SCIENTIFIC AMERICAN

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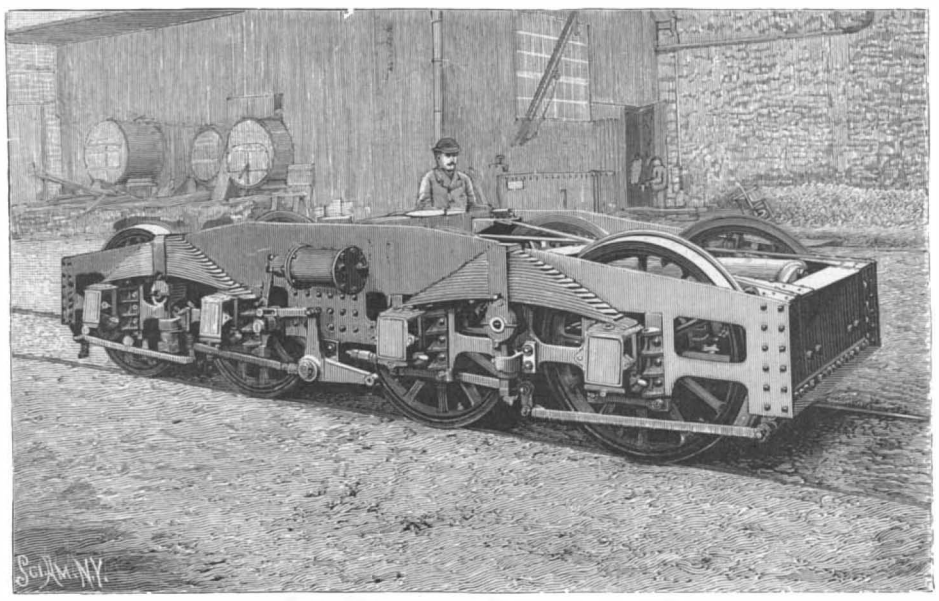

Fig. 1.—AN EIGHT WHEELED TRUCK.

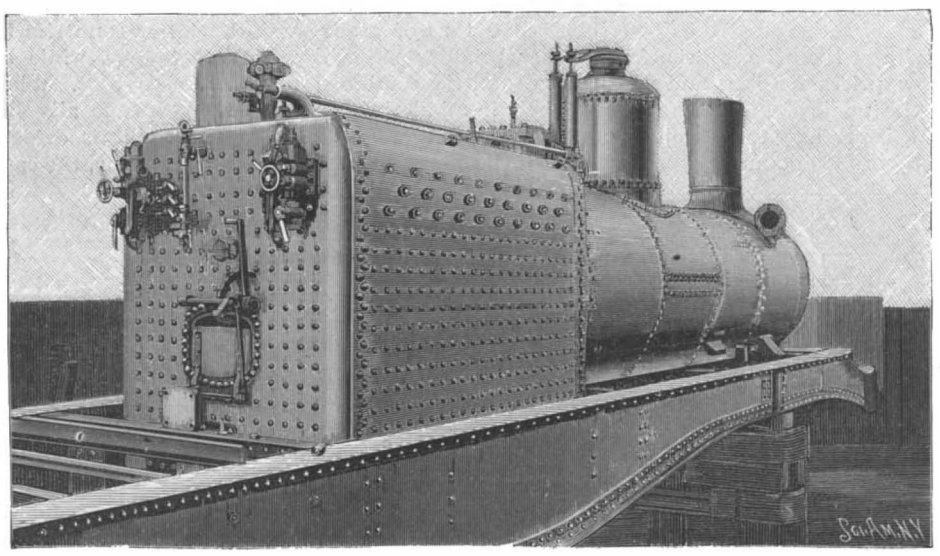

Fig. 2.—THE BELPAIRE BOILER.

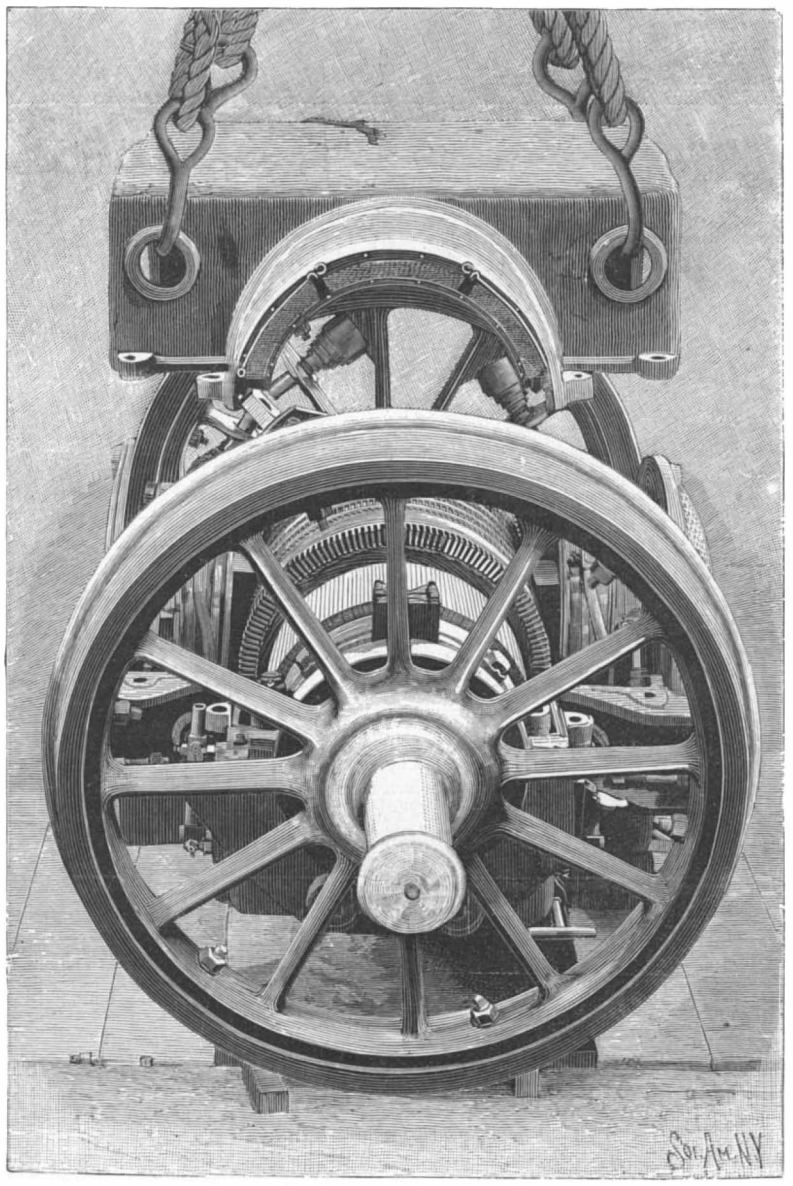

Fig. 3.—ONE OF THE EIGHT MOTORS.

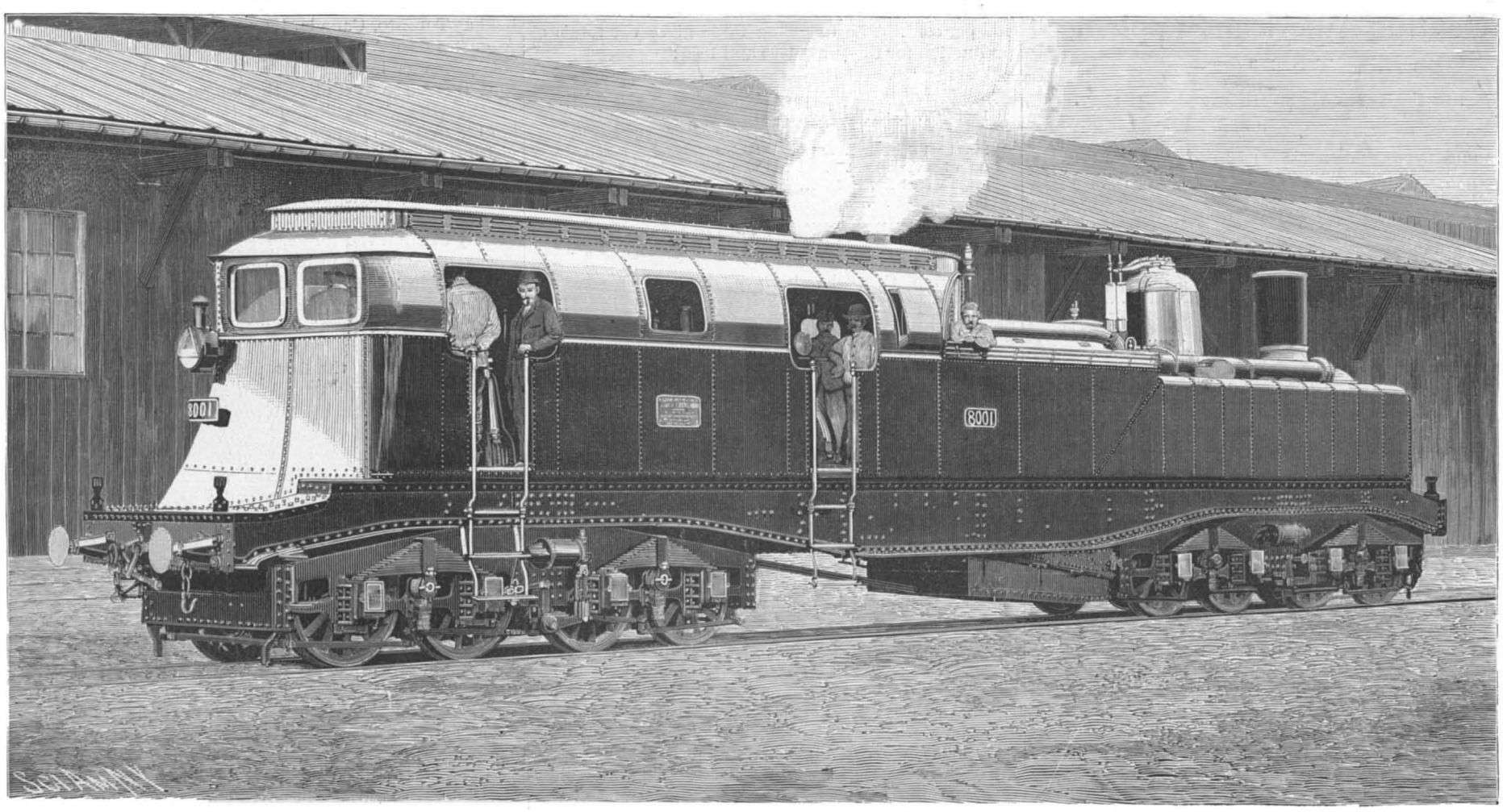

Fig. 4.—THE HEILMANN ELECTRIC LOCOMOTIVE.—[See page 152.]

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THE AMERICAN IRON TRADE FOR 1896.

If a copy of the statistics of the American Iron Trade for 1896 were put into the hands of a student fresh from a course of lectures on political economy, his belief in one of the cardinal truths of this science would be liable to receive a rude shock in the first few pages of the pamphlet. If the "cost of production determines the selling price," how comes it, he will ask, that the first pages of the "statistics" are taken up very largely with an account of various influences which caused the violent fluctuations in price of the past year? The "wire nail pool" came to an end about December 1, 1896, and "prices dropped rapidly." Its fate is shared by the "billet pool," and a similar fall in prices is noted. In May the "beam pool went to pieces" and prices experienced a simultaneous fall. An examination by the author of the statistics into the causes of low prices and depression leads to the conclusion that, though some of them may be "occult and intangible," there are two that are plainly visible—the distrust of the country's future due to the silver movement, and the pressure upon prices and profits of a capacity of production which is greatly in excess of our powers of consumption. A similar cause to the last is the reckless construction of unnecessary railroads which have since become bankrupt; and the wrecking of other railroads, which were needed, by hostile State and national legislation is also noted.

It is satisfactory to note the great increase which has taken place during the last few years in both our exports and manufactures of iron and steel. This has been particularly marked in the calendar years 1895 and 1896, our exports for these years being respectively $35,071,563 and $48,670,218. In each of the last four years our exports have exceeded our imports, the aggregate exports amounting to $143,844,873 and the aggregate imports being $95,778,838. The decline in imports is due to decreased demand for foreign tin plates and to the low price of our iron and steel. Our increased exports are due to the same low prices, though this increase has brought no appreciable relief to our glutted markets.

Since the close of the civil war there have been four periods of particularly low prices for iron and steel, the first occurring after the panic of 1873. The rate given in the following table is per long ton, except for bar iron, which is quoted by the 100 pounds.

Articles.	1873-9.	1884-5.	1891-5.	1896-7.
No. 1 foundry pig iron, at Philadelphia..	$16.50	$17.50	$12.00	$11 75
Gray forge pig iron, lake ore, at Pittsburg.....	16.00	14.00	8.90	8.50
Bessemer pig iron, at Pittsburg.....	19.50	17.00	9 95	9.25
Old iron T rails, at Philadelphia	18.00	16.50	11.00	11.50
Best bar iron, at Pittsburg.....	1.60	1.50	1.10	1.05
Steel rails, at mills, in Pennsylvania	40.00	26 00	22.00	17 00

There is a decrease in the production of all kinds of material except open hearth steel. There was a decrease of 5 per cent in the amount of iron ore mined; the output of pig iron decreased 8·7 per cent; Bessemer steel ingots, 20·1 per cent; other steel than open hearth decreased 13·6 per cent; structural shapes, 4·3 per cent; Bessemer rails, 14 per cent; wire rods, 21·1 per cent; wire nails, 19·1 per cent; cut nails, 24·1 per cent; open hearth steel (the one exception) showing an increase of 14·2 per cent. The following table gives the totals of production for the years 1895 and 1896:

	Total production. 1895.	1896.
Pig iron.....	9,446,308	8,623,127
Bessemer steel ingots.....	4,909,128	3,919,906
Structural shapes.....	517,920	495,571
Open hearth steel.....	1,137,182	1,298,700
Crucible steel.....	67,666	60,689
Bessemer rails.....	1,299,628	1,116,958
Wire rods.....	791,130	623,986
Wire nails.....	5,841,403 kegs	4,719,860 kegs
Cut nails.....	2,129,894 "	1,615,870 "

Although there has been a decrease of nearly a million tons in the total production of pig iron, it is noteworthy that the growth of the industry in the Southern States continues, Alabama, Virginia and Tennessee coming fourth, fifth and sixth in the list. Pennsylvania, of course, stands first, its output being 4,024,166 tons or 46 per cent of the total production of pig iron in 1896; Ohio produced 14 per cent; Illinois and Alabama each produced over 10 per cent of the total, and Virginia over 4 per cent. All the other States fell below 3 per cent. The largest falling off is in Pennsylvania, where the decrease was over 675,000 tons.

There is a small increase in the production of Bessemer steel compared with the averages of recent years, which has been somewhat more than 3,500,000 tons. The falling off in the production of Bessemer steel rails will not surprise any one who is familiar with recent railroad history and present conditions in this country. The extraordinary activity in railroad construction between the years 1885 and 1892, when the total construction for one year alone reached a total of over 12,000 miles, will explain the enormous demand for steel rails. At the close of that period some of the ablest railroad men in the country gave warning that the country was being over-supplied and stated that most of the country contained more railroads than would meet its needs for the next quarter of a century. The disaster which speedily overtook a large proportion of the roads, and the present depressed condition of those that did not go into the hands of receivers, has verified their forecast of the situation, and explains the great falling off in the total production of Bessemer rails. The total mileage upon which rails were laid in 1895 was 1,922 miles and in 1896 it was even less, being only 1,850. These figures are the lowest since the year 1875. Pennsylvania leads the States in the production of rolled iron and steel, having made 56·8 per cent of the total production of rolled iron and steel in 1896, against 56·4 per cent in 1895; Ohio made 13·9 per cent in 1896, against 14·4 per cent in 1895; Illinois made 10·7 per cent in 1896, against 10·1 per cent in 1895; and Indiana made 3·5 per cent of the total product in 1896. No other State produced 3 per cent in that year. Texas and Iowa were the only States having rolling mills located within their borders which did not roll either iron or steel in 1896.

One of the most interesting tables in the statistics is that of the world's great pig iron producers. In 1869 the United States produced 1,711,287 tons, Great Britain 5,445,757 tons, and Germany and Luxemburg combined 1,409,429 tons. A dozen years later, in 1881, the United States produced 4,144,254 tons, Great Britain 8,144,449 tons, and Germany and Luxemburg 2,914,009 tons. In the following ten years the United States not only doubled its own output but surpassed the total for Great Britain, the respective totals being 9,202,703 and 7,904,214 tons, Germany and Luxemburg producing 4,658,450 tons. We lost the lead to Great Britain in 1894 but regained it the following year, when we reached our maximum figure of 9,446,308 tons. The figures for 1896 are: United States, 8,623,127 tons; Great Britain, 8,563,209 tons; and Germany and Luxemburg, 6,374,816 tons. Of late years the most striking fact has been the rapid advance of the industry in other countries than the United States and Great Britain. At present, out of a total world's production of about 16,500,000 tons of crude steel, the latter countries together produce more than 9,500,000 tons, while all other countries combined produce 7,000,000 tons. When we bear in mind that half a dozen years ago all other countries produced only 4,400,000 tons, it is evident that if the present rates of increase continue, the combined output of the United States and Great Britain will be less than that of the rest of the world combined.

THE BRITISH ASSOCIATION MEETING.

To all who are interested in the promotion of useful knowledge for the general benefit of the race, the annual meetings of the British Association for the Advancement of Science have come to be looked forward to as seasons of special advantage, rich alike in their unfolding to the popular eye of the progress made in many branches of science for the preceding year and the promises held out and guide marks placed for future advancement.

