SCIENTIFIC AMERICAN

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THE ATLANTA EXHIBITION.

The progress of the Cotton States Exhibition at Atlanta has thus far been extremely gratifying to its projectors, and promises to be as highly successful as was expected in promoting the industrial and commercial growth of the new South. It would not be fair to compare this exhibition with that so recently held at Chicago, as is sometimes done, but, were it not that the late World's Fair is so much in every one's mind, the extent and variety of the display now being made at Atlanta, the beauty of the grounds and buildings, and the completeness of the show as distinctively representative of the growth of the Southern States in recent years, would excite the highest commendation everywhere.

Our illustration gives a view of the grounds and some of the principal structures as seen from the Art building. On the extreme left is shown a small portion of the Manufactures and Liberal Arts building, the Woman's building occupies the center of the picture, and at the right near the Ferris wheel is the California building. The later structure was erected by private subscription, and the State Board of Trade is making a fine exhibit, using the material collected at an expense of $100,000 for the World's Fair. The Woman's building was designed by a woman, as was the case at Chicago, and is classic in design, forming one of the most pleasing features of the Fair. It has an excellent display of the work of women, including a library of books written by women, their musical compositions and magazines, and patents and inventions due to females. The artistic work of women, paintings, etchings, architectural designs, etc., are well represented, and the educational exhibits are very complete, including technical instruction as connected with the industrial arts, as well as school and kindergarten work. The picturesque features of the landscape at the site of the exhibition were naturally of great beauty, but nearly a million dollars was expended in heightening their attractiveness, with the result of making the exhibition grounds surpassingly beautiful. Artificial lakes of considerable size form important features of the plan, and electric launches and gondolas on these lakes form pleasant means of transit from one section of the grounds to another.

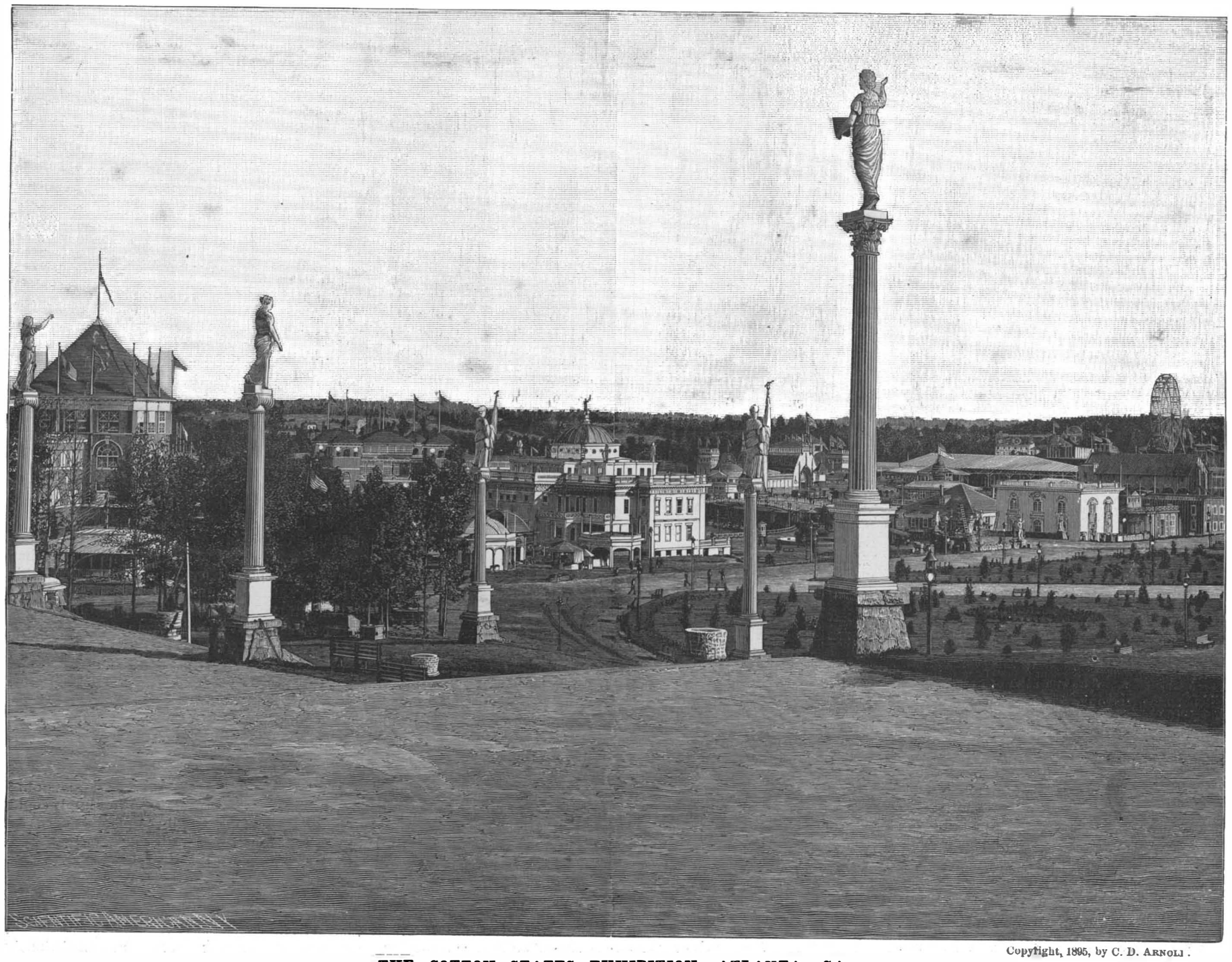
October 23 was President's day at the Fair, and brought a large attendance to the grounds. The Vice-President and most of the members of the Cabinet attended the President on his visit, and an important feature of the day was a military parade in which participated United States regulars from Fort McPherson and volunteers from Connecticut, Virginia, North Carolina and Georgia. In reply to an address of welcome from President Collier, the President made a brief speech congratulating the organizers and managers of the Exhibition on the splendid success they had achieved.

The principal buildings on the Exhibition grounds are: Manufactures and Liberal Arts, 206 feet wide, 356 feet long, and 90 feet high, with side and end galleries, including second and third stories in towers; Machinery, 118 feet wide, 500 feet long and 60 feet high; Minerals and Forestry, 110 feet wide, 350 feet long and 50 feet high to center of dome; Agriculture, 150 feet wide, 304 feet long, and 110 high to center of dome; Electricity, 85 feet wide, 262 feet long, and 109 feet to center of dome; Transportation, 150 feet wide, 450 feet long, and 68 feet high, with two end galleries 48 by 117 feet; Negro building, 112 feet wide 276 feet long, and 70 feet high; Administration building, combining main entrance, fronting 240 feet on Piedmont Avenue, 50 feet wide at center, and three stories high; Auditorium, including police department and express offices, 200 feet long, 135 feet deep, and four stories high, with mezzanine stories; Fire building, 205 feet long, 50 feet wide, and two stories high; Woman's building, 150 feet long, 128 feet deep, and 90 feet to top of statue on central dome; Fine Arts, 100 feet wide, 245 feet long, and 50 feet high.

Trial Trip of the St. Paul.

The preliminary trial of the International Navigation Company's new steamer St. Paul was, all things considered, very satisfactory. During a forty-four mile run from Cape Ann to Cape Porpoise she averaged 19½ knots an hour. The boilers, owing to their being fresh from the shops and more or less foul with dirt and grease, gave trouble by "priming;" and this materially reduced the speed. At times she made as high as 21 knots. When the boilers have been thoroughly cleaned, it is expected she will show a much higher mean speed on the official trial.

THE following is the daily ration of the animals at the Jardin des Plantes in Paris: Ten pounds of flesh for each lion, tiger, and bear, seven pounds for the hyena, one pound for the wild cat, two pounds for the eagle, all of which flesh must be fresh and without bone.



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Contents.

(Illustrated articles are marked with an asterisk.)

Atlanta exhibition*..... 273
Avalanche of Altels glacier..... 274
Axle breaking..... 275
Beetle, the longhorn..... 278
Bicycle notes..... 275
Bicycling, military..... 283
Birds, the flight of 279
Books and publications new..... 284
Cannon, 18th century*..... 276
Cranberries in cholera 276
Electric locomotive, the Baltimore..... 278
Electric road, Fair Haven*..... 280
Fruit market, New York..... 275
Heavens in November 275
Horseless carriage contest, the Chicago..... 278
Inventions recently patented.... 284
Isles of Shoals, the 274
Laurel and sassafras, the..... 279
Lignite in North Dakota..... 279
Pasteur, funeral of..... 278
Patent law, amendments..... 282
Patents granted, weekly record of 284
Pipe lines, wrought iron..... 275
Rack, a storing, Puffer's*..... 276
Railroad across Siberia..... 274
Railroading, fast, latest in..... 283
Railway, Trans-Siberian*..... 282
Rust..... 279
Sawing mouldings, Long's machine for*..... 276
Silk industry in India*..... 277
Smoke prevention on locomotives..... 278
Steam heat and pressure (6646)... 284
Telephone box, electric road*.... 282
Traction trials in Berlin..... 278
Trial trip of St. Paul..... 273
Trolley road, a model*..... 280
Water power, long distance transmission of 274
Water supply, the London..... 279

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1035.

