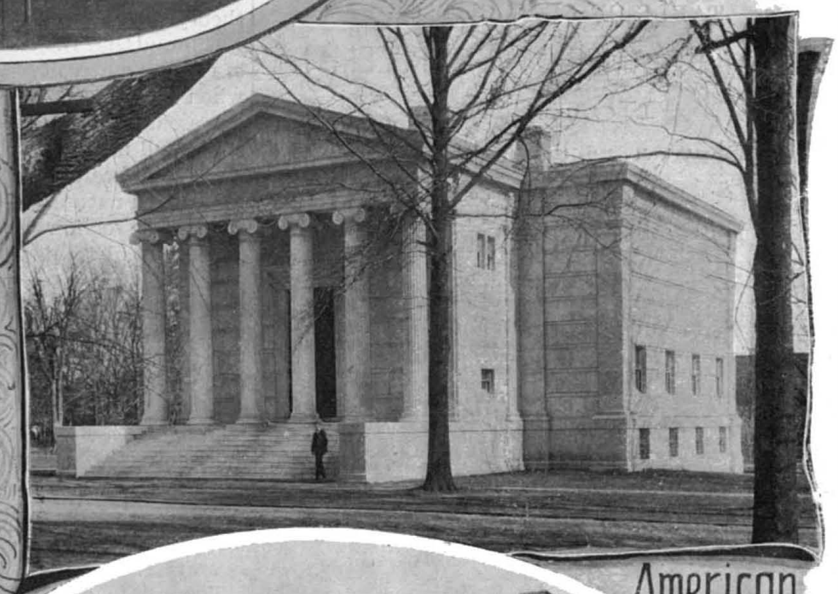
The Chapel.



Brokaw Memorial
New Athletic Grounds

J·C·Green·
Scientific School.

Library Building.



American
Whig
Society

University
Athletic Club.

The 150th Anniversary
OF THE
Founding of Princeton College.

(See page 317.)

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 24, 1896.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1086.

For the Week Ending October 24, 1896.

Price 10 cents. For sale by all newsdealers.

AMERICAN AND ENGLISH RAILROAD TRACK.

The long standing controversy as to the respective merits of the American and English systems of railroad track has lately been revived with considerable vigor in the columns of the English Engineer, and the various stock arguments have been brought out of the pigeonhole and presented, in company with such new facts as have developed with the improvements of the past few years, by a large number of more or less qualified writers and correspondents. In an editorial review of the discussion our esteemed contemporary betrays a woeful ignorance of the actual behavior of American track, in the construction of which it believes "nothing like finality has been arrived at." It further concludes that we provide a road "very difficult to repair;" and we are gravely assured that "a gang of platelayers" (section men) "could replace a couple of lengths of rail before an American gang would get the spikes out." Last, and most remarkable statement of all, we are assured that "very great difficulty is experienced with the joints," and that "one of the most serious objections to the flanged rail is that it is next to impossible to fish it satisfactory" (!) After such an arraignment of the alternative system, we are quite prepared for the writer's comfortable conclusion that he cannot "concede for a moment" that the English engineers have "anything to learn from American practice."

Among the many points of difference between American and English railroad practice, whether in roadbed or rolling stock, there are none so radical as those pertaining to the rail, ties and fastenings. With few exceptions, all the railroads of the world use one or the other of the two systems, and while the American is the most common, there are so many thousands of miles of the other system to be found outside of Great Britain and her dependencies as to save it in some measure from the charge of being antiquated or "behind the times."

The radical difference between the two systems lies in the shape of the steel rail itself: for it is this that determines the details of joints, ties and fastenings. The English roads use a double-headed or "bull-head" rail, which, instead of having the base flattened out to form a bearing surface on the ties, has its base formed into a rounded ball-shaped section similar to the head of the rail, but not so deep. Such a rail evidently has no power to stand up by itself, and it is necessary to provide cast iron bearers, known as "chairs," for the rail to rest in. These consist of a flat base, measuring generally about 7 inches by 10 inches, or 8 inches by 12 inches, which has two vertical jaws or braces, one of which is curved to fit snugly against the inside of the rail, the other being flat on its inside face and adapted to receive a hardwood key, which is driven in tightly between the jaw and the outside of the rail, and holds the rail in a vertical position. This form of rail was chosen in the days of iron rails from motives of economy, the idea being that, when the upper head had been worn down by the traffic, the rail could be taken out and reversed in the chairs. The theory was good; but the performance was bad. It was found that the chairs wore out a hollow in the base of the rail where it was seated upon them, and that when the rail was reversed the old base—now the head—presented a roughened surface, which made very noisy and uncomfortable riding. When the theory of the double-headed rail was proved to be wrong, it would have been natural to throw it aside and design a new rail, whose section should be determined solely by the work it had to perform. For some reason, however—probably an instinctive dislike to change—this was never done. What the English engineer did was to reduce the amount of metal in the base, and maintain this type—founded upon a wrong theory though it was—as the standard rail of English practice.

From these considerations, which are simple facts of history, it is evident that a strong prima facie case is made out in favor of the standard tee rail, whose section has been designed with a single view to carrying load, and is not modified, as is that of the double-headed rail, by any exploded theories of economy in operation.

The raison d'être of the English bull-headed rail is simply that it is a paternal legacy from the early days of railroading. What excellence the English track may possess to-day is obtained in spite of the inherent defects of the system, and is due to thorough, very careful, and, it is needless to say, very costly maintenance. If the chairs were thrown out altogether, and the weight of metal put into the rail itself; if their wide ties were split in half and more closely spaced beneath the rails, and if the miserably inadequate fishplates at the joints were replaced by heavy angle bars of the American type, the English engineers would find that, for the same total cost of construction, they would secure a quieter, stiffer and smoother riding track.

During a recent trip over some of the best English roads, we noticed that, while the level and alignment appeared to be perfect, there was a roughness and noisiness of riding, as compared with our best American track, which could not be accounted for merely by the stiff springs and disconnected axles of the rolling stock. We are satisfied that this is largely due to the wide spacing of the ties and the weakness of the joints. In regard to the first point, the ties are laid 3 feet apart, as against 2 feet and less in this country. Now the ideal track for smooth running is that which provides a continuous, longitudinal tie or "sleeper" beneath each rail. The great Brunel knew this, and built the Great Western Railway accordingly. If it were not for difficulties of maintenance, such as occur in drainage and level, we think this system would be more largely in use to-day. The old broad gage road had a smoothness of running that was very noticeable after riding upon a cross tie track. The cause of this was that the steel rail was evenly supported throughout its entire length, and hence (provided the tamping of the ballast had been evenly done), the elasticity of the rail was constant at all points. In the cross tie system, on the other hand, the rail is elastic between the ties and comparatively inelastic above them, the result of which is that there is a certain measure of shock as the wheel passes each tie. If the ties are spaced closely, this effect will be diminished to a point at which it can be neglected, as in the close spacing which obtains on American roads, where the distance between centers is less than 2 feet; but when they are spaced as in England, fully a yard apart, the effect must be sufficient to have a marked effect on the running. It may be claimed that this is pushing theory a little too far; but, if our English friends will apply the theory to the case of the single driver of one of their Great Northern engines, with its concentration of over twenty tons, they will at least agree that the rail with the closer spaced ties is in a better condition to receive the load than one with its ties a yard apart.

But by all odds the weakest place in the English track is at the joints, where the fishplates, answering to our angle bars, are singularly inefficient. This weakness is inherent in the bull-head system, and cannot be avoided. Owing to the space between head and base of rail being taken up by the jaws of the chairs above mentioned, it is impossible to extend the fishplates across the joint ties, as we do, and they are only a trifle longer than the distance between the inner edges of these ties, a matter of some 18 or 20 inches.

The arrangement cannot claim to be even a suspended or bridge joint, as the plates never reach the ties; and what stiffness the joint may have results from the cantilever action of the rail ends that project from the adjoining chairs. Moreover, the standard fishplate is without any lateral flanges, and, consequently, has very little lateral stiffness to keep the rails in alignment. The result of this inefficient design is seen the moment the train is in motion, especially if one is seated over a wheel in one of the six-wheeled "coaches." The joints give out a loud click as they feel the passing blow of the wheel, and the "hammering" is kept up with a painful monotony. It has been our custom to time the speed of a train by the click of the joints. When lighter rails were in use in this country, this was a ready means of ascertaining the speed; but to-day, on our best track, it cannot be done, for the reason that our joints no longer "hammer." There is never a time when one cannot sit in his seat and count the joints on an English road with the greatest ease.

The track of the New Haven road, from New York to New Haven, consists of 100 pound rail, 6 inches in depth, laid with 18 oak ties to the rail (as compared with 10 to the rail in England), upon 18 to 20 inches of broken stone ballast.

If it should ever be the privilege of the editor of our esteemed contemporary to take the run over this 80 miles of track, we think he would hasten to revise his opinion that "English engineers have nothing to learn from American practice."

OUR TRADE WITH THE SOUTH AMERICAN REPUBLICS.

The commercial alliance of the United States with the many sister republics which are strung out along the eastern seaboard of the southern continent was a favorite theme with the late James G. Blaine. Such an alliance would be natural; it is suggested by our geographical position; and there are historical and sentimental reasons why these people in the south should prefer to trade with us rather than with the nations of the old world. The Pan-American Congress was directed to this end; so was the great projected north and south railway through the isthmus to join our system to that of South America; and the remarkable interest shown by visiting delegates from that country during the World's fair at Chicago, in 1893, proved that the field is open and may be occupied, if a systematic effort be made to capture it.

Diplomacy can accomplish much in the way of preliminary work. It can remove artificial obstructions and rough out a roadway on which the wheels of commerce may travel; but it is to the joint efforts of commercial associations and the individual manufacturers that we must look for the actual development of trade. Nor can this work be done at home. It is necessary to be on the spot. If our merchants have better goods to sell they must be prepared to prove it by exhibiting them in the various countries side by side with the manufactured products of other competitors. Nor should the display be left to make its mute appeal to a people whose interest in the matter is not even awakened, and who, even if they had the interest, in many cases have not the intelligence to discern the superior excellence of any line of goods we might exhibit. The display should be placed in charge of a competent manager, well acquainted with the language of the country and with more than ordinary ability as a salesman. In other words, if our wholesale trade in these countries is to be successful, it must be pushed with something of that tireless energy and scrupulous attention to detail which characterizes the retail trade at home.

It gives us much satisfaction to note that the National Association of Manufacturers is getting down to systematic work on these lines by establishing in the city of Caracas, Venezuela, an "Exhibition warehouse for the display and sale of American products of various kinds." The aim of the association is to stimulate trade between the United States and Venezuela by familiarizing the merchants of Venezuela with the American products which they can purchase to advantage.

To carry out this plan it is proposed to lease a large building in the city of Caracas, which is admirably adapted by location and otherwise for the purposes of this exhibition. Samples of American manufactured products salable in Venezuela will be placed in this building, and the exhibition will be placed under competent management, solely under the control and direction of the National Association of Manufacturers.

It will be the endeavor of the association to charge exhibitors at a rate which will about cover the cost of maintenance. It is estimated that an entrance fee of $100 from each exhibitor and a charge of $1.50 per annum per square foot of space used for exhibits will yield enough to cover, or nearly cover, the running expenses of the warehouse. The minimum charge for space has been fixed at $25 per annum. This, with the entrance fee, would make the minimum charge for any exhibit $125 per annum, in addition to the costs of transportation from the United States to the warehouse in Caracas.

Exhibitors will be subject to no other charges, outside of the entrance fee and the charge for space above mentioned. The services of the manager and his assistants will be rendered without additional cost, and each exhibitor will have a trained salesman to look after his interests.

Commenting upon the opportunities for American trade in Venezuela, Mr. Theodore C. Search, president of the association, says: "From close investigations, it is believed that the American prices of hardware will compare favorably with the English. The German prices are low, but there is no comparison between the German and American goods, so far as quality is concerned, and Venezuelan merchants in hardware appreciate this.

"Furniture of a poor quality is mostly made in the country, but it is extremely expensive. There is undoubtedly a splendid opportunity for the introduction of American furniture.

"No leather is manufactured in the country, except a very poor quality, and as most of the shoes now selling in Venezuela are made in the country, there is a very satisfactory market for the sale of manufactured leather, uppers and shoe findings.

"If Venezuela should become better acquainted with the merits of American machinery and labor saving appliances, there would be no question that a good trade might be found there, but samples of this line of goods must be shown there before they can be sold, as the Spanish-American can seldom form any comprehensive idea of the merits of a piece of machinery from printed matter.

"The machinery used on the coffee and cocoa plantations comes mostly from England and Holland. It is believed, however, that this class of machinery is very heavy and cumbersome as compared with that of the United States.

"In brief, it is the opinion of the merchants of Venezuela that the following articles might be imported from the United States with profit, in addition to those that are now going in, viz.: American building material, hardware, common glassware, cutlery, fencing wire, mining and sugar machinery, agricultural implements, carriages, cars, steam engines, lumber, cotton goods, certain kinds of wearing apparel, and all kinds of articles for home furnishing and decoration, carpets, curtains, rugs, and novelties."

The value of our imports into Venezuela during the six years from 1889 to 1894 has varied from $3,738,961 in 1889 to $4,716,047 in 1891. During the same period the exports to the United States from Venezuela ranged from $12,078,541 in 1891 to $3,464,481 in 1894. In 1895 the exports were $3,740,464 and the imports $10,073,951, a falling off in exports, but a great increase in imports over the preceding year.

England supplies Venezuela with cottons, woolens and general merchandise; the United States furnishes breadstuffs, some cotton goods, oils, provisions and considerable machinery; Germany sells cotton goods, hardware, cutlery and general merchandise; France, silks and fancy goods; Spain and Cuba, wines and tobacco.

The trade of Venezuela with the United States and the principal European countries during the year 1894 was as follows:

	Imports into Venezuela.	Exports from Venezuela.
United States	$4,089,732	$3,464,481
Great Britain	3,344,565	706,674
France	1,196,600	9,264,000
Germany	1,740,018	5,229,574
Spain	350,859	601,134
Belgium	50,146	2,746

We commend this subject to the attention of our readers as containing a very practical solution of the problem as to the best method of introducing our manufactured goods into countries where they are at present comparatively little known.

The Indiana in a Gale of Wind.

On her trip from Hampton Roads to New York Harbor, the Indiana passed through the heavy gale which recently swept along the Atlantic seaboard. It was a trying experience for both ship and crew, and the accidents which happened show in a very dramatic way what enormous strain these ships are subjected to by the ponderous guns and armor with which they are loaded down. A battleship riding quietly at anchor in a sheltered bay and a battleship rolling 36 degrees in a gale of wind are two very different things, and it is in the wrenching and pounding of heavy weather that the strength of structure is tested and any weak spots are developed. The accident which happened to the Indiana has frequently occurred in other navies of the world, and indeed, had it not been for the shortness of the time, stronger clamps would have been fitted to the Indiana before she started out on this last cruise.

The story of that night's struggle with the runaway guns and turrets is a thrilling one as told to the New York Times by Captain Evans, and we give a few extracts below:

"Soon after we left Hampton Roads Monday all four of the 8 inch turrets broke loose at once from their gearing. That was about 2 o'clock in the afternoon. We went to work with 5 inch hawsers to tie the guns up.

"We tied the two forward turrets together by binding the guns each to the other and fastening the hawsers to the bits, and managed the aft ones the same way. It was a very hard job. About 2 o'clock the next morning the forward ones snapped their hawsers and got loose again. The storm was then very severe, and the ship was rolling at an angle of 36 degrees. The decks were flooded with water, and this, with the pitching of the ship, made working on deck very dangerous. It was black as ink, and we could not see how to get in order to head to sea. We could only guess.

"To make matters worse, the forward 13 inch gun turret got loose, and those enormous guns began thrashing about in full command of the deck. The 13 inch guns knocked great dents in the scupper pipe, broke stanchions and threatened to tear away the entire superstructure.

"It was very dangerous to work in that storm. I was afraid of losing two or three dozen men, and if I had not had the best crew in the world I don't know how we would have come out. We fastened a 5 inch hawser on the 13 inch gun and it snapped like a cotton string.

"We finally caught the big guns with an 8 inch hawser and tied them securely to the superstructure. It was an awful job, though, and we were in danger of being washed overboard every minute. All during the work the deck was completely flooded."

A Movable Post Office on the Streets of New York.

A postal van for collecting the mail, and sorting it on the way to the general post office, has recently made its appearance on the streets of New York. It is drawn by a pair of horses and its internal arrangements are somewhat similar to those of the new postal cars which were recently placed on the Third Avenue cable road. In size and appearance it is not unlike an ordinary Fifth Avenue bus. It is painted a plain white, unrelieved by any striping, and entrance is made from the rear by a door, below which are steps reaching well to the ground. Along the left hand side of the car is fixed the sorting and stamping table, and the front end is taken up with a letter rack. In the ceiling are placed two powerful gas burners which are supplied from storage cylinders, arranged beneath the floor of the van. A driver and two clerks are assigned to each vehicle.

The post office authorities have shown commendable enterprise in placing these experimental vans in service. They are a further extension of the idea which led to the placing of postal cars on the cable roads, which is to utilize the time occupied on the journeys from sub-post offices to the general office, by sorting the mail in transit. The postal van can reach sub-offices which are not served by the cable cars; and its greater mobility will render it an exceedingly useful branch of the service.

Polishing Aluminum.