In our last week's issue we gave a summary of the principal papers discussed at the meeting of the American Association, working on similar lines, and held a week earlier. The British Association meeting was held at Toronto, Canada, its sessions continuing from August 18 to August 25. The fact that the meeting this year was held on this side of the Atlantic, and that it came so soon after the magnificent celebration of the Queen's Jubilee, contributed not a little, no doubt, to the splendid enthusiasm with which the visiting scientists were received by our Canadian neighbors, and which was heartily participated in as well by a large delegation of American representatives of scientific advancement. The occasion also brought vividly to mind the former meeting of the British Association at Montreal, in 1884, the first that had ever been held outside of the United Kingdom, and the ensuing series of visits then made by representative foreign scientists to various great industrial establishments and notable engineering works in the United States. It was then that, for the first time, the gigantic strides which this country was making in many lines came to be fully appreciated, and, in the iron and steel manufacture, especially, it was felt that we were not only dangerous competitors in a field where England had heretofore claimed undoubted primacy, but that we were working in a direction and with a skill likely to give us the lead. The facts then so plainly set forth have acted as a spur to foreign manufacturers ever since, and consumers everywhere have reaped the benefit in better goods at lower prices.

At the meeting this year among the eminent foreigners present were Lord Kelvin, Lord Rayleigh, Prof. Roberts-Austen, and Messrs. Preece and Lodge, the famous electricians; Lord Lister, the father of antiseptic surgery, and last year's president; Prof. William Ramsay, who was associated with Lord Rayleigh in the discovery of argon, and who alone is entitled to the glory of first finding helium in terrestrial minerals; Sir John Evans, the new president; Prof. John Milne, recently of the University of Tokio, where he investigated the phenomena of earthquakes extensively; Prof. William Cawthorne

Unwin, one of the engineering experts who counseled the Cataract Construction Company when Niagara was harnessed; Sir Bosdin Leech, chief engineer of the Manchester Ship Canal; Prof. James Bryce, author of "The American Commonwealth;" and sixty or seventy others, who enjoy a high reputation in England, Scotland or Ireland, by reason of their professional activity in some department of science. A great many public and social or semisocial functions, with various excursions to different points of interest, including a visit to the Niagara Falls power plant, were pleasant features of the occasion, into which all seemed to enter most enjoyably.

In his opening address the president, Sir John Evans, said that he would undertake no general review of recent scientific progress, but would discuss a question belonging to his own special field of study.

ARCHÆOLOGY.

The relations which chemistry, mineralogy and history bore to this science, he said, were important, but the aid of geology and paleontology was imperative, if one inquired into the antiquity of man. When in 1859 human remains were found in the valley of the Somme, in France, in gravels that also yielded bones of the mammoth and the woolly rhinoceros, the coexistence of man with these animals in the quaternary period was established for a time. After the first excitement had subsided, there was a tendency among scientists to cut down the lapse of ages necessary to account for the changes in the earth's surface which had occurred since those gravels were deposited. He, however, sympathized with the view taken by Sir Charles Lyell that such penuriousness was a mistake. Many at the present day had got over this feeling, and of late years the general tendency of those engaged on the questions had been in the direction of seeking for evidence by which the existence of man on earth could be carried back to a period earlier than the quaternary gravels. The speaker cited some of the attempts in this direction. He was himself not satisfied with the supposed discovery of flint implements in pre-glacial deposits in the eastern counties of England, because they resembled too closely those of post-glacial times there, nor could he yet accept the evidence of the Norfolk Pliocene forest bed, where flints had been found within a few months that looked as if they had been worked by human hands. This alleged discovery and similar ones in France, Italy and Portugal were accepted by some geologists, but they were too few and too isolated to satisfy Sir John. Nevertheless, he did not despair of obtaining proof of man having lived in the tertiary period. Sir John did not indulge in specific figures, but effectively emphasized the remoteness of time to which belonged the earliest blunt stone implements of the paleolithic era in western Europe. He believed, however, that man existed before this in southern and eastern Asia. This, in fact, he considered the birthplace of the race, and he favored special investigations in that part of the globe.

This address will be published entire, as well as the other most valuable papers presented at the meeting, in current issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

GEOGRAPHY.

Before the geographical section, Dr. J. Scott Keltie, for many years secretary of the Royal Geographical Society, said he considered the present problem of this science in Europe, the region most in need of exploration being Albania. In Asia there was work to be done in the Malay Peninsula and Southern and Central Arabia. But the chief stress was laid upon the district lying between the Himalayas and the forbidden city of Lhasa, in Thibet. Parts of China, too, were still a blank on the maps, and there was something to learn about the source of the Irrawaddy River. In Africa it was desirable to explore the Central and Western Sahara, the region south of Abyssinia and northwest of Lake Rudolf and the highlands of British East Africa. On the latter Dr. Keltie remarked that it might be necessary to find homes for future generations when the United States and Canada became over-populated. The discovery by the young geographer and biologist, Moore, of salt water fauna near Lake Tanganyika, showing that that country had once been beneath the ocean, was an important revelation and indicated what fine surprises yet awaited the intelligent investigator. In the Arctic region the archipelago of North America was one now most needing attention. The speaker enlarged also on the desirability of studying Antarctic territory.

MATHEMATICS AND PHYSICS.

In this section Prof. A. R. Forsyth, of Cambridge University, made a forcible plea for the study of mathematics, not only in its relation to other branches of knowledge, but for its own sake. Lord Kelvin dwelt on the immense practical importance of mathematics, and said such work as harnessing Niagara was impossible without a thorough grasp of the higher mathematics. He dwelt, too, on the rapid spread of the study of this science by engineers in the last twenty years. An hour later an eminent city engineer of Liverpool, George Frederick Deacon, uttered an opinion seemingly contradictory to Lord Kelvin's. Mr. Deacon once worked in the laboratory of Sir William Thomson (now Lord Kelvin), and accompanied the latter on the expedition which laid the first successful Atlantic cable, in 1865. As president of the mechanical science section he discussed the education which young engineers ought to have. He commended the technical schools of the United States and Canada as superior to many in England in extent of the workshop practice provided for students. This he considered more valuable than some of the mathematical training given them. College bred men were not always the most successful engineers. Well directed observation and long experience were secrets of success.

THE WORLD'S FUEL SUPPLY.

At another session of this section, Lord Kelvin discussed the world's fuel supply and air supply in a highly original manner. By fuel he meant not only heat, coal and oil, but existing forests and mould; in fact, all ancient and modern vegetation. Referring to the familiar phenomenon of plant life, that it absorbs carbonic acid and throws off oxygen, he argued there was possibly, even probably, a distinct relation between the amount of oxygen gas in the earth's atmosphere and the amount of vegetation past and present. Three tons of oxygen are required to burn one ton of standard fuel. Consequently, he would assume that for every three tons of oxygen in the air one ton of fuel had come into existence. The outcome of this rough computation was 340,000,000 tons of fuel.

PROF. RAMSAY LOOKING FOR ANOTHER ELEMENT.

Prof. William Ramsay, of London, who divides with Lord Rayleigh the honor of discovering the new element in the atmosphere which they named argon, presided over the chemical section. His address was devoted to showing why he expected still another element would in time be found resembling both helium and argon in some respects. Chemists were familiar with several groups of three elements each, in which the difference in atomic weight between the first and the third members was 36. The atomic weight of helium was first placed at 4, and that of argon at 40. Eventually both of these figures would be reduced somewhat, but the interval would probably remain about the same. He was thus led to believe that another member would be found for this group to fill a vacancy between helium and argon. Such discoveries, based on Mendeleef's "Periodic Law," have been predicted and made before this. Prof. Ramsay and his assistant have already examined an extraordinary number of substances in the hope of finding the unknown gas, but so far without success. The speaker expressed his own confidence in the soundness of Mendeleef's law, in spite of some discrepancies between the actual atomic weights of many elements and the weights which the theory demands.

THE HUMAN STRUCTURE.

In the anthropological section, its president, Sir William Turner, of Edinburgh, spoke of "Some Distinctive Characters of Human Structure." Some of the peculiar features of man's frame, he said, are the curvature of his spine, the crooked way in which the thigh bone fits into the hip, the greater freedom and grace of the movements of the legs than are possible with apes and lower animals, the more highly developed hand and certain characteristics of the foot. All of these, interesting and significant as they are, are overshadowed by the superiority of the brain in relative weight and in complicated structure. Boys' brains at birth weigh more than girls'. The brains of men of intellectual eminence weigh fifty-five or sixty ounces on the average, while imbeciles may have only thirty ounces. The mean internal capacity of the craniums of adult Europeans is about one thousand five hundred cubic centimeters, and in Australian aborigines one thousand two hundred and eighty. That of adult male gorillas is about four hundred and ninety.

THE PARIS EXPOSITION OF 1900.

The French stand easily first among the peoples of the world in the matter of getting up fetes and shows and in arranging pageants which shall have the highest spectacular effects. The world of fashion has always looked to Paris for its leaders, and those in pursuit of pleasure for its own sake have made their Mecca on the banks of the Seine. How much of the idea of the Paris Exposition of 1900 is to be attributed to the desire to make of it something far larger and more splendid than ever before achieved, with the view of making Paris itself more attractive, and how much is due to French ambition for a comparison of their educational, industrial and material progress with the best the world can show, it is not at all important to define. The French government and people are working to make the exposition one which will far surpass all its predecessors, as well in the extent and variety of the exhibits as in the pomp and magnificence of the splendid accompanying fetes and entertainments, and it is safe to say that never before were plans for such a project more thoroughly elaborated or more completely worked out, down to the finest detail.

The importance of a good representation of the United States at the exposition is generally conceded, primarily, from the fact that our growth in many lines of manufacture has now reached such proportions that further material increase cannot well be looked for, unless we can sell largely in foreign as well as the home markets.

Our ability to successfully compete with foreign manufacturers in their own markets, in many lines of manufactured goods, cannot be doubted, and some efforts in this direction have already met with marked success, but the exposition will afford an opportunity to put such representation on a better basis, and to effectively bring American goods more thoroughly before foreign buyers than ever before. To the end, therefore, that our participation in the exposition may be fully representative, and that American manufacturers may have sufficient space allotted them, Major Handy, the United States commissioner, intends to apply for 500,000 feet to be devoted to exhibits from the United States.

Commissioner Handy sailed for Europe last week, intending to return and report to Congress at its next session, giving all available information to intending exhibitors, and asking for a liberal appropriation from the government, that the United States may be creditably represented.

MOUNT ST. ELIAS ASCENDED.

Prince Luigi of Savoy and his party of Italian mountain climbers are now on their way back to Italy after accomplishing the feat of scaling Mt. St. Elias. The party included Prince Luigi, Lieut. Cagni, Dr. Phillippi and Vittorio Sella, the well known photographer of mountain views. The expedition sailed from Seattle in June and reached Yakutat Bay on July 22. A landing was made with some difficulty and the overland trip was begun. They took with them over 6,000 pounds of provisions. After six days travel inland Malaspina glacier was reached. The glacier is twenty miles wide, and it took four days to cross it. They crossed various other glaciers and passes and finally reached Mt. St. Elias. At the foot of Mt. Newton glacier the American party of Mr. Bryant was met; they had abandoned the project and were returning. Here the Italian members of Prince Luigi's party were left. The prince was, it seems, jealous that any save his countrymen should have the honor of climbing with him the summit of the lofty mountain, which was ungracious, to say the least.

The ascent of Mt. St. Elias began on Friday, July 30, and after seven hours hard climbing they arrived at the top of the divide; here a tent was pitched and a few hours of much needed rest were taken. Then the ascent began again, and four hours from the divide saw them standing on the top of the mountain. About two hours were spent on the peak, and during this time much was done in the way of scientific observations and Signor Sella secured some very fine negatives from the summit. The descent occupied about two hours, the mountaineers sliding most of the way down, and the camp was reached at nightfall. The dreary backward journey over the glaciers was accomplished without accident. The actual height is, according to Prof. Davidson, 18,060 feet. A number of previous attempts have been made to ascend Mt. St. Elias, which was discovered by Behring on St. Elias day, 1741.

WILL ASCERTAIN THE VALUE OF CALCIUM CARBIDE.

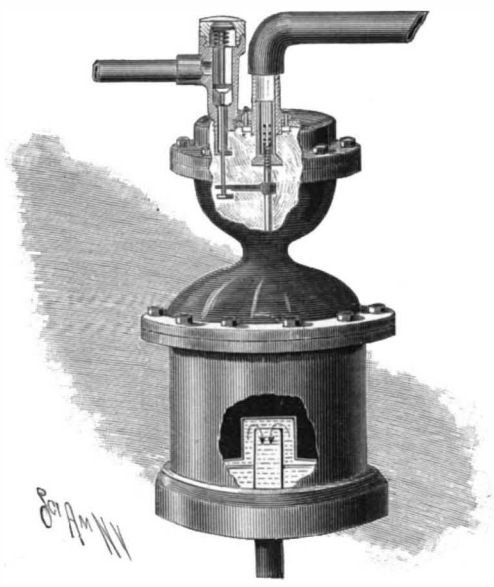
The American Druggist and Pharmaceutical Record, under the head of "Tariff Problems Considered," says the Treasury Department will send out a special agent to make an investigation of the value and market price of calcium carbide. This article is used in the manufacture of acetylene gas, a product which is now being extensively exploited by a large syndicate, which controls the patents under which it is manufactured. The tariff law levies an ad valorem duty on this product, and, as it has been brought in at several ports, collectors have varied more than 200 per cent in their valuations; but in all cases have materially exceeded the invoice valuation. The company controlling the patents have an important interest in keeping the apparent cost of the article as low as possible, as they are disposing of royalties in nearly all the States, and the economy of production necessarily depends upon the cost of the raw material. In view of the limited supply and circumscribed market, the department sees no way of ascertaining the value of the article without a special investigation.

The American and British Associations' Addresses and Papers.

Attention is called to the fact that in the SUPPLEMENT of last week and in the current issue there are a number of addresses and papers which were read at the meeting of the American Association for the Advancement of Science and at the British Association. Thus in the current number will be found a continuation of Prof. Gill's "Edward Drinker Cope, Naturalist," the presidential address by Sir John Evans before the British Association and the conclusion of Prof. W J McGee's "The Science of Humanity." In next week's SUPPLEMENT these papers will be continued and others will be begun.

A CONDENSER FOR STEAM ENGINES.

The illustration represents a condenser arranged to prevent the water from accumulating in the condenser casing, irrespective of the working of the pump, and without causing back pressure on the engine. It has been patented by William T. Snell, Laurium, Mich. It has a closed casing from whose bottom extends a suc-

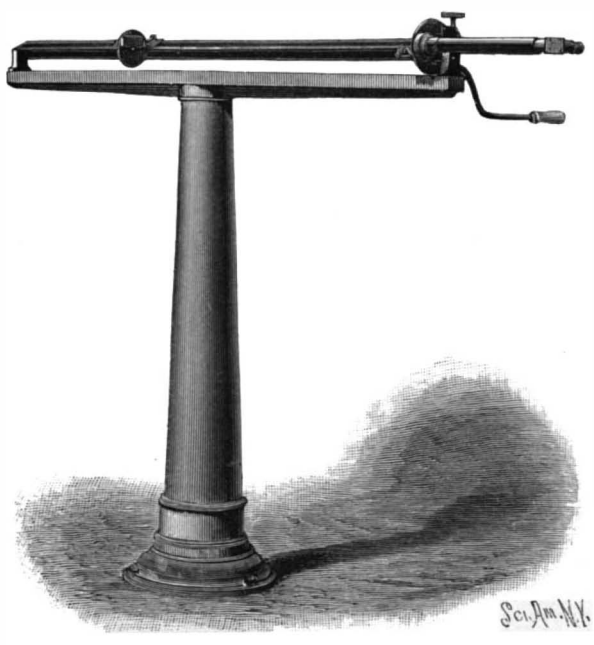


SNELL'S CONDENSER FOR STEAM ENGINES.

tion pipe connected with a pump, and in the casing is a bell-shaped float on whose upper end is a vertical stem connected with a spraying nozzle sliding in a pipe leading to the water supply, the rise and fall of the float thus shutting off or regulating the admission of the cooling water. On the upper end of the condenser is also a valve casing connected with the exhaust pipe of the engine, the casing having two valves attached to a common valve stem, whose vertical movement causes the steam to be passed into the condenser or to the outer air. A coiled spring near the upper end of the valve stem holds it normally in uppermost position, the steam then passing into the condenser; and on the lower end of the stem, within the condenser casing, is a collar adapted to be engaged by an arm which is vertically adjustable on the stem extending upward from the float. In case the water accumulates in the casing, from not being drawn off fast enough by the pump, the rising of the float shuts off the supply of cooling water, which is again admitted through the spraying nozzle, when the pump reduces the amount of water and the float moves downward. Should the water supply fail, or water be drawn from the casing faster than supplied, the sinking of the float would cause the arm extended from the stem of the float to engage the collar on the lower end of the valve stem in the casing connected with the exhaust steam pipe, thereby shutting off steam from the condenser and passing it out to the atmosphere. In the under side of the float, as shown in the broken-away portion in the engraving, is a small chamber into which extends the upper end of the suction pipe, permitting air bubbles to be readily drawn out, a spider on the bottom of the float forming a guide for the float on the fixed suction pipe.

TWO NEW RANGE FINDERS.

We illustrate herewith two range finders, invented by George M. Searle and George N. Saegmuller, of



SEARLE AND SAEGMULLER'S RANGE FINDER.—Fig. 1.