For the Week Ending November 2, 1895.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHÆOLOGY.—The Refuge Tunnels of Naours, France.—Curious remains of primitive people now existing in France.—3 illustrations 16548
II. ARCHITECTURE.—The Halles of Ypres.—A beautiful market building dating back to the early days of Flemish architecture.—1 illustration 16535
III. BACTERIOLOGY. A Suggestion of a Use for the Rare Metals.—By HENRY C. DEMMING.—Application of rare metals for the destruction of bacteria 16545
IV. CHEMISTRY.—Arndt's Patent Econometer.—The application of a continuously indicating specific gravity apparatus to the analysis of furnace products.—1 illustration 16538
Jamaica Dragon's Blood.—By HENRY TRIBBLE.—Chemical analysis of this resin and possible uses of it in pharmacy and technology 16550
Recent Discoveries of Gaseous Elements.—Argon and helium.—Notes on the chemical triumphs of the past year 16544
V. CIVIL ENGINEERING.—Public Hydraulic Power Supply.—Notes on hydraulic power supply in towns, Glasgow, Manchester, Buenos Ayres, etc.—By EDWARD B. ELLINGTON.—Continuation of this exhaustive article on the distribution of power.—23 illustrations.. 16538
VI. ELECTRIC ENGINEERING.—The Electric Plow in Germany.—By OTTO DOEDERLEIN, United States Consul at Leipsic.—The application of electricity to agriculture as now practically carried on in Germany.—7 illustrations 16542
VII. GEOLOGY.—The Isles of Shoals.—By HORACE C. HOVEY.—An interesting article on this favorite summer resort.—Changes of level of the islands 16547
VIII. METALLURGY.—An Ore Testing Plant.—By H. C. CUTLER.—A recent addition to the apparatus of the University of Minnesota 16537
IX. METEOROLOGY.—Facts About Lightning.—Recent examinations into the efficacy of lightning rods.—Last theories and data.. 16543
The Ice Avalanche of the Gemmi Pass, Switzerland.—By C. S. DU RICHE PRELLER.—An interesting review of recent avalanches in Switzerland 16550
X. MISCELLANEOUS.—President Faure's Country House at Havre.—A typical French villa, with notes of its furniture, and life of its occupants.—4 illustrations 16535
XI. NATURAL HISTORY. The Zoological Position of the Trilobites.—A valuable article on this interesting and important form of primitive life 16549
XII. NAVAL ENGINEERING.—Stopping, Steering and Resistance of Floating Vessels.—By JOSEPH R. OLDHAM.—Difficulties of navigation and maneuvering of modern steamships 16541
XIII. PHOTOGRAPHY.—The Photosphere.—The improved magazine camera described.—2 illustrations 16546
XIV. PHYSICS.—Notes on Electricity.—By JOHN TUNBRIDGE.—Interesting notes on different expositions based on modern theories 16541
On the Photography of the Rays of Smallest Wave Length.—By VICTOR SCHUMANN.—Application of photography to spectrum analyses 16546
XV. SURGERY.—Remarkable Surgical Operations in Recent Years.—By GEORGE J. MANSON.—A very interesting article from a popular point of view on surgical achievements 16545
XVI. TECHNOLOGY.—Acetylene Gas.—Its properties and its commercial value.—A recent exhibition of acteylene gas, with details concerning it 16544
The By-products of Slaughter Houses.—The importance of by-products in the meat industry; views of a Chicago establishment.—3 illustrations 16537
The Future of the Turpentine Industry.—The destruction of the pine forests of America by the use of incorrect methods..... 16535
The Gum Benjamin Industry in Siam.—Collection of gum for varnish in the country about Siam 16536
XVII. TRAVEL AND EXPLORATION.—Magellan's Strait.—Notes on this remarkable sea passage, with illustration.—1 illustration.. 16547

THE ISLES OF SHOALS.

Attention is called to an interesting article by Dr. Horace C. Hovey, in this week's SUPPLEMENT, announcing recent discoveries concerning the Isles of Shoals. This picturesque group is nine miles from Portsmouth, and includes nine small islands, five of which belong to Maine and four to New Hampshire. Although discovered in 1614 by Captain John Smith, and visited by thousands of tourists, their geology has been neglected. After briefly giving a few historical facts, Dr. Hovey tells what he found during his explorations among the rumpled and twisted rocks of this group. There are proofs that Star, Haley, Cedar and Malaga islands are undergoing a process of elevation, having risen six feet within fifty years. Potholes that once were at tide level and used by the fishermen as basins for cleaning fish are now a hundred feet back from the sea, and six feet above the ordinary tides. The channel between these islands was formerly six feet deeper than it now is. The petrography of the islands has only been partly worked out; but the signs of igneous action are impressive. Dikes of diorite and gneiss and seams of quartz and feldspar run in every direction. The trap rock yields more readily to the action of the sea than do the granitic rocks, and on being worn away leaves channels through which the waves rush with violence. In some cases the work is not yet complete, and the huge basaltic blocks lie like gigantic stairs, thus justifying the etymology of trap from "trappa," meaning steps.

A remarkable column on Appledore Island is described that is eleven feet in diameter, and that must once have been as much as twenty-five feet high, but now has been singularly sliced off by the waves. In shape it is sharply hexagonal. The rock is light colored granite crushed and baked, and protrudes from a mass of black gneiss, beyond which are walls of white granite. It is an altogether unique occurrence.

The violence of the waves that beat about these islands would seem incredible, were not so many proofs at hand. Some of them are given. The Laightons, who own most of the islands, built a wall to protect their Appledore hotel. The wall was six feet high and six feet thick. But a single winter storm broke it down and scattered the stones in every direction. Last winter a storm carried great bowlders completely across the islands. A bowlder weighing many tons was tossed by the waves and lodged on the cliff of White Island fifty feet above the sea level. The lightning has also done its share in the work of demolition. Glacial action has been powerful. These causes combined, glacial, aqueous, igneous and electrical, have rent these islands apart, severed them from the mainland, and comminuted their rocks into the masses of sand now piled up as dunes about the mouth of the Merrimac.

THE RAILROAD ACROSS SIBERIA.

The Russian government is displaying an activity in prosecuting this great enterprise which makes it certain, not only that it will be completed, but that it will be completed before the date originally arranged.

Before the close of this year the road will be opened as far as the River Obi. It will then be possible in the Old World to take a continuous journey from the Atlantic eastward of over 4,000 miles. It is probable, judging from the present rate of progress, that, by the opening of the twentieth century, a continuous belt of steel will stretch from Paris to the Pacific.

It has already been suggested—and, as the Siberian road approaches the Pacific Ocean, the matter will receive increasing attention—that it would be possible to extend our American system of roads northeasterly to Alaska, to a terminus at Bering Strait on the Pacific.

With a powerful and efficient system of train ferriage across the strait—a distance of say fifty miles—the United States system of railroads would be placed in touch, not merely with that of Siberia itself, but with the whole Asiatic and European system.

Regarding Siberia, it is certain that that country has vast mining and agricultural possibilities, which only need transportation facilities to develop them. In the manufacture of implements and plant for agriculture and mining, the United States are particularly successful. Such a railroad to Alaska, while developing our own territory, would undoubtedly foster a large trade with Asia. China, to the south, must ultimately establish a railroad system; and, when she does, it will merely be a matter of time before she touches the Siberian road to the north and the Indian roads to the south. With an Alaskan road built, every such extension in Asia will lay a new country open to our trade. Freight could then be shipped from New York or New Orleans to Canton, Irkutsk, St. Petersburg, or Paris without breaking bulk.

A railroad to and through Alaska would present engineering difficulties, it is true; but probably no greater than the eleven thousand foot pass on the Rio Grande Railroad, or the famous pass through the Andes of South America.

It is interesting to note that such a scheme, if completed, would make the circuit of the globe a matter of not more than one month's traveling. Allowing five days from New York to the coast, six days to Bering Straits, fourteen days from Bering Straits to London, and six days from London to New York, it would only consume thirty-one days of twenty-four hours to perform the feat which, only a few years ago, in a daring flight of his imagination, M. Jules Verne suggested might be done in eighty days.

Thus it is that in the arts and sciences the marvels of yesterday become the commonplaces of to-day!

THE GREAT AVALANCHE OF THE ALTELS GLACIER.

When we speak of the magnitude of the pent-up forces of Nature, the mind can only have a vague sense of the meaning of the words. Occasionally, as in the awful cataclysm that happened some years ago among the islands of the Indian Ocean, or as in the case of this recent fall in the Alps of a whole glacier through some thousands of feet into the valley below, we get a concrete example of what ruin these forces of Nature can work, when once they lose their equilibrium and are violently set in motion.

We publish in this week's issue of the SUPPLEMENT a very interesting contribution to the London Engineering, from the pen of Mr. C S. Du Riche Preller, describing in detail the fall of the Altels glacier. He analyzes the momentum set up by this immense body of ice as it swept down through a vertical height of nearly a mile upon the doomed valley of the Spitalmatte below. An approximate idea of the magnitude of the forces at work may be formed by considering that this mass of ice, whose bulk was equal to one and a half times that of the great pyramid of Egypt, swept down a mountain side through a vertical height equal to ten times the height of the pyramid, and in so doing acquired a momentum that carried it up some 1,200 feet to the crest of the opposite mountain, before it finally fell back to a state of rest in the valley below.

LONG-DISTANCE TRANSMISSION OF WATER POWER.

The history of human progress in the mechanical arts is the history of a great struggle between the forces of Nature, active or dormant, on the one hand, and the intelligence of man on the other. No sooner does the mind perceive the magnitude and utility of these forces than it begins to seek out a way to control them. Every new invention marks a further mastery of matter by mind, a more complete subjection of Nature's forces to man's service. Among the many natural storehouses of power that have been drawn upon, perhaps the most available and earliest used was that contained in the rivers and waterfalls. Here was a seemingly boundless supply; and men were quick to avail themselves of it. A glance at the map shows that very often the location of a city has been determined by the presence of available water power. A notable instance of this is the city of Minneapolis, with its world-renowned water-driven flour mills.

But though it is true that, where circumstances permitted it, cities have been built up around a natural source of power supply, it frequently, and more often than not, happens that the particular spot where the fall of water is located, or where the topography of the country favors the impounding of the waters, is ill adapted for the building of a city and the location of factories. In such cases the forces of Nature have been left to run to waste; not because their value was not appreciated, but simply because men knew of no means by which they could utilize them from a distance.