Aluminum will take and retain a very high polish—fully equal to that of silver. The truly distinctive and beautiful color of aluminum is best brought out in a highly polished plate. Aluminum can be polished on a buffing wheel with rouge, the same as brass; and for polishing any considerable quantity of sheet this, of course, is the most economical way. In the absence of any special aluminum polish, several of which are on sale, the ordinary cold brass polish will be found quite efficient, if it is ground fine enough. "Acme Polish" has earned a well merited reputation in America; it consists of the following materials: Stearic acid, 1 part; fuller's earth, 1 part; rottenstone, 6 parts. The whole ground very fine and well mixed. Use a fine white polishing composition, or rouge, or tripoli, and a sheep skin or chamois skin buff, although it is often polished with an ordinary rag buff. A steel scratch brush run at a high speed will give a high polish to sand castings, and will remove any yellowish streaks that may have been produced by too hot metal. A fine brush gives a most beautiful finish to sheet metal or to articles manufactured from the sheet. By this means a frosted appearance is given to the metal—an effect in many cases equal to that given by a high polish. Remove the grease and dirt from the plates by dipping in benzine. To whiten the metal, giving a beautiful frosted surface, the sheet should be first dipped in a strong solution of caustic soda or potash. This solution should be strong enough to blacken the metal. The plates should then be dipped in a mixture of two parts of strong nitric acid and one part of strong sulphuric acid; then in a solution of undiluted nitric acid; afterward in a mixture of vinegar and water, and finally washed thoroughly in water and dried as usual in hot sawdust. For burnishing, use a bloodstone or steel burnisher. For hand burnishing, use either a mixture of melted vaseline and kerosene oil or a solution composed of two tablespoonfuls of ground borax dissolved in about a quart of hot water, with a few drops of ammonia added. For lathe work the burnisher should wear upon the fingers of his left hand a piece of canton flannel, keeping it soaked with a mixture of melted vaseline and kerosene, and bringing it in contact with the metal, in order to supply a constant lubricant. Very fine effects can be produced by first burnishing or polishing the metal, and then stamping it with polished dies, showing unpolished figures in relief. In spinning or turning aluminum plenty of oil should be used to prevent the clogging of the tool, and to make it cut smooth in the turning, and to assist in the spinning.—From the Aluminum World.

Method of Making Diagram Ground Glass Slides.

BY H. WOOD.

Scratching diagrams on gelatine, celluloid and other substances has been advocated when one wished to make a small tracing to project by means of a lantern. These scratchings have to be filled in with black in order to enable them to be seen clearly, and they have the disadvantage that, if a mistake is made, it cannot altogether be eradicated; besides, it is no easy matter to thus etch a line, as there is a great tendency for the point to run more or less to one side.

The Dallenger method—used first by Dr. Dallenger—is to get a piece of extremely fine ground glass, lay it upon the diagram to be copied, and trace it with pencil. Should it be required to take out certain lines, these are easily rubbed out with a piece of rag and water.

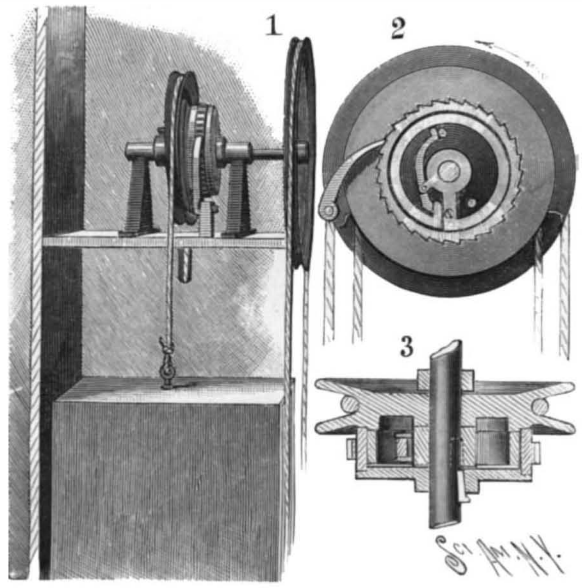
When the sketch is finished the glass is coated with spirit varnish, which intensifies the pencil marks, and at the same time renders the ground glass quite transparent, as the varnish fills up the inequalities caused in the grinding; and thus to all intents and purposes converts the glass again into clear glass, so that the diagram appears as though it had been drawn with Indian ink upon clear glass.—The Optical Magic Lantern Journal and Photographic Enlarger.

Broke the High Kite Record.

The observers at the Blue Hill observatory have sent to William A. Eddy definite details of their great kite ascension of October 8, when records were made with their meteorograph at a height of 9,385 feet above a level. More than three miles of piano wire were paid out, the ascension beginning at 9:15 A. M. and ending at 9:05 P. M. The pull on the wire was from 20 to 50 pounds at the start, and ranged from 50 to 95 pounds at the highest point, after which it slowly decreased. The instrument entered and passed through the clouds, as shown by the record of very dry air above the clouds. The temperature fell from 46° at the hill to 20° at an altitude of 8,750 feet. The meteorograph record in ink on a revolving cylinder run by clockwork was the best yet obtained. The lifting force consisted of seven Eddy and two Hargrave kites from six to nine feet in diameter, and the ascension was managed by Clayton, Fergusson, and Sewatland of the observatory. The instrument was more than a mile high during three hours. This breaks all kite altitude records. The height, 9,385 feet, is about 1,000 feet less than two miles.

A NEW DUMB WAITER SAFETY CLUTCH.

The illustration represents an improvement in the hoisting apparatus for dumb waiters, which has been patented by Anton Larsen, of One Hundred and Thirty-fourth Street and Brook Avenue, New York City. The construction is strong and not liable to get out of order, and the arrangement is such that the cage, with its load, will be safely held at any point when one lets go of the hoisting rope. Fig. 1 shows the application of the improvement, Figs. 2 and 3 being sectional views. At the top of the usual dumb

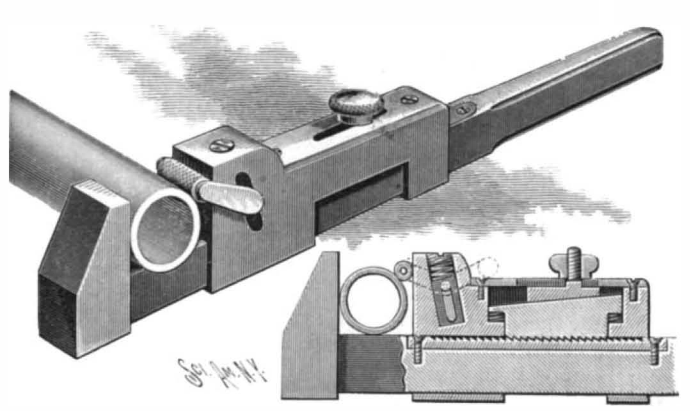


LARSEN'S DUMB WAITER SAFETY CLUTCH.

waiter well is journaled a shaft on which loosely turns the pulley carrying the counterbalanced cage rope or cable, the hoisting pulley being secured on the outer end of the shaft, and the hoisting rope passing over it with two downward runs, either of which can be taken hold of to pull the load up or draw it down. On the shaft, near the cage-carrying pulley, a disk is secured by a key, as shown in Fig. 3, and on the inner face of the disk are two lugs, one adapted to engage an arm at one end of a spring friction band, while the other is adapted to engage a lever fulcrumed on the band. The arm of this spring band extends inwardly, and is secured by a screw to the cage-carrying pulley, the arm also having an opening for the passage of the hoisting shaft. The band is fitted within a ring-shaped ratchet wheel engaged by a pawl, as shown in Figs. 1 and 2. The arrangement is such that a downward pull on one run of the hoisting rope causes the lug on the disk to engage the lever to effect an opening of the spring band, and move it out of frictional contact with the inner face of the ratchet wheel, as shown in Fig. 2, when motion is transmitted to the cage-carrying pulley in the direction indicated by the arrow. At the moment that the pull on this run of the rope is released, the friction band moves back into its normal position, or into strong frictional contact with the inner surface of the ratchet wheel, which is held against rotation in an opposite direction by the pawl, thus holding the cage, with its load, stationary in the well. The spring band is sprung into position in the ratchet wheel, and is adapted to engage it with a force more than that of the highest load to be carried by the cage. This is the fifth patent which this inventor has obtained through the SCIENTIFIC AMERICAN patent agency.

A COMBINED PIPE AND MONKEY WRENCH.

This wrench, which has a roller jaw fulcrumed in arms on its movable jaw, has been patented by



DIXON'S PIPE AND NUT WRENCH.

Thomas Dixon, of Highland Avenue, McKeesport, Pa. One of the figures in the engraving shows the wrench in use, and the other is a sectional view. Within the movable jaw is a recess in which is a block having on its bottom teeth adapted to engage teeth in the top of the wrench handle, springs normally holding the teeth of the block up out of such engagement, and permitting the movable jaw to slide on the handle. The top surface of the block is inclined, and is engaged by a longitudinally sliding wedge to move the block down against the tension of the springs and into engagement with the teeth on the handle, a thumb nut on a screw projecting upwardly from the wedge facilitating its ready adjustment as the movable jaw is to be moved forward or backward or fixed in any desired position relative to the outer jaw. The tool is adapted for use as a pipe wrench by the addition of a roller jaw journaled in arms on a transverse shaft or pin which slides in bearings near the front end of the movable jaw, a spring resting on the shaft being engaged by a screw block. As shown by the dotted lines in the sectional view, the roller jaw is moved to a rearward position when the tool is to be used as a monkey wrench, being swung forward only when it is desired to use the wrench as a pipe wrench.

The Vital Statistics of Egypt.

The vital statistics of Egypt, as recently published by the Lancet, are full of matter for reflection. In the first place, the rate of increase can be paralleled in no European country at any period since records have been kept. It represented 1·79 per cent in the year 1894!—births reaching nearly 42 per 1,000, while deaths only reached 24 per 1,000. If there be any fraud in the return, it must go to diminish the asserted increase, not to enlarge it, for the motive would be to evade conscription. A death rate of only 24 per 1,000 in a country which ignores sanitation is startling; but the wonder grows immeasurably when we observe that in Alexandria and Cairo, where laws of health are enforced as strictly as may be, deaths represent 86 per cent of births, while in the rural districts they are but 54 per cent. It is the consequences, however, which interest us. In 1894 the population of Egypt below the Second Cataract was estimated at 8,000,000; the census of 1882 showed 6,469,710. A rise of 1,500,000 in twelve years! Authorities have hesitated hitherto to credit the population of 12,000,000, in the time of Rameses II, which Champollion and the French savants made out upon such evidence as they could find. But these extraordinary returns make it quite probable. The land under cultivation then was vastly more extensive than now. But the encroachment of the desert can be repelled, if an irrigation system equal to that of old be once more established. Egypt, therefore, has a boundless expansion. But if the people multiply at such a rate under the pax Britannic, so they must in varying degrees elsewhere, and not in all our colonies is there surplus land for them to occupy. But meanwhile the birth rate of Europe steadily lowers. Any one can draw conclusions.

Measurement of Hallucinations.

PROF. SCRIPTURE, IN SCIENCE.

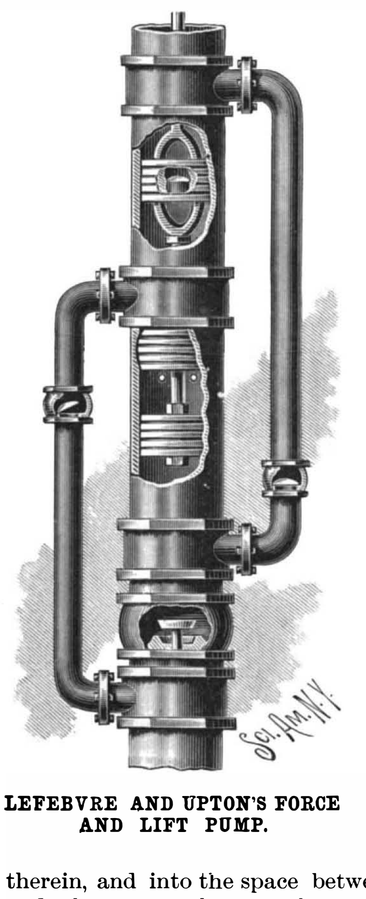
A typical case of the application of the method is found in measuring hallucinations of sound. The person experimented upon was placed in a quiet room and was told that when a telegraph sounder clicked, a very faint tone would be turned on, and that this tone would be slowly increased in intensity. As soon as he heard it he was to press a telegraph key. The experimenter in a distant room had a means of producing tone of any intensity in the quiet room. In the first few experiments a tone would be actually produced every time the sounder clicked, but after that the tone was not necessary. It was sufficient to click the sounder in order to produce a pure hallucination. The persons experimented on did not know they were deceived, and said that all tones were of the same intensity. The real tone could be measured in its intensity, and since the hallucination was of the same intensity, it was also indirectly measured. Similar experiments were made on other senses. For example, in regard to touch, a light pith ball would be dropped regularly on the back of the hand to the sound of the metronome. After a few times it was not necessary to drop the ball. The person would feel the touch by pure hallucination.

Similar experiments were made on taste. Of six bottles two contained pure water and the other four a series of solutions of pure cane sugar—the first one-half per cent, the second one per cent, the third two per cent, and the fourth four per cent sugar, according to weight. A block was placed in front of them so that the observer could not see them, although he was aware that they stood near him, because he saw them when he received his instructions. It was required of him to tell how weak a solution of sugar he could positively detect. The experimenter took a glass dropper and deposited drops on his tongue, drawing first from the two water bottles, and then from the sugar solutions, in order of increasing strength. The sugar in the solutions was detected in the first trial. Proposing to repeat the test, the experimenter proceeded as before, but drew from the first water bottle every time. The result was that when the pure water had been tasted from two to ten times the observer, almost without exception, thought he detected sugar. A test on olfactory hallucinations was conducted similarly, with the result that about three-fourths of the persons experimented upon perceived the smell of oil of cloves from a pure water bottle. In another set of experiments the subject was told to walk slowly forward till he could detect a spot within a white ring. As soon as he did so, he read off the distance on a tape measure at his side. The spot was a small blue bead. The experiment was repeated a number of times. Thereafter the bead was removed, but the suggestion of having previously traversed a certain distance was sufficient to produce an hallucination of the bead. It is to be clearly understood that the persons experimented upon were perfectly sane and normal. They were friends or students, generally in total ignorance of the subject, who supposed themselves to be undergoing some tests for sensation. One case was found, however, of a suspicious observer who expected deception and who declared that he had waited every time till he was sure of the sensations; the results were just as hallucinatory as usual. The value of the method and the experiments lies mainly, I think, (1) in pointing out a method of determining the portion of a sensation due to the suggestion of circumstances rather than to the stimulus; (2) in application to mental pathology; (3) in beginning a scientific treatment of hypnotism and suggestion.

LEFEBVRE AND UPTON'S FORCE AND LIFT PUMP.

This is a pump designed to throw or lift a continuous stream of water, having a plunger barrel containing two reciprocating plungers separated from each other by a packing fixed in the barrel. A suction pipe having a valve extends from the lower end of the pump barrel, and a valved pipe leads from the suction pipe above its valve to the barrel above the uppermost plunger, while a second valved pipe leads from the suction pipe below its valve to the barrel between the upper plunger and the fixed packing.

The improvement has been patented by Julian L. Lefebvre and Charles S. Upton, of Eureka Junction, Washington, and in the illustration parts are broken out to show valves, plungers and fixed packing. The plungers are rigidly connected by a stem which passes through the packing, and the upper plunger rod extends upwardly through the discharge pipe to connect at its outer end with a power mechanism. The upper plunger is made with two cylindrical parts screwed together, and has a valve which opens upward on the down stroke of the plunger and closes on its upward stroke. When the plungers are on the up stroke, as shown in the engraving, water drawn in through the suction pipe passes into the lower part of the pump barrel and also up the pipe at the left, past the valve therein, and into the space between the fixed packing and the upper plunger, the water above the upper plunger being at the same time forced out through the discharge pipe. On the down stroke of the plungers the water previously drawn in at the lower end of the barrel section is forced by the lower plunger up through the pipe at the right into the discharge pipe, and the water in the pump barrel above the fixed packing is also forced through the valve in the upper plunger to the discharge pipe. Just below the fixed packing are air openings in the pump barrel to permit air to pass in and out on the up and down movement of the lower plunger. The pump is not liable to get out of order and the several parts may be readily taken apart for repairs when necessary.



LEFEBVRE AND UPTON'S FORCE AND LIFT PUMP.

M. GROSHEINTZ (says the Gas World) has been investigating the action of coal gas on rubber tubing. He found when a pressure gage was connected to the gas supply by means of a rubber tube and the stopcock closed, in twelve hours there was not only no pressure, but actually a defect of pressure indicated by the gage. Then he found that the tube had gained weight, for it had absorbed and, as it were, dissolved the gas; and then he found that the greatest sinner in this respect was the purest rubber, black rubber, which contains ½ to 1½ per cent of solids; next came red rubber, with its 11 or 12 per cent; and the best of all was the ordinary gray rubber, with its 52 to 55 per cent of added solid material. The last will endure the longest time before allowing gas to permeate it so as to produce a smell in the apartment.

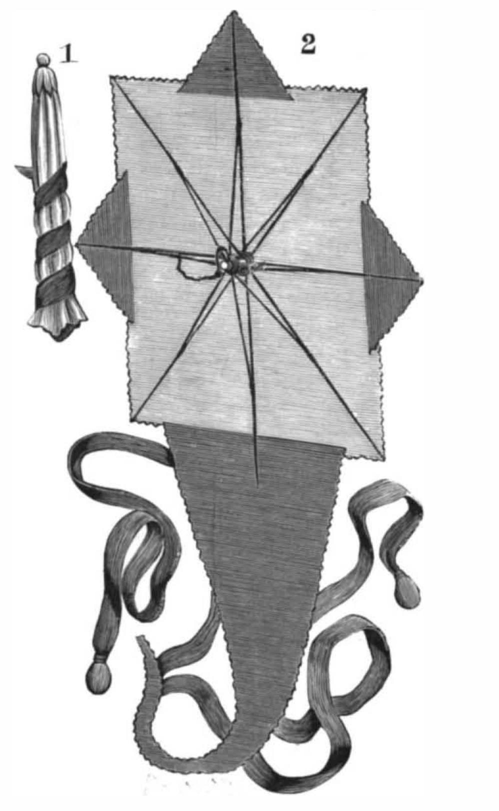
THE AEROPHILE.

Since schoolboys will have the run of the fields for a few weeks to come, we shall make known to them a companion that loves liberty as much as they do. It is a question of a kite—not of that cumbersome and fragile object that as children we pulled with great trouble over the brush or through the fields, only to see it wrecked upon a rock or a bush, but of a strong and easily transportable affair, that rises so readily into the air that it has been named the "aerophile."

The frame, which is metallic, and like that of a parasol or umbrella, presents the triple advantage of offering great resistance, of assuring perfect stability to the kite, and of being capable of closing so as to take up but little space in a trunk or handbag. The covering is of cloth, and there is therefore no tearing to be feared at the first collision with some object. As for raising the kite, that is a very easy matter. The frame having been spread, it suffices to fix the string to the central ring either by a knot or by means of a small hook that, if need be, may be formed of a hair pin.