Washington, D. C., for which United States letters patent Nos. 588,093 and 588,094 were granted them August 10, 1897. The purpose of these devices is to determine the distance of remote objects, such as an enemy's vessel at sea, in a rapid and convenient manner, by means of a scale on the instrument, and without the delay of calculation.

Fig. 1 is designed for use on the deck of a ship, or other horizontal surface, and its base line is horizontal; its principle of operation being that of a constant angle by means of an adjustable base line. It comprises a graduated base line bar having a fixed right angular reflecting prism at one end, and also a movable one, with a pointer, traveling on the graduated scale of the base line bar, said two reflecting prisms being in different planes to throw their images on different portions of the object glass of a telescope, and a telescope constructed to bring these two images into coincidence whenever the movable reflecting prism reaches the point on the scale indicating the distance of the object viewed.

Fig. 2 is designed to meet the conditions of range finding or distance measuring from an observation point aloft, on the mast head of a ship, for instance. The base line in this case is vertical, and is of a fixed and definite length. This range finder comprises a telescope, two reflecting prisms separated, in fixed relation, a distance apart representing a base line, and arranged in different planes, so that each sends its own rays upon a different portion of the object glass of the telescope; an axially adjustable refracting plate for receiving the rays from one of the reflecting prisms and bringing them into coincidence with the other rays of the other prism; a pointer fixed upon the adjustable refracting plate; and a cotangent scale of equal parts for marking equal spaces for variable distances. This latter device (Fig. 2) is being put upon the United States battleship Iowa, and great results are expected from it. From a preliminary test the following comparison of distances by triangulation and the range finder were obtained.

Fig. 2.
RANGE FINDER.

By Triangulation.	By Range Finder.
2154 yards	2140 yards
1814 "	1800 "
1212 "	1220 "
1184 "	1190 "
4300 "	4270 "

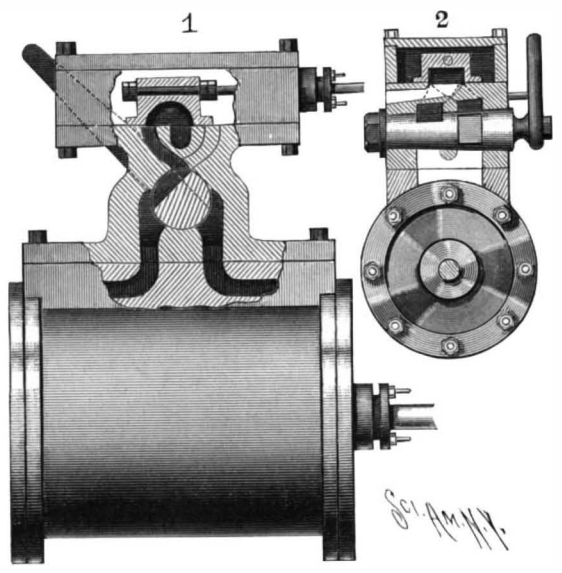
The instruments are being manufactured by George N. Saegmuller (Fauth & Company) Mathematical Instrument Works, No. 108 Second Street, S. W., Washington, D. C.

Time for Surgical Operations.

In regard to the best time for capital operations, a writer in Gaillard's Journal states that in following the course of such cases and of various operators for a number of years in the hospitals of a large city, it seemed that the early morning hour presented many advantages—that is, a good night's rest, attained artificially if necessary, an empty stomach, the patient all ready for anæsthesia upon awakening, the fear and dread of what is coming being crowded into the fewest possible moments, the whole day with active attendants constantly moving about and alive to every demand of the patient, etc., are a few of the points which seem to recommend an early hour; on the other hand, it is not to be denied that it may be a source of greater task upon the surgeon's powers, especially if he be concerned and anxious, as conscientious men always must be in regard to capital operations, and if this anxiety interferes with the operator's sleep. Even with this disadvantage, however, the operator is capable of doing really better work before he has become tired and annoyed by the various demands upon him during the early hours of the day. Consequently, those who have operated extensively in the early morning hours never volunteer any afternoon operations.

A REVERSING VALVE FOR ENGINES.

A reversing valve chest is, according to the improvement represented in the accompanying illustration, interposed between the ordinary cylinder and steam chest, and this valve chest contains a reversing valve and connecting ports, the device being readily applicable to any ordinary engine, although for new engines the reversing valve chest may be made integral with the cylinder or the steam chest. The improvement has been patented by David W. Roy, of Tucson, Arizona Territory, Fig. 1 representing it in side elevation and Fig. 2 in transverse section. The port at one end of the cylinder connects with two ports in the reversing valve chest, containing a reversing valve in the form of a plug valve, and the port at the other end of the cylinder connects with two other ports in the chest, and leading to the bore in which the valve is mounted to turn, the several ports of the valve being arranged opposite each other, but in pairs which lie in a different vertical plane, and each pair connecting by different passages with ports leading to the steam chest, where the slide valve is operated from the main driving shaft of the engine in the usual manner. Between the ports leading to the steam chest is an exhaust port, and on the outer end of the plug valve is a handle by which the valve may be turned to the right or left for reversing the engine, or moved to a vertical position for cutting off steam.

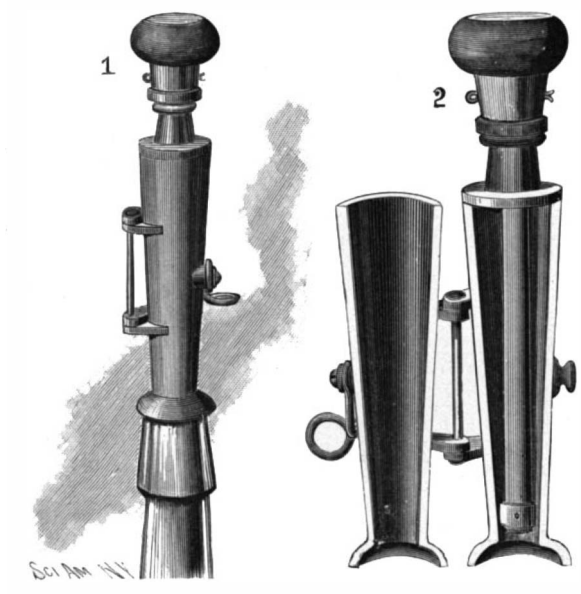


ROY'S REVERSING VALVE FOR ENGINES.

H. WILDE has exceeded his own estimated limit of 400 lb. per square inch for magnetic traction by means of annealed charcoal iron wire 0·57 in. in diameter. The electromagnet was excited by a current of 40 amperes. With a piece of wire 1·2 in. long the unprecedented tractive force of 422 lb. per square inch was obtained. That the magnetization limit was virtually arrived at was shown from the fact that, when the current transmitted round the electromagnet was reduced from 40 to 26 amperes, the amount of the tractive force remained constant. The determinations were made with a single pole electromagnet, says the Electrician.

INSERTING CORKS IN BOTTLES.

For driving corks into place in bottles, as may be necessary in small bottling establishments or where families preserve domestic products, the device shown in the accompanying illustration has been invented and patented by Charles von der Linden, of Rhinebeck, N. Y. Fig. 1 shows the device closed, applied to a bottle, and Fig. 2 shows it open. It has two tapering sections, pivoted to swing to open and closed position, the sections being held closed by a clamping arm, and the lower end of each section has a semicircular flange, the flanges forming a dish-shaped cavity adapted to receive the mouth of the bottle. A circular head closes the upper ends of the sections, and in an upwardly extending boss is held a sliding rod or plunger, to the upper end of which a hand knob is removably attached by a cotter pin. A washer of greater or less thickness is placed on the plunger below the hand knob, thus regulating the amount of vertical movement of the plunger. In use, the cork is placed in the open lower end of the device, when the sections are closed to hold the cork firmly, and the flanges are made to embrace the mouth



VON DER LINDEN'S CORKING DEVICE.

of the bottle, after which the hand knob is struck to drive down the plunger rod and force the cork into the neck of the bottle. To drive the cork completely down, flush with the mouth of the bottle, the washer is removed from the plunger rod.

The Grand Central Station.

This great headquarters and metropolitan station of the New York Central and Hudson River system is now being enlarged and changed as to its exterior in a most radical way, although the interior arrangement of the ground floor is not to be changed at present. The original building, not counting the more recently added train-receiving house, was 240 feet on Forty-second Street by 692 feet on Vanderbilt Avenue, built of brick, stone and iron, and costing nearly $2,250,000. On the streets named it was three stories high and was surmounted by several Louvre domes, and three more stories are now to be added, giving a uniform height of six stories, the towers also to be carried up proportionately, except the clock tower, which is to be obliterated. The entire building will be faced with stucco work, giving it the appearance of Indiana limestone, and the improvement will cost in the neighborhood of $700,000. The added room thus provided has long been needed for the use of the executive officers and the 500 to 600 clerks employed. It may be added that at the same time that this very considerable work is being carried on, employing a large force of men, the neighboring streets are also being occupied by the workmen and materials necessary in constructing the new underground trolley, by which many of our leading street railways are to be operated by electricity.

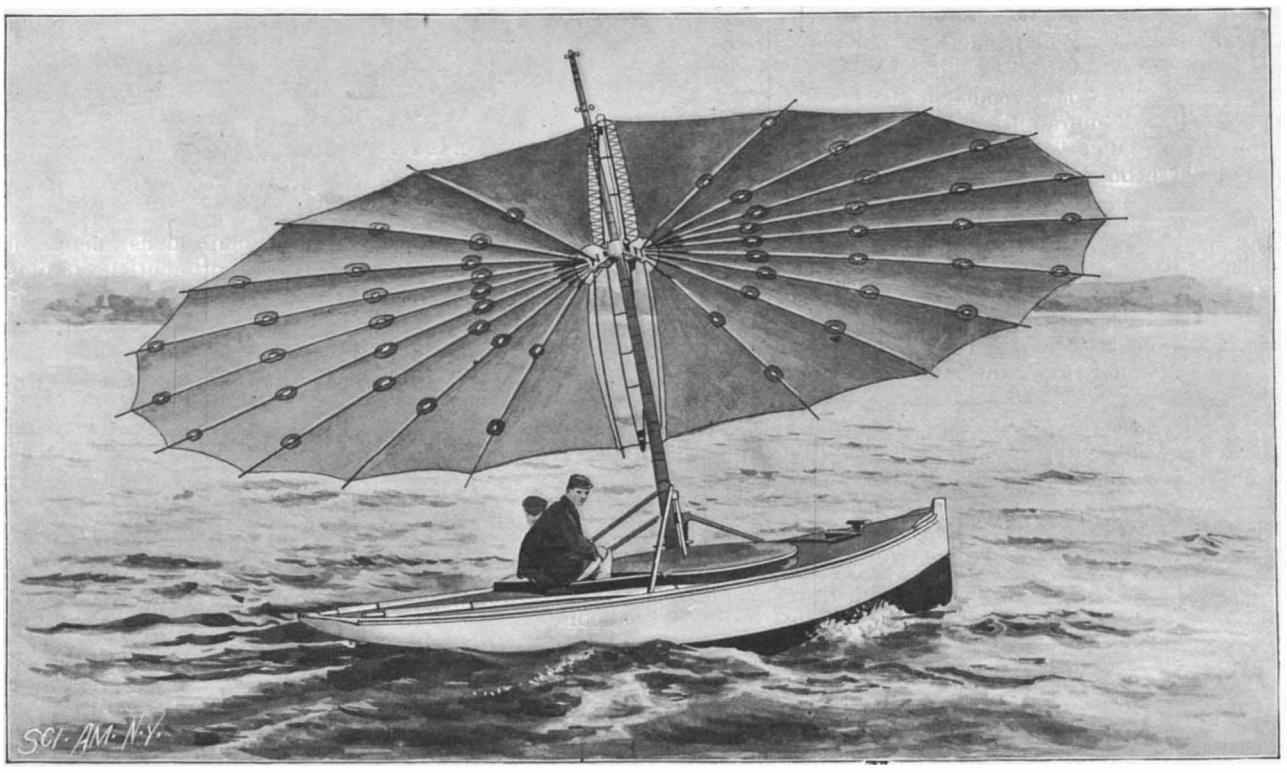
THE UMBRELLA BOAT.

The queer sailing vessel shown in our engraving is called the "umbrella boat," and is also known as the boat with the cyclone sail. This boat has been very conspicuous at Cowes and in the Solent. Our engraving was made from a photograph by West & Sons, Southsea, Eng. The chief feature of the cyclone sail is, it is said, that "the wind pressure does not tend to incline the boat. When the wind is making a large angle with the sail the center of pressure is almost at the center of the surface, but when the wind strikes the sail at an acute angle, as in all sails or kites, the center of pressure moves toward the weather edge; but, by suitably adjusting the sail, the desirable result of obliterating all heeling movement has been achieved.

"In practice this has been obtained by putting more sail to leeward than to windward of the mast and also by placing the sail not quite at right angles to the mast, but more raised on the lee side. The sail is made oval, with the major axis horizontal, so as to be able to carry more sail with a definite height of mast.

"The training in a horizontal direction is accomplished by means of a turntable, and the elevating and lowering by two tackles. There is a balance weight which helps in elevating the mast and which is just sufficient to balance the dead weight of sail in a calm not inclining the boat. The sail can be set and furled in a minute; it does not close like an umbrella, but each side shuts up like a fan. The object of the sail is to be able to sail without inclining the boat, so that the limit of driving force is not governed by the stability of the boat in any way, and also that the boat sailing on an even keel has less resistance than when sailing with a list."

In addition to the inventor's claim for his boat, the following particulars may be of interest: The sail in the illustration measures 30 feet horizontally and 16 feet up and down, while the total length of the boat is only 17 feet on the water line. With an ordinary rig 200 square feet of canvas was found too much for this boat, but with the umbrella sail she carries 360 feet of canvas and sails much faster. A light boat especially adapted for the sail is now being built by Messrs. Thornycroft, of Chiswick, England, the well-known manufacturers of torpedo boats.



THE UMBRELLA BOAT.

Shrinkage of Castings of Metals.

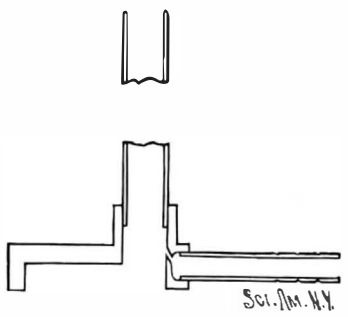
Pure aluminum (13-64 inch)	0·2031	inch to the foot.
Nickel aluminum casting alloy (3-16 inch)	0·1875	" "
Special casting alloy of the Pittsburg Reduction Company (11-64 inch)	0·1718	" "
Thin brass castings	0·167	" "
Thick " "	0·150	" "
Zinc	0·3125	" "
Lead	0·3125	" "
Copper	0·1875	" "

—Aluminum World.

AN IMPROVED FORM OF BUNSEN BURNER.

A great drawback with the ordinary form of Bunsen burner is the liability of the central jet to become choked up by anything falling down the tube, says Hugh Marshall, D.Sc., F.R.S.E., in the Journal of the Society of Chemical Industry. A single drop of water is often sufficient to extinguish the flame, and a fused borax bead is still more objectionable, owing to the difficulty of properly clearing the jet. This is troublesome enough in ordinary laboratory work, but is much worse with a large practical class. Various methods of getting over the difficulty have been tried more or less successfully. I think, however, I have now succeeded in evolving a form of burner which is a considerable improvement on preceding ones.

The improvement consists in replacing the central



jet by a suitably inclined lateral opening in the wall of the burner itself. The burner is left open right through, and the side air holes are done away with. An air regulator can be fitted on the base in the form of a pivoted diaphragm. A simple form of the burner is illustrated in the diagram. This represents a section through the gas supply tube and inlet (to the right of drawing) and one limb of the tripod base (to the left). The upper tube screws into the lower portion. This consists of a very shallow tripod with circular opening for the tube. At one side of the opening is a block into which the gas supply tube is fixed and through which the gas inlet is drilled. The inclination of the inlet and its diameter depend somewhat on the richness of the gas used.

The advantages of the burner are that the gas inlet does not become choked; anything dropping down the tube passes right through to the bench. Further, if the gas inlet is properly arranged, the flame can be turned down very low without its striking back or the air supply requiring regulation. Again, the air regulator fitted on the bottom cannot jam in the way the usual circular regulator does; in fact, it can be completely removed by the aid of a screwdriver in a few seconds; it is unnecessary except when a luminous flame is desired.

The burner is now in use in Edinburgh and Aberdeen Universities, and works well.

ALTHOUGH there is always a fascination attaching to the invention of a device affecting what might be called the conspicuous and larger needs of mankind, it is probably the improvements on the common articles of daily use that have proved the most profitable to the inventor. As an instance, our attention has lately been drawn to a case of this character, where a device known as the Johnson anti-rattler for thill couplings realized a sale of 1,700 gross in the past six months in the United States alone, and there was an excellent foreign trade, which indicates that Americans are not alone in appreciating improvements of the smaller kind.

Pennock's Electric Power Transmission Plan.