Electricity, the annihilator of space, has solved the problem of transmission; and the water turbine has solved the question of conversion of the stored-up energy of all our streams and rivers. The matter has passed the experimental stage; and there are cities in the United States to-day where the people are transported, lighted, and their factories driven by water power that is located at a distance of many miles, perhaps amid hills or mountains difficult of access.

It is difficult adequately to estimate the benefit that will accrue to this country from the utilization in this way of its vast natural supplies of water power.

Not to mention Niagara, whose possibilities are shown in the successful plant now in operation, it is asserted by experts that Great Falls, Montana, has 268,000 horse power within reach. The Snake River, in Idaho, has three great falls, the American Falls of 50 feet, the Twin Falls of 90 feet, and the celebrated Shoshone Falls of 310 feet. The Grand River in Colorado has been estimated as affording 200,000 horse power. The Colorado River, formed by the junction of the Grand and Green Rivers, flows in great volume and very swiftly for hundreds of miles. By impounding the waters of such rivers as these a power supply could be obtained that would cover all the possible needs of those countries through which they flow.

The States that lie to the west of the Rocky Mountains, and furthest from the sources of coal supply, have been, as was to be expected, the first to avail themselves of the electrical transmission of water power.

Among the earliest instances of this transmission is

the Pomona and San Bernardino supply, which has been in successful operation for a few years. This enjoys the distinction of being "the first long-distance transmission system operated in the United States."

In the adjoining State of Oregon a very fine and successful plant has been in operation for some time at the Falls of the Willamette at Oregon City. The head of 40 feet gives a minimum capacity of 50,000 horse power; and the Portland General Electric Company have now in operation a hydraulic and electric installation of which one-fourth is in operation, which is to have a full capacity, when completed, of 12,800 horse power. The station building, as planned, will have a length parallel to the river of 364 feet. The hydraulic plant consists of Victor turbine wheels, arranged in pairs; each pair consisting of a 42 inch and a 60 inch wheel, running respectively at 200 and 100 revolutions per minute. The larger wheel is to be used during extreme high water as an auxiliary. The power plant will consist of twenty three-phase generators and two direct current generators, acting as exciters. The generators are set upon the floor of the station, the armatures revolving in a horizontal plane. They are over seven feet in diameter and two feet high. The armatures deliver current directly to the line, at a working potential of 6,000 volts effective pressure, without the intermediation of step-up transformers.

With a view to obtaining the best results the company selected the three-phase system of electric power transmission. The current when it reaches Portland, 14 3-10 miles distant, is transformed down to a potential of 400 volts.

In addition to lighting the city, which contains between 70,000 and 80,000 inhabitants, and operating the various motors, the Oregon City plant works an extensive system of trolley lines in the city on the west side of the river. It is proposed to carry the line across the river to East Portland and from there back to Oregon City. The whole plant is giving great satisfaction, and "its operation so far shows admirably, not only the effectiveness of the three-phase transmission system for general service, but also its feasibility."

The latest plant to be put in successful operation was that for the Folsom-Sacramento Power Transmission. By impounding the waters of the American River, and the construction of a complete plant of turbines and electric generators, the city of Sacramento has been furnished with a power and light supply that will meet its needs for many years to come.

The dam on the American River possesses an interesting feature in the shape of a long apron or "shutter," which pivots in a groove extending along the crest. This shutter is raised by hydraulic rams, and thereby the head of water in the river can be at any time increased. The hydraulic equipment consists of four pairs of 30 inch McCormick turbines, of 1,260 horse power each. They run under a head of 55 feet at 300 revolutions per minute; and they are directly coupled to the armature shafts of four 750 kilowatt three-phase General Electric generators. This is claimed to be the largest three-phase dynamo yet built. The height is 8 feet 8½ inches and the base 11 feet by 8 feet 8 inches, and each weighs 59,897 pounds. At the electric power and light station in the city are three 250 kilowatt motors and the various electric railway generators and are lighting dynamos comprising the plant.

The largest consumer at present is the electric railway company, which operates 24½ miles of single and 17 miles of double track.

The Southern Pacific Company, whose railroad shops are situated in the city, are negotiating for 900 horse power, to be utilized in place of their present steam power; and there is a proposal to erect a city drainage plant that shall be electrically driven.

The total length of pole line for transmission purposes is 21½ miles.

THE HEAVENS IN NOVEMBER.

Venus, having attained her greatest brilliancy as a morning star on the 25th of October, will continue to withdraw from the neighborhood of the sun until the end of November. Last summer, when she dazzled the eyes of her admirers in the western sky, she was approaching the earth. Henceforth she will recede from it. She passed nearly between the sun and the earth on the 19th of September. At this time, when the two globes were at their nearest approach to one another and when Venus was hidden from the eyes of terrestrial star gazers by the blaze of sunlight surrounding her, the astronomers of that planet had an opportunity to witness the phenomenon of a solar eclipse on the earth. Our globe must then have appeared to them as a much more brilliant planet than Venus ever is for us, and even the moon would be clearly visible to them. Watching with telescopes, they might have seen the moon swinging into line between the sun and earth, and then her round black shadow creeping across the Antarctic snows and the Southern Pacific Ocean.

But some one may say, "What's the use of talking about inhabitants of Venus? Perhaps there are none."

Just so; but then we, ourselves, become, in a certain sense, inhabitants of Venus when science enables us to place ourselves in imagination upon that planet and to see with the eye of the mind the things that would there be visible. Man does not live by bread alone; neither, if he opens the wings of his intelligence, does he dwell only on the earth.

In regard to the habitability of Venus, I may remark that since I wrote in August last I have talked with the Italian astronomer Schiaparelli at Milan, and he has assured me that his latest observations of Venus absolutely confirm him in the opinion that the rotation of that planet is exceedingly slow, and probably exactly coincident in time with the period of its revolution around the sun. Venus, then (if Schiaparelli is right), has perpetual day on one side and unending night on the other. The bearing of such a condition of things on the question of habitability is too evident to need pointing out, but I have not room to discuss it here. In the meantime Venus as a morning star is worth getting up early to see, even though her splendor is fading.

Nearly at the same time when Venus reached her greatest splendor in October, little Mercury was swiftly passing between the sun and the earth, as if in chase of his greater sister. At the beginning of November a sharp eye might detect him emerging from the rays of the morning sun. The leash of gravitation by which his solar master restrains him is not long enough to permit him to overtake Venus, but on the morning of the 10th he will be at his greatest elongation from the sun, straining, as it were, to break his bonds, and then will be a good time for early risers to catch a glimpse of him.

Mars, Saturn and Uranus are all assembled near the sun in the morning sky in the constellation Libra. Mars and Saturn will be in conjunction on the 16th, an evil aspect, according to the astrologers, since both of these planets are "malefics," and very desperate malefics, too. Let us not, however, be alarmed. The temper of Mars has improved since he has been the object of so much flattering attention on the part of the inhabitants of the earth, while Saturn must surely be too busy keeping his rings of clashing meteors in order to trouble himself about such small affairs as ours.

On the 18th there will be a close conjunction of Mars and the star Alpha Libræ; on the 20th a conjunction of Mercury and Saturn; on the 23d a conjunction of Mercury and Mars, and on the 25th a conjunction of Mercury and Uranus. These conjunctions are certain to play a conspicuous part in the horoscopes of the astrologers, who, some readers may be surprised to learn, did not disappear with the dark ages, but flourish in large numbers to-day, and find thousands of credulous dupes.

Jupiter, near the borders of Cancer and Leo, rises between two and three hours before midnight, during November, and is a brilliant object in the small hours of the morning. His belts of varying shapes and hues are not less beautiful than they were last spring, while the phenomena of his circling satellites are never without interest to the possessor of a telescope.

The month opens with a full moon, the phase occurring on the evening of the 2d in Aries. The moon reaches last quarter in Leo on the evening of the 9th, and becomes new moon in Libra on the 16th about midday, first quarter following in Aquarius early on the morning of the 24th.

The lunar planetary conjunctions occur as follows: With Neptune on the 5th, with Jupiter on the 9th, with Venus on the 13th, with Mercury on the 15th, with Mars on the 15th, with Saturn on the 15th, and with Uranus on the 16th. The moon is nearest the earth on the 13th and farthest from it on the 25th.

Among the double stars that are well placed this month are γ Arietis, the first discovered double, magnitudes 4 and 4½, distance 8″; ε Arietis, magnitudes 4½ and 6, distance 1″.5; η Cassiopeiæ, magnitudes 4 and 7½, distance 5″, colors yellow and purple; ι Cassiopeiæ, triple, magnitudes 4, 7 and 8, distances 1″.5 and 9″; and γ Andromedæ, also triple, although ordinary telescopes cannot at present show the third star. The two principal stars are of magnitudes 3 and 6, distance 10″. Their contrast of color, gold and blue, is very decided and beautiful. GARRETT P. SERVISS.

The New York Fruit Market.

The first Almeria grapes of the season have arrived, and 1,542 barrels have been sold at the wholesale auction recently. The prices ranged from $3 to $6.50 a barrel, the average for the entire sale being $4.65. This sale is ten days earlier than the first offering of last year. The fruit was not of the best quality, though the prices were high. It is estimated that 90,000 barrels will constitute the total shipments to the United States this year, against 125,000 barrels last season. The only oranges now to be had, excepting a few from Sicily, are those from Jamaica, and the fruit is of fair quality, considering its earliness. Several car load of Albemarle pippins from Virginia have already been shipped from this port to England.

Other American apples now in European markets are Baldwins, Greenings, Kings, Northern Spies and Ben Davis, the highest grades selling there for $3 to $6 a barrel. Although 17,845 barrels of cranberries have thus far reached this city, besides 3,082 crates, twice as many as were received up to the same time last year, the demand for this fruit has been active enough to force high prices. The excessive heat during September is said to have injured the Cape Cod crop, and frosts have more recently damaged the New Jersey cranberry bogs, so that it is estimated that the total yield will not more than equal the short crop of last season. Extra large varieties from Cape Cod command $8 a barrel.