The tail, which is formed of ribbons three or four yards in length, is provided at its lower extremity with pockets designed to receive sand or pebbles as ballast. These pockets are filled more or less, according to the strength of the wind, and are closed with a string or a rubber band.

The aerophile is capable of raising relatively heavy weights, and may therefore be used for experiments that necessitate the lifting of certain apparatus of light construction, such as photographic apparatus, registering apparatus, etc.—L'Illustration.



THE AEROPHILE.
1. Apparatus closed. 2. Apparatus open.

AN IMPROVED COFFEE DRIER.

Coffee is grown on small trees and resembles a big cherry, in which the pit is replaced by two grains of coffee, face to face, coated with a parchment-like cover, but, rather surprisingly, the surrounding meat, or pulp as it is called, is said to be poisonous. The latest method of cleaning it is as follows : The freshly picked berries are continuously fed into a "pulper," chiefly consisting of a roughened face cylinder rotating in close proximity to a breast plate, which separates the pulp from the pits. As considerable of the pulp still adheres, the berries are now introduced into the "washer," filled with a running stream of water, and composed of a round bottomed iron trough through which a rapidly revolving shaft extends, containing numerous paddles. The coffee must next be dried to enable the removal of the parchment cover. This is usually accomplished in a natural way, by spreading it out on barbacoes—expensively prepared hard floors of earth or brick—where it is exposed to the sun's rays for a week or more, during which it is repeatedly turned over by laborers, and is often liable to injury by sudden rains, cloudy weather, or uneven handling. Evidently this is a very objectionable method of treating such a valuable and delicate product, and, consequently, numerous attempts have been made to dry it artificially, but they have repeatedly failed, owing to the tenderness of the berry and its excessive percentage of moisture. In complete plants using drying machines the best practice is to mechanically extract the surface water from the washed coffee in a centrifugal, very similar to those employed in refining sugar, then evaporate the remaining moisture in the drier.

The coffee is afterward fed into the huller, much like a large coffee mill, which rubs off the parchment cover, which is removed by an attached exhausting fan, separates and polishes the berries and discharges them in a clean condition. The berries are then passed through a winnower, which separates the coffee into different grades and delivers it ready for the market. The coffee planter formerly performed these laborious operations by hand on very crude apparatus, but now the large plantations generally include an expensive cleaning plant, as perfectly arranged as a flour mill and managed by a skillful foreigner.

Mr. S. E. Worrell, of Hannibal, Mo., has built and introduced a successful drying machine, which is illustrated herewith. Fig. 3 is a perspective view of the largest size machine, No. 4, having a capacity for handling 10,000 pounds of washed coffee per day of twenty-four hours, in which the drying cylinder is six feet in diameter by fifteen feet long. Two smaller sizes are made of a capacity of 5,000 and 2,500 pounds each per day. The rotating cylinder, A, as shown in the sectional views, Figs. 1 and 2, is made of steel plate, covered by a wood jacket to save heat and equalize the temperature, and has at each end a heavy iron rim, supported and rotated by two chilled iron flanged rollers, carried on short steel shafts, journaled in inclined selfoiling boxes bolted to iron bed plates resting on timber blocks and stone foundations. Motion is transmitted to the cylinder through the taper drum pulley, spur gearing, sprocket wheels and chain belt, from a countershaft overhead. To the inside of the cylinder are attached a series of segmental pockets, I, as shown in Figs. 1 and 2, of galvanized steel plate, the inner sides of which are gridironed with numerous traverse slots, i, for dropping the washed coffee in the falling streams, J. In rotating cylinder driers as heretofore constructed these streams have extended longitudinally through the drying chamber, which permits a portion of the hot air to escape without doing its duty—a waste which is saved in these machines.

In operation a charge of 5,000 pounds of washed coffee is introduced into the stationary drying cylinder from the floor above, by movable spouts, through the five upper doors, H, and then the apparatus is put into motion. During each revolution of the cylinder the damp berries are carried up and dropped down in the numerous transverse streams, J, extending entirely across the interior drying chamber. The exhausting blower draws the air down into the top of the steam heater, containing 800 feet of steel pipe, seen in the background of the engraving, where it is heated to the required temperature, which is indicated by a thermometer, and the hot air is forced into one end of the drying drum. After passing through the drum in the direction of the arrows in Fig. 2, it is discharged through the open gates shown in the top of the pipe at the extreme left of the large engraving. To equalize the operation the direction of the hot air currents is reversed at regular periods by manipulating a gate in the air pipe where it branches near the blower, not in view in the cut. From time to time a small sample of coffee is removed from the doors, H, without stopping the apparatus, to examine its condition. When the contents are thoroughly dried all these doors are opened and the coffee is dropped on the cooling floor underneath, or, if preferable, the gate in the pipe connecting the blower with the steam heater is closed and a special gate of the blower is opened, admitting cool air, which quickly cools the coffee before discharging it, in which event it can be immediately fed into the hullers or stored in bulk. The wire cloth division rings, L, and air distributers, c, prevent drifting of the coffee. A belt shifter on the taper drum driving pulley is provided to gradually increase the speed of rotation of the drying cylinder, as the segmental pockets, I, empty more rapidly as the product becomes drier. As the exhaust steam from the engine driving the plant is utilized in the heater and only six motive horse power is required for running the drier, the expense of the drying operation is very moderate.

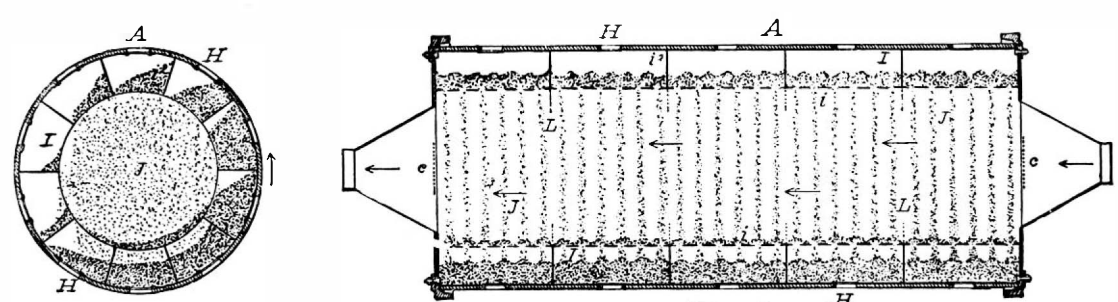


Fig. 1. Fig. 2.

WORRELL'S COFFEE DRIER—SECTIONAL VIEWS.

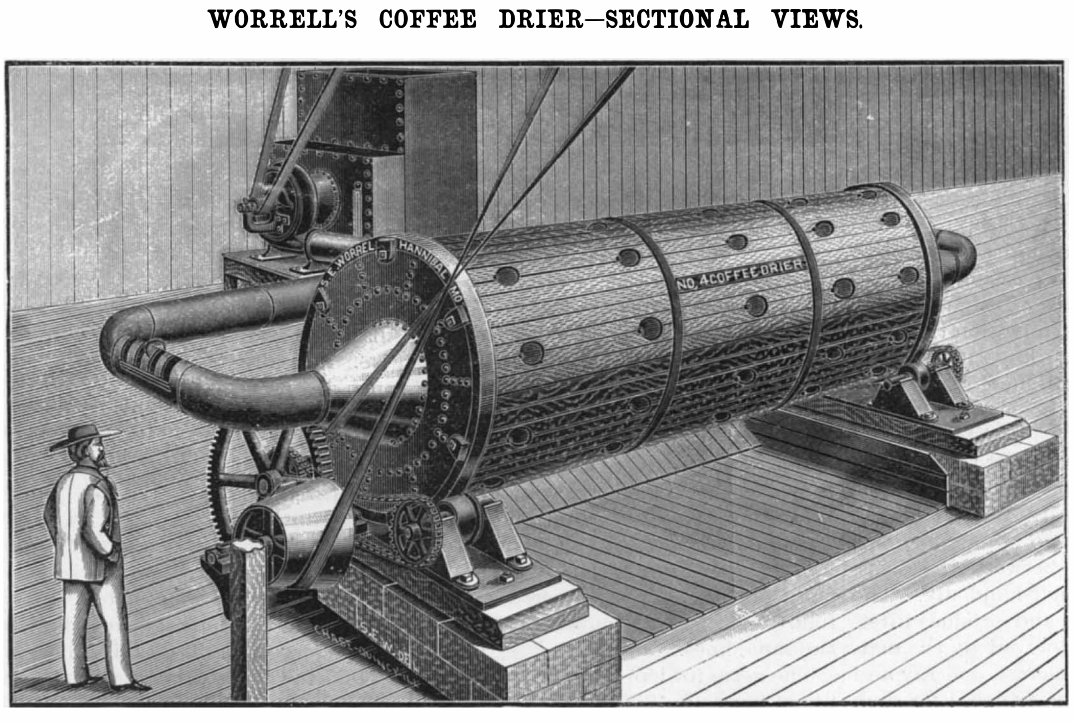


Fig. 3.—WORRELL'S COFFEE DRIER.

A Neolithic Burial Ground.

The discovery at Worms of a burying ground belonging to the later stone age, by Dr. Koehl, the conservator of the Paulus Museum there, is, in view of the rarity of such graves, an important archæological event, says the London Standard. Up to the present about seventy graves have been examined, or only a part of this burying ground of neolithic man, and already the number of the vessels found, most of them very tastefully ornamented, exceeds one hundred. Not the slightest trace of a metal has as yet been discovered in the graves ; on the other hand, the presence of arm rings of blue and gray slate is curious. In the most recently opened graves of women three arm rings made of slate were removed from the upper arm of one skeleton, four from that of another and six from the lower arm of a third skeleton. In a man's grave there was on the neck of the skeleton a small conically polished ornament of syenite, not perforated, but provided with a groove for the string. The other ornaments from the graves consist of pearls, mussel shells made in the form of trinkets, perforated boars' tusks and small fossil mussels. These ornaments were worn by men and women alike. There existed, according to this, every kind of ornament, in that time of want of metal, made of stone, mussels and bones. Ruddel and ocher fragments, which were used for tattooing and coloring the skin, are also frequent.

In hardly a single case was there missing from the women's graves the primitive cornmill, consisting of two stones, the grinding stone and the grain crusher. The men's graves contain weapons and implements, all of stone, with whetstones and hones for sharpening purposes. They consist of perforated hammers, sharpened hatchets, axes and chisels, as well as of knives and scrapers of flint. That there was no want of food is shown by the many vessels, often six or eight, in one grave, and the remains of food found near them, the latter being bones of various kinds of animals. Several successful photographs have been taken of the skeletons as they lie in the graves with their belongings, so that their appearance after a repose of thousands of years can be preserved for all time. Especial value may be attached to these remains, and particularly to the skulls, of the successful recovery of which Prof. Virchow has already been apprised.

Science Notes.

Five new asteroids were discovered on photographs of the heavens one evening recently by Dr. Max Wolf, of Heidelberg. This brings the number of minor planets up to 423.

A French physicist, M. Chassevant, has found that by adding alcohol to the water the generation of acetylene gas from calcium carbide can be regulated much better than by using water alone.

A thought weighing machine has been invented by Prof. Mosso, the Italian physiologist, the rush of blood to the head turning the scale. The machine is said to be so delicate that it can measure the difference in the exertion needed to read Greek from that required for Latin.

A block of granite bearing the following inscription has, says the Academy, been recently placed on the southern shore of the Lake of Sils in the Engadine: "In memory of the illustrious English writer and naturalist, Thomas Henry Huxley, who spent many summers at the Kursaal Hotel, Maloja."

A twelve year old boy at Parma has just had his heart washed. He was suffering from acute pericarditis, and his doctor, using an instrument invented by Prof. Riva, drew off the purulent serous matter in the sac, and then washed the heart and its serofibrous covering with a solution of sodium biborate. The boy recovered rapidly.

Prof. Flinders Petrie has some large ideas about museums. He wants the government to buy a tract of 500 acres, somewhere within an hour's ride of London, and gradually build it all over, for a storage place for ethnological materials. No museum in London is large enough to hold the treasures that are being discovered by Englishmen all over the world.

Leydenia gemmipara Schaudinn is the name given to a parasitic amœboid rhizopod which Berlin professors have recently found in the fluid taken from patients suffering from cancer of the stomach, and which they think may possibly be the cause of the disease. The discovery of this new form of protozoa was made at Prof. Von Leyden's University Hospital.

It is announced from Berlin that Herr Dormann, of Bremen, has succeeded in photographing objects, by Roentgen's method, through iron plates 22 centimeters (8½ inches) thick. He has already taken more than fifty such photographs. Prof. Slabyc, of the Charlottenburg Polytechnic Academy, who is greatly interested in this achievement, will continue Herr Dormann's experiments.

The Austrian war vessel Albatros telegraphs from Cooktown, Queensland, that a party from that ship, detached for purposes of scientific research, was attacked on August 10 by the natives of the island of Guadalcanar, one of the Solomon group. M. Foullon, the geologist, a midshipman named Beaufort, and two sailors were killed, while four men were seriously and two slightly wounded. Many of the natives were shot dead and the rest took to flight.

Rockall, a desolate granite rock rising only 70 feet above the sea, between Iceland and the Hebrides, is to be made an English meteorological station. It lies 250 miles from land, the nearest point to it being the little island of St. Kilda, 150 miles away, and itself nearly a hundred miles from the main group of the Hebrides. Rockall is in the path of the cyclonic disturbances on the Atlantic, and the station there would give timely warning of storms approaching the British coast.

A sub-committee of the American Institute of Electrical Engineers, appointed in 1893 to investigate the subject of a suitable standard of light for photometric purposes, has recently issued a preliminary report, says The Engineer. Of all the standards thus far used, it finds the candle the least reliable. It is also evident from the bolometric curves that naked flames are subject to sudden and rapidly recurring fluctuations that may be almost entirely eliminated by the use of a properly constructed chimney. It seems likely that many of the difficulties which are unavoidable with flame standards may be overcome by the adoption of a standard consisting of some surface electrically heated to a standard temperature. With this object the results of the committee's experiments on incandescent carbon will be looked forward to.

Prof. Thomson, in his presidential address to Section A of the British Association, made a pleasing reference to the attempts made by Prof. Oliver Lodge to determine whether a moving body puts in motion the ether of space in its neighborhood. The huge machine on which the experiments have been conducted is built on a pillar, isolated from the floor of the laboratory, and consists essentially of an electric motor, with its axis of rotation vertical, and having on its shaft two parallel steel disks 3 feet in diameter, the whole being capable of spinning like a top at a high speed. Light from an electric arc lamp is divided into two equal portions, each of which traverses the space between the disks, one right-handedly and the other left-handedly. The two beams then unite in a telescope and produce interference fringes. If the ether were moved by the matter, rotation of the disks would accelerate one ray and retard the other one, so shifting the fringes; no such shift has, so far, however, been noted.

What Sanitation has Done for Life.

For conciseness and force in dealing with the results of sanitation, the address of Prof. Brewer, of Yale University, recently delivered before the Life Association of Western Massachusetts, has rarely been excelled. The question has often been debated, but never satisfactorily answered, whether there was any substantial gain to human life from the ordinary medical methods of combating specific cases of disease, or whether the mere elimination of one form of disorder did not have its compensation in the development of some other. In respect to sanitation, however, there can be no dispute. The gain is unquestioned and immense. The span of life measured from infancy to old age may not have been lengthened, but the number of those dropping by the wayside has been so effectually reduced that life insurance rates to-day are not what they must have been a hundred years ago. We cull the following striking passages from the address of Prof. Brewer:

That human life has been prolonged by the application of science in the last fifty years, no one doubts. How this has come about forms an intensely interesting chapter in the history of our civilization. But it is not a simple story. How much, mathematically, this amounts to, in years, in per cents, is an unanswerable question. We can never have the data in figures. Even if we had our vital statistics completed for that period, men would differ as to the relative value of the several factors in this problem. Our great cities would not exist—they could not exist without the aids of science. As to what would take place, the answer is as uncertain as the answer to the question, "What would now be the condition of Europe if Napoleon had never been conquered?" "If Columbus had not discovered America, who would have discovered it?" What we can say is that science has wrought so many changes that our civilization of to-day is very much in advance of what it would have been without science, and the prolongation of human life is but one phase of the relations of science to modern civilizations. We have had an ancient Egyptian and Greek and Roman civilizations, which were pagan, and later Christian civilization, and all were powerless to convert practices. Between the epidemics that raged from time to time and the high death rate in the best of years, the population of Europe, as a whole, probably scarcely increased at all for 1,000 or 1,200 years.

This century came in without a single city in Christendom with a million of inhabitants. Paris had in 1800 but 548,000; London and its suburbs in 1801, 864,845. The other great English cities had less than 100,000. Great cities could not endure then. First, the people could not be fed. Then, most of the population had to be fed and food produced within 20 miles of the place of consumption. Science has now made it possible to transport food half way around the globe, and has discovered new methods of preservation as well. City population was not self-perpetuating. Man died off; the death rate was continually high, and from time to time there was death by pestilence. Even where there were sewers, they were to drain the ground of water, rather than to carry away sewage. Now cities are made nearly as healthy as the country. Another reason why there could be no great cities in the modern sense related to business matters purely. I have dwelt upon this phase because cities are containing a larger and larger proportion of the inhabitants of civilized countries. And human life in cities is much prolonged. It is a law long ago demonstrated that the death rate increases as the density of population increases. This is still true, but sanitary science has enormously diminished this rate.

Sanitary science has been of slow growth but of rapid fruitage. It was 200 years ago that a Dutch scientist discovered the yeast cell, but the actual significance and working of the cell was not understood until 150 years later. In 1837 it was discovered that in the yeast cells were living organisms which were multiplying in the fluid in which they grew. This was the cause of fermentation. For years chemists quarreled as to whether these germs were the cause or the effect of this fermentation, but the former theory is now fully established. Then another dispute arose as to whether life could originate in decaying animal and vegetable matter, but it was finally proved that this did actually occur.