George B. Pennock, a New York electrical engineer, says he has invented a system of electrical distribution which will revolutionize the present methods of railway transportation. His claim is that he can so distribute electrical energy by means of a new kind of third-rail system that a hundred trains can be moved at a cost no greater than is now necessary to move one train, and that he has practically demonstrated the value of his discovery in electric lighting by supplying sixty standard candle power incandescent lamps with one horse power. The inventor was formerly a train dispatcher on the Pennsylvania Railroad, but for many years has given his entire time to electrical subjects. In an interview published in the New York Sun he says:

"In moving cars by electricity we generate at a central point a certain amount of horse power in the shape of electricity. That must be sent out over the route on which the cars run, and there must be as many times the power required to move one car as there are cars. To achieve the results which I claim will come from my system—that is, not to need a power increased in proportion to the number of cars used—I would build a central station midway between the terminals of the line, and in this I would put a 1,000 horse power engine and a 500 horse power dynamo. That is all that would be necessary to move any number of trains. Then I would put up my voltage distributer, which brings about the required result. This is a circular track cut up into 100 segments each 10 inches long. Mounted on it is an electric motor car of one-half horse power designed to run at a very high speed, to complete the circuit of the track 400 times in a minute. It is locked in by two tracks above, one of which carries the current to run the motor, and the other the current from the 500 horse power dynamo to the distributer.

"Between the rails of the railroad tracks, along their whole length, is placed a series of conducting segments, a brass rail one inch in diameter, each segment 500 feet long, the segments separated from each other by a space of three inches. Running side by side with these segments will be a similar but continuous conductor to complete the circuit. Each of the segments in the distributer is connected with wires to a 500 foot segment between the tracks. When all is ready the motor car on the distributer is set in motion, and, as it flies around the circle at the rate of 400 times a minute, it successively closes the circuit between the small segments in the distributer and the large segments between the tracks, and conveys to each segment sufficient electricity to start a train. This current is taken up from the large segment into another but smaller voltage distributer on the train, in charge of the motorman. This consists of ten segments, each attached to a motor on the train. The force of the current is 100 volts. The motorman has charge of this, and by turning his switch can use one motor with 100 volts or ten with a thousand. The current will be taken from the segments on the track to the voltage distributer on the trains by means of a connection underneath the car similar to a trolley pole. One of these trolley wheels or shoes will rest continuously on the continuous rail, so that by generating 500 horse power at the dynamos, distributing it to the segments and putting just enough in each one to start the cars, I can do all the work of the road with 500 horse power. In other words, the same power is intermittently transmitted from one train to another several hundred times a minute. When the cars are started they move on to the next segment, where a new contact is made, thus giving fresh impetus. Finally, I have invented an automatic negative pole stepback to use in connection with the motors on the cars that will multiply the current ten times. [The Editor of the SCIENTIFIC AMERICAN assumes no responsibility whatever for this newspaper story.]

Recent Archæological News.

Paul Dubois' equestrian statue of Joan of Arc has been set up provisionally in the quadrangle of the Louvre, to see what the effect will be.

Prof. Jakob Burkhardt, the historian and art critic, best known by his famous art guide to Italy, "Der Cicerone," died recently at Basel, his native town, at the age of 79 years.

In the Architectural Record for quarter ending September 30, there is an interesting article by Prof. W. H. Goodyear entitled, "A Discovery of the Entasis in Medieval Italian Architecture." It is accompanied by eighteen illustrations and plans, and, like the rest of the series, is of great interest.

Though the acoustic properties of the Roman theater at Orange have been highly praised, the recent performance by the Comédie Française, before President Faure, of "The Erinnyes" could hardly be heard, as the wind howled through the building. Two great persons, M. Francisque Sarcey and the Duchesse d'Uzès, complained that they had been treated rudely by the officials.

A tapestry map of Warwickshire, Shakespeare's county, 24 feet by 18, and made in 1598, is now on exhibition in London, where it has been sent to be repaired. It is one of five made by Flemish weavers imported into England, and is the largest and most minute topographical record of the time. It once belonged to Horace Walpole, but is now the property of the York Museum.

Dr. W. Flinders Petrie, the Egyptologist, has sent, according to the daily papers, to Dr. Breasod, of the University of Chicago, a valuable collection of relics excavated along the Nile. Among these are statues of Nen Khefea, a wealthy nobleman, and his wife, which are said to be nearly 5,000 years old. They are of limestone and are remarkably well preserved. They will go to the Haskell Oriental Museum of the university.

Prof. Nehring, in describing the domestic animals of the ancient Peruvians, states that the subject is scientifically important, because all the other peoples of ancient America were very poor in this kind of property as compared with the Peruvians and some of the Central American peoples. Nehring examined eighteen dog mummies from old Peruvian graves and ascertained that they belonged to three different races—a shepherd's dog, a dachshund and a bulldog. This discovery is interesting, as it shows the influence of domestication on the formation of races.

Public opinion in Holland is much moved by the sale of three important pictures from the famous Six Collection, the last survivors of those which were formed during the lifetime of the great painters of the seventeenth century. Every art-loving visitor to Amsterdam knows the house where hang Rembrandt's magnificent "Burgomaster Six," and perhaps a hundred other pictures of the highest class. Innumerable attempts have been made at various times to induce the family to sell, but till now without success. At last they have yielded so far as to cede, fortunately not the Rembrandts, but three others—Cuyp's "View on the Maas," the Terburg, and the Gerard Douw. These have lately been sold, after long negotiations, for a prodigious price. It is believed that they have gone to England.

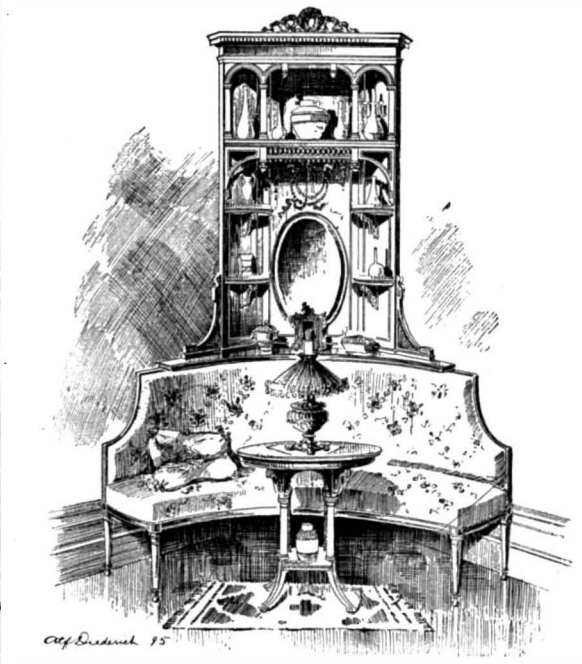
In the will of the late Lady Wallace, her pictures, porcelain, bronzes, artistic furniture, armor, miniatures, snuff boxes and works of art, on the ground and first floors and in the galleries of Hertford House, as well as the Louis XIV balustrade, are bequeathed to the British nation. The bequest does not include personal and modern jewelry, trinkets and effects, nor ordinary modern furniture and chattels, says The Builder. The government in return are to give a site in a central part of London, and build a special museum for the collection. It is also stipulated that Mr. John Murray Scott is to be one of the trustees of the collection. The other trustees appointed by the Treasury are the Earl of Rosebery, Sir Edward B. Malet, Sir John Stirling-Maxwell, Major-General Sir Arthur E. A. Ellis, Mr. A. B. Freeman Mitford and Mr. Alfred C. De Rothschild. Mr. Claude Phillips has been appointed keeper of the collection. The committee appointed to consider how the collection should be housed having recommended the purchase of the interests in Hertford House and its adaptation to a museum, a sum of £80,000 will be obtained for that purpose. No arrangement could be more satisfactory. The character of the Wallace collection would suffer if placed in a new building of a severe character like the National Portrait Gallery. The pictures were specially selected to adorn a private mansion, and it would be difficult to erect one better adapted for their display than the house in Manchester Square. Mr. Waterhouse acknowledged that at first he was not in favor of keeping the collection there, but, on considering the decoration of the rooms and their matchless chimney-pieces, he came to the conclusion that, if the bequest were taken away from its present surroundings, it could never be shown to such advantage. The value of the collection is set down officially, according to the New York Tribune, at the enormous sum of $22,000,000.

Excavations at Treves.

The excavations that have been going on for months past on a plot of ground belonging to Herr Schabb, a manufacturer at Treves, have resulted in the discovery of a Roman private house, which will excite the interest of antiquaries almost as much as the famous public buildings at Augusta Trevirorum. The front of the house lies parallel with the principal street of the old Roman city. A number of blocks which served as pedestals for the wooden or stone pillars of a portico still remain. The entrance is distinctly recognizable between two buttresses and an immense heap of stones. A long entrance hall running right through the house, from front to back, is intersected by another corridor, so that the gigantic building is divided into four parts. Side corridors lead into the rooms. Of these the marble tesselated bath rooms for hot and cold water and warm air lie side by side, and deserve special mention. The two latter were supplied with warm air through subterranean passages. The escape of the smoke was effected by means of hollow tiles laid on one another. The southwestern rooms have cellars under them. In a light court in the same part of the house there is a well-preserved window, the first ever found in a Roman building. The most interesting thing, however, is the magnificent and richly colored mosaic floor, a rarity of the first order. Experts assign the building to the first half of the fourth century, when Augusta Trevirorum attained the zenith of its splendor under Constantine and his sons.—Public Opinion.

COMBINATION CORNER PIECE.

The accompanying engraving was loaned by the American Carpet and Upholstery Trade, and represents a very neat corner piece. For small drawing rooms,



COMBINATION CORNER PIECE FOR LADY'S APARTMENT.

such as are found in many apartment houses, it is a piece of furniture that might be found very desirable, as it is dainty in design, and occupies but very little space.

Andree's Balloon Expedition.

A telegram from Stockholm, July 27, to the London Times, says that in a letter to the Aftonblad, Dr. Nils Ekholm, who accompanied Herr Andrée to Spitzbergen last year with the intention of taking part in his aerial voyage, offers some remarks on the prospects of the expedition based on the full details now received of Herr Andrée's ascent. Herr Ekholm declined to go this year because he considered that the impermeability of the balloon was unsatisfactory. In his letter he points out that from the day the balloon was fully inflated it lost 51 cubic meters of gas every 24 hours, representing a diminution in carrying capacity of 56 kilogrammes per day. This, he says, shows that the imperviousness of the balloon had not been essentially increased since last year. Besides this daily escape, various circumstances led to a certain loss of gas in the ascent itself, necessitating a corresponding sacrifice of ballast. After making allowance for these losses of gas, and taking into consideration the fact that in the ascent part of the dragropes were lost and that the balloon at once rose to a height of 15,000 feet to 25,000 feet—which was more than had been reckoned upon—Dr. Ekholm comes to the following conclusions: The longest time for which the balloon would remain in the air would be from 22 to 24 days, and less if mountains exceeding the height attained at the start had to be crossed. As the duration of the projected voyage may be estimated in ordinary conditions as regards wind at 24 days, remarkable good fortune would be necessary for success. Dr. Ekholm declares himself skeptical with regard to the supposed loss of the balloon in the White Sea, but he proposes, nevertheless, that a search expedition should be sent to the White Sea from Vardoe.

Science Notes.

The Brooklyn Institute of Arts and Sciences announces that Dr. Nansen will lecture before that body during the coming season.

A sanitary Bible for the use of courtrooms has just been put on the market, says the Medical Record. It is bound with white celluloid instead of leather, and it can therefore be washed and disinfected from time to time.

The statue of Charles Darwin erected in his native town of Shrewsbury has been placed in front of the school which he attended for nine years. It was recently unveiled and was the gift of the Shropshire Horticultural Society and cost 1,000 guineas.

Andorra, the little republic on the border of France and Spain, is going to give up its picturesque isolation. It now has a telegraph line connecting it with the French system, and a carriage road is being constructed to take the place of the mule track over the Pyrenees, which for ages has been the only means of access to the town.

It is reported, says Science, that the Secretary of Agriculture will ask Congress, at its next session, to authorize the establishment of an agricultural experiment station in Alaska. Suitable scientific experiments would be of great value in showing what agricultural products and domestic animals could be introduced to advantage.

Holborn and Wien have invented a thermo-element composed of iron and "constantan" wire, says the Pharmaceutical Era. This latter is an alloy composed of copper containing 40 per cent of nickel and possesses the peculiarity that its electrical resistance is not influenced by temperature; also, next to the bismuth-antimony element, it is the most sensitive.

The London correspondent of the New York Evening Post cables that Mr. George Murray, keeper of botany in the British Museum, has proceeded to Panama at the instance of the government grant committee of the Royal Society for researches on little known pelagic algæ. During the voyage these organisms will be obtained by pumping sea water through fine silk tow nets.

A committee of the Paris Academy of Sciences, appointed to report on the precautions to be observed in the installation of electric conductors in the neighborhood of powder magazines, concludes that no distinction can be drawn between telephone or telegraph wires and electric lighting mains; that a distance of 10 meters appears sufficient to avoid all risk in the case of underground wires; but for overhead lines a greater distance is advisable—20 meters at least.

Lieut. Keising has lately been lecturing before his comrades in Berlin upon the subject of the value of photography in field operations, says the Army and Navy Journal. He recalls how the Germans employed it in the war before Strasburg and Paris. He is of the opinion that every officer's patrol should have a small hand camera, which should hang at the belt or the saddle, the plates being developed when the patrol rejoins the troops. He advocates also the use of captive balloons for photography.

A Roentgen society has been formed, with Prof. S. P. Thompson as the president, says The Engineer. The intention of the founders is that the society shall occupy a position between those devoted purely to medicine, to physics, or to photography. Some of the members will study the sources of the Roentgen rays, others the applications; some the induction coils, others the tubes and the various forms and adaptations of the apparatus used in the production of the rays. Roentgen photography has been found serviceable in so many branches of scientific investigation that the society appeals to a large constituency for support. It should be the means of increasing the efficiency and applications of the rays, and should also be of assistance to surgeons and others who have entered the new field of work without previous training in physics.

The number of matriculated students attending German universities during the summer semester of 1897 is indicated by the first figures, the whole number of hearers by the second figures, and the number of women among the hearers by the third figures in the following list: Berlin, 4705, 344, 114; Bonn, 1889, 103, 13; Breslau, 1541, 83, 22; Erlangen, 1140, 13; Freiburg, 1449, 95; Giessen, 663, 29; Göttingen, 1123, 72, 34; Greifswald, 834, 19; Halle, 1534, 101, 6; Heidelberg, 1230, 92; Jena, 704, 50; Kiel, 727, 37; Königsberg, 695, 31, 11; Leipsic, 3064, 157; Marburg, 1042, 48, 7; Munich, 3871, 160, 2; Academy of Münster, 487, 10; Rostock, 499, 10; Strassburg, 1016, 31; Tubingen, 1289, 12; Würzburg, 1430, 13. The whole number of matriculated students was 30,982, and hearers 1519, of whom 207 were women; students of theology 4326, of law 8368, medicine 8232, and philosophy 10,006. There was a marked decrease of students of theology and medicine, and an increase of students in the philosophical department, especially in philology and natural science. There seem to have been no women hearing lectures at Leipsic, although there were several in attendance last winter.

The Alaskan Reindeer—the Camel of the North.

BY GEORGE ETHELBERT WALSH.

Since the discovery of large quantities of gold in Alaska and the Klondike excited public attention in this country and Canada, some mention has been made of the reindeer farm established at Port Clarence, on the lower Yukon, and the suggestion comes from Washington that these "camels of the North" could be utilized in carrying freight and the United States mails to the new mining regions. Dr. Sheldon Jackson, whose long residence in Alaska gave him an opportunity to study the needs and condition of the country, first recommended the introduction of the reindeer in the newly acquired territory of the United States, and it was through his representations and urgent appeals that Congress finally, in 1893, appropriated $15,000 for the new experiment. It was estimated then that it would cost $500 to import an old reindeer into Alaska from Siberia; but even this apparently large price did not seem too great for the good which the promoters of the scheme expected in return. When Alaska was first purchased from Russia there were many people who claimed that the price was exorbitant, and that the country was a useless piece of waste territory; but in 1893 scientists and practical men of business had begun to think and know differently. The climate was against the development of the territory; but the resources had been found to be tremendous.

The reindeer experiment farm consequently received little opposition from either politicians or private individuals. In fact, it was indorsed by nearly every man of science who had given the question any consideration. The interminable snow fields and stretches of ice could not be traversed by any other animals in the depth of winter, and the reindeer seemed as essential to the development of the country as they have been for ages past to Lapland. The first importation of the animals was small, in order to see if they would thrive in their new quarters. At first everything seemed to go against the experiment; but matters took a turn for the better in the second year. A number of Laplanders were brought over to reside in the new country, to act as keepers and breeders of the animals.

Since then life on the reindeer farm at Port Clarence has been both interesting and profitable. In 1894, when the original herd was reported to be in a thriving condition in their adopted country, the government imported nearly fifty more. The original herd had by this time increased to over one hundred, so that the farm contained about one hundred and fifty reindeer when the revenue cutter Bear left Port Clarence in the summer of 1894.

Hardly any information has been published since then concerning the reindeer. So far as the reading public was concerned, one might never know that reindeer were being raised anywhere within the territory of the United States. Moreover, the Alaskan authorities and people knew little about the experiment, and no accounts were given in the annual reports to Congress about their usefulness. But the animals were thriving in their new quarters, and new importations were being made by the government as the case seemed to demand.

It is therefore with considerable gratification that the news comes from Port Clarence announcing the excellent condition of the reindeer herd. Altogether about five hundred of the animals have been imported from Siberia by the government, and these have increased in the natural manner to over one thousand. The animals take naturally to the country, and find ample food in the reindeer moss which thrives throughout the great Alaskan snow fields. This moss is so abundant that it is estimated that millions of reindeer could exist on it, while almost any other animal would starve or freeze to death. The reindeer on the farm have not only been bred for future usefulness, but they have been trained to carry loads, and every full grown animal has been broken to harness by their Lapland keepers.