The season for California fruits is drawing to a close. The last plums, prunes and peaches have been received. Pears are scarce, and will continue to be so during the winter, since much of this fruit has been forwarded to England. One hundred carloads of California fruits have crossed the ocean during the summer and autumn, and Clairgeau, Duchesse, Easter Beurre, Comice and Glout Morceau pears now command $3.50 to $5 a box at wholesale in Great Britain; prices for the same sorts here range from $1.85 to $3.20 a box. Grapes constituted the bulk of thirty-seven car loads of Western fruits sold in this city recently. Chestnuts, which early in the week sold for $7.50 to $8 a barrel, fell to $4 by Saturday, and hickory nuts were plentiful at seventy-five cents and $1 a barrel.—Garden and Forest.

Cycle Notes.

Bicycles are taxed in Belgium, but the proceeds of the bicycle tax are used for the improvement of the streets and highways.

A number of wheelmen with guns strapped across their backs may be seen speeding over the roads almost daily in the neighborhood of Manchester, N. H. They use the bicycle to reach the outlying woods in quest of game.

In Montreal, Canada, the law provides that every bicycle must be equipped with a brake.

A Chicago inventor has devised a three compartment pneumatic bicycle tire which, while not unpuncturable, still reduces the liability of injury to a minimum, because if the rubber in one of the compartments is punctured, the other two are still sufficient to carry the rider and keep the tire in cylindrical form. The partitions are arranged spirally. The tire is inflated through three separate tubes, each chamber requiring separate pumping.

In many bicycles it is a difficult matter to flush the bearings of the crank shaft with kerosene, owing to the absence of or smallness of the oil hole; they can, however, be admirably flushed in most bicycles by removing the saddle post and pouring kerosene down the frame. The crank shaft should of course be rapidly rotated and the bicycle inclined from side to side.

Women bicyclists of Belding, Or., wear bloomers and a short skirt while riding through the streets of the town, but as soon as they strike the city line they doff the skirt, strap it to the handle bar, and ride unencumbered through the country districts. When they reach the city line on their return, they don the skirt again.

The street railroad companies of Kansas City have decided to allow bicycles to be carried on their cars when the wheelmen have their tires punctured or their wheels otherwise injured so that they would be obliged to walk.

For a long time the Kings County Elevated Railroad, of Brooklyn, has been carrying bicycles, and the road is well patronized by wheelmen, so that sometimes on Sundays special trains are provided for their accommodation. The charge for bicycles is 10 cents.

Many of the Western cities have passed absurd ordinances curtailing the privileges of wheelmen. For instance, one Wisconsin city has passed an ordinance which prohibits riders from leaning their machines against hitching posts.

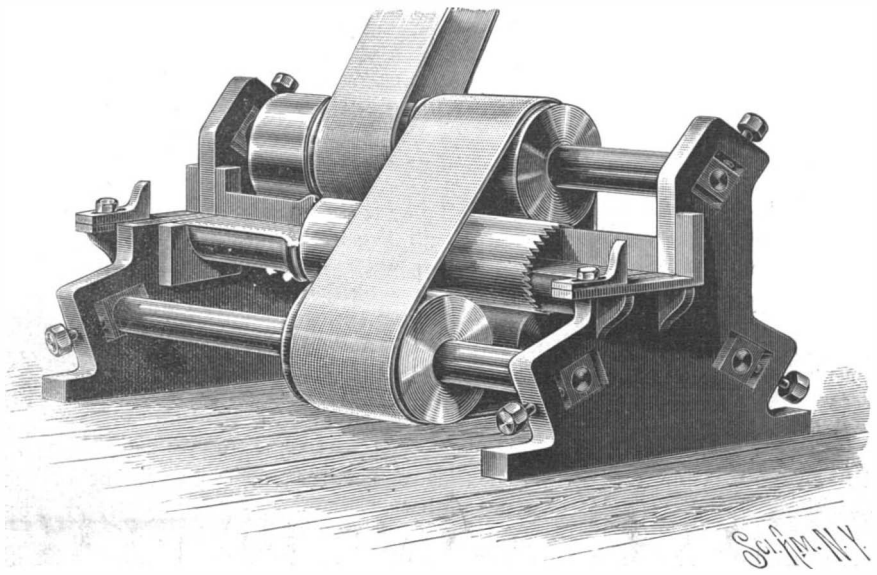
The first annual convention of the United States Military Wheelmen was held at the Broadway Central Hotel New York City, October 15. The object of holding the convention was to invite all the officers and soldiers and ex-officers and soldiers of the regular or volunteer armies of the United States or of the National Guards of the various States who are wheelmen to meet together and express their views in regard to the utility of the bicycle for military maneuvers.

The spread of the bicycle fever has had a marked effect on the rubber trade. A well known rubber dealer states that in the past eighteen months $5,000,000 worth of crude rubber has been purchased by tire makers.

An Oregon paper cites an instance of what it considers the crowning act in the degradation of the horse. A man in Dalles owns a horse and also a bicycle, and the bicycle is the latest love. For it he has neglected the horse until the latter has grown fat and lazy for want of exercise. His stableman said the horse really must have exercise, so the owner ties it by a long halter to the handle of his bicycle and trundles along three or four miles a day, leading the horse ignominiously behind him.

A MACHINE FOR SAWING MOULDING STRIPS.

With the machine shown in the illustration a piece or bar of lumber may be cut into two strips at one operation, preventing any waste of material, one of the strips having a cove and the other being quarter round. A patent has been granted for the improvement to W. V. Long, of Leesville, Ohio. Upon a fixed spindle having a lengthwise recess is a revoluble cylinder with saw teeth at its front edge, the cylinder rotating freely on the spindle and its rear end abutting against a shoulder on the spindle. The cylinder is rotated by three rollers engaging its peripheral surface, the rollers being made of rubber or similar material



LONG'S MACHINE FOR SAWING MOULDINGS.

and journaled in adjustable bearings, and being connected with each other by a belt, the shaft of one of the rollers having fast and loose pulleys, and receiving power from other machinery. On the standards of the frame are guideways, and when the saw cylinder is rotated and a bar of wood is pushed through the guideways along the lengthwise recess of the spindle against the saw teeth, one corner passes inside the cylinder, the wood being thus cut into two strips.

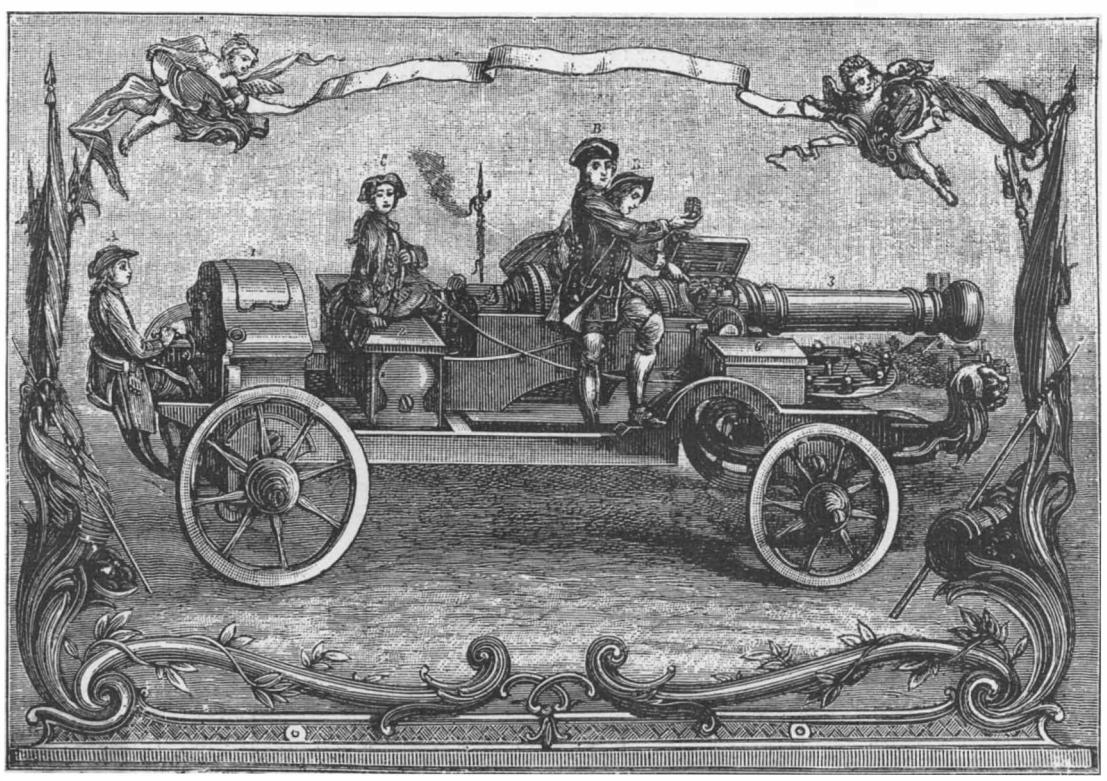
AN EIGHTEENTH CENTURY PROJECT FOR A HUGE CANNON.

The engraving that we reproduce is made from a very rare print of the last century, and is certainly Dutch, as shown by its peculiar aspect and the manner in which it is engraved.

The following is the quaint legend that interprets the letters and figures engraved upon the print:

A. He who causes the machine to move. B. The two gunners. C. The assistant mechanician who serves to control the front wheels in order to keep the cannon in balance and to apply the match to it. 1. The framing of the entire machine. 2. Large powder magazine and piece of artillery. 3. The gun. 4. Priming pan that closes and opens of itself. 5. An endless screw that serves to direct all. 6. Cartridge chest. 7. Disk of the traces that steer the front wheels.

We publish this engraving of a large cannon as a matter of curiosity. We have consulted specialists and men posted on history in regard to it, but no one has been able to give us any information. We may recall the fact that much attention was paid to cannon in the last century, and that in the first part of this century lived the celebrated mechanician Robin, a great mathematician and physicist, who set forth the first principles of modern artillery.—La Nature.