This theory forms the foundation of the modern disinfecting processes, and from this time diseases of all kinds were studied in a new light and given radically different treatment. In 1849 and 1850 French scientists showed that the blood of animals who had died of anthrax contained small particles, and ten years later it was discovered that these particles, when introduced into a living organism, would cause the disease. In 1870 it was proved that putrefaction, like fermentation, was due to germs. In the same year the germ of relapsing fever, one of the most dangerous diseases on the Continent, was discovered, and during the decade following there was much further investigation along the same lines.

The germ for leprosy was discovered in 1879, for typhoid fever in 1880, for consumption in 1882 and for cholera in 1884. This last discovery was the greatest discovery of all, and it resulted from the heroic efforts of scientists who went to Egypt to investigate the disease while it was raging there in 1883. But the accuracy of the theory was not generally accepted until 1890. Now we know the cause of the disease, and there can be no excuse hereafter for an epidemic of cholera in any of our cities. When there was cholera in Hamburg a few years ago, the commercial interests of England were of such vast importannce that she refused to quarantine her ports against the disease. Hundreds of cases were brought into England, but the disease was so thoroughly understood that it was stamped out as soon as it appeared in every case, and there was no epidemic. To what extent human life in the aggregate has been prolonged by better food and more of it, improvement in sanitation and the advances made in the scientific treatment of disease, can never be statistically determined. But it is certain now that diseases are due to the operation of causes which are pretty well understood. Cities understand that they can no longer afford to have bad sanitation, and these improvements alone mean the prolongation of the working periods of men's lives.—Insurance Monitor.

Some Queer Industries.

The St. Louis Republic has compiled from the latest census the following odd ways of making a living:

Occupations open to the thrifty individuals of both sexes have greatly increased during the last two decades, or even since the taking of the last decennial census, in 1890.

The extraordinary progress of science during the time specified and the application of its principle to the practical problems of human life have not only had the effect of greatly increasing the capacity for production in the trades already firmly established, but have opened hundreds of queer side alleys which lead direct to the avenues of trade.

There are, of course, dozens of these new and remarkable occupations with which science does not deal even in the remotest sense. In this class we find the rat catcher, the skunk farmer, the man who makes his living by picking up lost things in depots, theaters, hotels, etc., and returning them to their owners with the expectation of being rewarded; the clock winder, the man who collects orange and lemon peels, and the Lake Michigan syndicate, which is now engaged in raising black cats for their fur. They are not raising these cats on water, as might be inferred from the title, but have leased an island in the great lake, which is now plentifully stocked with both sexes of screeching felines.

There are still others in the non-scientific category of queer occupations, but it will only be necessary to mention a few. One is a "rattlesnake farmer," who lives in the Ozark Mountains, and makes the products of his "farm" bring money from three different directions. The oil he disposes of to druggists, who have regular customers that believe it to be a panacea for a hundred different ills; the skins he sells to would-be cowboys, who use them as hat bands, and the skeletons are always a ready sale, the purchasers being the curators of the natural history departments of the different college and society museums. The man who wakes people up in the morning, the old cork collectors, and the dog catchers are well known characters in every large city.

The individuals who gain a livelihood in pursuits that are strictly scientific are equally as numerous as those who follow the more humble callings. In the list of occupations that are strictly scientific is the manufacture of artificial eggs, artificial coffee, and false diamonds. Also the industry of making buttons, combs, penholders and other articles of a similar nature from blood collected at the slaughter houses. The man who makes billiard balls, buttons and rings from potatoes which have been treated to a solution of nitric and sulphuric acids is also the proprietor of an "industry" wherein the fundamental principles are strictly scientific.

But the queerest of all is carried on by two young Pennsylvanians, who are making a regular business of extracting the poison from honey bees. According to the accounts, they have two different ways of collecting their crop of venom. In the first the bees are caught and held with their abdomens in small glass tubes until the poison sacs have been emptied. In the second they are placed in a bottle on wire netting and enraged until the tiny drops of venom fall into the alcohol which fills the lower third of the bottle. This venom is said to be a sovereign remedy for cancer, rheumatism, snake bite, and a hundred others of the more terrible ills of humanity.

USE OF A METAL GLOBE FOR ROENTGEN RAYS.—Mr. Ben Davies, of University College, Liverpool, has been able to dispense altogether with the glass globe, making the sphere partly of copper and partly of aluminum. By means of his process, he is able to see small objects through three feet of solid timber, and the bones of the hand at a distance of thirty feet from the source.—Photography.

Correspondence.

The Highest Balloon Ascent.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1081, for September 19, 1896, under the head of "Miscellaneous Notes," I find the statement that "the highest balloon ascent ever made was by Dr. A. Berson, near Kiel, in Germany, December 4, 1894," naming 30,000 feet as the greatest altitude reached.

I take it this statement is scarcely correct.

In the memorable ascent of Glaisher and Coxwell from Wolverhampton, England, on September 5, 1862, Mr. Glaisher's last record before losing consciousness was of a barometric pressure of 9¾ inches, indicating a height of 29,000 feet.

At this great elevation Mr. Glaisher tells us the balloon was ascending at the rate of 1,000 feet per minute, and that when he resumed his observations, after regaining consciousness, it was descending at the rate of 2,000 feet per minute.

Comparison of the times of record indicate the interval to have been thirteen minutes.

This, according to Mr. Glaisher's estimate in the Britannica, gives 36,000 or 37,000 feet for the greatest height attained.

Of course, this barometric reading was not actually observed by Mr. Glaisher, owing to his insensibility at the time of greatest elevation, but Mr. Coxwell, who was occupied with the management of the balloon, could have made the observation had he been seated in Mr. Glaisher's chair and been called upon for no other exertion.

This, one might say, is not positive proof; still, I submit that a balloon, when at an elevation of 29,000 feet and ascending at the rate of 1,000 feet per minute, would not come to a stand until several additional thousand feet had been added to this, at least then, unapproached altitude.

Mr. Coxwell tells us that several minutes, seven or eight, elapsed between his discovery of Mr. Glaisher's unconsciousness and his successful effort in opening the valve and terminating the ascent.

With these facts before us, the ascent of Glaisher and Coxwell would seem to be the highest ever made by man.

W. C. GURLEY.

Marietta College Observatory, Marietta, O.

Premature Burial.

To the Editor of the SCIENTIFIC AMERICAN:

I have waited for a number of months hoping that some one else would take issue with the article on the above subject, written by James R. Williamson, of London, England, and published in your issue of May 9, 1896.

This article is about like many others which are to be found floating around through the daily papers and which voice, in one way, the popular idea that the danger of being buried alive is by no means slight. Yet there is little doubt that these newspaper yarns are, without exception, pure and simple fabrications, without the slightest real foundation in fact. Even were a person really in only a trance when placed in the coffin, our present burial customs would cause death to occur from suffocation, by closure of the coffin, long before the grave would be reached.

Some years ago I took occasion to carefully investigate all of these cases as reported in our local papers, and I have medical friends who have pursued similar lines of investigation. In not a single instance have any of the cases investigated been found to have any foundation in fact. I append a single instance, from the Columbus Evening Dispatch, of March 12, 1890, as the details as published in the paper seemed to be unusually complete.

"PREPARED FOR HIS GRAVE.

"REMARKABLE CASE OF SUSPENDED ANIMATION—A LITTLE BOY SUPPOSED TO BE DEAD, AFTER BEING PLACED IN A COFFIN, IS FOUND TO BE ALIVE.

"Special to the Dispatch:

"Findlay, O., March 12.—A remarkable case of suspended animation is reported from Mount Blanchard, this county. Last Sunday, Arthur, the four year old son of Aaron Naus, after a long illness, apparently died. All the signs of life were gone; there was no breathing, no pulse nor warmth of the body. The undertaker was sent for, and proceeded to prepare the remains for burial, accomplishing his work in the full belief that the child was really dead. The body remained in this condition until about three o'clock Monday afternoon, when those about the coffin were amazed to observe signs of life. A physician was called and it was not long until resuscitation was complete. He has continued to grow stronger, and there is now no doubt of his full recovery. It is the most wonderful case ever reported in the county."

A request for full particulars elicited the following from Dr. William N. Yost, of Mount Blanchard:

"The report is substantially without foundation. I am the family physician of Aaron Naus, and live across the street from him. The boy, Arthur, has not been sick in the last six months. The only wonder to our people and myself is as to the origin of the report."

Mr. Williamson says that the case which he cites is "only one of several hundreds of authenticated cases," but he fails to state the means used to authenticate. A single authenticated case with the proofs accompanying the report would be of more value than hundreds about which we know nothing except the report itself.

I feel perfectly safe in saying that no authenticated case of premature burial can be found to have taken place in this country during the last fifty years, unless it be possibly during the hurry and excitement of an extensive cholera or yellow fever epidemic, when bodies are sometimes buried within a few hours after death.

J. F. BALDWIN, M.D.

Columbus, O., October 2, 1896.

A Century of Vaccination.*

A hundred years have passed away since Jenner's first successful vaccination on May 14, 1796. Jenner's brilliant idea, pondered over for more than 25 years, was that smallpox might be abolished by the universal adoption of vaccination. Others had vaccinated before Jenner, but he was the first to rouse the civilized world to take an active interest in the subject; and we must not forget that vaccination was not the outcome of laboratory experiments, but a practice resting upon a common experience in many countries of Europe, not to mention Mexico and Persia, that dairy maids and others who had "sore hands" from milking cows affected with cowpox were afterward found to be protected against smallpox. The present time invites us to review the progress of vaccination in this and other countries, with the concomitant alterations in the mortality from smallpox, and to make an attempt to gather into a few lines the teachings of a century.

What was the average yearly mortality per million living from smallpox, which we will throughout call the mean rate, during the last century? In the large cities it was over 3,000, and in the whole nation it was at least over 2,000. This is the mean rate. During some years the mortality rose as high as 5,000 or 6,000 per million, and even higher. Now we find a rapid fall of smallpox in every country which we examine as soon as vaccination became common. The fall was abnormal in one respect, because the adult population of Europe then consisted largely of survivors of smallpox in childhood. This fall is closely connected with the rise of vaccination in every country separately. Thus, in Sweden, during the 28 years 1774–1801, before vaccination the mean rate is 2,045; during 15 years 1802–16 of permissive vaccination it is 480, and during 77 years, 1817–94, of compulsory vaccination it is 155. During the last 10 years the mortality is insignificant. In England in the last century the mean rate was over 2,000, according to able statisticians; during 12 years of permissive vaccination, 1838–53, the mean rate is 417; during the succeeding 18 years of enjoined vaccination the rate sinks further to 154; and the mean rate since the epidemic of 1871–72 under enforced vaccination is only 53, that is, for the 22 years 1873–94; while for the 10 years 1885–94 the mean rate is 26. The law really enforcing vaccination dates only from 1871. In Prussia vaccination was encouraged only, not enforced on all children, till the law of 1874, after which all children born in the German empire were required to be vaccinated by the end of the second year of age, and all school children to be revaccinated. Well, the permissive era yields a mean rate of 309, but the 18 years 1875–92 have a mean rate of only 15, and during the last 10 years of this the deaths from smallpox in Prussia average only 7 per million yearly. In Austria vaccination is not compulsory yet. Austria's mean rate during the 35 years 1847–82 is 580. One more example of a country still without compulsory vaccination, namely, Belgium. The mean rate for the 10 years 1875–84 is 441. This, again, is a rate resembling that of England or Sweden in the permissive era. In fact, we can say with confidence what the vaccination law is in any country from a mere inspection of the smallpox mortality for some years. Italy has followed Germany since 1888. Vaccination in infancy was then made universally compulsory, and also the revaccination of all children attending public schools. The mean rate per million in the chief townships during the nine years previous to the law as put in practice is 440—just as we might have expected; the average during the 5 years 1890–94 is 100; the average for all Italy during this latter period is 110.

We are dealing now with large countries and vast populations, and we are considering the smallpox mortality alone, apart from the question of the vaccinated or non-vaccinated condition of those who died. Examples enough have been given to show the remarkable uniformity that exists in the death rates of various countries, according to the state of the law in those countries. No other cause than vaccination can account for this. It cannot possibly be improved sanitation that has caused the remarkable changes in the mean death rates above given, for more than one reason. Compare Prussia with Austria. There is a sudden and striking change in the smallpox death rate of Prussia in the period succeeding the law of 1874. Now Austria shows no such change in the death rate, and Austria is still without compulsory vaccination, while Austria has participated in the sanitary improvements of the age. And, on the other hand, Prussia did not suddenly jump into an ideal sanitary condition between 1870 and 1880. But further, the reduction in smallpox mortality has not affected all ages alike, whereas improved sanitation does affect all ages alike. Again, it is absurd to talk of a natural decline of smallpox, as plague has declined and vanished, from this country at least, when we observe the virulence of smallpox in local outbreaks, and when we think of the very large mortality which countries like Spain and Russia still show, countries where there is very little vaccination. Here are the smallpox death rates per million living for the single year 1889, in the following provinces of Spain: Almeria, 3,080; Murcia, 2,670; Coruña, 1,230; Malaga, 1,340; Cadiz, 1,330; Cordoba, 1,400. The rate for Germany is 4 for the same year.

What are the lessons which a hundred years' experience of the practice of vaccination by various nations taught mankind? First, we know that the rapid spread of this practice was partly due to an erroneous idea of the early vaccinators, Jenner himself included, namely, that one vaccination in childhood was sufficient to protect for life. Secondly, we know that the most rigidly enforced vaccination in infancy alone in any country is insufficient to prevent severe outbreaks of smallpox. Thirdly, primary vaccination vastly reduces the mortality from smallpox, but it also shifts the incidence of this mortality from childhood to adult life. The natural susceptibility toward smallpox sinks of itself from the first year of life till the end of childhood or the beginning of puberty, when it is lowest, after this it rises gradually with age. More adults now die of smallpox than in the early days of vaccination.

But statistics teach us that a successful revaccination during school age completely alters the situation, and renders a person safe for life against smallpox, with rare exceptions. Even a survived attack of smallpox does not absolutely protect against death from a second attack. Germany over twenty years ago acted upon these well known truths, and by the law of 1874 enforced both the compulsory revaccination of all school children and the vaccination of all children before the age of 2 years. And in Germany smallpox epidemics are abolished, and most of the few cases which occur are on the boundaries of the empire.

*British Medical Journal.

A Potato Tercentenary.

The holding of a potato tercentenary in England this year is now being agitated. As one of our foreign exchanges states: "In 1596 the first potato was planted in England, in Holborn, about the time that Sir Walter Raleigh was planting the first Irish potato at Youghal, near Cork. For two centuries the potato continued as a botanical curiosity. When first eaten it was a delicacy, sometimes roasted and steeped in sack, or baked with marrow and spices or preserved and candied. When Parmentier developed the plant in France, Louis XVI and Marie Antoinette wore the flowers as ornaments. Frederick the Great had to force the Pomeranian farmers to plant potatoes by the fear of his soldiers. It was the famine of 1771–72 in Germany that first demonstrated the value of the 'tubers.' The fact is that it has been only within the past century that the potato has risen in its prominence as an esculent, even in Ireland, the land of the 'murphies.'"

The introduction of the potato into England was directly due to Sir Walter Raleigh, whose Virginia expedition ships brought back some of the tubers in 1586; but to the Spaniards is really to be credited the discovery and European introduction of the new article. It was undoubtedly through the Spaniards that the potato was brought to Virginia. There is no proof that the North American Indians cultivated the potato before the date of the Spanish Conquest. It grows wild to-day, as then, in Peru and Chile. The Spaniards carried the tuber to Spain long before the Raleigh incident; and from Spain it was taken to Italy, from which country it was introduced into Flanders, in 1558. The date of the proposed English tercentenary will, therefore, be about ten years too late. The very name of potato comes from the Spanish "batata."

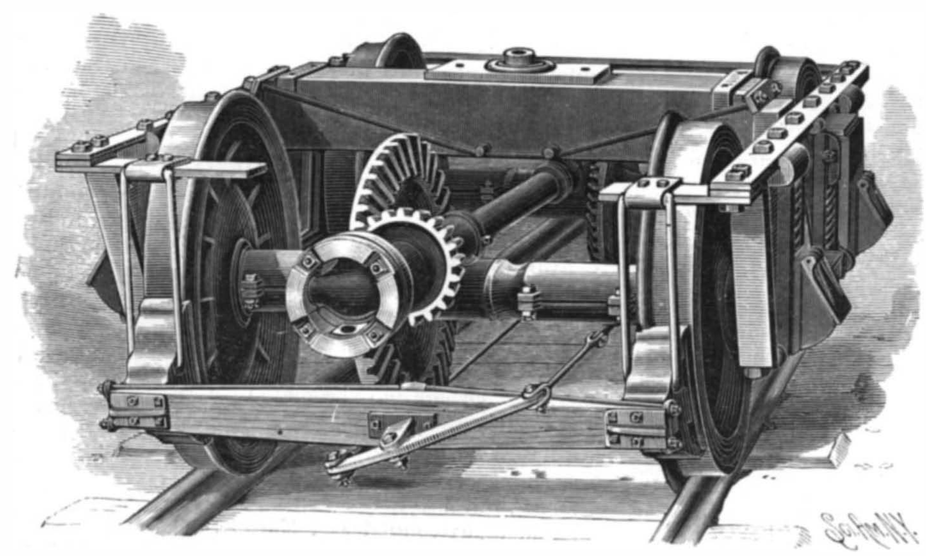
But the potato has of late years fallen into something of its early contempt. The scientists of the cuisine, such as Dr. Cyrus Edson and Mrs. Rorer, are warning eaters not to depend too much upon the potato for nutriment. Leguminous food should largely supplement its use. Furthermore, overindulgence in a potato diet conduces to dyspepsia; and herein may be revealed the origin of the prevalence of that distressing complaint in America. The potato is not a root, as so many are accustomed to style it; it is an underground stem, swollen by accumulated starch stored up for future use. Its exact place in the dietary has not yet been settled. It is a curious thing to note, too, that to the same genus (Solanum) belongs tobacco, which was given to Europe at about the same time as the potato; and the tobacco and the egg plant are its fellow esculents.—Southern Planter.

A TWENTY-FIVE TON GEARED LOGGING LOCOMOTIVE.