In a short time the full herd will probably be needed to accommodate the gold seekers who are now flocking to the Klondike. It is announced semi-officially that the government will establish next summer a reindeer express service from Bering Strait to Kadiak Island, where the steamers which sail for Sitka touch. A new station or farm for the reindeer will also probably be established somewhere on the upper Yukon, within easy reaching distance of the new gold fields. It is believed that these animals will prove more serviceable than either dogs or a railroad in carrying small loads and the mails from the placer mines of the Klondike to civilization. Mongrel dogs in Alaska cost from $100 to $200 apiece; but a trained reindeer is worth a whole pack of such animals for carrying loads.

The reindeer require little or no care if properly handled. In Siberia and Norwegian Lapland the work of rearing them is a profitable industry. There is a disease similar to the rinderpest in cattle which occasionally attacks and carries off whole herds; but, when free from this pest, the herd is almost sure to double itself in numbers year by year. So long as the reindeer moss flourishes, the deer will have ample nourishment, and the owners have only to supply them with shelter.

In return for this simple care the animals transport the burdens of the keepers across the country at a most remarkable speed and in the face of every discouragement. In the palace at Drotinghold, Sweden, there is preserved the portrait of a reindeer who is said to have accomplished six hundred miles in forty-eight hours, drawing a bearer of dispatches. This remarkable feat may not be susceptible of proof, but it furnishes us with an approximate idea of the speed and endurance of the animals.

Besides serving as good horses, the reindeer are extremely valuable to inhabitants of Arctic climates in other ways. The does yield nearly a pint of milk a day, which is so rich that it is almost wholly cream, and it will stand a good deal of water before it becomes inferior to our best cow's milk. This milk is of great nourishing and refreshing value in the winter season, and is eagerly sought after by those forced to live in such cold regions. A herd of several hundred reindeer can furnish milk for a good size town or mining camp. The Lapps, of Norwegian Lapland, make a cheese or skier out of the milk, which is also a very desirable article of diet in winter.

When dead, the reindeer's services to man do not cease. The blood is drunk warm, and every part of the body utilized in some way. The flesh is dried or smoked, in which condition it can be kept indefinitely in such a climate. The surplus blood is preserved by freezing, and is then used for puddings, and the stomach and contents are frozen for special delicacies. The Lapps make bow strings and a rough thread out of the sinews and intestines, and glue from the hoofs, and various articles of use and ornament out of the antlers. But more important than any of these are the blankets and clothing which the skins of the reindeer yield. There is no skin of any wild animal that surpasses that of the reindeer for keeping out the severities of an Arctic winter. A single skin wrapped around the body of a man enables him to withstand the rigors of a climate as intense as any that prevails in the Klondike. On the coldest Arctic night the Lapp and Samoijede find comfort and pleasure under the protecting covers of their reindeer clothing and blankets. The same skins are utilized for mufflers and gloves. In Russia the skins of new-born fawns are in special demand for glove making.

The ease with which the reindeer traverse marshy tundras, swim ice-cold streams of water, and pass across fields of soft snow, has made them special objects of wonder to all travelers in the cold northern countries of Europe. The singular foot conformation of the animal is probably the most interesting part of the reindeer, for it is owing to this that it is enabled to perform feats that defy all other animals. Besides crossing crusted snows, icy lakes, and marshy tundras with the greatest facility, the reindeer can scale icy precipices that would baffle almost any other creature, and all of this is done with perfect safety both to the animal and the load that it drags behind.

The foot of the reindeer is cloven in the middle, and each half is turned up in front. These two sections of the foot are greatly elongated, and capable of great lateral expansion. When the foot is placed on the ground the two sections expand three or four inches, and when it is raised again a muscular contraction brings the two digits together with a loud clattering noise. It is this peculiar sound which one hears half a mile away when the reindeer are approaching. Secondary hoofs that are not developed in other deer are greatly prolonged in the reindeer, and having a slight backward inclination, they add valuable support to the animal. Thus, with such a peculiar foot conformation, the reindeer secures a good foothold on any solid substance, and performs wonders of strength and agility within the Arctic circle where all other animals are placed at a disadvantage.

What Constitutes Negligence.

Is it negligence to step off the pavement in a street without looking to the right to see if the way is clear on the near side? The London Law Journal makes the above query and then adds: Formerly a pedestrian might with tolerable safety have trusted to his ears to find out if there was any vehicle close to him, but now that the bicyclist is ubiquitous, common prudence suggests that for his own security a foot passenger should look in both directions before he crosses the road. The safety of the bicyclist does not count with the majority of non-riders. He is not altogether unreasonably regarded as a nuisance where there is much traffic; yet he is entitled to pursue his way along a thoroughfare, and in regard to him the foot passenger has duties as well as rights. In a case which was before the court of appeal recently the facts were that a butcher's boy with a knife in his hand stepped suddenly off the narrow pavement of a street without even a glance to the right, and came at once into collision with a bicyclist, who, as the jury found, was riding along carefully and at a reasonable speed. The result was that one of the unfortunate rider's hands was struck by the knife and seriously hurt, and he brought an action to recover damages for his injuries. The jury found that the occurrence was a "pure accident," and the court were unanimous in saying that they would have come to the same conclusion. It seems to us, however, that the jury would have been justified in finding that the butcher's boy, who admitted that if he had looked he would have seen the bicyclist, and waited for him to pass, was guilty of negligence. On the other hand, it may be that a street is so narrow or so crowded that a bicyclist is not justified in riding through it, or that he ought, at any rate, to ring his bell continuously, irritating though the tinkling may be to himself or to the people within earshot. These points, however, are wisely left for the determination of a jury.

The Sleep of Plants.

Like animals, all plants require intervals of repose, during which the vital functions are slowed down and the organic structures undergo repair. Some plants repose during the rainy season, others during periods of drought, but while some plants sleep during the cold or the comparatively cold season of the year, others again take their rest when the average temperature is high. It occurred to a Norwegian observer to investigate the sleep of plants, more particularly with the object of shortening the period of repose, and this he claims to have attained by subjecting the bulbs or buds to the action of chloroform vapor. He asserts, indeed, that plants thus treated subsequently develop more rapidly than those whose repose has not been intensified by the narcotic action of this drug, and the observation is not without considerable interest.

If his observations are trustworthy, it follows that sleep in plants is not strictly comparable to that of animal life, for we do not suppose that the period allotted to sleep by animals could advantageously be shortened by the administration of an anæsthetic. Sleep, on the other hand, is a relative rather than an absolute condition. Its value as a restorative depends in a very marked degree on its intensity, and certain individuals derive more benefit and recuperate their jaded energies more effectually in five or six hours than others do after twice as long. This recuperative energy is asserted to be an indication of a high standard of vitality, and common observation certainly lends color to the view that diminished recuperative power is indicative of physiological deterioration.—London Medical Press.

Pasteurizing Milk at Home.

Milk has been pasteurized successfully, according to the American Agriculturist, by taking any ordinary bottles, filling with milk to the neck or a little below, placing a stopper of cotton batting in the neck, then setting on a thin strip of wood, or inverted pie plate, which has been perforated, in a thin basin or pail of water. The whole is then heated until the milk shows a temperature of nearly 150°. The bottle is then stoppered and the pail and contents are removed to the back of the stove, where the temperature will remain fairly constant for twenty minutes, especially if covered with some non-conducting material, as a cloth or dry towel or the pail cover. At the end of the twenty minutes the bottles are removed and set in warm water, which is gradually cooled and then iced. The bottle may finally be put in the refrigerator after being partially chilled in water.

Pasteurizing may also be accomplished with equally good, if not better, results in tin vessels, either a double boiler oatmeal cooker or two dishes of suitable capacity, one with a diameter two inches shorter than the other. The water is poured into the outer dish at boiling point, the milk dish and contents being set in at once and the milk constantly stirred until its temperature is 150°. It is then removed for a moment, while the water in the outer dish is tempered to the same or a degree or two higher. The milk is then set back into the boiler, put to one side and closely covered and wrapped, in order to retain the heat for fifteen or twenty minutes. The advantage of tin vessels is that they may be plunged from hot water to ice water without danger of breakage, and with possible advantage to the milk.

If the object of pasteurizing be to destroy the bacillus of tuberculosis, a minimum temperature of 149° should be maintained for fifteen minutes, or 140° for half an hour.

If milk can be got from a herd known to be free from tuberculosis, or the person has no fear of this trouble, a pasteurizing temperature of from 133° to 140° maintained for fifteen or twenty minutes is sufficient to give good keeping qualities and to effectually get rid of 95 per cent of all bacteria, including the forms which produce stomach disturbances, vomiting, and cholera infantum in children.

In all pasteurizing work the sudden chilling of 50° or thereabout is imperative. The milk should be kept covered and at as low a temperature as can be obtained. Treated in this manner, pasteurized milk will be found to have a delightfully sweet, pure taste long after common milk has lost its freshness. On the average it keeps from six to thirty-six hours longer than unpasteurized milk in the same temperature.

THE HEILMANN ELECTRIC LOCOMOTIVE.

It is now some three years since Mr. J. J. Heilmann, of Paris, designed and placed in operation his first standard gage electric locomotive, which was known as La Fusee Electrique and was tested upon the lines of the Compagnie des Chemins de Fer de l'Ouest, of France. The Fusee was of 600 horse power and 120 tons weight and it was designed for hauling the ordinary class of passenger trains. The novelty of this locomotive consisted in the fact that it did not take its current from a feeder connecting with a distant power station, but carried its power station with it—the boiler, engine, generators, and motors being all combined in one machine upon one set of wheels and comprising an absolutely self-contained electric locomotive.

In spite of a vast amount of adverse criticism based on theoretical à priori grounds the builders of the Fusee were so well satisfied with its performance that they have constructed two more locomotives of the same type, but having much greater power and embodying the improvements suggested by the trials above referred to. By the courtesy of the builders we present a series of views of the first of these engines taken during its construction at the shops.

The designs of the Heilmann locomotive have been subjected to considerable criticism, mainly on the ground that it is at an evident disadvantage compared with the ordinary steam locomotive, because it necessitates an extra conversion of power, with its inevitable attendant loss. But while the loss in conversion is admitted, it is claimed by Mr. Heilmann that there are valuable compensations to be realized. In the first place, the absence of reciprocating parts and counterbalance weights secures a perfectly balanced engine which is easy upon the track and bridges. There is a further economy, it is contended, in the use of a many-cylindered high speed engine, and although considered as an electric motor, there is a greater weight of machinery to be carried than in a motor driven from a central station, this is offset by the absence of any loss by transmission over a line of greater or less length.

Regarding the first claim that this type of locomotive is perfectly balanced there can be no dispute, and the designer is entitled to full credit for having solved one of the most difficult problems connected with high speed locomotives. In the ordinary type the evil effects of "excess balance" are met or mitigated by the use of large driving wheels. This, however, necessitates a slow piston speed and a corresponding reduction of the indicated horse power. In the Heilmann machine the main engine is completely balanced by the arrangement of the six cranks, and the tests which have taken place show that there is a complete absence of the well known hammering and plunging effects noticeable in the ordinary locomotive.

It will be argued that the ordinary electric motor is also balanced, and that the extra load of boiler, engines and generator are a distinct handicap to this engine. To this it must be answered that in a locomotive of 1,350 horse power, which it is claimed the new machines will develop, the load of boiler, engines, etc., is almost necessary to give the requisite adhesion when the locomotive is working up to full power, as in starting or on a steep grade. It is evident that in proportion as the weight of the steam boiler, engines and generators become necessary for adhesion, the advantages of their installation in a separate power house disappear.

The above facts show that the design is per se not so altogether indefensible as many of its critics have roundly declared; and the aims of its designers appear yet more reasonable when they state that in building the Heilmann locomotive an effort is being made to make it possible to equip the trunk railroads electrically, without making any radical changes in the road itself. With this fact in view, it must be admitted that whether the arguments above given are sound or not, this machine will enable the railroad companies to experiment with electric traction on a limited scale without undertaking the great expense which will be entailed in the use of the central station system.

The machine is built upon a pair of deep plate girders and carried by a couple of eight-wheel trucks, one under each end. The total length of the engine over all is 61 feet and the rigid wheel base measures 37 feet 3 inches. The front of the engine is not, as one would suppose from looking at the engraving, the end occupied by the boiler, the latter being placed over the rear trucks, the forward half of the platform carrying the engines, generators, exciters, etc. Water is carried in two tanks, one on each side of the boiler, and the coal bunkers are situated just ahead of the tanks and on each side of the fire box. The engines, generators, etc., are completely housed in by a large plate steel cab or casing which is given a sharp plow-like form at its forward end with a view to reducing the air resistance.

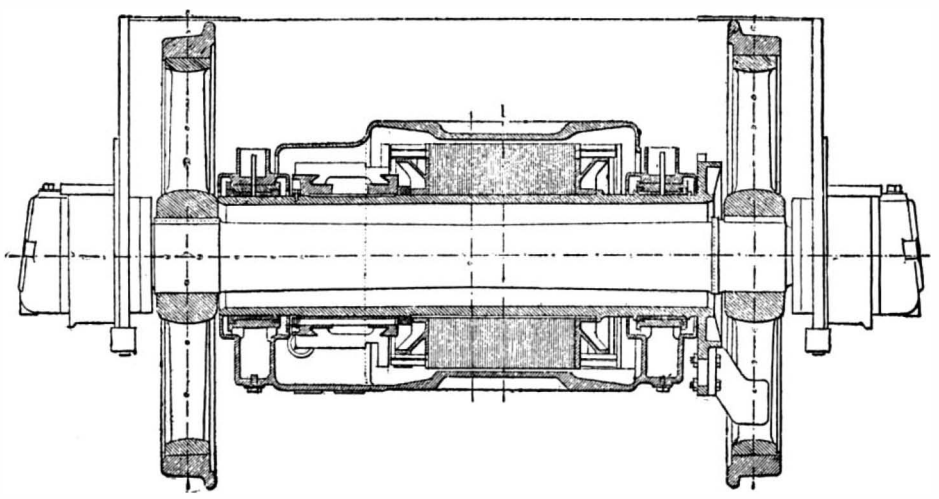


Fig. 5.—CROSS SECTION THROUGH MOTOR—HEILMANN LOCOMOTIVE.

The boiler of the first experimental locomotive was of the Lentz type, with corrugated fire box and combustion chambers, but in the present type the designer has returned to the ordinary locomotive style of boiler, the fire boxes being, however, of copper and built on the Belpaire pattern. There are 351 tubes 1·77 inch in diameter and 12·5 feet long, and there are 35·95 square feet of grate surface, the total heating surface of the whole boiler being 1,996·5 square feet. The boiler pressure is 200 pounds to the square inch. The generators are driven by a Willans compound six-crank vertical engine, the cranks being set at 0°, 120°, 240°, 240°, 120° and 0°, by which arrangement the difficulties of counterbalancing are completely overcome. In spite of its high speed, the engine runs in perfect equilibrium. As we have said, this is one respect in which Mr. Heilmann claims a distinct advantage over the ordinary form of locomotive, in which the well known counterbalance problem is causing no end of trouble and expense.

There are two continuous current generators directly connected to the main shaft, one at each end of the engine. The generators, which were built by Messrs. Brown, Boderi & Company, are continuous machines coupled in parallel, and each has a capacity of about 1,000 amperes at 450 volts. They are excited by a small four-pole self-exciting dynamo which is driven by a simple Willans engine of about 28 horse power. The current is led to eight motors, one for each axle of the trucks. The motors have four poles, with two field cores placed horizontally. The field winding is an insulated copper strip and the armature is a toothed drum wound in series and mounted on a hollow steel shaft which carries at one end a disk. This disk transfers the motion to the axle by means of three powerful links which are carried upon three corresponding pairs of springs secured between the arms of one wheel. The arrangement is shown in Figs. 3 and 5 in the accompanying illustrations. The axle passes with sufficient clearance through the hollow shaft, and the springs have sufficient flexibility, even under the full power of the motor, to allow free movement of the hollow shaft. The motors are all connected in parallel and each motor is fed by a special circuit from the switchboard and has its own switch and automatic cut-out. For low speed and under heavy loads the motors may be grouped in a series of four by means of a controller. There is an eight-way switch for reversing the current in the armatures of the motors and for instantaneously changing their direction. The speed may be varied by means of a rheostat placed in the exciting circuit of the generators.

The controlling gear is arranged in duplicate, one set being placed at the forward end of the locomotive and the other near the boiler in the position usually occupied by the throttle and reversing lever in an ordinary locomotive. This is done to enable the engine to run in either direction. It is claimed by the makers that these locomotives will take a train of nearly 400 tons at a speed of 62 miles an hour. We are informed that the preliminary trials, of which we do not as yet possess the details, give reason to expect that when they are in active service these locomotives will be capable of performing the full duty for which they are designed.

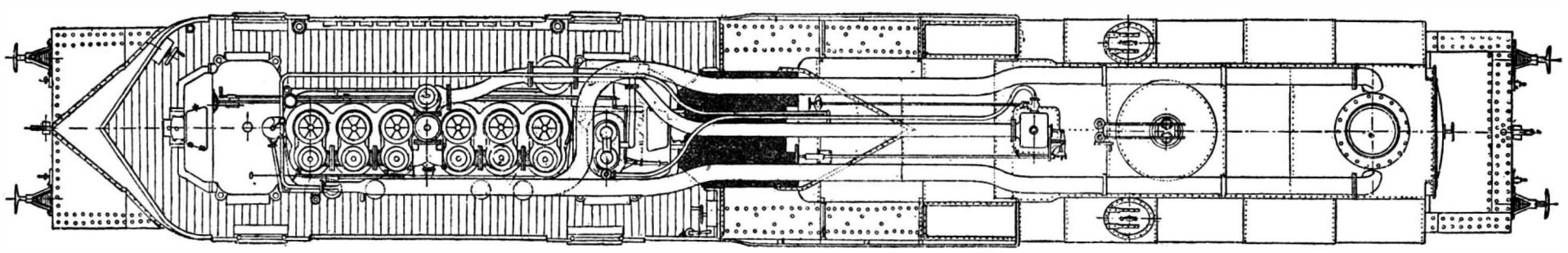


Fig. 6.—PLAN OF THE HEILMANN LOCOMOTIVE SHOWING ARRANGEMENT OF BOILER ENGINES AND GENERATORS.