EIGHTEENTH CENTURY PROJECT FOR A LARGE CANNON.
(Reproduction of a Dutch Engraving on a Scale of One-quarter.)

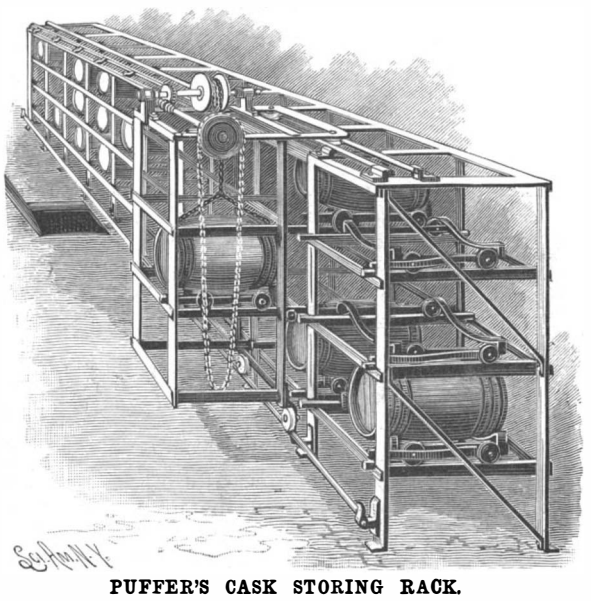
Breaking of an Axle Inside the Wheel.

In February of this year a North London train on the Great Northern main line met with an accident at Wood Green station which was caused by the leading axle of the engine breaking off inside of the wheel fit of the right hand wheel. The train did not leave the rails immediately, but upon striking the corner of one of the platforms it was turned over upon its left side, killing the engineer and fireman. The engine was running backward with the coal bunker ahead. It was an eight-wheel tank passenger type, with a bogie under the front end, which in this case was the trailing end of the engine. In the official report upon the accident Lieut.-Col. Yorke attributed the accident to an old fracture which previously existed, and when the engine turned over, the left hand leading axle was broken short off close to the wheel, which was thought to be the effect and not the cause of the accident. The axle was of steel and 25½ years old, having run 578,020 miles. It had been under more than one engine and had been placed under the last one in November, 1887. In 1889 the wheels were retired; in October, 1894, the engine was shopped for tire turning and repairs, and at this time the axles were examined without the discovery of any flaws. The method of examination of axles by the inspector in charge of this work is given in the report. It consists in carefully cleaning the axle and placing it in a lathe and, after it has been exposed to the vibration produced by the tire turning, the surface of the axle is closely examined for flaws with a magnifying glass. The axle is also subjected to a shock by hammer or otherwise in order to force the oil out of any crack which may exist. The report shows that on February 27, the day previous to the accident, the customary examination of the axle was made, but of course could not disclose the existence of this fracture, which was inside of the wheel. The report also gives the requirements imposed for the acceptance of new axles, which consist of the drop test and in some cases of chemical analysis. The inspector, after examining into the methods for the testing of new axles and examination of old ones, came to the conclusion that there was no means of detecting fractures which occurred within the boss of the wheel. He considered the mileage of the broken axle as being high, but stated that no limit of age, either in years or miles, has ever been laid down for locomotive axles, though it was usual to subject all engines to a special examination after reaching a mileage of 250,000 and after every subsequent 100,000 miles. This examination is carried out on the North London Railway, which also makes an additional examination at every 40,000 to 60,000 miles run.

The average yearly mileage of this axle was 23,000. It was examined in 1887, 1889, 1892, and 1894, or at intervals of from 46,000 to 69,000 miles. The report says that a crystalline appearance of the fracture was found, and it was thought that the previous partial fracture and the complete fracture of February 28 were due to age, combined with a severe frost. The inspector speaks well of the tests for new axles, and was disappointed to fail in discovering a method to disclose such fractures as this one. In conclusion the report says: "It has sometimes been suggested that it is desirable to fix a limit of age, either in years or miles, for all locomotive axles, after reaching which, whether they are apparently sound or not, they should be withdrawn from use. But the locomotive superintendents of railway companies have not as yet seen their way to act upon this suggestion. It is right to mention that it is now the custom of all the companies with whom I have been in communication, including the North London Company, to make the wheel seat of every axle slightly larger in diameter than the journal and body. In this way the strongest part of the axle is that inside the wheel, and failure of an axle in the wheel seat is consequently nowadays extremely rare. This modern form of design was not adopted in the axle which led up to the disaster under consideration, and the diameter of the wheel seat was the same as that of the journal and the body."

AN IMPROVED CASK STORING RACK.

A rack with which is connected a traveling hoisting apparatus, to facilitate the storage of casks and other articles, is shown in the accompanying illustration, and



PUFFER'S CASK STORING RACK.

forms the subject of a patent issued to William D. Puffer, North Adams, Mass. The framework of the rack forms a series of cells, in each of which are tracks adapted to receive wheeled trucks, a spring arm on the truck having a hook or keeper engaging one of the uprights to lock the truck in proper position in a cell. Along the front of the rack, near the bottom, a rail is secured upon brackets, and upon the top of the rack, near its front edge, are two parallel rails between which travel grooved wheels journaled in a horizontal frame, a cage attached to this frame having also grooved wheels traveling upon the rail near the bottom of the rack, whereby the cage is supported to travel along the front face of the rack. The cage is of a width and height corresponding to a vertical tier of cells in the rack, and in each compartment of the cage are tracks adapted to register with the tracks in the rack cells, spring arms locking the cage in front of any one of the vertical tiers.

A lifting mechanism, actuated by a hand chain passed over a sprocket wheel, forms a part of the cage, and when a cask or article to be elevated is rolled under the cage, the grapples or clamps are lowered and made fast to it, when the article is raised to the desired cell by means of the hand chain. A worm meshing with a worm wheel on the shaft of the lifting drum prevents a reverse movement of the chain, and a car or truck is then moved from a cell in the rack, when the article is lowered upon it, and the truck with its load is moved back into the rack in which the article is to be stored. This storage system is adapted for all shapes of merchandise, the cars being built flat for boxes, and casks or boxes may be readily raised from a cellar through a trap door by the lifting mechanism, the cage being conveniently moved to the front of any tier of cells in the rack for the storing or removing of merchandise.

Cranberries in Cholera.

Dr. Goriansky declares that the use of the pure and fresh juice of raw cranberries, given freely, either undiluted or with an equal part of water, is an excellent means of relieving the thirst and vomiting peculiar to cholera. In fifty cases, in which ice and narcotics failed to make the slightest impression, the cranberry juice in small but repeated doses rapidly checked both vomiting and nausea.

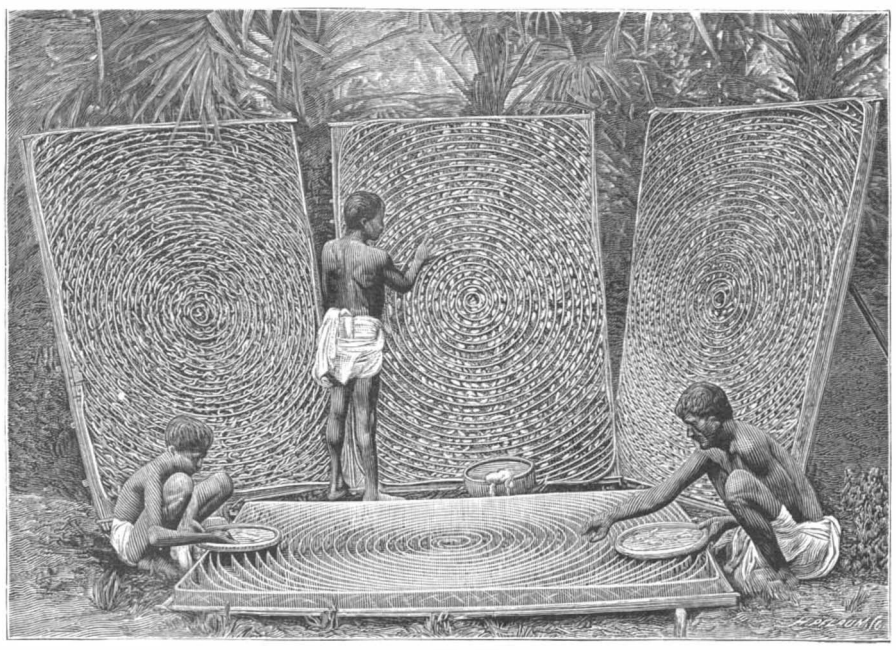
SILK GROWING IN INDIA.

Though the Indian trade in silk has fallen off since the days when the Portuguese found the silk-laden ships of the merchants of Cambay the greatest prize they could win, or the industry constituted the chief source of revenue to the old "Honorable Company," yet still it forms in the raw a very appreciable item in the commerce of India. A recent number of the Graphic, London, contains an interesting article on the subject, from which we abstract the following particulars and illustrations: To see something of the conditions, both of silk spinning and weaving, no better centers can be chosen than Berhampore and Murshidabad. The Indian government has placed here its laboratory of practical sericulture under the direction of Mr. N. S. Mukerji, who was trained for his work at Cirencester Agricultural College (where he was gold medalist of his year), Lyons, and in Pasteur's laboratory. Unfortunately, among the other influences which have handicapped the Indian output of silk had come to be that of those diseases among the silkworms known to bacteriologists as Pébrine, Flacherie and Grasserie. By a long series of patient experiments, Mr. Mukerji has not only succeeded in stamping out a great amount of disease, but has placed within reach of the village silk rearers a large available supply of perfectly healthy eggs, which, after the long time that seems absolutely indispensable for the native mind to overcome prejudice against any sort of innovation, they are now beginning to take advantage of. The Bengal worms are those scientifically classified as Bombyx Fortunatus and B. Crœsi, and differ from B. Mori of most of the other silk-producing countries in that they give more "crops" in the course of the year, and require their food in a much younger and less developed condition. Instead, therefore, of the mulberry trees associated with silk districts here in Bengal, one sees literally mulberry fields which are cut down three or four times a year with a sickle like so much wheat. Mr. Mukerji and other experts are greatly in favor of introducing the European worms and system of culture to a greater extent, and in Kashmir and the Punjab—looked upon by many as a coming field of silk production—it is probable that climatic and other influences might give satisfactory results in due course, though experiments so far have not given unqualified encouragement. It is, of course, the exceeding cheapness of labor that would give India such an immense advantage in the world's markets could only her possibilities in silk growing be fully exploited, and meantime the primitive methods that have been in vogue for years are practiced for the winding and reeling with very little advance in the use of machinery.