The geared locomotive is finding increasing favor for work on the heavy grades encountered in mountain logging. The device of coupling on another pair of axles when it is desired to increase the adhesion, which is practicable on trunk railroads, is impossible on the average logging road, on account of the sharp curvature of the line. The length of the rigid wheel base must be kept down to a point which prevents any successful coupling up of many drivers by the ordinary methods.

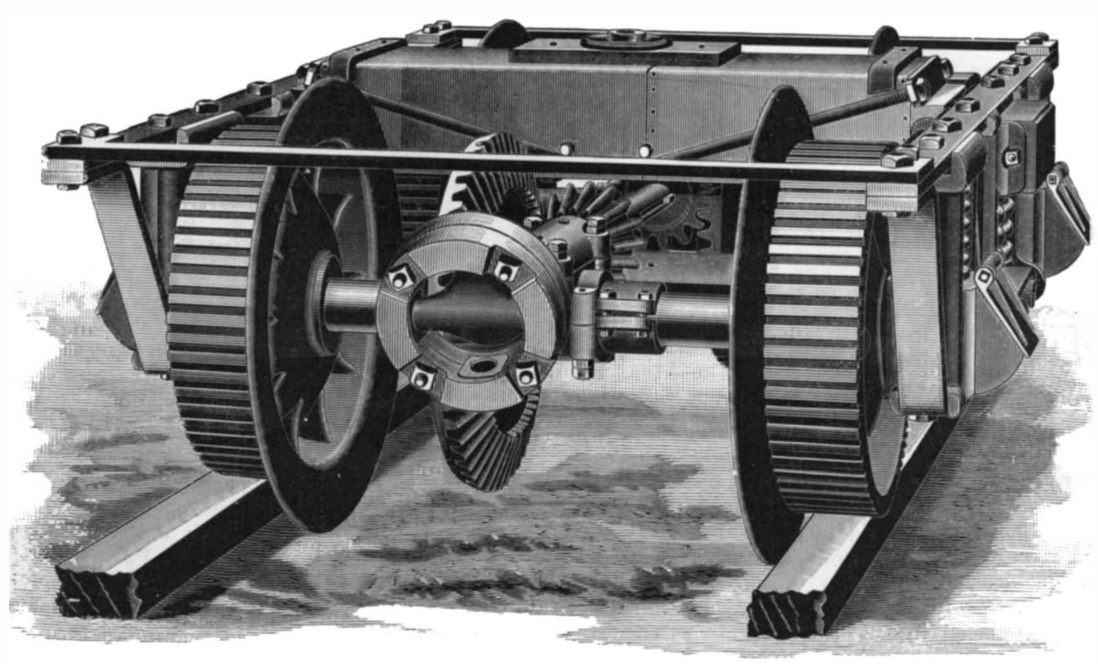
The 25 ton locomotive shown in the accompanying illustrations is one of a type that is manufactured by the Climax Manufacturing Company, of Corry, Pa., for use in logging camps, coal mines, sugar plantations and under any conditions where heavy grades and rough and uneven track are encountered. The necessary lateral flexibility is obtained by carrying the locomotive upon two end trucks and transmitting the power to the wheels, all of which act as drivers, by means of flexible shafting and bevel gears.

The frame consists of two 8 inch channel irons, and has large corner brackets riveted to the channels and bolted to oak end sills. The channels are also connected by double trussed iron bolsters which distribute the weight to the trucks.



DRIVING GEAR OF TRUCK FOR LOGGING LOCOMOTIVE.

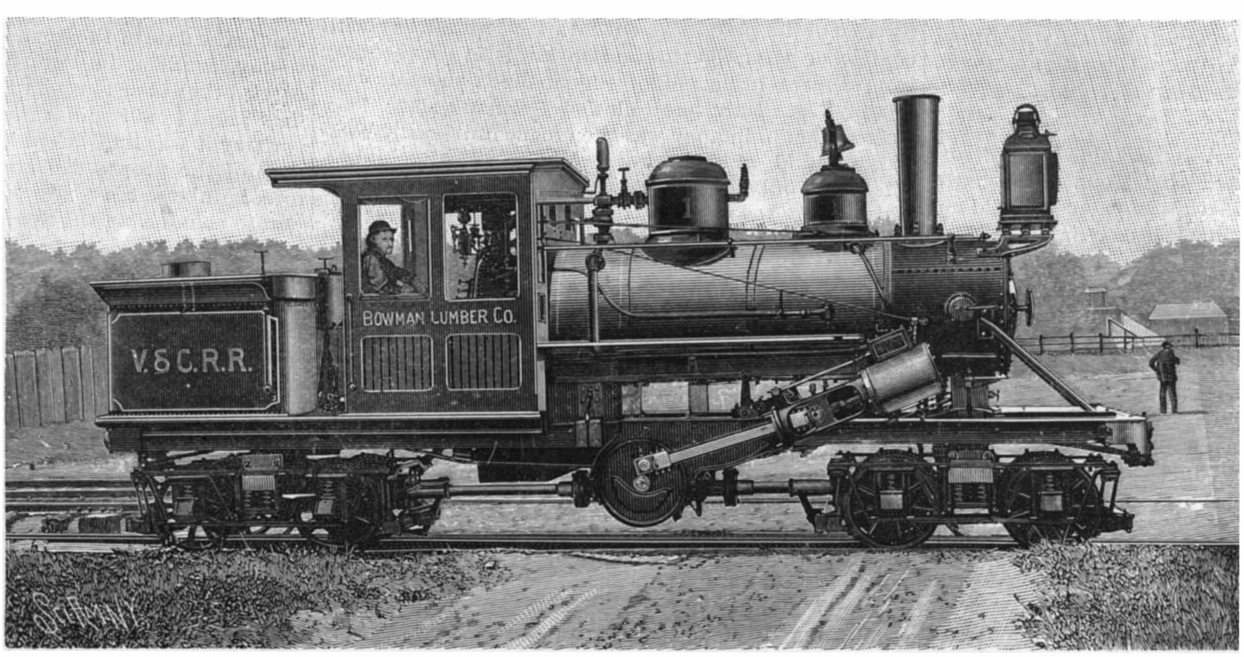
The cylinders are bolted to the frame and the power is transmitted from the engine shaft by means of heavy steel bevel gears to a flexible shaft, which runs beneath the frame and over the center of the trucks. The details of the driving mechanism on the trucks are shown in the accompanying illustrations, one of which shows the style with corrugated wheels adapted for use on wooden track and the other for use on ordinary steel rail. At its junction with the trucks the line shaft is provided with a universal joint, and it is carried in cross boxes journaled upon the axles, the alignment being secured by means of sleeve couplings and bronze rings, which hold the gears in mesh and the line shaft in position. The cross boxes are provided with metal liners 14 inches long, adjustable to wear. The two inside pinions, which are cast solid to the horns, are keyed to the line shaft, and thus each wheel of the locomotive is made practically a direct driver. The axles are 4 inches and the line shafts 3 inches in diameter. There are ten coil springs in each truck, one over each axle and the others between the sandboards. A steam brake cylinder is attached to the center of each truck, by which means the use of long brake rods, which cause corner binding on curves, is avoided.



TRUCK OF LOGGING LOCOMOTIVE FOR USE ON WOOD RAILS.

The latest system of carrying the cross boxes and arranging the gear is that shown in the truck for use on steel rails, where the pinions are arranged on the outside of the axles.

These locomotives are doing good work on logging roads having grades up to 8 feet in 100. In one case a 25 ton engine has pulled four loaded standard gage logging cars, with 3,000 to 5,000 feet of green hemlock logs on each car, up an 8 per cent grade and twelve loaded cars over a 4 per cent grade.



A TWENTY-FIVE TON GEARED LOGGING LOCOMOTIVE.

NATURE says that Mr. George J. Gould has decided on an elaborate and systematic scheme of Arctic exploration, which includes the building of a permanent depot at a point always accessible during the season when navigation is open. A cordon of depots will be established at points further north from year to year.

What is Scientific Plagiarism?

This is an all-important question, accentuated rather than solved by the legal answer just given to it by the Court of Appeal at Rouen. The case before that tribunal was as follows: Prof. Cesare Lombroso, of Turin, the well-known anthropologist, was invited by a publishing house in Milan to compile a manual of "Graphology," the science, truly or falsely so called, which professes to read a man's character in his handwriting. Prof. Lombroso had already been among the first to make this an object of study—his special investigations having been made with a view to find another aid to diagno is in cases of lunatics and delinquents. In the manual compiled for the Milanese house he confined himself to what had already been published by contemporaries (he had no predecessors) on the same subject, and among others he made copious citations from the book of M. Cremieux-Jamin, a dentist practicing in Rouen. So little intention had he of plagiarizing from this author that he acknowledged his obligations to him in the preface, warmly eulogizing M. Cremieux-Jamin's talents and industry, and styling him the "first graphologist living." Unfortunately, in the chapter dedicated to invalids and their handwriting, Prof. Lombroso, in the midst of his own matter, interpolated three pages from M. Cremieux-Jamin's book, accompanied by three small clichés, omitting at the same time to cite that author's name, apparently a piece of sheer forgetfulness occasioned by Prof. Lombroso's unsystematic mode of working, certainly not designed to injure M. Cremieux-Jamin's claims, which had already been amply acknowledged under headings of greater importance. This plea, however, was disallowed by the Rouen tribunal, which found in those three pages—and in those three only—a flagrant act of plagiarism, while at the same time admitting that every other use made of the book by Prof. Lombroso was within the limits of the law. The verdict seems to the Italian public a somewhat ungenerous one, the offense of Prof. Lombroso having been due to an obvious oversight, which an apology tendered in open court ought surely to have condoned. But the significance of the verdict does not stop there. Instances constantly occur in which after a general acknowledgment of indebtedness one scientific writer makes free use of another's work without suspecting that his failure to give name, chapter, and verse on each individual citation renders him liable to prosecution for plagiarism with (as in Prof. Lombroso's case) the penalty of a considerable fine. True, in the vast majority of cases the "chivalry of science" accepts the general acknowledgment of indebtedness as covering all special obligations, and only where there are "strained relations" subsisting between individuals or schools (as the Italians say subsist between their countrymen and the French) is that acknowledgment deemed insufficient. The fact remains that it is in the power of a susceptible author to avail himself of such a plea as that which found favor with the Rouen tribunal. Moreover, it is often very difficult to decide between two authors pursuing the same line of inquiry as to who has priority in observation or discovery. Indeed, as research multiplies and workers become more numerous in identical fields, the chances of coincidence in their findings are more and more apt to occur. Are these coincidences to provoke collisions between rival claimants to priority? The Cremieux-Jamin v. Lombroso case would seem to favor the possibility. Meanwhile the corollary to be deduced from it is a reinforcement of Prof. Michael Foster's demand for an international organization of science to register at frequent intervals the results of contemporary investigation, and so by placing the worker and his output en évidence to minimize the risk of retracing ground already trodden, and to make clear what has already become common property and what still remains the possession of the original author.—Roman Correspondent London Lancet.

THE horror of being buried alive is with many people so great that they leave instructions for some small mutilation to be inflicted upon them when the breath has apparently left them, so that assurance may be made whether they are really dead or not. But, thanks to the X rays, a Chicago physician claims to change this. He announces, says the Photographic News, that those rays will determine positively whether real death has occurred. Dead flesh, he says, offers more resistance to the penetration of the rays than living, and a glance at the radiograph of the person would determine whether it was that of a corpse or not.

THE SESQUICENTENNIAL CELEBRATION OF PRINCETON UNIVERSITY.

The picturesque and historic village of Princeton, New Jersey, is now filled to overflowing by the alumni and friends of the famous institution which henceforth is to bear by right, as it has hitherto done by courtesy, the title of Princeton University. Its official designation, according to the first charter of October 22, 1746, was "The College of New Jersey;" but by the combined action of the State legislature and the college trustees, its name has been changed to Princeton University, the new title being assumed on October 22 of the present year.

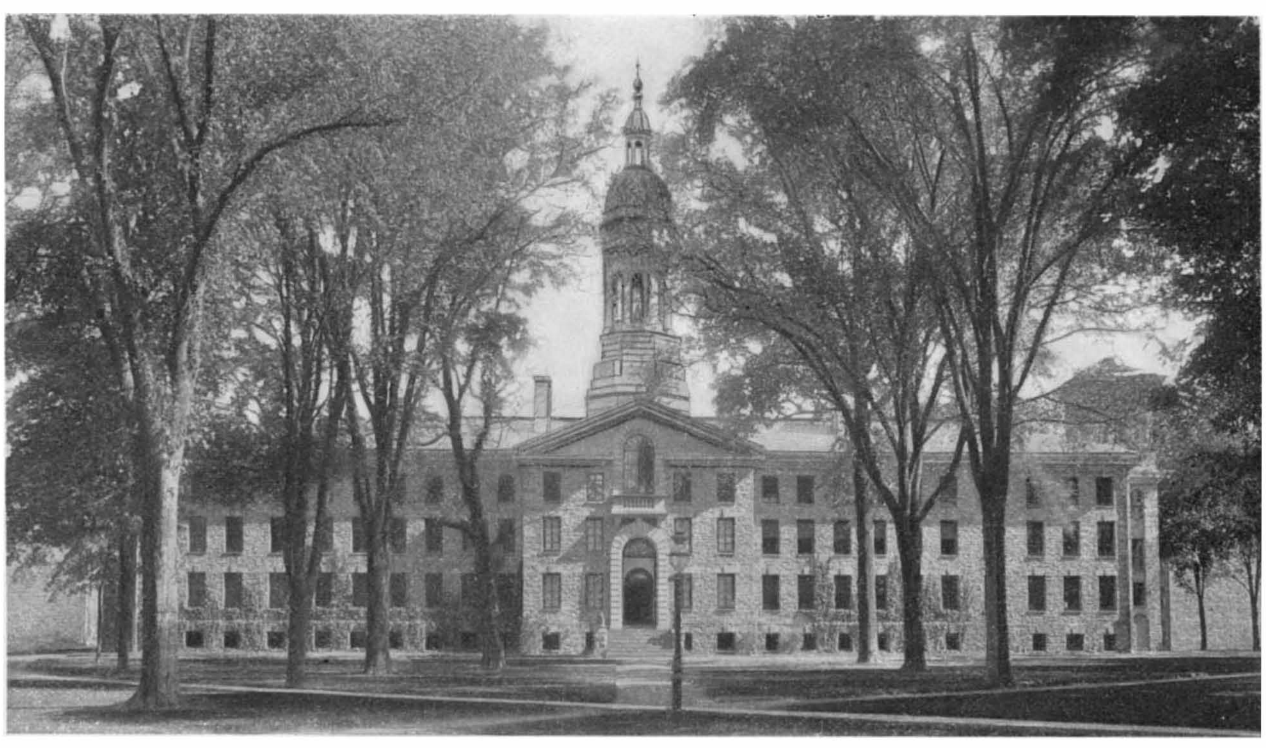
The celebration by an American university of the one hundred and fiftieth anniversary of its foundation has awakened an international interest, and many of the chief seats of learning in England and on the Continent are represented at the various gatherings and exercises. Among the specialists engaged for the preliminary course of lectures were Prof. J. J. Thomson, of Cambridge, England; Prof. Felix Klein, of Göttingen; Prof. Edward Dowden, of Dublin; Prof. Andrew Seth, of Edinburgh; Prof. Karl Burgmann, of Leipsic; Prof. A. A. W. Hubrecht, of Utrecht. The programme of the formal exercises covered three days, October 20, 21, and 22. The first day was devoted to a commemorative service, followed by a formal reception of the delegates from other colleges and universities. The day following was set apart for the alumni and students, and included an oration by Prof. Woodrow Wilson in the morning and athletic contests in the afternoon. On Thursday, October 22, the red letter day of the exercises, official announcement was made of the university title, which was followed by the reading of the list of recent endowments, and by the conferring of commemorative degrees.

UNIVERSITY HALL.

The history of this famous institution carries us back some twenty years beyond the century and a half which marks its present age, to the time when a certain Rev. William Tennant, a clergyman from the north of Ireland, settled as pastor of the Presbyterian church of Neshaminy and built a small log school house, which soon acquired the name of "Log College." This was in 1726, and when the charter was granted to the College of New Jersey, in 1746, the friends and patrons of "Log College" became "the principal supporters and trustees" of the new institution. The second charter, in its amended form, is the fundamental law of Princeton. It was granted September 14, 1748, by Governor Belcher, of the Province of New Jersey and was subsequently confirmed and renewed by the Legislature of New Jersey.

The college was opened in May, 1747, at Elizabethtown, with Jonathan Dickinson as president. At his death, in the following August, it was removed to Newark, where Aaron Burr took charge. In 1751 the trustees decided to build a college at New Brunswick, provided the inhabitants agreed to furnish five thousand dollars, ten acres of land, and two hundred acres of woodland. At the same time, Princeton made an offer accepting these terms, with the result that New Brunswick lost the college, the corner stone of historic Nassau Hall being laid at Princeton, in September, 1754. Upon the completion of the building in 1756, the college was removed from Newark to Princeton.

One must travel far to find a spot around which are gathered more stirring memories than associate themselves with the little town which has been the center of the recent scholastic gathering. Princeton would be famous if it were known merely as the constant home for one hundred and fifty years of one of our most famous seats of learning; but to the odor of scholarship it adds the glory of patriotism. Through all the long years of the revolutionary struggle the college maintained an unwavering constancy to the cause of freedom. This was largely due to the influence of Dr. John Witherspoon, president of the college, who was one of the signers of the Declaration of Independence, and altogether one of the most famous of that band of leading patriots, to whose patience, sagacity and unconquerable faith and courage the final victory was due. We are told by Prof. John G. Hibben, of Princeton, in the current number of the Forum, that in a critical moment, when there was some hesitation in signing the famous document, it was Dr. Witherspoon's stirring words that moved his colleagues to take the momentous step: "There is a tide in the affairs of men," be said, "a nick of time. We perceive it now before us. To hesitate is to consent to slavery. That noble instrument, which insures immortality to its author, should be subscribed this very morning by every pen in this house. For my own part, of property I have some, of reputation more. That reputation is staked upon the issue of this contest—that property is pledged; and, although these gray hairs must soon descend into the sepulcher, I had infinitely rather they should descend thither by the hands of the public executioner than desert at this crisis the sacred cause of my country." Subsequently Dr. Witherspoon was a member of the Secret Committee of Congress, of the Board of War, of the Committee of Finance, and of the Committee to Procure Supplies. Nor were the graduates one whit behind their president in zeal. Brevard, with two other graduates, drew up the resolutions pledging "life, fortune and sacred honor" to the sacred cause. It was from churches presided over by three Princeton graduates that the so-called "Regulators" went forth to fight the troops of Governor Tryon.