The Scientific American in Russia.

The following is a letter of G. Wilfred Pearce to the editor of the New York Sun. It gives some interesting particulars about the state of trade in Russia and incidentally bears witness to the appreciation of the SCIENTIFIC AMERICAN in that country:

Sir: Several mechanical engineers and manufacturers of machinery which find markets in Europe, Asia and Africa, who have had opportunities for conversing with Major Moses P. Handy, commissioner to the Paris Exposition of 1900, are of the opinion that the 500,000 square feet of space which Major Handy has applied for will be quickly taken up by American manufacturers, who are keenly alive to the fact that the exposition will be open sesame to a large and profitable trade in certain lines of manufactures in metals in which we can control the markets of the world.

Russian merchants who do business in our city [New York] are saying that nearly every merchant, engineer and manufacturer in Russia will visit Paris during the exposition year, by which time business will be lively all along the line of the great Transsiberian Railway, which is destined to play a great part in the commerce of Europe and Asia. At the present time the European and Asiatic demand for American machinery and agricultural implements is very great. In electrical and steam apparatus our makers are driving a lively trade with Russia.

During this week I have seen a letter from a large firm having warehouses in St. Petersburg and Moscow, inquiring as to the reliability of the Richmond Locomotive Works, whose advertisement the Russian says he saw in the Sun. The concern wants about $100,000 worth of apparatus, which it could not get at the Samavar Locomotive Works, owing to the rush of orders at that new plant, equipped with American machinery. St. Petersburg is in the market for more than $1,000,000 worth of apparatus. The imperial engineer, who gave me the data for the proposed electric lighting plant at St. Petersburg, informs me that he reads the Sun and SCIENTIFIC AMERICAN, in order to "keep up with the march of Father Time."

Electrical Cabs in London.

In London a company has placed a dozen electrical cabs in the streets. They resemble coupes, and the accumulators consist of forty cells, capable of propelling them over fifty miles, at a cost of fifty cents. The rear wheels do the driving and the front wheels do the steering. They have heavy rubber tires and upholstered spring cushions, are lighted by electricity, are speedy, and almost noiseless. They appear to be giving every satisfaction. The machines seem under perfect control, and thread their way wonderfully through the traffic. The tariff is the same as that of the cabs. They look like a cross between a brougham and a four-wheeler, with accumulators underneath.

THE French used the bicycle in 1871, during the siege of Belfort, for carrying dispatches. The wheel adopted at that time was of course the "ordinary" or high wheel. This was the earliest introduction of the cycle in the army.—Stahl und Eisen.

HOUSE BUILDING BY RITUAL.

BY COSMOS MINDELEFF.

The man who builds a home, be he white or red, appears to be the special target of all kinds of trouble and annoyance; but in the latter case, that is to the red man, there are certain requirements which make the task even more onerous, while on the other hand there are compensating advantages. The pueblo tribes of Arizona and New Mexico, alone of all the Indians, build permanent stone houses, quite equal to those of white settlers in that country, and they have developed a peculiar system of building of their own which is of interest to every house builder.

The pueblo Indians now number about ten thousand souls, living in thirty villages, principally along the Rio Grande in New Mexico, and several distinct languages are found among them, but their house structures are essentially the same throughout. The largest of the villages, the pueblo of Zuni, which has a population of sixteen hundred, has been often visited, and the seven villages of the Moki, in northern Arizona, are also becoming known through the periodical performance there of the celebrated snake dance. Both of these groups have been studied for some years by the assistants of the Bureau of Ethnology, and the results of their work are now being published.

The houses of these people consist of groups of rectangular rooms, built of selected stone, or in recent years of adobe brick dried in the sun but not baked. The rooms are arranged in connected rows or clusters. Some of the latter are of huge size, resembling in appearance a gigantic hive and containing several hundred separate chambers. These were at first supposed to be communal structures, but it is now known that while each cluster is the home of a certain clan or combination of clans, the different families who compose it each have their own quarters in it.

The clustering of rooms into huge hivelike structures grows directly out of certain rules of house building, which are the result of peculiar social conditions under which the people live. Among them descent is in the female line; the children of a marriage belong to the mother and are members of her clan and of her family. As a man is not allowed to marry within his own clan, he loses some of his rights when he takes to himself a helpmate, or more correctly when his helpmate takes him, for when he marries he goes to the home of his wife to live, and to a certain degree is adopted into her family.

From this it comes about that families in which there are many girls must necessarily increase and spread out over more area, while those in which the children are all boys become extinct in the second generation. But as the house cluster is the home of the clan, when it becomes necessary to erect additional rooms they are invariably added to and connected with those already occupied, and it is not unusual to see houses in course of construction at one end of a row while at the other end, or in an adjoining row, rooms are abandoned and going to decay. This odd condition misled the early explorers, who reported that the tribes were rapidly becoming extinct, whereas they are holding their own or increasing slightly in numbers.

The clans, which are great artificial families, all the members of which claim descent from some mythical common ancestor, are themselves subject to change from the same social conditions. Some grow and increase in size, while others wane and eventually become extinct. Thus in the Corn clan there are groups which claim to be of the stalk, leaves, grain, pollen, etc., and should the clan prosper, each of these subdivisions will develop into a full-fledged clan. It all depends on the number of girl children who are born into the clan.

In one of the Moki villages there is a little cluster of four or five rooms standing separate and apart from all other houses. It is the home of the remnant of the Butterfly people, now consisting only of an old woman and her young daughter, besides two sons. As the sons will eventually marry and go elsewhere to live, the future of the clan depends entirely on the young girl. Should she live to marry and have many girl children, it is quite within the possibilities that the Butterfly clan may spread out and cover the whole village; but should she die unmarried, the clan will become extinct, the house will be abandoned, and in a few years its site will be marked only by a few heaps of stone, for it is the custom under such circumstances for the relatives of the family to tear down the house and re-employ the material.

The position of the women in the tribe is all that any of them could ask. They do no field labor, other than assisting in the harvest, and are free to devote their whole time and energy to their domestic duties and the care of their children. In the house their sway is absolute and undisputed. The crops in the field are considered the property of the man of the house and he is required to work them; but when they are garnered and brought in they become the property of the woman, who is also the sole owner of the house in which they are stored. The status of the husband is merely that of an honored guest, and should he misbehave in any way, he can be sent back to his family or turned adrift to shift for himself. It is hardly necessary to add that the greatest affection prevails in the household, and that such a thing as wife beating or ill treatment of women is unheard of in the tribe.

When a family finds it necessary to build additional rooms, notice is sent to the priestess of the clan, who makes the necessary arrangements. This priestess is the social head of the clan, and no business connected with the house can be conducted without her aid. She has also the final say in all proposed marriages, etc. The men of the family are required to bring in the necessary material; broken and dressed stone for the walls, beams for the roof, clay for mortar, etc. As the villages of the Moki are all situated on the tops of the mesas, 600 feet or more above the valley, this is no small task.

When everything is in readiness, announcement is made from the housetops by a crier, for the building of a house is a social function participated in by the friends and relatives of the woman who is to build. As the women own the houses and exercise absolute control over them, they are also the builders. There is always a man or two about, however, to do the heavy work. This duty is generally assigned to some of the male members of the family, and is not always willingly performed.

The chief of the village provides four eagle feathers, with a short cotton string tied to the stem of each. These are sprinkled with sacred meal, and prayers are breathed upon them for the welfare of the proposed house and its occupants, and that the walls may take a firm hold of the ground. The feathers are called nakwa-kwoshi, meaning a breathed prayer, and the prayers are addressed to Masauwu (the sun) and other deities concerned in house life.

The feathers are placed at the four corners of the house and a large stone is placed over each one. The place where the door is to be is marked by bits of food placed on each side of it, with prayers that there may always be plenty of food within. The lines to be occupied by the walls are then marked by passing around the site from right to left, scattering on the ground particles of bread and other food mixed with native tobacco. This ceremony is accompanied by a song to the sun couched in archaic terms, the meaning of which the people have now forgotten.

After this ceremony, the women proceed to lay up the stones in the walls, the heavier ones being lifted into place by the men, who are there for that purpose. Mud mortar, from a pile nearby previously prepared, is used sparingly, and the stones are laid in it in irregular courses. When the walls reach a height of 7 or 8 feet the top is brought to a fair level and the roof beams are put in place.

The roof beams are often brought from great distances, as suitable timber does not grow near the villages. In the Moki traditions it is stated that the beams for the mission buildings erected for the monks in the early part of the seventeenth century were brought on the backs of men from the San Francisco Mountains, a distance of more than a hundred miles. Although the missions were destroyed in the insurrection of 1680, and never rebuilt, some of these old beams were used in other structures, and still can be seen there.

Above the main roof beams, which are about two feet apart, there is another series of lighter poles placed across them. Over these a layer of reeds or twigs is placed, and over this grass and brush. A layer of mud is then spread over all, and being covered with dry

PUEBLO HOUSE BUILDING BY RITUAL

earth, is trodden down firmly. The women do all this work, and when it is finished, a floor is made inside with a thick coating of mud, trodden down in the same way; in fact, roofs and floors are much the same, and in the upper stories the floors of the rooms were once the roofs of those below. When the floors are done, the walls are plastered with mud, nicely smoothed with the hand. Sometimes they are finished with a wash of white clay, which gives them a very neat appearance. Formerly a custom prevailed of leaving a small space on the wall bare, a belief existing that one of the gods came and finished it; and although the space remained bare, it was supposed to be covered with an invisible plaster.

When the house is completed to this point, four feathers are prepared, similar to those used under the four corners of the house. These are tied to a short willow stick which is inserted over one of the central roof beams. The feathers are renewed every year at the feast celebrated in December, when the sun begins to return northward; that is, at the winter solstice.

The ceremony known as "feeding the house" is then performed. This is an offering to the sun, and consists of placing bits of food among the rafters, with prayers to the sun that he may smile upon the occupants of the house and not hasten the departure of any of them to the other world. After this, the women build a fireplace in one corner of the room under a hole left in the roof, and construct over it a chimney hood to confine the smoke to the proper exit. A binlike arrangement, or stone trough, is built in another corner, and three flat stones are mounted in it for grinding corn. The house is then ready for occupancy. The door is merely an opening, closed by hanging a blanket over it when necessary, and windows are merely holes left in the walls when they were constructed. In the cold winter weather these are closed by stone slabs, or built up solid with masonry, the filling being removed again in the spring.

The Mummy of a Pharaoh.

The greatest discovery of mummies ever made in Egypt, says Public Opinion, was in the year 1881, when the remains of thirty-nine royal personages were brought to light at Deir-el-Bahari, Thebes. One of these was proved to be the mummy of King Rameses II, the third king of the ninth dynasty and the Pharaoh of the Jewish captivity. This mummy was in a perfect state of preservation. The mummy case itself was of sycamore wood, plain and unvarnished, and without a spot or stripe of paint, something reckoned as unusual. The case was, however, carved to represent Rameses in the position of Osiris. The crossed arms rested upon the breast. In the right hand was the royal whip and in the left the royal book. The features were most delicately carved in the soft wood, and the whole was surmounted with the crown of Upper and Lower Egypt and surrounded by a carved representation of the uræus serpent. The name of Rameses was written in plain black characters upon the case, which bore no other text or representation whatever, strongly contrasting with the exaggerated dedications noted on almost all the other cases found in the same pit. The mummy itself was carefully wrapped in rose-colored and yellow linen of a texture finer than the very finest Indian muslin. In the different folds of this linen several dried lotus flowers and leaves were found. In the folds of one of the bands which passed across the grave clothes to keep them in shape was a folded papyrus bearing inscriptions which informed the reader that this, the mummy of Rameses II, was concealed in the pit where it was found at a time when a foreign army invaded Egypt. This quaint bit of information, which was probably written two thousand or two thousand five hundred years ago, is as plain as though it had been penned but yesterday.

A Nebraska International Exposition, 1898.

Congress has adopted a resolution to the effect that the President be authorized, if in his judgment it would not be incompatible with the public policy, to invite foreign nations to make exhibits at the Transmississippi and International Exposition to be held at Omaha, Neb., between June 1 and November 1, 1898. Congress has already recognized the Omaha exposition to the extent of appropriating $200,000 for a government department and exhibit. The States in the neighborhood of the Mississippi River district are making special preparations too, and Iowa, at the last session of the Legislature, made a preliminary appropriation. California is another of the States which is to take part, and Louisiana, by act of Legislature, has intrusted to the State board of agriculture the business of providing for a fitting display of Louisiana's products. The purpose of the Omaha exhibition is primarily to show "the products, resources, industry and civilization of the States and Territories west of the Mississippi," embracing, it is said, two-thirds of the area, one-third of the population, and one-half of the wealth of the United States. The Transmississippi and International Exposition is a corporation organized under the laws of Nebraska with a capital stock of $1,000,000.

The Field of Landscape Art.

We are constantly asked whether the profession of landscape gardening offers a promising field for young men who are looking for some calling in life which will be useful and remunerative. We have always felt obliged to reply that there is comparatively small demand for the counsel of landscape gardeners in this country, and we have added that until the true functions of these artists are more thoroughly recognized the call for their professional services will be limited. Most of the men who make inquiries on this point have themselves hazy notions as to what the legitimate field of a landscape gardener is. The prevalent idea is that his work is chiefly ornamental, and that his province is to do about the same thing for the surroundings of a house that the decorative artist does for its interior when he selects the furniture, rugs and hangings and decides upon color schemes and the like. That is, after an architect has built a house, it is considered proper to call in a landscape gardener to plant some ornamental trees and shrubs about it and lay out paths and flower beds in order to beautify the grounds. Now, it is true that the landscape gardener, like other artists, has to deal with beauty, but his first and fundamental study is to provide for human use, for comfort and for convenience. An architect of taste does not make a building and then hang ornaments upon it without and within. His structures will be beautiful, but this beauty is developed out of the design so as to be an essential part of it, and this is so profoundly true that the best architectural work will be beautiful primarily because it serves the purpose for which it was created. The same rule should hold in regard to the development of the grounds about a house. These should be primarily laid out for use and convenience, and their beauty should grow out of their perfect adaptation to the wants of those who are to use them. In short, as we have said a great many times, the house and grounds should be planned together, so as to make one picture; but, even beyond this, they should have a unity of design which is more than superficial. In fact, the beauty of the scene, which includes both the house and the grounds, should grow up from the general design and framework of the house and grounds, as a place where all the varied necessities of the family in the way of health and happiness and home life are the first things considered. This is the reason why no ready-made house plan is adapted to all sorts of ground and why any ready-made planting plan is not available for use with all sorts of houses.

The most hopeful symptom we know is that architects are inquiring more and more for competent designers in landscape to assist them. That is, they feel the need of advice from some one who is trained to the planning and modeling of ground, one who is skilled to see at once all the possibilities that lie in any situation, not only for appearance but for use; one who knows how to take advantage of any diversities of surface or differences of outlook so as to make them available for varied purposes. Such a man can be of assistance to an architect, not only in locating the house in such a way that it will appear to the best advantage, but also for placing it where the principal rooms will have a pleasing outlook. He will contrive facilities for access to it and agreeable lines of approach. The arrangement of different parts of the grounds for special uses requires thought and experience which are outside of the ordinary lines of the architect's study, and therefore the best architects have learned that the highest service which a landscape gardener can render is precisely at the point where the essentials of the combined design of house and grounds are being considered.

All this means that a landscape gardener ought to be much more than a mere decorative planter. The successful designing of public parks or of private grounds for daily occupation means first of all the study of human wants—the necessities of men and women and children of various circumstances and conditions. A good artist must be primarily a man of sound judgment, and he should have cultivated mind, wide sympathies and catholic tastes. Reading and travel and scholarship can do for the designer in landscape all that they can accomplish for the architect. A man may be able to mass a shrubbery effectively or arrange a border of herbaceous plants with skill and yet not have a particle of that profounder art which was seen in the grouping of the great buildings at the Columbian Exposition and the planning of that Court of Honor which was the crowning artistic success of Mr. Olmsted's life. This view of the case contemplates an ideal that is rarely attained, and it is because the work of real artists in this line is rarely seen and still more rarely appreciated that the very existence of such an art is practically ignored or denied. If city park boards realized what a trained park maker is capable of creating out of a given piece of ground, they would never content themselves with asking an engineer or surveyor or mere gardener to design a public pleasure ground. We ought to have reached a stage of civilization when it is no longer believed that any unskilled journeyman is competent to lay out a park or garden, or pass judgment on the plans of a park or garden. If any artist needs sound judgment united with taste and training, it is the man who studies public and private grounds and prepares them for the use and enjoyment of man.—Garden and Forest.

How Fire Causes Death.

A writer in the Hospital says: Those who lose their lives in conflagrations do not by any means always suffer physical pain. In many cases, no doubt, sharp terror is the one thing of which the victim is conscious, and in many more, strange as it may seem, consciousness plays no part, life ceasing painlessly and without a struggle. . . .

In great conflagrations gases are produced which have much the same effect [as chloroform or similar anesthetics], and it is a fact that of those who lose their lives in such catastrophes a considerable proportion pass into death without any evidence of having suffered. This result is produced especially when a fire has smouldered, when the access of air has at first been insufficient to cause complete combustion, and when that deadly gas, carbonic oxide, has sent its victims into lethal sleep before the actual flames have reached them.