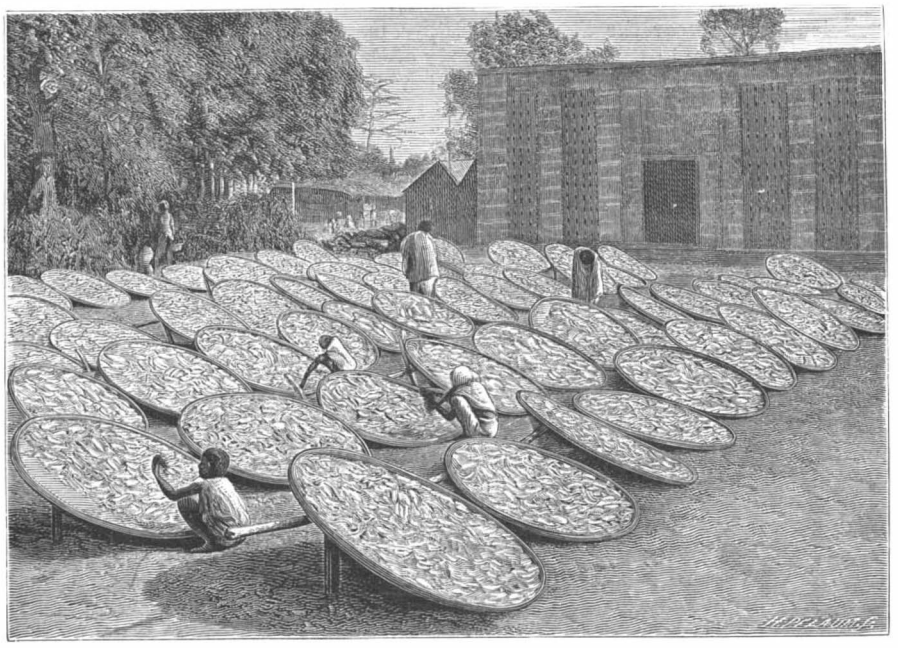
Most of the rearing is done by villagers in their own homes, while the wild tussus cocoons are collected by the Santals—the great hunting and jungle tribe of Bengal—who go out with a large amount of superstition and many strange observances to gather in their harvest. The treatment of the silk is practically the same after the first process of steaming the cocoons to soften them has been gone through, the tussus being subjected to a chemical bath, which is not necessary for the cultivated material. When the cocoons are brought to the filature, they are spread out upon enormous trays of plaited palm leaf in the sun to dry, and a curiously brilliant scene of color one sometimes obtains from the mass of row upon row filled with bright canary and pale amber oval balls, against walls of dull Indian red, while about the inclosure move dark figures turbaned in some rich, bright hues, or habited in white or colored saris, with overhead the eastern sky glowing in its deep unclouded blue. Steaming is the next process, the cocoons being brought to the hot chamber in large baskets covered by a piece of sacking. When sufficiently softened they go to be unwound, and in a large factory this is perhaps the busiest scene of all. Each latai, as the wooden appliance on to which it is wound is called, is in charge of two persons, generally a man and woman or man and boy. The man (or sometimes a woman, as there is no sex restriction of custom in the matter) sits upon his heels upon a long raised stone bench before a bath in which the cocoons are kept moist. The fine silk filament passes through his fingers on to the latai beyond, which the woman or boy keeps in rapid motion so long as the thread remains unbroken. Among the poor native spinners in their own homes mechanism even more simple is employed, and one may often see there a woman winding the cocoon through her fingers while she keeps her small rough latai of bamboo sticks in swift movement with her toes. When spun, the silk, which to non-expert touch seems beautifully soft and even, is twisted by women's fingers into hanks, and is then ready for the market. The exceeding delicacy of touch which the natives show in sorting the different grades and thicknesses of silk is, perhaps, to European eyes one of the most marvelous features of the industry. They detect any variation of fineness instantly, and place a skein with unerring accuracy in the category to which it belongs.

At the great Alliance Silk Mills of Bombay—the only ones in the Dependency—there is a very large and increasing outturn now of the lighter silken fabrics. There the machinery is all of the latest and most approved of modern patterns, and save for the presence of Eurasian and Parsee foremen and dusky skinned Hindoo hands, male and female, it would not be difficult to imagine one's self in one of the great factories of Manchester, Congleton, or Leek, whose products, indeed, these Bombay ones much resemble in quality, coloring, and design, as aniline dyes are used, and European patterns are freely copied. The Mohammedans are large buyers, but for them are woven specially the Mashru and Sufi, i. e., "permitted" and "lawful" materials with an appreciable admixture of cotton, in obedience to that injunction of the Prophet which forbids the wearing of perfectly pure silk.

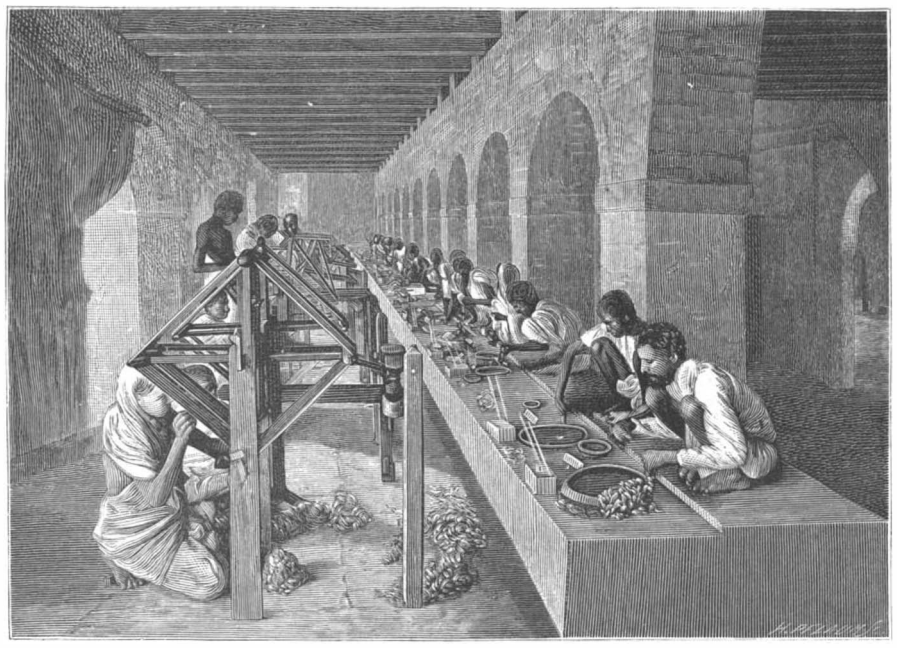
Of greater interest, perhaps, from the point of view of an art craft, are the works that are executed upon the hand looms of the silk districts. Down in Murshidabad and Berhampore are still woven the old-fashioned saris with the anchlas, or bordered end, in which is reproduced the immortal and universal knop and flower pattern, or those strangely conventionalized forms of mango, the sacred fig, or the lotus, which have come down through the centuries, as well as the chelijor which are seven yard lengths of (usually) plain, colored and bordered silks, which form part of the ceremonial garb of the Hindoo bridegroom. The shawls, too, are very interesting, though the art of weaving these is on the verge, it is to be feared, of extinction. For at present the secret in this district of setting the complex naksha looms necessary for making them remains a secret of an old man of eighty years of age, named Dubraji. There is a beautiful example of his work in the Imperial Institute of a white twilled ground, with a design probably suggested by the ivory and inlaid work characteristic of many parts of India.



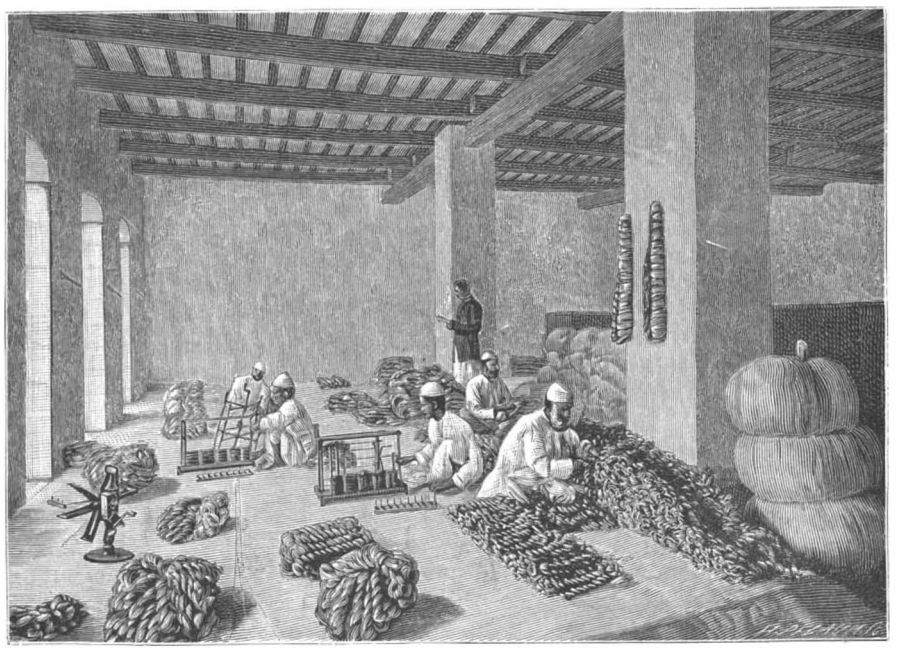
PLACING SILKWORMS IN THE SPINNING TRAYS AND REMOVING THE COCOONS.