NASSAU HALL, ERECTED 1754—USED AS THE HALL OF CONGRESS, 1783.

Frederick Frelinghuysen, a graduate of the class of 1770, said on leaving college, "I have learned patriotism in Princeton as well as Greek." Then there is the famous deed recorded of a certain Rev. John Craighead, of the class of 1763, who early in the war preached a sermon urging his congregation to enlist in the cause of independence, and as a climax to his discourse threw aside his gown, "disclosing a captain's uniform of the Continental Army." Thenceforth he left the pulpit for the battle field, and led the men of his congregation forth from the Cumberland Valley. Dr. Robert Cooper, a classmate of Craighead's, was another warrior priest, acting for a time as captain of a company.

It was fitting that such a stronghold of revolutionary sentiment should be the battle ground on which was fought one of the most decisive conflicts of the war. It is matter of history how Washington, by a masterpiece of strategy that was worthy of Napoleon himself, with characteristic daring threw himself upon the British lines of communication, and won a glorious victory at Princeton, thereby frustrating the enemy's whole plan of campaign and marking the turning point of the war. The retreating British had occupied Nassau Hall, from which they were driven by the American artillery. The battle of Princeton, January 3, 1777, was the culminating point of the ten days' maneuvering, which commenced on that famous Christmas night when he crossed the Delaware and captured Trenton. The result was the relief of Philadelphia, "the abandonment of the British cantonments along the Delaware, the evacuation of Trenton and Princeton by British soldiers, and the almost total delivery of the State of New Jersey from the hostile army. Before this the cause of American freedom had been declining, while after it, until the end of the war, it was in the ascendant." It was in Nassau Hall that the Congress of the Confederation was assembled when on October 1, 1783, the news of the signing of the treaty of peace with Great Britain was announced. Madison, a graduate of Princeton and a pupil of Witherspoon, was the author of a plan which was substantially adopted by the constitutional convention which met at Philadelphia in 1787, and nine out of the fifty-five members of that body were Princeton graduates.

Of the four hundred and sixty-nine graduates belonging to these stirring times, one hundred and fourteen were clergymen, thirteen of whom became presidents of colleges; of the remaining three hundred and fifty-five, one, James Madison, was for eight years President of the United States; one was vice president; six were members of the Continental Congress; twenty became senators of the United States; twenty-three entered the House of Representatives; thirteen were governors of States; three were justices of the Supreme Court of the United States, and some twenty served as officers in the revolutionary army.

The college grounds at Princeton cover an area of about two hundred and fifty acres. The buildings, which collectively are very impressive, and in some cases are of great architectural beauty, are not, as is usual, arranged in quadrangles, but are widely distributed over the spacious grounds. Historically they arrange themselves into two groups: first the colonial period, which includes Nassau Hall and the Dean's house, 1756; the college offices, 1803; East College 1833, and West College 1836, with four other buildings erected before 1850, and a magnificent group of twenty-two later buildings, erected during and since the presidency of Dr. McCosh.

The historic spot most dear to the heart of a Princeton alumnus is the front campus, which spreads its greensward before the venerable walls of Nassau Hall. Here it is that the college graduate delights to lounge on the summer evening, shaded by the historic elm trees, that rival the hall in age and associations. Flanking it is the Dean's house, in front of which stand the two sycamores planted in 1765 by order of the trustees (so says the college tradition), to commemorate the resistance to the stamp act. Nearby stand the college offices, dating from early in the century. To the south of Nassau Hall lies the back campus, flanked by the East and West Colleges. The name is scarcely descriptive any longer, for some fifteen of the later buildings now stand far behind the "back" campus, and reach to the handsome Brokaw Memorial lying far to the south.

Of the buildings chosen for illustration, Brokaw Memorial was one of the latest to be erected. Its existence bears eloquent tribute to the fact that the spirit of self-sacrifice, which prompted the patriot students of Princeton a hundred years ago, lives within its walls to-day. It commemorates the heroism of Frederick Brokaw, who lost his life at Elberon, N. J., in a brave attempt to rescue a drowning girl. It is the gift of his father, Mr. I. V. Brokaw, of New York City, while the grounds were laid out by admiring friends and alumni.

Marquand Chapel, 1881, the gift of Mr. Henry G. Marquand, of New York, is built in the form of a cross, of a rich brown stone. Its interior is enriched with frescoes and an interesting series of memorial windows.

One of the most notable buildings is the John C. Green School of Science, 1873. It is quadrangular in plan and Gothic in design, with a clock tower at one corner. On the first floor is the Physical Laboratory, and on the east side are situated the rooms devoted to Civil Engineering and Graphics. On the second floor are the Botanical department and the Herbarium. The third floor is devoted to the Museum of Biology, which is particularly rich in rare and curious specimens. The Library Building, 1873, consists of a central octagon, with two wings. The bulk of the main library is in the large octagonal room, and the remainder—some 15,000 volumes—is in the basement. It was probably founded with the college, and it was enriched by a gift of books from Governor Belcher in 1755. Its first catalogue, in 1760, shows that it had 1,200 volumes. In 1854 there were but 9,313 volumes; but in 1868 it was enriched by the munificence of Mr. John C. Green, and when the present building—his gift—was opened, there were 25,000 volumes. There are now some 100,000 volumes and 25,000 unbound periodicals and pamphlets.

The famous American Whig and Cliosophic Societies hold their meetings in handsome classic structures, of white marble, which are among the most striking of the many buildings of the university. These secret societies are organized and conducted upon the lines of the halls of Congress. Whig Hall was founded by the celebrated James Madison aforementioned, who, as we have seen, was a graduate under the Witherspoon administration. Undoubtedly the teachings of the patriotic president were strengthened and wrought into action by the influence of these societies. They numbered in their rolls of membership all those courageous and gifted men who subsequently went forth to give valuable counsel in the early difficulties of the young republic.

University Hall was built in 1876 as a hotel, its proceeds to be given as an endowment to the E. M. Museum. It was ultimately turned over for use as a college dormitory.

Not the least interesting of our illustrations is that showing the University Athletic Club House, for has not Princeton won a worldwide fame by her many victories in baseball and football? Within the walls of this club house are the training tables at which the baseball and football teams sit during those days of common sense training to which the late successes of the college are mainly due.

We would fain linger among these classic surroundings and speak at greater length of the museum and archæological collection of Nassau Hall, and point out its historical war scars, and the famous portrait of Washington upon its walls; of the Halstead Observatory, gift of the late Gen. Halstead; of the beautiful Alexander Hall, gift of Mr. Charles B. Alexander; of the Art Museum; and last, but not least, the Theological Seminary, wherein was laid the foundation of that ripe erudition which has so greatly enriched the pulpits of the Presbyterian church.

How to Estimate Trolley Car Speed.

There is in the public mind a confusion of ideas as to the speed of electric street cars, says the International Ticket Agent. Two inexpert observers guessing at this speed will rarely come within miles of the correct estimate. Yet it is possible for anybody, by a simple calculation, to arrive at very nearly accurate information. An electric car going at the rate of a mile an hour travels eighty-eight feet in a minute. At two miles an hour it makes twice that distance in a minute, or 176 feet. At three miles an hour the distance traveled in a minute is three times eighty-eight, or 264 feet. This distance of 264 feet is about the length of an average city block. If it takes a car a minute to go a block, the rate of speed is three miles an hour. If the car goes two blocks in a minute, the rate is about six miles an hour. Three blocks in a minute means nine miles an hour. Four blocks in a minute indicates a speed of about twelve miles an hour. At five blocks in a minute a car is going fifteen miles an hour. When six blocks are traversed in a minute the speed is eighteen miles an hour. A rate of seven blocks in a minute is a speed of twenty-one miles an hour. It must be understood that average blocks are required to make good such estimates.

Whitewash for Exterior of Buildings.

The Washington or government whitewash is made as follows: Take half a bushel of unslaked lime, slake it with boiling water, cover during the process to keep in steam, strain the liquid through a fine sieve or strainer, and add to it a peck of salt, previously dissolved in warm water, three pounds ground rice boiled to a thin paste and stirred in while hot, half a pound of Spanish whiting and one pound clean glue, previously dissolved by soaking in cold water and then hanging over a slow fire in a small pot hung in a larger one filled with water. Add five gallons hot water to the mixture, stir well and let it stand a few days, covered from dirt. It should be applied hot, for which purpose it can be kept in a kettle or portable furnace. The east end of the President's house at Washington is embellished by this brilliant whitewash. It is used by the government to whitewash lighthouses.

A pint of this wash mixture, if properly applied, will cover one square yard, and will be almost as serviceable as paint for wood, brick or stone, and is much cheaper than the cheapest paint.

Coloring matter may be added as desired. For cream color add yellow ocher; pearl or lead, add lamp or ivory black; fawn, add proportionately four pounds of umber to one pound of Indian red and one pound common lampblack; common stone color, add proportionately four pounds raw umber to two pounds lampblack.—The Hub.

AN extraordinary instance of hereditary tendency to suicide was told by Prof. Brouardel in Paris lately. A farmer near Etampes hanged himself without apparent cause, leaving a family of seven sons and four daughters. Ten of the eleven subsequently followed the father's example, but not until they had married and begotten children, all of whom likewise hanged themselves. The only survivor is a son, who is now sixty-eight years of age and has passed safely beyond the family hanging age.

EXPERIMENTAL DETERMINATION OF THE MOTION OF PROJECTILES INSIDE THE BORE OF A GUN.*

In a previous paper† were described some preliminary experiments with the polarizing photo-chronograph applied to the measurement of the velocity of projectiles outside of the United States 3·2 inch breech loading field rifle. The results of these experiments being submitted to the Board of Ordnance, a chronograph built on this principle, making use of polarized light, was authorized and constructed.

The original experiments were more of the nature of a laboratory investigation than practical tests in actual service. The objects of these experiments were twofold: To perfect a practical chronograph upon this principle, and to determine the adaptability of this instrument to the study of the motion of projectiles inside the bore of a gun.

In the papers referred to a full description of the instruments was given. Many important improvements, however, in details which add to the efficiency of the instruments, were developed during the progress of these experiments, although no change was made in any essential particular. A perfectly satisfactory source of artificial light was obtained, which afforded a great advantage over sunlight, in being always ready and uniform.

In the improved apparatus the illuminated image of the magnified perforation in a piece of aluminum attached to a fork was allowed to fall upon a plate. The parts of the image which fall somewhat behind the rest gave waves differing in phase from the other part, so that results like those exhibited in Figs. 1, 2 and 3 were obtained. The fine circular lines seen in the engraving are shadows cast by ordinary hairs fastened across the slit. They serve as reference circles by which the center of revolution may be accurately found.

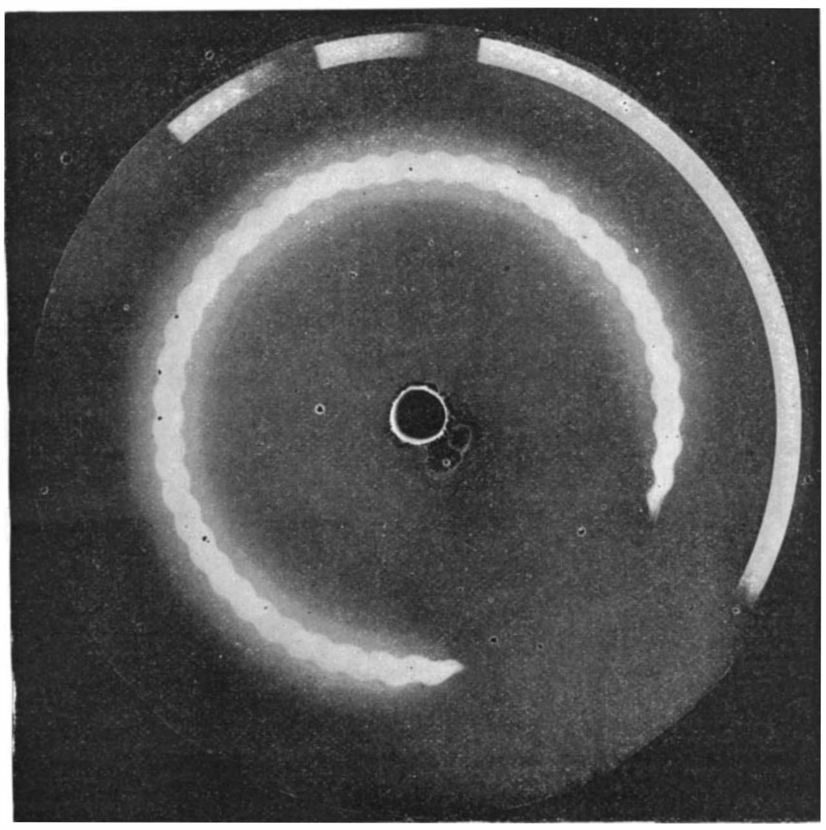


Fig. 1.—TUNING FORK RECORD OF THE MOTION OF A PROJECTILE IN A GUN.

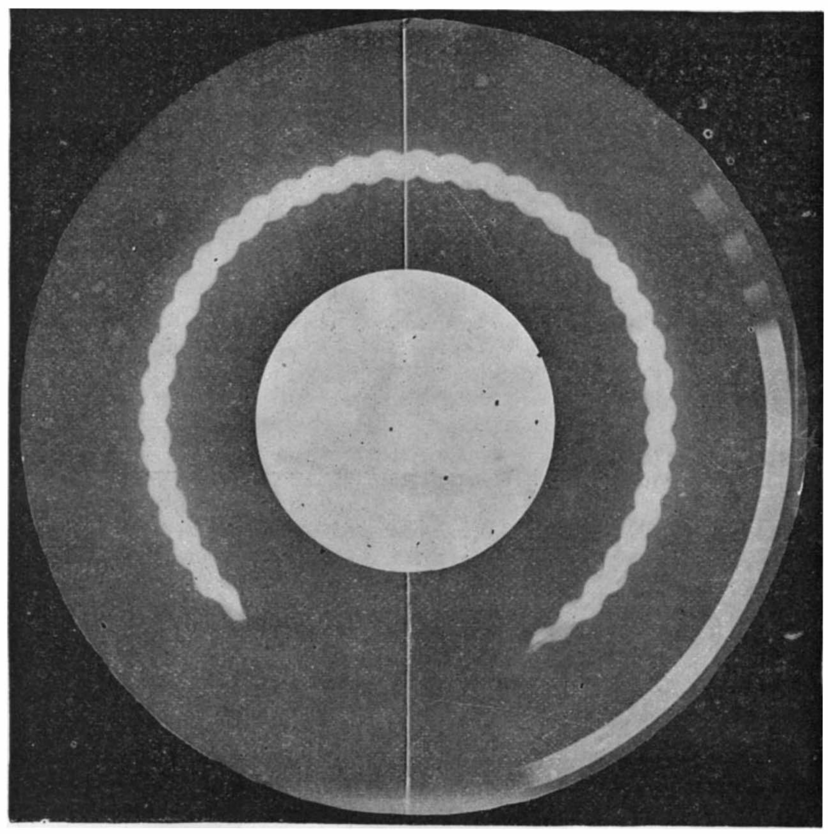


Fig. 2.—TUNING FORK RECORD OF THE MOTION OF A PROJECTILE IN A GUN.

In carrying out this experiment a rod of wood is attached to the end of the projectile and allowed to extend a little beyond the muzzle of the gun. This rod is furnished with a number of copper ferrules, as shown in Fig. 4, and in the longitudinal groove was embedded a wire which was connected with each of the ferrules, and arranged to communicate electrically with the inner surface of the gun. The projecting end of the rod is supported by a ring, G, attached to radial pieces, E, F, supported by plates, C, D, held by a split cylinder, A, of wood, clamped on the muzzle of the gun by yokes, B. The ring, G, carries brushes which bear upon the wooden rod or ferrules carried thereby. To the support of one of the radial pieces, F, is attached one of the electrical conductors, the other being connected with the gun.

The photographic plate being in motion and the light being in position to throw a beam through the aperture of the aluminum on the fork, the prism and carbon bisulphide of the chronograph, the gun is fired and contacts are made by the brushes with the ferrules, thus producing the record on the plate by the opening and closing of the "massless" shutter.

By means of this device as many as seven observa-

* From a report by Dr. Albert Cushing Crehore, Asst. Prof. of Physics, Dartmouth College, and Dr. George Owen Squier, 1st Lieut. 3d Artillery, U.S.A., Instructor Department of Electricity and Mines, United States Artillery School.

† SCIENTIFIC AMERICAN, vol. 74, page 280, and SUPPLEMENT No. 1054.

tions of the projectile were taken in a distance of 57 centimeters, which is somewhat less than one-third the whole travel of the projectile. The shortest distance between observations was 3·7 centimeters; the greatest distance observed along the bore was about 76 centimeters. Some of the time intervals were as small as the 1-2000 of a second. The seven interruptions above mentioned were recorded in 1-200 of a second. These figures indicate the great sensitiveness and accuracy of this apparatus. These experiments were confined to a 3·2 inch field rifle.

We understand the same experiments are to be tried in connection with some of the big guns.

The Craze for Relics.

The collecting mania is a direct result of the passion for religious relics so prevalent in mediæval times. Hardicanute, in 1041, commissioned an agent at Rome to purchase St. Augustine's arm for one hundred talents of silver and one of gold. Henry III, deeply tainted with the superstition of the age, summoned all the English notables to meet him in London, when the king acquainted them that the great master of the Knights Templar had sent a phial containing "a small portion of the precious blood of Christ which He had shed upon the cross"—attested to be genuine by the seals of the patriarch of Jerusalem and others! A procession between St. Paul's and Westminster Abbey was performed, although the road between the two places was "very deep and miry." Herbert, in his life of Henry VIII, notices the great fall of the price of relics at the dissolution of the monasteries.