Of those, however, who have evidently struggled and fought, and whose charred corpses are afterward found in attitudes suggestive of violent efforts made in attempting to escape, it must not be imagined that they have of necessity been burned alive and have died in the agony which such contortions are popularly imagined to express.

Death from agony is really death from shock, a condition in which the body is limp and helpless; whereas in death from suffocation struggling may go on even after consciousness has passed, and the strained attitude of the corpse may be expressive only of the final paroxysmal effort made in a state of entire unconsciousness.

Suffocation in a fire depends on something more than mere carbonic acid poisoning. It is the stoppage of the breathing by the stifling vapors which does the mischief. Carbonic acid would doubtless kill if it could be breathed, but any one who has attempted to enter a burning building will know that suffocation depends, not on the stuff one breathes, but on the fact that one cannot breathe at all. The lungs are as much deprived of their supply of oxygen as if the sufferer were plunged over head in water, and the struggle produced is much the same.

While then we must admit the horror of the moment, the terror, the fight for breath, and finally the death from suffocation, we must remember that all this is often a matter of short duration, and that it is something very different from the slow torture of being burned alive.

The writer reminds us that, owing also to the excitement of the moment, the body of one who is in a great fire is probably insensible to pain, just as it often is in battle. He says:

The instances are so frequent in which more or less severe and painful wounds have only been discovered after the necessity for action had passed away that we are driven to hope and to believe that, so long as all the energies are absorbed in the effort to escape, actual suffering, even from fire, may not be great—may even be unfelt.

Yet there is another, and not so comforting, side to the picture. Says the writer:

It must be recognized that, while all this is true, there are cases in which people are actually burned alive—consumed little by little until the heart stops from shock.

Familiar pictures of martyrs at the stake show us one of the conditions for such an event; the wind driving the smoke aside so that the head, the brain, and thus the consciousness, are left intact until the heart is stopped by sheer agony.

It must always be remembered that no one can live or retain consciousness when actually within the flames. But those who are caught and held fast in the full blast of fresh air which is being drawn into the center of the conflagration cannot be suffocated, they cannot make those violent efforts which would numb their consciousness of pain; they can but wait and suffer until, as the result of agony or terror, let us hope the latter, their hearts stand still. This is indeed a terrible fate.

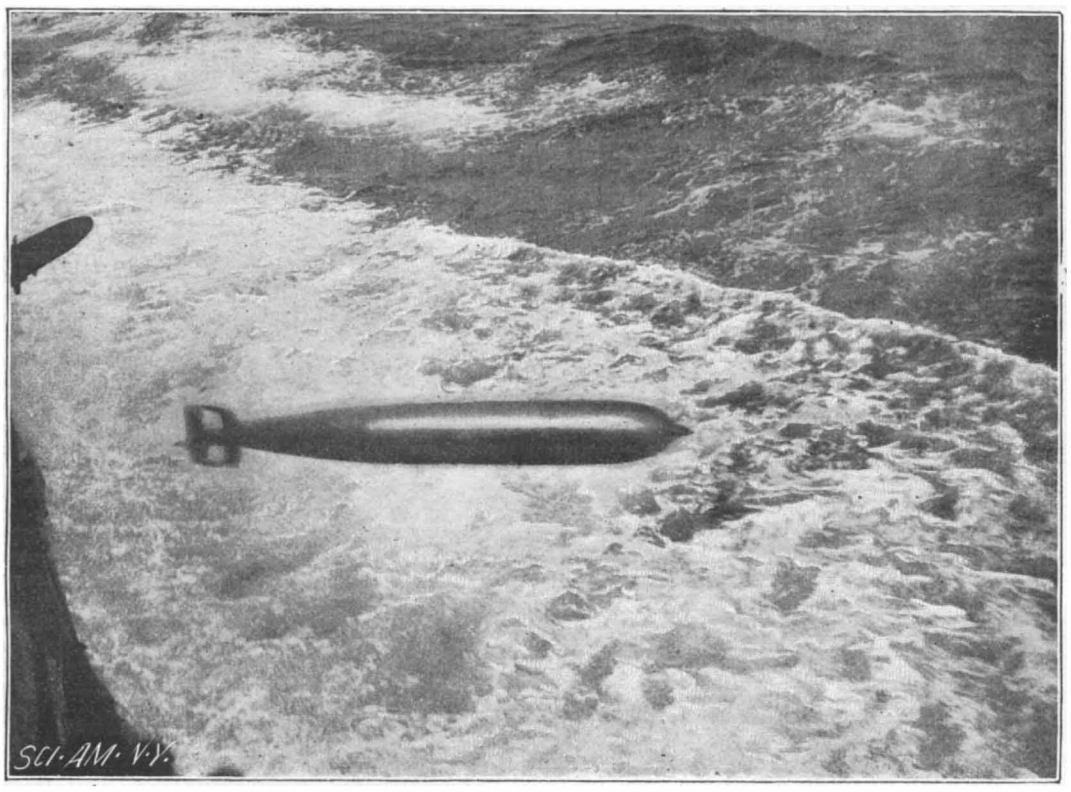
Be Good to Yourself.

The Medical and Surgical Reporter gives the following practical advice: "Think deliberately of the house you live in—your body. Make up your mind firmly not to abuse it. Eat nothing that will hurt it. Wear nothing that distorts or pains it. Do not overload it with victuals or drink or work. Give yourself regular and abundant sleep. Keep your body warmly clad. Do not take cold; guard yourself against it. If you feel the first symptoms, give yourself heroic treatment. Get into a fine glow of heat by exercise. This is the only body you will have in this world. Study deeply and diligently the structure of it, the laws that govern it, the pains and penalty that will surely follow a violation of every law of life and health."

FIRING A TORPEDO.

The accompanying illustration of a torpedo in its flight from the ship to the water must certainly be reckoned as one of the curiosities of photography. It was taken during the recent naval maneuvers in Great Britain, and it represents the position assumed by the torpedo just after it has left the firing or launching tube.

As our readers are doubtless aware, the Whitehead torpedo is nothing more nor less than an air-propelled cigar-shaped little ship, carrying its own air chambers amidships, its propelling engines in the stern and the deadly charge of guncotton in the bow. When a warship goes into action she carries several of these torpedoes ready charged with guncotton and compressed air. When she is within striking distance of the enemy, one of them is placed in the launching tube, a long cylinder of metal of approximately the same internal diameter as the external diameter of the torpedo, and when the object is within range a small charge of powder or compressed air serves to eject the torpedo in just the same way as a shell is fired from a gun. The discharge of the torpedo starts the propeller engines, which continue to drive the torpedo after it has entered the water.



PHOTOGRAPH OF A WHITEHEAD TORPEDO TAKEN JUST AFTER ITS DISCHARGE FROM THE BATTLESHIP.

Before it is fired provision is made for causing the torpedo to travel at a certain depth below the surface of the water. This is done by means of a beautiful piece of automatic and delicate machinery acting upon small vanes or rudders. This is so set that after it has made its preliminary dive the torpedo will rise, and, after a few oscillations, settle down upon the fixed horizontal course for which it is set. The full speed is about 30 knots an hour, though, if it is desired, the engines may be set to carry the torpedo a greater distance at a slower speed. Great as this speed is, it is not sufficient to insure their keeping ahead of the modern torpedo destroyers, and for this reason the bow launching tubes are no longer built into the fastest boats. In the illustration we are supposed to be standing on a higher deck than that from which the launching takes place, and we are looking forward in the direction in which the ship is steaming. The streaked and milky appearance of the water is caused by the wash from the vessel's bows. Our engraving is from Black and White.

The Sculptor's Profits.

One of the most puzzling problems is to ascertain the ratio between artists' fees and the cost of works at different periods. An attempt of the kind has been made in Berlin, apropos of the memorial of the Emperor William I. For that work the Reichstag voted a sum of 4,000,000 marks, and the expenses, it is believed, will not exceed that sum. Professor Reinhold Begas has received one-fourth of the amount, but as he has not furnished a debit and credit account—nor should he be expected to prepare one for the public gratification—it cannot be ascertained whether he has gained or lost by his great work. But it may well be doubted whether his commission was as profitable as Rauch's when he executed the fine memorial of Frederick the Great, which is so prominent an object in the Unter den Linden. The payment was arranged differently. During the twelve years he was engaged on the work he received 3,000 thalers annually, and he was therefore able to devote himself to his task without anxiety. On the completion of the memorial he received 20,000 thalers; so that in all he obtained 168,000 marks, which was a fourth of the total cost. But the money, amounting to over £8,000, was mainly for his own services, while Professor Begas has had heavy disbursements. Schlüter, the sculptor, was paid 2,000 thalers for his design for the memorial of Frederick I, or the "Reiterbild des Grossen Kurfürsten," which is so prominent an object on the Lange Brücke, near the Schloss, in Berlin. About the same time he was intrusted with the superintendence of the inclosure to the royal palace. He received from 800 to 1,000 thalers yearly, but whether that was for sculpture alone is uncertain. It is calculated that he was rewarded with 11,000 thalers, or 33,000 marks, which would be about one-eighth of the cost of the most excellent example of German sculpture in the beginning of the eighteenth century.—The Architect.

THE "SPIRITUALISTIC POST TEST."*

BY W. B. CAULK.

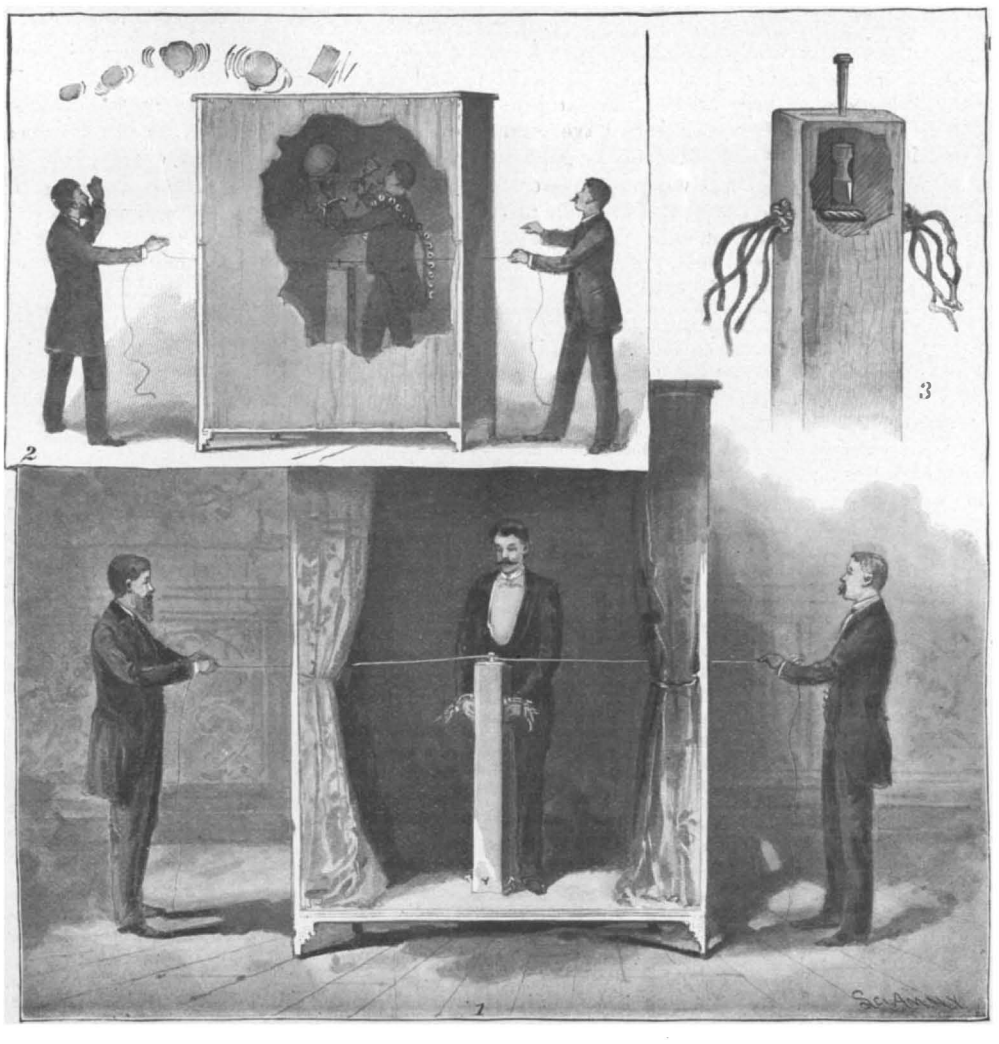
The "spiritualistic post test" is among the latest and most successful of mechanical fastenings. A piece of wood four inches square and three feet long is given to the committee, who bore a hole through it near one end, and then pass an ordinary rope through the hole, tying a knot in the rope on each side of the post, pressing the knots against the post so that the rope cannot be drawn through the post. The ends of the rope are now unraveled, and the post secured to the floor of the cabinet.

The performer, standing behind the post, places his wrists against the knots in the rope, one on each side of the post, and the unraveled ends of the rope are bound around his wrists and tied securely, and all knots are sealed with wax. A large nail is driven in the top of the post, to which are fastened cords that are passed out through the cabinet and held by members of the committee in order that they may know if the performer moves the post in any manner during the performance of any test, such as the ringing of bells, etc. Fig. 2 of our engraving shows the performer tied to the post and the committee holding the cords. The curtains of the cabinet are closed and the usual manifestations take place.

Before the performance a hole is bored in the center of the end of the stick or post, in which is placed a chisel-shaped piece of steel sharpened at the lower end and blunt at the upper end, as shown in Fig. 3. The opening in the end of the post is now carefully closed and all signs of such an opening are concealed by the aid of glue, sawdust, and a little dirt rubbed over it.

When the committee are invited to bore a hole in the post, the performer takes care to start the bit, in order that there will be no mistake about getting the hole directly beneath the chisel concealed in the post. When the rope is passed through the hole and knotted it is directly under the sharp edge of the chisel, with a thin layer of wood between. When the nail is driven in the top of the post it strikes the chisel, forcing it through the thin shell of wood above the rope and through the rope, thus releasing the performer, who can withdraw his hands from the post and do any trick he chooses, and when finished, by merely replacing the ends of the rope in the holes from which he removed them, and holding the hands tight against the post, can allow a most rigid examination of the seals to show that it was not possible for him to have released his hands, and the persons holding the cords that are fastened to the nail testify that they did not feel any movement of the performer or the post.

*Copyrighted, 1897, by Munn & Company.—From "Magic: Stage Illusions and Scientific Diversions, including Trick Photography." Ready September 15. Price $2.50. Send for illustrated circular.



THE SPIRITUALISTIC POST TEST.

Some Startling Figures.

The New York Sun in an editorial bunches some significant pension facts, so that the inference drawn is that a great proportion of pensioners are unworthy of government bounty and that the list should be cut down. Figures recently published show that at the present rate of expenditure the annual pension list has been consuming more than nine-tenths of the revenue taken in at all of the custom houses in the United States; or again, if the customs duties are considered as paying the general expenses of the government, the pensions have been using up not less than 96 per cent of the total receipts from internal revenue. Thirty-two years after the end of the civil war, the number of pensioners on account of that war exceeds by about a quarter of a million the number of soldiers actually engaged in service in all of the armies of the government at any time between the firing upon Sumter and the surrender of Lee at Appomattox. The number of pensioners after a third of a century is between 30 and 40 per cent larger than the fighting army at any time during the war. We have already paid in pensions since the war two billion dollars or two-thirds as much as it cost the government to carry on the war.

ACCORDING to some researches of Biernacki, in a German physical journal, alcohol containing water may be deprived of its water by dipping into it amalgamated aluminum. Aluminum may be amalgamated by connecting it to one pole of a battery and repeatedly dipping it into mercury which is connected to the other pole. The spark produced upon withdrawing it yields sufficient heat to bring about the amalgamation.—Elec. World.

RECENTLY PATENTED INVENTIONS.

Engineering.

COMBUSTION ENGINE.—Augustus G. Pace, New York City. This engine has two cylinders in which pistons operate, and combustion chambers have port communications at the top and bottom with the cylinders, the pressure of exploded gas being exerted on the top of one piston and the bottom of the other. The gas admission valves are operated by the suction of the pistons, and the exhaust valves by a rotary part of the engine The engine is designed to be of greatly reduced weight as compared with other combustion engines, while developing a corresponding amount of power.

Railway Appliances.

SWITCH OPERATING DEVICE.—George M. Patterson, Providence, R. I. A mechanism is provided by this invention for automatically shifting switch rails from a siding to the main track, the mechanism being under the full control of the engineer or fireman on the locomotive, and being designed to entirely obviate danger of accident by side tracking a train. It comprises switch tongues pivotally connected with a boxing in which is a spring-actuated block engaged by a spring-actuated plunger, an operating shaft being connected with the boxing, and there being devices on the locomotive cowcatcher by which the switch mechanism may be operated by means of a pull rod which extends into the cab.

Bicycles, Etc.

A NOVEL BICYCLE.—John Carlyle Raymond, Brooklyn, N. Y. On each side of the drive wheel shaft, according to this invention, is a pinion, each pinion meshing with a gear wheel on a crank shaft journaled in bearings of the frame, the shaft having two crank arms, one arm connected by a link with a treadle and the other arm connected by a link with a fulcrumed lever on the forward end of which is the saddle. The construction is designed to afford exercise for the rider's whole body, the up and down motion of the rider in his seat, as well as the pressure on the pedals, assisting to propel the bicycle.