DRYING COCOONS IN THE SUN.



UNWINDING THE COCOONS.



TESTING, SORTING, AND PACKING SILK.

THE SILK INDUSTRY IN INDIA.

The Funeral of Pasteur.

Amid the signs of national sorrow, the funeral of Pasteur took place on Saturday, October 5, 1895. France, more than any other nation, knows how to do honor to the memory of those who have contributed to her greatness, and by giving a national funeral, as well as taking the cost of it upon herself, she has once more shown the esteem in which she holds those who have devoted their lives to the increase of the world's knowledge and happiness. How very full was this expression may be gathered from the report of the London Times correspondent at Paris. We read: "Quite a small army of infantry, marines, cavalry, artillery, and municipal guards, mounted and on foot; deputations from all the schools and learned societies; most of those who speak and of those who govern and command in the name of France came to render homage to the stainless glory of this Frenchman, whose genius devoted its efforts to the whole of mankind, and who deserves the gratitude of the world, not merely for the labors which he accomplished, but for the new paths which he opened to science by the fresh discoveries which he made for the benefit of mankind." Shortly after ten o'clock on Saturday morning, the troops and innumerable deputations, which had assembled in and near the Pasteur Institute, marched past before the coffin containing the body of the illustrious investigator. The funeral procession was then organized. General Saussier, surrounded by his staff, and followed by the first division of infantry, preceded the hearse, and behind him came a long line of deputations, many of which had wreaths in their center. A number of wreaths were borne on litters, and others were carried on six cars, each drawn by a pair of horses.

"Along the route from the Rue Dutot to Notre Dame," says the Times correspondent, "the compact and silent crowd respectfully uncovered their heads as the hearse passed, and the two thousand soldiers and policemen, drawn up in line to keep the way clear, had absolutely nothing to do. The pall bearers were M. Poincaré, M. Joseph Bertrand, M. Georges Perrot, Dr. Brouardel, M. Gaston Boissier, and M. Bergeron. After marching for an hour and a half along the left bank of the Seine, the procession reached the square of Notre Dame. The aspect of the cathedral was most impressive. The presence of President Faure, the Grand Duke Constantine, Prince Nicholas of Greece, Cardinal Richard, the whole of the Diplomatic Corps, the ministers, the Institute of France, the office bearers of the Senate and the Chamber of Deputies, the red robed judges, the members of the university faculties, in orange, red, and crimson robes, and the other distinguished persons invited—all this display of official mourning was coupled with and yet eclipsed by the profound silence, the manifest grief. The immense crowd was a rare and impressive, if not a unique spectacle."

The Royal Society was represented by Mr. W. T. Thiselton-Dyer, C.M.G., director of the Royal Gardens, Kew. At the final funeral, which was held in connection with the centenary of the Institute, on the 25th ult., several of the officers and fellows of the society were present, together with many delegates from other of our learned societies.

After the service in Notre Dame, the coffin containing Pasteur's remains was removed to a catafalque outside the cathedral, and M. Poincaré delivered an oration before it, on behalf of the government.

"Thus," says Nature, "does France venerate the memory of her noblest son. But France is not alone in her grief. The human race joins with her in mourning the loss of one who has done so much for humanity and science. The name of him to whom the world owes so much good is imperishable."

The Chicago Times-Herald Motocycle Contest.

All contestants will be on hand with their motocycles at 8 o'clock Saturday morning, November 2, at the junction of Jackson Park and the Midway Plaisance. At a signal from the starter, a platoon of mounted South Park policemen will proceed west on the Midway Plaisance, followed by the competing motocycles formed in parade line, the vehicles being separated by spaces of about forty yards. In this order the motocycles will move west on the Midway, through Washington Park and Fifty-fifth Street Boulevard to Halsted Street, where the contest proper will be started. The judges decided on this programme for the reason that three important railroad crossings are situated between State and Halsted Streets, over which it would be impractical to conduct a contest in which the element of speed was a factor. At Halsted Street and Fifty-fifth Street Boulevard the motocycles will be started in pairs at intervals of one minute. Each motocycle will have assigned to it a referee or umpire who will pass upon all questions which may arise on the route from Chicago to Waukegan and the return to Lincoln Park. Each motocycle will register at the established relay points, namely, Jefferson Park, Half Way, Waukegan and Winnetka.

The judges decided to make a time limit of thirteen hours, which is based on the minimum time specified in the recent Paris-Bordeaux motocycle contest. It is confidently predicted that some of the vehicles will make the 100 mile run in less than half this time. No motocycle will be admitted to competition unless it first passes the examination at the preliminary tests which will be held October 29, 30, and 31. An exception to this rule will be made for such foreign vehicles as won prizes at the Paris-Rouen or Paris-Bordeaux races. All competitors should bear in mind that the judges will take largely into consideration the showings made in these preliminary tests.

There were present at the session of the judges, October 22, Prof. John P. Barrett, city electrician; President Henry Timken, of the National Carriage Builders' Association; Colonel Marshall I. Ludington, C. F. Kimball and Leland L. Summers.

Prevention of Smoke on Locomotives.

The third annual convention of the Traveling Engineers' Association was held at Pittsburg, beginning September 10 and lasting until the 12th. The balance of the week was spent by the members in visiting the Galena Oil Works at Franklin, Pa., and the Pennsylvania Railroad shops at Altoona, Pa. Among the reports was one on the following subject:

"How can the traveling engineer assist in preventing the unnecessary emission of black smoke."

The committee on the above question say:

We consider the brick arch one of the greatest aids to the engineman in the prevention of smoke, inasmuch as the smoke and gases to a great extent are consumed in coming in contact with it, which in its absence would escape through the flues.

We consider a good solid fire the best, i. e., about six to eight inches good white fire, then when fresh coal is added there will be more heat units to ignite the smoke and gases than there would be if a light fire was carried, and there will be less likelihood of the air coming through the grates in too great volume. And further, because, if service is heavy, the heavy fire will stand the action of the exhaust better than a light one.

We recommend the wetting of the coal when weather will permit of it, as the vapor arising from the coal when put in the fire will materially assist in the consumption of smoke.

We consider the baffle plate over the door of great value, inasmuch as the cold air that enters at the door when open will be turned downward onto the surface of the fire, a great percentage of which, in the absence of the plate, will pass direct to the flues.

In cities where a little smoke is annoying, we recommend the use of a good smoke consumer, which, if in the hands of careful men, will do good work and prevent the emission of smoke.

Gigantic Long Horn Beetle in Spruce Timber.

I send you a bug for a name. I found it in a cavity which it had to all appearances cut out for itself in an old piece of (I think spruce) timber, that had been for I don't know how long under a pile of lumber. This bug was in the cavity, headed out, and fastened its jaws viciously on a piece of straw when it was placed close to its head.

The cavity was oval in shape, about 1¾ to 2 inches long, ¾ to 1 inch wide and perhaps ⅝ inch high, with an opening in front. The wood was somewhat rotten on top of the hole, but only dozy for the larger part where it had cut it out.

It was exceedingly lively when discovered, but did not attempt to run far. C. A. SUMNER.

ANSWER BY THE LATE PROFESSOR C. V. RILEY.

The light brown beetle with long feelers having cylindrical joints and three rather stout spines on each side of the thorax, sent by Mr. C. A. Sumner, of Milford, Mass., is known as the Cylindrical Orthosoma (Orthosoma brunneum, Forst.) There are several of these brown longicorns known to occur in the North American fauna, some of them three times as large as the present species. The larvæ of this and the allied species are large, fat, elongate creamy white grubs, the posterior portion somewhat narrowing, but the anterior portion broadening and terminating in a dark horny head armed with a pair of strong jaws. The whole body is quite wrinkled and there are especially a series of transverse wrinkles both on the upper and under or dorsal and ventral surfaces of the principal segments. It has long been known that the larva of this particular species feeds in old stumps, whether alive or dead, of various pines and spruces, so that there is nothing surprising in the beetle being found in an old piece of spruce timber. The larva had fed on the timber and had transformed to the beetle, which was probably just ready to eat its way out to the surface when found. The larvæ of some of the other species, especially of the broad necked Prionus (Prionus laticollis, Drury) and of the tile horned Prionus (Prionus imbricornis, L.), affect not only the old stumps, but the live roots of a number of different trees, including various orchard trees, like the apple, and have been found particularly injurious at times to grapevine roots, as was shown many years ago (Riley's First Report on the Insects of Missouri, 1868, pp. 87-91).

The Baltimore Tunnel Electric Locomotive in Service.

The first of the lot of four electric locomotives to be built by the General Electric Company for the Baltimore & Ohio tunnel at Baltimore is in active service. The second one is being shipped in parts. The contract requires the engines to haul 15 loaded passenger cars and a locomotive at 35 miles an hour and 30 loaded freight cars and locomotive at 15 miles an hour through the tunnel up an 0·8 per cent grade; the object being to keep the tunnel free from locomotive smoke, which would, of course, be aggravated when pulling up the grade. The tunnel is large and handsome and well lighted by incandescent lamps on the walls, and through it passes the traffic of the Philadelphia Division of the Baltimore & Ohio Railroad.

There have been some changes on the electric locomotive since it was put in service, but probably not more than might be expected from the limited experience had so far with such motors. The locomotive is now pulling all the eastbound freight trains through the tunnel, that is about 12 trains a day. Going west the trains run through without steam, the grade descending at 42 feet per mile all the way.