"The respect given to relics, and some pretended miracles, fell; insomuch, as I find by our records, that a piece of St. Andrew's finger (covered only with an ounce of silver), being laid to pledge by a monastery for forty pounds, was left unredeemed at the dissolution of the house; the king's commissioners, who upon surrender of any foundation undertook to pay the debts, refusing to return the price again."

Lord Cromwell's commissioners found, in St. Augustine's Abbey, at Bristol, some extraordinary relics, including "two flowers which bore blossoms only on Chistmas Day, Jesus' coat, our Ladie's smocke, part of the Last Supper, part of a stone on which Jesus sat in Bethlehem," and others. Henri Estienne, in the traite preparatif to his "Apologie pour Herodote," speaks of a monk of St. Anthony having seen at Jerusalem an extraordinary assemblage of relics, among which were a bit of the finger of the Holy Ghost, as sound and entire as it had ever been; the snout of the seraph that appeared to St. Francis; one of the nails of a cherub; one of the ribs of the verbum caro factum; some rays of the stars which appeared to the three kings in the east; a phial of St. Michael's sweat when he was fighting against the devil; a hem of the garment which Joseph wore when he cleaved wood, and others, all of which the enthusiastic monk devoutly brought home with him to France. Such relics as these—to which may be added that of a tooth of our Lord's, which Guibert de Rogen describes as having operated many miracles, with the assistance of the monks of St. Medard de Soissons—such relics as these, we repeat, make all others hide their diminished heads.

Few of these venerable and impudent absurdities have survived the iconoclastic tendencies of the last few decades, while even the rival holy coats of Treves and Argenteuil are palpable swindles. The record of that of Treves goes back, it is true, to the year 1190, but as a relic it is as authentic as the feather from Gabriel's wing. Quite recently the Moslem population of Southern Russia were reported to be in a state of great excitement owing to the theft of a valuable casket containing three hairs from Mohammed's beard, accompanied by an imperial firman certifying their absolute authenticity! The casket, with its precious contents, was sent as a present from Constantinople to Samarcand in Turkestan, but was stolen at Kharoff. A few months ago three genuine teeth of Tasso were sent to Signor Baccelli, the Italian minister of public instruction, by a priest who received them under seal of confession from a thief. The teeth had been stolen from the skeleton of the poet, and the robber, probably finding no market for them, took this method of returning them to their owner. Apropos of teeth, it may be mentioned that some time ago a certain nobleman constantly wore a remarkable ring, in which was set a tooth of Sir Isaac Newton; it was purchased for £730 in 1815.

The gold cross and collar of Edward the Confessor came under the hammer of Thomas, King Street, Covent Garden, in January, 1828, and was purchased by a Mr. Atkinson for £16 5s. 6d. Its authenticity appears to have been undisputed at the time. It was originally brought from Palestine by the British Princess Helena, the mother of the Christian Emperor Constantine, and passed into the hands of Edward the Confessor, with whom it was buried, and was exhumed many ages afterward. It was included among the royal jewelry of James II. The crozier of the same realized two and a half guineas in the same sale, and was originally in the museum of Sir Hans Sloane.

The counterpane which covered the bed of Charles I the night before his execution, and which is made of a thick rich blue satin, embroidered with gold and silver in a deep border, was, up to about half a century ago, used by the family of Champneys of Orchardleigh, near Frome, Somersetshire, as a christening mantle, from the period it came into their possession by marriage with the sole heiress of the Chandlers, of Camm's Hall, near Fareham, Hampshire, a family connected with Cromwell. The sheet which received the head of this king, after his decapitation, was until quite lately carefully preserved with the communion plate in the church of Ashburnham, Sussex; the blood, with which it had been almost entirely covered, turning quite black. This king's watch was also preserved with this grewsome relic, both of which came into the possession of Lord Ashburnham immediately after the death of the king. These, not having been sold, cannot be appraised at their full fancy price; but it may be mentioned that not long ago the prayer book used by King Charles I on the scaffold sold for one hundred guineas, or just half the amount which Sterne's wig fetched.—Temple Bar.

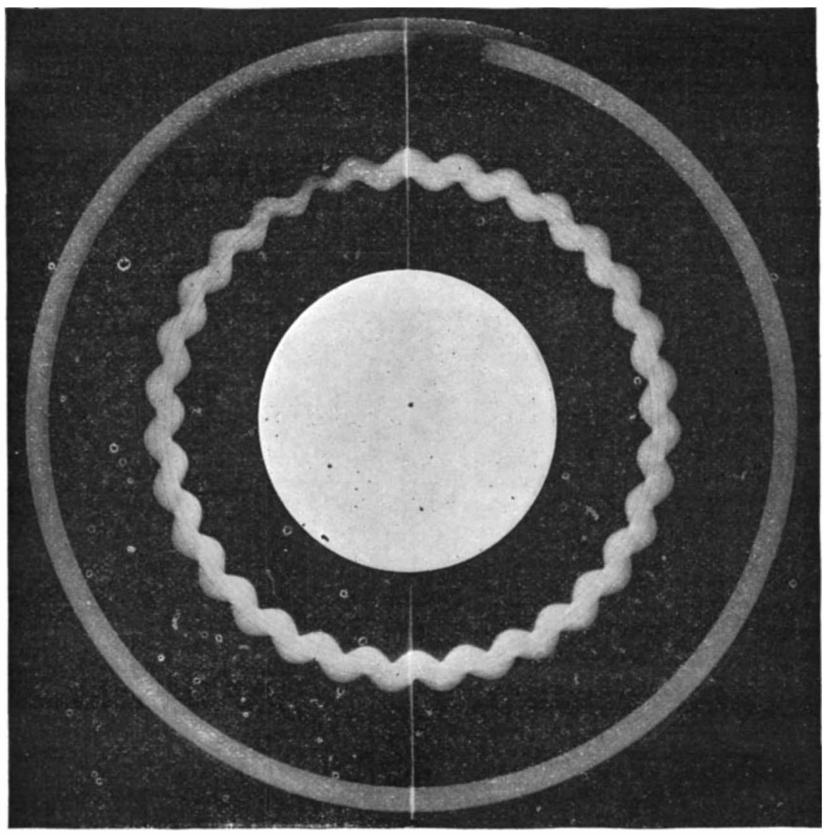


Fig. 3.—TUNING FORK RECORD—512 (SINGLE) VIBRATIONS PER SECOND.

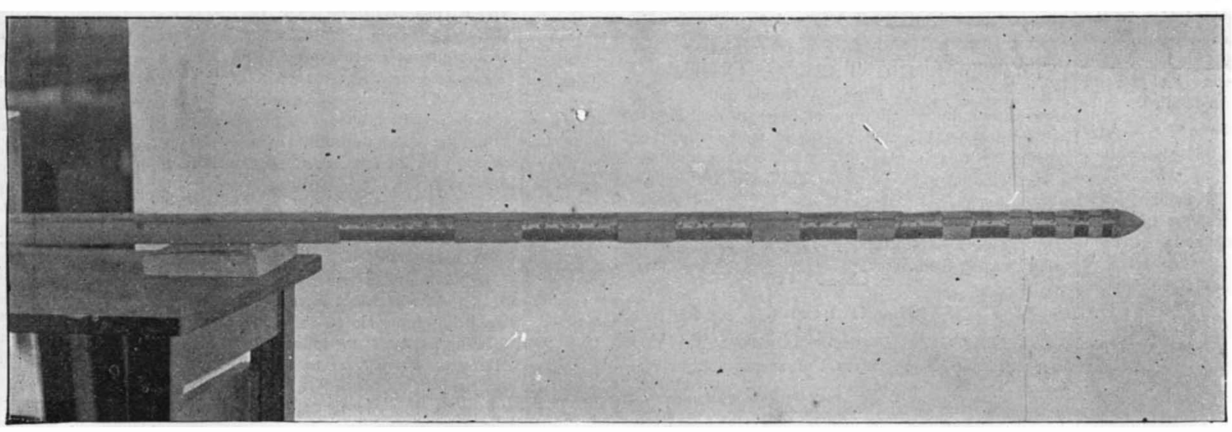


Fig. 4.—ROD CARRIED BY THE PROJECTILE.

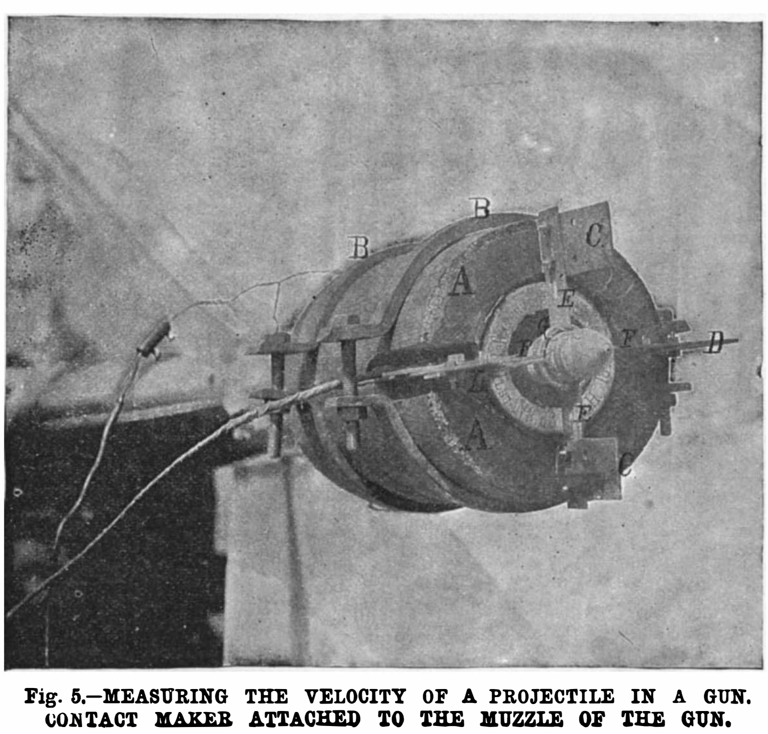


Fig. 5.—MEASURING THE VELOCITY OF A PROJECTILE IN A GUN. CONTACT MAKER ATTACHED TO THE MUZZLE OF THE GUN.

A Year of Thirteen Months.

Our attention has been directed by Mr. C. E. Gillespie, of Edwardsville, Ill., to a proposal to shorten the length and increase the number of the months of the year. Our correspondent says: "I notice in the SCIENTIFIC AMERICAN of August 15 your editorial on the Metric System of Weights and Measures,' and will say that I most heartily concur with your suggestions, in relation to the same, and believe it will undoubtedly, if adopted, add greatly to the facility and convenience of transacting business throughout the world.

"In connection with this idea I inclose an article which, I think, might be appropriately indorsed by leading journals, like the SCIENTIFIC AMERICAN, as it will be likely to prove a great convenience in estimating or computing time (as the other system might, in weighing and measuring), being so much more convenient, simple, and easily remembered than the complicated system now in use."

It is suggested by Mr. John S. Brooks that on January 1, 1900, a new division of the year into thirteen months be instituted. It is claimed that this is not so preposterous as most people would be likely to consider it at the first thought. Mr. Brooks says that if such a division were made, the first twelve months would have just twenty-eight days, or four weeks each, and the new month twenty-nine, to make 365, and thirty in leap years. After a few days there would be no need to refer to calendars, as the same day of the week would have the same date through the year. If January 1 were say Monday, every Monday would be the 1st, 8th, 15th, and 22d; every Tuesday the 2d, 9th, 16th and 23d, and so throughout the year. The changes of the moon would be on about the same dates through the year, and many calculations, like interest, dates of maturing notes, Easter Sunday, and many other important dates, would be simplified. Mr. Brooks is of the opinion that although the present generation would have to figure new dates for birthdays, and all legal holidays, except new year, would be on different dates, yet the gain would be more than the loss, as that would be permanent, and the objections trifling.

The proposed change certainly has the merit of novelty, and it is just to say that the arguments in favor of the metric system on the ground of utility apply with considerable force in the present case. We fear, however, that the objections on the grounds of sentiment, which are strong in the matter of weights and measures would be even stronger against the proposed revision of our methods of computing time.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

METALLIC CAR TRUCK. — James S. Hardie, Eldorado, Kansas. The invention covered by this patent consists principally of truck arches carrying the journal bearings and formed with transverse openings for the spring seats and springs, a truck bolster sliding in the opening and resting on the springs. A truck thus made is of strong and simple construction, not liable to get out of order, readily set up without the aid of skilled labor, and may be conveniently inspected and repaired whenever necessary.

HOSE COUPLING.—Sherman W. Day, Avonmore, Pa. A hose that works automatically in coupling and uncoupling, requiring no personal attention when cars come together or are separated, has been devised by this inventor. The head carries a valve, and in the head is a rocking valve block having a port, there being a connection between the port and the valve and the block and the valve, whereby the valve may be opened and closed by the movements of the block. The coupling may be attached by bolts or otherwise to the drawhead of the car coupling, or to the sill or framework of the car at one side of the drawhead, projecting slightly forward, to insure close connection when the cars come together.

RAIL JOINT.—Carl W. Dehn, Topeka, Kansas. This joint comprises two fish plates, made approximately L-shaped in cross section, and base plates integral with the outer sides of the bottom parts of the fish plates to form a rest for the base of the rail, the base plates having S shaped edges abutting against one another and extending in direct line with the rails at their meeting points, the plates having on their under side longitudinal ribs to fit snugly between adjacent ties. This joint cannot become loose, and on the loosening of the bolts and spikes the parts cannot be removed unless the rail is raised to permit of sliding the base plates longitudinally over the ties.

SWITCH.—Charles H. and Wilbur H. Sturgis, Swartz Creek, Mich. This switch has a rocking instead of the usual sliding lateral movement, and is designed to be inexpensive and durable, unaffected by snow and ice, and safe under all conditions. A switch member comprising a rounded bottom and sides and a flat top is mounted to rotate between adjacent ends of a track rail, and a switch rail is located on the flat upper portion of the body, the switches being so shaped that the point thrown from the rail will have a surface adapted to be engaged by the wheel flanges of a train, in such manner as to prevent accidental displacement of the switches when the train first reaches them or while it is passing over them.

ELECTRIC BRAKE.—Edgar A. Hauerwas, Saratoga Springs, N. Y. This invention relates to auxiliary or emergency brakes, and provides a brake that may be used in connection with the ordinary brakes to stop a car or train. Electro-magnets normally in open circuit are arranged to engage with the track rail on closing the circuit, and means are provided whereby the magnet circuit may be closed by the opening of a normally closed main circuit either at the engine or upon any car. The circuit will be automatically closed and the air brakes operated should a truck be derailed.

PNEUMATIC SIGNALING SYSTEM.—Abner J. McGehee, Jackson, Tenn. According to this improvement a conductor's release valve on the cars has combined in it both a brake-operating valve and a signal valve, capable of discharging a limited volume of air to operate a whistle on the engine without applying the brakes. The conductor's valve is adjustable to the length of the train, from any part of which a signal may be transmitted to the engine, and all extra train pipes and hose connections are dispensed with, air to blow the whistle being taken from the main reservoir back of the engineer's valve. The improvement may be adopted without changing any brake system.

Mechanical.

DRILL DRIVING MECHANISM.—Foster Milliken, New York City. According to this invention a skeleton frame carries a seat or saddle, with pedal shaft, driving cranks, etc., together with a balance wheel, connecting gears and driven shaft for imparting motion to a drill, thus affording a convenient and efficient bicycle driving mechanism for drills, reamers, etc. The construction is such as to enable the drill or other tool to be carried within a certain radius of any desired point, particularly in iron buildings, and there operated to great advantage with the least possible exertion.

BICYCLE WHEEL TRUING.—Frederick Schrader, Rockaway, N. J. This invention provides means by which a workman may accurately true a wheel, consisting of a series of pivoted jaws arranged in a circle and adapted to engage the inner face of the wheel rim, with means for simultaneously moving the jaws in and out of engagement with the rim. The jaws are pivoted on blocks arranged in a circular series on a carrier which may be turned and moved axially, there being means for moving the jaws into engagement with the wheel rim when the carrier is moved.

DRIER FELTS OF PAPER MACHINES.—Thomas Pusey, Stockton, Cal., and Thomas H. Latimer and Thomas H. Savery, Wilmington, Del. An automatic tightener for the drier felts has been patented by these inventors, giving the felt at all times a uniform and proper tension without undue strain on any of the rolls and insuring the proper drying of the paper. A normally stationary but adjustable tightening roller is engaged by the felt at one side, while another tightening roller arranged to move freely in the same plane is engaged by the felt on the opposite side, a weight connected to the second roller automatically tightening the felt, so that no attention is required on the part of the machine tender for compensating in the varying length of the felts.

FLUXING MACHINE. — Nehemiah R. Saulsbury, Ridgely, Md. In the capping of tin cans this machine is designed to deliver the proper amount of acid to the cans preparatory to soldering them. It has a tank with bottom outlets closed by vertically sliding spring pressed valves, and the valves are raised to open the outlets by pivoted levers controlled by the movement of the cans. The amount of acid delivered to the cans can be readily regulated and the acid may be sprayed or delivered in bulk.

Mining, Etc.

QUARTZ MILL.—Frank P. Snow, Baker City, Oregon. This invention provides, within a suitable casing, a circular grinding track on which a series of balls is propelled by the material fed to the mill, there being below the track a channel containing mercury to take up any precious metal in the material ground by the balls. The fineness of the product may be governed by changing the speed of the mill or the supply of water or material to be ground, particles too coarse and heavy to be partially floated and carried by the current remaining in the path of the crushing balls until they are reduced to such fineness that they will pass with the current to the overflow.

ALLUVIAL GOLD WASHER. — James Miller, Sault Ste. Marie, Canada. This is a trough made of pressed metal, such as copper, zinc, aluminum or galvanized iron, and having transverse interior corrugations or ribs, over which are inverted V-shaped riffle plates, there being at each end rockers or crescent-shaped ribs of steel in the exterior depressions. At each end are lugs or rings by which the washer may be suspended from the inside or the outside. The washer, when supplied with the material to be treated, with sufficient water, is rocked to allow the gold to settle below the edges of the riffles, when the treated material is shoveled out and new thrown in until enough gold has collected to serve as amalgam in the usual way.

Agricultural.