TROLLEY BICYCLE.—Robert T. Oney, Charleston, West Va. This is a wheel adapted to carry an electric motor, and having on the front portion of its frame a jointed extensible trolley pole carrying two trolley wheels to contact with two separate conducting wires, whereby the wheel may be run by the electric current on an ordinary dirt road. The bicycle is provided with the usual pedals, so that it may be propelled in the ordinary way, with the trolley pole folded down in front, or both means of propulsion may be simultaneously employed if desired.

Mining, Etc.

SEPARATING PRECIOUS METALS FROM ORE.—Gustaf M. Westman, New York City. A process for separating gold and silver from refractory ores, according to this patent, comprises the bringing the mass of ore to a molten condition, and then subjecting the running molten mass to the action of jets of steam, air, or other fluid, to form mineral wool, thus causing the minutely divided particles of the precious metal to collect on and adhere to the mineral wool. The latter is then subjected to a leaching process, as with free chlorine gas in a solution, to separate the precious metals from the mineral wool.

Mechanical.

POWER CONVERTING MECHANISM.—Benedict J. Ross, Louisville, Ky. To convert reciprocating into rotary motion, this invention provides a device which consists essentially of bars pivoted together in one or more pairs, similarly to the two bars of a toggle joint, the outer ends of the bars being restrained within guides so that they have a reciprocating movement therethrough, while short arms extend at right angles from their outer ends, these arms being connected by rods with double cranks on a shaft. The movement of the center pivot of the bars forming a toggle joint causes a reciprocating movement of the connecting rod and a rotary movement of the shaft.

WORK HOLDER. — Olof R. Johnson, Escanaba, Mich. This is a device in the nature of a bench clamp, more especially designed for the use of carpenters and other mechanics, to hold work in place, and to be itself conveniently placed in position on a bench or board or other support to form a temporary bench to facilitate doing small jobs in houses. It consists principally of a bit plate on which a dog is fitted to slide, a disk turning in an opening in the dog and formed with a spiral groove engaged by a lug or pin on the bit plate. A device is provided for securely fastening the bit plate in position on the bench or board, and auxiliary dogs for holding boards upon edge and holding work in an inclined position.

Miscellaneous.

COMPUTING SCALE.—William R. Dunn, Alton, Ind. A computing or price indicating scale is provided by this invention, a movable weight being adapted to traverse two beams, one graduated to indicate pounds and ounces and the other the price in cents of the substance being weighed. The price-indicating beam is a tubular rotative body, and has on its periphery longitudinal series of graduations, with an index character at the end of each series, showing the price per pound in the weighing of which each particular series of graduations is to be used, such graduations running, as described, from three to thirty-five cents per pound, or to be varied as desired.

ADDING MACHINE.—William J. Ensworth, Erie, Pa. A machine which may be used for adding columns of figures, or as a cash register in mercantile concerns, is provided by this invention, the operation of the machine being indicated to the operator and others present. The operation is effected by turning arms on registering disks whose peripheries have each a hundred notches, one form of the machine being adapted to add and register up to ninety-nine dollars and ninety-nine cents and other forms up to thousands and millions.

DRY OIL GAS BURNER.—Charles H. West, Kearney, Neb. For burning oil gases in a dry state, instead of burning the oil in the form of a mist or spray, this burner is made with an overhanging vaporizing pipe and a subjacent burner pipe, while an adjustable deflector or flame spreader with broad, flat base connects the top and bottom and receives the vaporizing pipe, there being a set screw for adjustably fixing the position of the deflector on the vaporizing pipe. An oil cut-off valve may be adjusted to regulate the amount of heat and flame.

SASH LOCK.—Charles T. Redfield, Glen Haven, N. Y. This lock brings the meeting rails of the sashes together in a manner somewhat similar to the action of a parallel ruler, drawing the rails together and alongside of each other and at the same time forcing them at their opposite ends against the opposite sides of the window frame. The device comprises a slotted link sliding and swinging on a securing stud, and an abutment stud over which the link may readily be applied and removed.

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.

SCIENTIFIC AMERICAN BUILDING EDITION

SEPTEMBER, 1897.—(No. 143.)

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No. 1. Plate in colors, also another perspective elevation and floor plans of a residence at Bensonhurst, L. I., recently erected for Mr. Walter Jones. A design treated in an attractive style of architecture, with Colonial feeling and classic detail. Architect and builder, Mr. Walter Jones.

No. 2. A Colonial residence at Springfield, Mass., recently completed for Mr. N. N. Fowler, at a cost of $13,000 complete. Two perspective elevations and floor plans. Mr. Guy Kirkham, architect, Springfield, Mass.

No. 3. Residence at Scranton, Pa., recently erected for Mr. Thomas R. Brooks. A unique design. Two perspective elevations and floor plans. Mr. John A. Duckworth, architect, Scranton, Pa.

No. 4. Elm Park Methodist Episcopal church and parsonage at Scranton, Pa. Two perspective elevations and floor plans, also two perspective elevations of the parsonage, with floor plans, Architects, Messrs. George W. Kramer & Co., New York City.

No. 5. English dwelling at Overbrook, Pa., recently erected for Mr. Smucker. An attractive design treated in the English style, half timber and stone. Perspective elevation and floor plans, also interior view. Architect, Mr. William L. Price, Philadelphia, Pa.

No. 6. Cottage at Binghamton, N. Y., recently erected for Mr. G. N. North, at a cost of $3,200. Two perspective elevations and floor plans. A design with many excellent features, good elevations and well arranged plans. Mr. Elfred Bartoo, architect, Binghamton, N. Y.

No. 7. Modern cottage at Nyack, N. Y., recently erected for the Rev. Edward Mitchell, at a cost of $2,500 complete. Two perspective elevations and floor plans. A unique design for small cottage. Mr. George F. Morse, architect, Nyack, N. Y.

No. 8. Moderu suburban villa at Chestnut Hill, Mass., erected for Messrs. Merriam, Isbenbeck & Alvord. A design well treated in the modern American style with Colonial detail. Two perspective elevations and floor plans. Architect, Mr. J. H. Morse, Boston, Mass.

No. 9. A residence at Binghamton, N. Y., recently erected for Miss Q. M. French. Perspective elevation and floor plans. A very attractive design with excellent elevations.

No. 10. An actress' home at Chevy Chase, Md., illustrating the residence of Miss Annie Lewis. Two perspective elevations and floor plans. Mr. Louis D. Meline, architect, Chevy Chase, Md.

No. 11. Half page design of the New Rathsapotheke in Bremen.

No. 12. Pulpit of the Cathedral of Sainte Gudule, Brussels.

No. 13. Miscellaneous Contents: New York as a furniture market.—Advantages of fresh air in apartments.—Exterior plaster for dwellings.—Rules for making good mortar.—Premature occupation of new homes; a test for relative humidity of habitable apartments.—Ventilation of apartments.—Does your faucet leak?—A new recording thermometer, illustrated.—Beautiful work in wood finishing.—Slate roofs.—Dec-co-re-o, illustrated.—Berkfeld filter, illustrated.

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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.

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Minerals sent for examination should be distinctly marked or labeled.

(7197) W. T. P. asks: 1. Could some one describe the most effective electro-magnet to give a lift of 5 inches at a pressure from 50 to 75 pounds? And state how much electricity it would take to work the same in volts and amperes. A. The electro-magnet best suited to your purpose, probably, is the coil and plunger. The coil would be 15 inches long and the winding would have 17,000 turns of No. 18 wire. The iron core should be a bar about 2¼ inches in diameter and 20 inches long, in order to get the very long pull you specify. The type of magnet is described in S. P. Thompson's "Electro-magnet," page 54, and shown in Fig. 30, page 55. 2. And state which is the most productive of magnetism, volts or amperes? I have a generator that gives 50 volts and 3½ amperes. Shall I be able to produce enough magnetism to give me the desired lift? A. The current for the above winding is 3½ amperes. The ampere turns give the lifting power. One ampere going once around the core constitutes an ampere turn; 60,000 ampere turns are provided for in the above winding, and there is a surplus of iron in the core as an allowance for safety.

(7198) W. E. B. asks: Will you please give the process of laying water-tight cement floor over boards? A. A board floor for a water-tight cement cover should be made of very narrow thick stuff, say 2 inches wide and 1½ inches thick, on beams close enough to prevent springing. The upper corner of the flooring strips should be slightly beveled to allow of the cement pressing in between the boards to prevent cracking; bottom edge of flooring should be laid tight. Portland cement should be used and laid thick enough to prevent breaking up by the special use of the floor.

(7199) E. N. M. asks: Will you please inform me through the Notes and Queries columns of your paper how to make a selenium cell, such as is used in electrical experiments? You will find valuable articles on selenium cells in SUPPLEMENT, Nos. 246, 264, 270, 271, 281, 283, 676, and 749, which we can supply at 10 cents each.

(7200) J. E. S. asks: Can you give me any information regarding flash boilers? A. The flash boiler has been the subject of engineering experiment during the past thirty years with no practical result beyond a few horse power. On the larger scale the unequal heating of the steam-making surfaces has produced unequal expansion to such an extent as to ruin every boiler tried in a very short time. The Reid boiler went through several forms, the principal of which was two cylindrical shells, concentric, vertical, with a space of ⅜ of an inch between them, with jets distributing the water upon the hot surfaces as evenly as possible with the surplus, if any, falling to the bottom. The fire box was beneath the boiler, with the heated gases rising in contact with both inside and outside of the shell. The Mitchell boiler was a revolving cylinder over the furnace so that its entire surface became an intense heating surface. The water was fed through a stuffing box on one of the journals, with a central perforated pipe that jetted the feed water in all directions, the steam being taken from the opposite journal with a stuffing box connection. The only style of flash boiler that has done any real service is the coiled pipe form with the water injected at the bottom, which, by its foaming with the sudden heat, rises through the coil and is all converted into steam. The coiled pipe boilers have been of many forms, the most durable of which are made in a single length of extra strong iron pipe. The most successful of the pipe boilers are of the kind made by Serpollet, in Paris, France, and used on steam carriages in the recent road motor trials. The Serpollet is illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 664 and 732. Ten cents each, mailed.

(7201) J. L. writes: Will you kindly send me a receipt for tempering four ribbed reamer so it will harden and not curve? I have tried oil and salt water and they curve. I have given you the drawing so as to make it as clear as possible. A. The sketch of our correspondent represents an ordinary four ribbed reamer 12 inches long, taper, and of small size. The hardening of long slender tools is the most difficult operation in the machinist's hands. We can only advise the necessary precautions used by those who succeed. The steel should be annealed a second time before the last cut is made, by heating slowly in a low fire buried in an iron box or tube of clear ashes or fine sand; then finished. The heating for hardening should be done in the same way as before, with a little pulverized charcoal mixed with the ashes or sand. When the box and reamer has been heated through, to a full cherry red, the reamer should be carefully drawn out endwise so as to prevent the possibility of bending while hot; and immediately dipped vertically in oil, not too quickly. Any variation from the vertical is liable to warp the tool by cooling one side faster than the other. In drawing temper care should also be taken to heat evenly on all sides alike to the straw color, brown, or light blue, for whatever use the tool is for. The long delicate reamers of the tool trade are trued with an emery wheel and guiding machine.

(7202) L. L. S. asks how to make dry cells for faradic and galvanic batteries, e. g., as the chloride of silver dry cell batteries. A. To make the chloride of silver cell, provide a glass tube about 1 inch in diameter and 3 inches high. This is closed at the top by a cork. Through the cork passes a rod of chemically pure zinc, which may extend to within 3/8 inch of the bottom of the tube. This is the positive plate. The negative plate consists of chloride of silver cast around a silver wire, and wrapped in fine parchment paper. To prepare the negative plate, melt the chloride of silver in a porcelain crucible and cast it in a hard carbon mould upon a silver wire, long enough to extend through the stopper and attach to the zinc of the next cell in series. The charging solution is made by dissolving 1 ounce of pure ammoniac chloride (sal ammoniac) in 1 quart of water. The tight fitting stopper retains the liquid in the cell. If the cell is not overworked, no gas is formed by it; so that there is usually no need of a vent. The cell is thus a watertight rather than a dry cell. Dry cells are made by mixing plaster of Paris, gelatine, or similar substances with saturated solution of sal ammoniac in water, so that the liquid will not run out of the mass. In this sense only they are dry. This is packed between and around the zinc and carbon. Much valuable information regarding dry cells and a description of many types will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1001, 10 cents.

(7203) J. M. W. asks for formulas for aromatic vinegar: A. 1. Henry's.—Dried leaves of rosemary; rue, wormwood, sage, mint and lavender flowers, each ½ oz.; bruised nutmeg, cloves, angelica root and camphor, each ¼ oz.; alcohol (rectified), 4 oz.; concentrated acetic acid, 16 oz.; macerate the materials for a day in the spirit; then add the acid and digest for a week longer at a temperature of 14° or 15° C. Finally, press out the now aromatized acid and filter it. 2. Concentrated acetic acid, 8 oz.; otto of English lavender, 2 drachms; otto of English rosemary, 1 drachm; otto of cloves, 1 drachm; otto camphor, 1 oz. First dissolve the bruised camphor in the acetic acid, then add the perfumery, after remaining together for a few days, with occasional agitation, filter. All vinegars are used by pouring 3 or 4 drachms into an ornamental smelling bottle, previously filled with crystals of sulphate of potash.

NEW BOOKS, ETC.

A PRACTICAL MANUAL OF LINSEED OIL MANUFACTURE AND TREATMENT. Varnish manufacture, superior, medium and cheap grades. By John Bannon. New York and Chicago: Published by the National Provisioner Publishing Company. 1897. Pp. 217. Price $10.

Linseed oil is a very essential constituent of a good paint or varnish, and it is strange that there should be so little literature on the subject. The present work is by a man who is thoroughly acquainted with the manufacture of linseed oil and linseed oil varnishes, and possesses great value on this ground. The subject is treated in order and the latest methods of manufacturing oil are described. Toward the end of the book the manufacture of varnishes is taken up and a number of tested formulas are given. This book is an addition to technological literature of the utmost importance, and all who are in any way interested directly or indirectly in the manufacture of linseed oil should possess a copy.

Sargent's "Book of Designs" is the title of a very beautifully got up and handsomely illustrated monograph, in quarto form, issued by Sargent & Company, of New York, makers of artistic hardware and fine locks with the view of making the public better acquainted with the elegant designs and fine finish of the goods produced by the house. The company is one of the oldest and largest in this line of business, and the great variety and beauty of their several finishes in antique copper, old brass, oxidized silver, etc., of such articles as escutcheons, door plates and knobs, locks, butts and hinges, and other household trimmings, are well brought out in the fine half tones furnished in this "Book of Designs." It is sent free to applicants.

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AND EACH BEARING THAT DATE.

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MODERN PHOTOGRAVURE METHods.—By Horace Wilmer. An interesting description of the process of making photogravure plates for illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1007**. Price 10 cents. To be had at this office and from all newsdealers.

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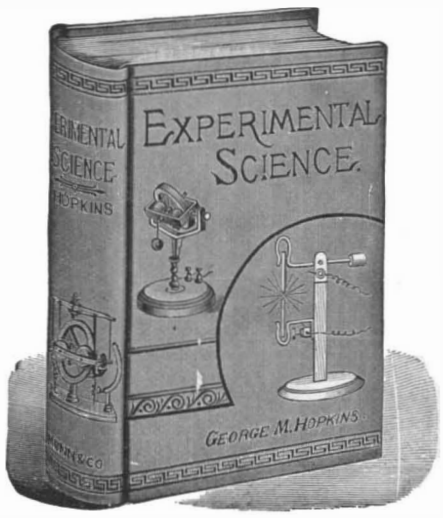

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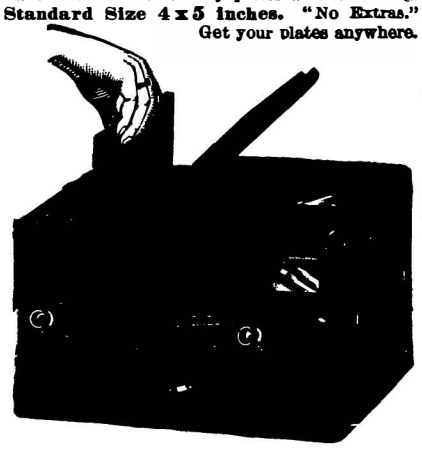

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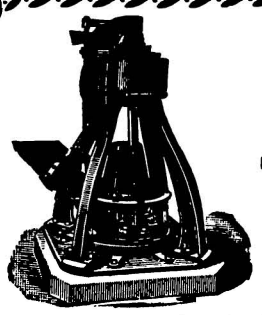

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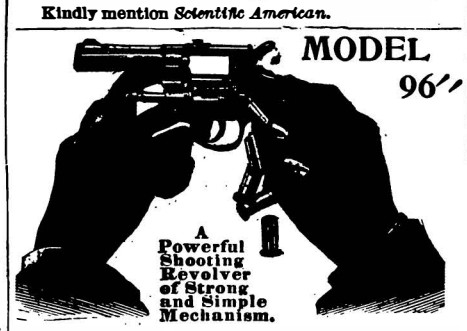

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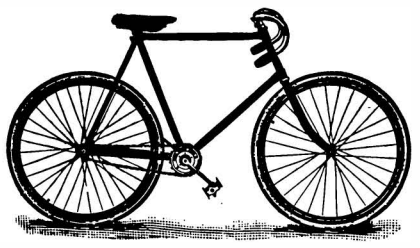

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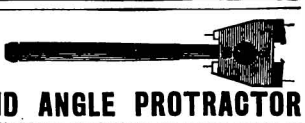

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