GRAIN DRILL.—Calvin C. Blair, Beloit, Kansas. For a grain drill or other form of planter, this invention provides disk furrow openers, each consisting of two disks having independent supports, each pair of disks so mounted that they will come together at their forward edges and remain so while the seeds are being dropped, the point of contact regulating itself according to the depth to which the disks enter the ground. The disks may be straightened to use for pulverizing purposes, or when the machine is to be moved to and from the field, and the seed-dropping mechanism is driven from a caster wheel at the front of the machine.

CLOVER SEED HARVESTER.—Samuel Hamilton, Wilson, Mo. According to this improvement, a gathering device and rake and mechanism for operating the rake are so attached to a mowing machine that the gatherer will at all times travel close to the ground, and it and the rake will be unaffected by the vibratory movement of the mowing machine, the stubble also assisting in carrying the harvested straw to the rake. A drop bar attached to the mower bar by short links has rearwardly projected teeth with upturned ends which direct the cut material to the rake, and the latter may be conveniently rocked to and from the drop bar teeth.

TRANSPORTING TREES. — Charles O. Halling, Minneapolis, Minn. A simple and easily operated truck, by which trees of large growth may be safely transported from one place to another, has been devised by this inventor, the truck having a divided axle, a winding and hoisting mechanism, and a collapsible and expansible basket in which the roots of the tree are placed, the members of the basket being made, by compressing devices, to clamp firmly the roots and the earth incasing them.

Miscellaneous.

LANTERN HOLDER.— George T. Van Riper, Freeport, N. Y. Instead of suspending lanterns loosely on stakes, when using them as signals during building or excavating operations, the lanterns being thus liable to be stolen, this inventor provides a special form of lantern holder and means of securing it to a stake driven into the ground, or to a flat surface, such as a board or flooring. It comprises a casing having an opening through each of its walls, one of the walls being hinged, there being also an opening in the top of the casing, and means for locking it, and for conveniently attaching the casing to a support.

POST FASTENING. — Joseph Schmidt, New York City. This is a device for securing standards or posts to a flooring, to facilitate erecting partitions, or for anchoring railing posts, stair posts, etc. It comprises a casing to be secured in a floor opening, with its top plate flush with the floor, while in the casing is movable a screw whose shank has a worm thread. A shaft extended through the casing has its outer end adapted for engagement by a turning tool, and a worm gear on the shaft meshes with the worm thread on the screw shaft, whereby the latter may be turned and the screw entered into a post or standard.

WHEELED SCRAPER.—William Ackerman and Albert A. Hasselquist, Elgin, Ill. This invention is for an improvement on a formerly patented invention of the same inventors, providing a scraper in which the scoop will be entirely under the control of one man, who may also drive the machine, the parts being so arranged that the entire machine will be better under the control of the operator, and so that the scoop may also be more readily carried to the dumping position or restored to the working position.

CALCINING CEMENT.—Clifford Bonneville, Allentown, Pa. This invention is for a method of and apparatus for calcining cement, the raw cement material and a portion of cement being combined with a combustible material, the mass made plastic with water and then immediately subjected to a calcining and rolling action to form balls or lumps prior to the setting of the cement contained in the mass, after which the balls or lumps are immediately calcined, the apparatus affording convenient means for effectively carrying out this process.

GAME BOARD.—Harold Gregson, Detroit, Mich. This board has an inside cushioned marginal flange, various designated bottom spaces with elastic projections, with balls arranged in the field, in which also turns a catapult adapted to expel projectiles. The game is designed to represent a battle field, the balls representing men arranged as bodies of soldiers, against which the projectile is thrown from the catapult.

SLEIGH TRUCK.—Seth C. Nutter, Sherbrooke, Canada. To facilitate the transfer of sleighs over floors or over ground not covered by snow, this inventor has devised a light and simple truck consisting of a pair of reach bars, on each of which is a grooved track rail, there being casters on the under side of each end of two connecting cross bars and a buffer block with downwardly inclined nose projecting from each end of the truck, but avoiding contact with a level surface.

HARNESS.—Nelson H. Mesick, Glencoe Mills, N. Y. In harness used on horses drawing two-wheeled vehicles, this inventor has devised improvements whereby the jars and jerks incident to the stepping or shoulder motion of the animal are not transmitted to the vehicle, making easier riding for the occupants. A strap connected with the saddle is also connected by a link with a tug, the strap being arranged to yield longitudinally and vertically to relieve the tug of the shoulder motion.

VEHICLE POWER STORAGE.—Martin J. McDonald, Trenton, N. J. This invention covers a mechanism for accumulating and storing the power lost by vehicles in descending grades, and its subsequent efficient application to propel the vehicle. A power-transmitting gear engages the driving mechanism, and a clutch-controlled gear carried by an accumulator shaft on which are coiled springs is in winding connection with the transmitting gear. There is a second clutch connection between the accumulator shaft and the transmitting gear, and a third clutch connection whereby the springs may be wound up by the winding mechanism. The apparatus is particularly adapted for use in connection with velocipedes.

FENCE.—John F. Melvin, Mayfield, Ky. This is a picket fence made without posts, and composed of vertical slats connected by upper and lower longitudinal wires looped around each picket, bracing wires extending outwardly and downwardly from both sides of the fence, at suitable intervals, to separate anchorages in the ground. Corner brace wires are crossed as they extend downward and outward, preventing sagging and holding the fence straight and firm.

RULING PEN AND HOLDER.—Albert N. Dow, Exeter, N. H. This is an improvement designed to be especially useful to accountants for ruling single and double lines, the holder being made to serve as a guide to the alignment without the assistance of an ordinary ruler. The holder has bearing surfaces or points near the pen end and farther back, designed to slightly sink into the paper by pressure, and permit the holder to move over the paper only in a straight line. The device is also designed to be useful as an ink eraser, pencil mark eraser, paper cutter, etc.

STRINGED INSTRUMENT IMPROVEMENT.—William H. Richardson, Trenton, N. J. This invention provides a wrist guide especially adapted for mandolins, and which is an integral portion of the tail piece, the guide and tail piece being so shaped as to be readily placed in firm position on the instrument, and the guide supporting the wrist during the work of playing without interfering with the freedom of a full or a forearm movement.

STEAM RADIATOR. — Augustus Eichhorn, Orange, N. J. This is a single inlet radiator, adjustable to different degrees of radiation, and with a central inlet pipe, improving the symmetry of the radiator. It is composed of a series of loops forming two separate sections, there being inner loops shorter than the outer loops, forming a space at the lower central portion in which is a three-way valve communicating with each section and with the steam feed, and capable of independently controlling the inlet of steam to the sections.

STOVEPIPE HOLDER.—Frank J. Norton, Ithaca, N. Y. For holding a stovepipe safely connected to the chimney into whose flue it is entered, so that it will be impossible for it to become accidentally detached, this inventor has devised a holder consisting of a piece of strap iron having one end bent to form a stop on the inside of the chimney, an adjustable stop sliding on the body of the iron outside the chimney, and the device being secured in position on top of a pipe as the latter is placed in position, when the pipe and holder are secured together by a rivet or nail passed through one of several apertures in the holder and an aperture made in the pipe.

ASH SIFTER. — John N. Fordham, Brooklyn, N. Y. To effectively separate the cinders from the fine ashes without raising any dust, this invention provides a circular casing adapted to be placed on an ash can or barrel, there being within the casing an inclined pivoted grate, from whose lower end extends a discharge chute and from whose upper end extends a hopper in which the ashes and cinders to be sifted are placed. The hopper has a hinged cover, which is closed while the sifting is being done, which is effected by turning the grate on its pivot pin by means of a handle extending through one side of the casing.

FILTER.—Joseph T. B. Selman, Toronto, Canada. This is an inexpensive filter designed for attachment to an ordinary service pipe and having automatic mechanism which makes it self cleaning, the filter being easily taken apart and put together when necessary. In passing through the T connected to the water supply pipe the water is made to revolve a brush shaft, the brushes on which scrub a screen through which the water passes to a filter bed, and when the water is turned off the impure water runs back and off through an automatically opening valve at the bottom.

DESIGN FOR A DISPLAY BOX.—Charles Spilka, New York City. This box contains one or more dual pockets, each pocket of a set having one end of approximately semicircular shape.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SHAKESPEARE'S TOWN AND TIMES. By H. Snowden Ward and Catharine Weed Ward, London. New York: Truslow & Comba. London: Dawbarn & Ward. Pp. 176. Price $3.

The book is beautifully gotten up, having nearly one hundred and twenty illustrations, most of which are from excellent photographs by Mrs. Ward, handsomely reproduced by the half-tone process. The interior views of the Shakespeare historical buildings are superior to any in that line we have seen. In addition to the numerous illustrations, we note the excellence of the letterpress and the remarkable freedom from errors.

The authors confine themselves strictly to the town of Stratford-on-the-Avon and a chronological statement or arrangement of the various incidents of town life as gathered from the accessible records relating to William Shakespeare's parents and other relatives prior to his birth, during his life, and after his father's and his own death. Any contributory evidence that can be found bearing on the life of the family and its probable effect in preparing the young poet for his future work is candidly given, and weight is also given to the strained religious state of affairs that occurred during the early part of his life. All of the facts are written in the usual pungent, clear cut, entertaining style that Mrs. Ward is noted for.

The book is divided into nine chapters, arranged in progressive sequence, as, for example, chapter one relates to "The Town and District;" the next is on "Some Historical Notes;" the third relates to "Shakespeare's Ancestors," the fourth to "Shakespeare's Childhood," the fifth to his "Boyhood," the sixth to his "Youth and Courtship," the seventh to "Seeking a Fortune," the eighth to "Manhood and the Close of Life," the ninth to "A Great Man's Memory." There are also three appendices, one giving Shakespeare's will in full, and another relating to "New Light on Shakespeare's Lineage," and two very good maps of Stratford and vicinity.

One of the valuable historical features of the book is an illustration showing a profile of the death mask and of the Davenant bust beside each other. The resemblance is striking. The bust is one but lately discovered, having been bricked in out of sight in an old theater building in London, and only found when the building was torn down. The bust is now preserved in the museum of the memorial building at Stratford. A reproduction of the only letter found written to Shakespeare, October 25, 1598, by Richard Quiney, is an interesting relic. The book is certain to be a valuable addition to the many that have been published on the life of this great poet, and gives a candid and accurate view of domestic life at that period, which has heretofore only been lightly touched upon. We regard it as a very necessary and useful book to all interested in the life and works of the immortal Shakespeare.

LEE'S VEST POCKET POINTERS. Chicago: Laird & Lee. Pp. 220, vest pocket size. Price, cloth, 25 cents; morocco, 50 cents.

For "busy people" this little book is designed to be a convenient and always accessible repertory of facts most likely to be asked about, either from interest or curiosity.

ALTERNATING CURRENTS AND ALTERNATING CURRENT MACHINERY. By Dugald C. Jackson, C.E., and John Price Jackson, M.E. New York: Macmillan & Company. Pp. 730. Price $3.50.

This book is issued as Volume II of a text book on electro-magnetism and the construction of dynamos, by Dugald C. Jackson, who is professor of electrical engineering in the University of Wisconsin, John Price Jackson being professor of electrical engineering in the Pennsylvania State College. It is a book designed to be of high value to electrical engineers who labor to keep abreast with the complex problems almost daily presented in the steadily enlarging scope of modern electrical development.

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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(6987) G. M. asks for a recipe for making modeling wax such as sculptors use? A. Melt over a moderate fire 100 parts yellow wax, and add 13 parts Venetian turpentine, 6½ parts lard, 72½ parts elutriated bole. Mix thoroughly, pour the mixture gradually into a vessel containing water, and knead it several times with the hands. The wax must be melted at a temperature sufficiently low not to create bubbles. Add Indian red if desired for color.

(6988) C. J. S. asks for a receipt for a brass sign polish, such brass work as is used in front of store windows and exposed to all sorts of weather. A. Rottenstone made into a paste with sweet oil makes a good polish for brass. The following may also be used: Rottenstone, 4 ounces; oxalic acid in fine powder, sweet oil, 1½ ounces; turpentine, a sufficient quantity to make a paste.

(6989) C. A. F. asks what compound may be used to braze casting (cast iron) successfully. A. Cast iron is very difficult to braze. Make the surfaces that are to be brazed very clean by using file or scraper. Rub up some borax with water on a piece of slate and rub the surfaces to be brazed with a piece of zinc wet with the borax. Then bind the surfaces together, apply a strip of brass or the spelter and additional borax, and proceed as with other metals.

(6990) T. L. R. asks for a formula for liquid bluing. A. Water, 15 parts; dissolve in this 1½ parts indigo carmine. Add ¾ part gum arabic.

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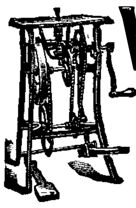

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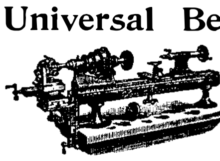

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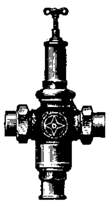

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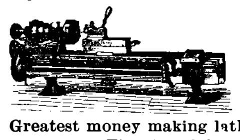

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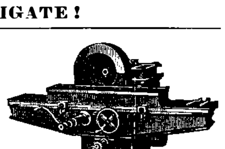

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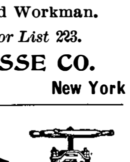

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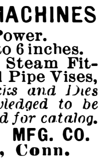

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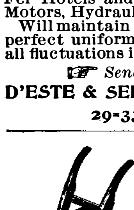

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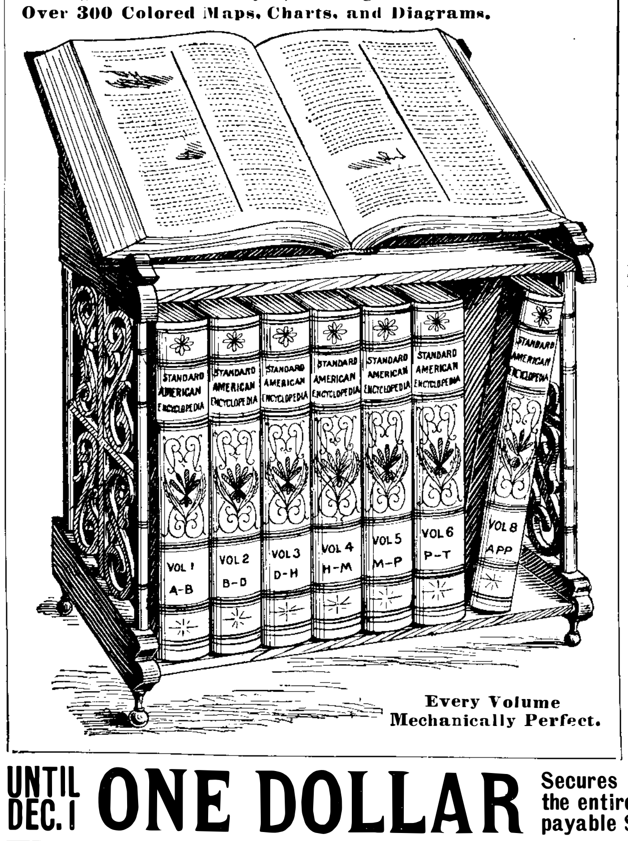

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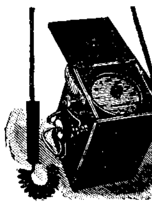

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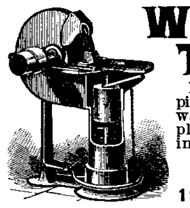

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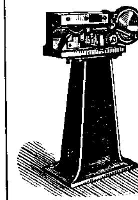

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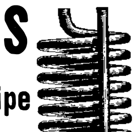

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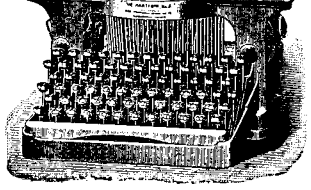

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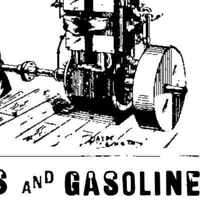

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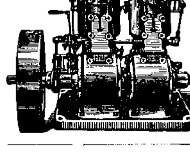

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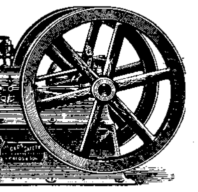

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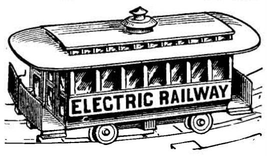

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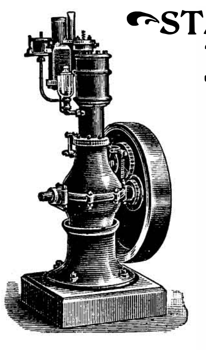

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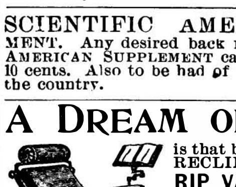

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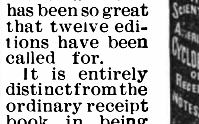

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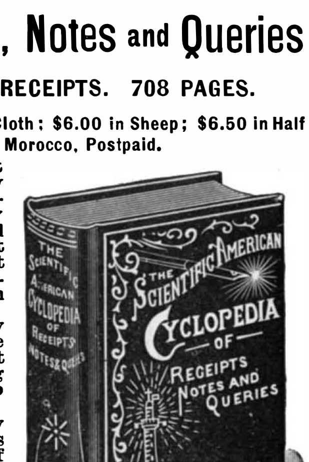

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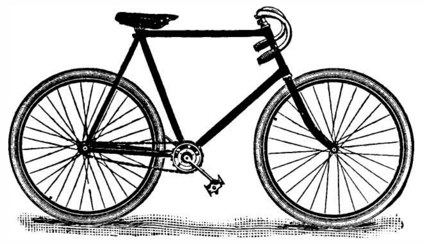

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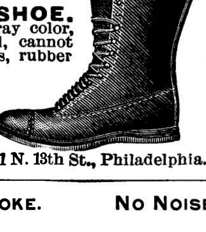

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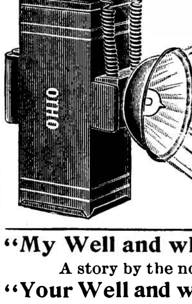

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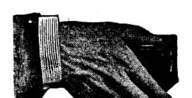

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