The speed made with the guaranteed load is not so fast as agreed upon. About eight miles an hour is all that the locomotive is capable of making with the 30 loaded cars and a locomotive, according to the statement of the engineers on the ground. It is said that the motors will not stand the current required to haul such a train up the grade at 15 miles an hour. This is not to be wondered at when it is known that the current required at eight miles an hour is 1,500 amperes, the motors being in series, so that all the current flows through all of the motors.

The locomotive is not being used now on passenger trains. The smoke clears from the tunnel between trains when pulled by steam locomotives, if the trains are not too close together, so that the freedom from smoke that could be obtained by the use of the electric locomotive is not very important. The steam locomotives on the freight trains that are hauled through make a good deal of smoke while in the tunnel and moving at eight miles an hour.

An observation made recently shows that the freight locomotives hauled at a slow speed foul the tunnel as much as the passenger train locomotives running at a high speed and using steam.

The length of the tunnel run is about 1·4 miles, and the useful service of the electric locomotive is about 28 miles a day, as learned from the attendants. The cost per mile run is, of course, very great, as it must include a heavy charge for that part of the stationary electric plant that is not needed for lighting the tunnel, yards and shops.

Whatever may be the outcome of the use of electric locomotives in the Baltimore tunnel, there is one valuable practical lesson already: there is a possibility of getting any reasonable pull with an electric locomotive. This fact will be impressed on the mind of any one who sees the machine take hold of a train of 30 cars and start them without using the slack. In the matter of speed, there is nothing about this service that is intended to show how fast electric locomotives can run.

A far better example is found in suburban street car lines. It has been said in the press reports that the Baltimore electric locomotive has reached 61 miles an hour. This is quite probable, as there is sufficient power to drive the locomotive and several cars at 100 miles an hour if the motors were all placed in multiple instead of series. Speed with electric motors is largely a matter of connection of the wiring, and high speeds are generally more feasible and economical than slow speed with heavy loads.

Taken as a whole, the Baltimore tunnel engine is a very interesting mechanism, and the controller in the cab for directing the electric current is a study in details that makes a profound impression on the layman. The sparking in the overhead conductors has been reduced by using two collectors, but the rusting of the iron conductors is a continual source of annoyance. It is well worth a trip to Baltimore to see the locomotive pull a train, and the experience of the next six months with this plant may be very interesting to electricians as well as to railroad men who are looking to electric locomotives to bring back the passenger traffic which the street lines have "stolen." It may be well to say, in closing, that this theft is simply an illustration of the fact that the natural public, like nature herself, follows the line of least resistance, and it is often easier and more comfortable to take the trolley car than to walk to the station and wait for a train.—Railroad Gazette.

Traction Trials in Berlin.

The Elektrotechnischer Anzeiger announces that the municipal authorities of Berlin have resolved to grant a credit of 50,000 marks ($10,000) for the purpose of carrying out experiments with various forms of traction, more particularly with the Serpollet steam car, the Dessau gas car, and the improved accumulator systems.

The Lignite Industry of North Dakota.

According to the American Manufacturer, lignite is found in all the western half of North Dakota, cropping out of the bluffs and hillsides. In most localities there are three or four strata of it, the upper being from a foot to 3 feet thick, and the lower one from 5 to 30 feet thick. The upper veins are softer than the lower veins, and are too thin to be of any value. Most practical miners believe that still lower veins would be found if the shafts were sunk, and that these veins would prove to be harder than the ones now worked, but the industry of mining in the State is everywhere in a rather rudimentary stage, and there is no capital available to make experiments. A level is run in from the face of some bank convenient to a railroad, a track is laid into the opening, and the coal is taken out by the simplest and most economical method.

The mines now worked for shipping are at Sims, on the Northern Pacific, 35 miles west of Mandan; at Lehigh, 106 miles west of Mandan, and also at Minot, where the Soo road crosses the Great Northern, and at Burlington, a short distance from Minot, on the latter road. Mines worked by settlers to supply neighborhoods with fuel are numerous. Perhaps the most notable of these are in McLean county, north of Bismarck, where a superior quality of coal is found.

So vast are the lignite fields of North Dakota in their extent and so wide in their geographical distribution, that only such as are very near to a railroad track and present thick veins exposed for the most economical mining operations have any present commercial value. In other words, coal lands are worth no more than other lands unless they are contiguous to a railroad and unless the lower vein is thick and can be entered on a level.

The cost in carloads on the track at Fargo is $3.25 per ton. This is now the furthest eastern point of supply, but it will not be long before lignite will cross the Red River and become established as the favorite fuel in the northern Minnesota towns. At Mandan lignite costs $2; at Bismarck, $2.25; at Jamestown, $2.55; at Carrington, $2.90; at Leeds, $3 25; at Oakes, $3.10; and at Lisbon, $3.15. It is not possible to market it in South Dakota by reason of the excessive charges of the railroads operating in that State. They demand as much for hauling it from Oakes to Aberdeen, about 50 miles, as they charge for hauling Eastern coal all the way out from Chicago, about ten times the distance. Such rapid progress has lignite made in public favor during the past year or two, and so ample have been the demonstrations of the economy resulting from its use, that it is evident that this home fuel will soon almost wholly supplant Eastern coals throughout North Dakota, except for locomotive use.

The mine now working at Sims is on a 7 foot vein. The owners say that their coal compares with the best Pittsburg coal in the ratio of 14 to 20, and with Iowa coal in that of 16 to 20. The freight rate to points of consumption is 25 cents a ton less than that from the Lehigh mines, which are 70 miles further west, and this difference is added to the coal, so that the product of the two localities comes into equal competition at all places where it is sold. The Minot coal, which finds its markets along the lines of the Great Northern and Soo roads, is sold at the mines for $2 a ton. It is of no better quality than that mined at Sims and Lehigh. The coal field worked at Sims is broken by numerous ravines.

The Lehigh and East Lehigh mines at Lehigh, near Dickinson, work a 26 foot vein, but only 15 or 16 feet of coal is taken out. Rooms are excavated in the thick coal body each side of the entry, and sufficient coal is left above to form an arched roof, which requires no timbering. The pillars between the rooms are "robbed" after the rooms have been fully blasted out, and then the mass of superincumbent clay, having a depth of about 50 feet, caves in. The process of mining is exceedingly simple. Holes are bored with a breast auger and dynamite shots put in to bring down the coal. A track runs into each room from the main line of the entry and the cars are loaded with fork shovels which allow the slack and fine coal to slip through the tines. All this fine stuff, although it is good coal, is left on the floor of the mines and only the lump coal is taken out in the cars. About 30,000 tons will be mined at Lehigh during the year and the product of the Sims mine will be about the same. At either place 100,000 tons could be mined annually.

Rust.

The following are some interesting remarks made by Professor Skidmore, of Philadelphia, with regard to the distinction between minerals and metals. It is not possible, he observed, to define exactly what a metal is, yet there is little liability of mistake in distinguishing a metal from a non-metal. The metallic properties of luster, toughness, fusibility, opaqueness, conductivity, and rust may be possessed separately by non-metals, but they are not associated as they are with metals. Most metals may be bent, twisted, drawn, and hammered to an extent far beyond what any mineral not a metal could endure. Professor Skidmore showed by a series of interesting experiments that sodium, potassium, lithium, and, in a lesser degree, calcium, strontium, and barium, rust instantly when exposed to moist air, their white rusts quickly dissolving in water and forming alkalies. Other experiments demonstrated the fact that another group of metals, in which are zinc, lead, magnesium, and antimony, have white rusts which are not soluble in water. These rusts form a thin adherent coating, which only half conceals the metal, and gives to it a dull, tarnished appearance. It was shown that at higher temperatures than the ordinary, and especially if the metals are finely divided, the chemical energy of rusting is so great that the metals burn with a vivid light and emit a dense white smoke. The permanency of these rusts and their protective character are utilized in white paints. Professor Skidmore then directed attention to a third group of metals, which include those which have dark or colored rusts, as with copper, iron and silver. A series of experiments followed to show how these rusts were formed, and the changes which iron undergoes in appearance in the tempering process were carefully noted. Attention was directed finally to the fourth group of metals, which never rust. These are gold and platinum, and it was noted that they are also the metals which are found as metals in the earth, and not as ores from which the metal must be manufactured. In the case of the other metals it is an advantage that they are found in the rust or ore condition, as they can be manufactured much easier than they could be cut from ledges of the pure metal.

The Flight of Birds.*

We often have, while the sun is shining, a layer of cold air superposed on a layer of hot air. Now as hot air has a less specific gravity at the same pressure than cold air, it follows that these two layers of air are constantly changing places, the relatively warm air at the surface of the earth ascending, expanding, doing work and becoming cooled, while the cold air from above settles to the earth to take the place of the warm air. The velocity with which these vertical currents move is, say, from one mile to six miles an hour, and their movement is quite independent of any other horizontal current that the air may have as relates to the earth at the same time. These currents may be going on in a valley surrounded by mountains without any other action of the atmosphere. On a plain, however, there is also another action taking place at the same time, but which does not in the least interfere with the vertical action, that is, the whole body of air may be passing along over the surface of the earth at the rate, we will say, of ten miles an hour, while the vertical action is going on at a velocity of, say, four miles an hour.

The soaring of a bird may be compared with a boy sliding downhill on a sled. If a hill is, say, 100 feet high, and the sides slope off in a horizontal direction 2,000 feet from the summit, and if the snow is smooth, a boy can mount a sled and advance 2,000 feet while he is falling, as relates to the earth, 100 feet; that is, the sled with the boy on it in falling through a distance of one foot develops sufficient power to drive the sled forward 20 feet, but when the boy is at the bottom of the hill and can develop no more power by falling, the sled soon comes to a state of rest. Suppose now that a hill could be made in such a manner that it would constantly rise at such a velocity that the sled would never reach the bottom of the hill. The boy would then be able to slide forever, and this is exactly what occurs with a bird. A bird places its wings in such a position that, as it falls in the air say one foot, it moves forward through the air 20 feet; that is, it slides along on the surface of the air underneath its wings in the same manner that the boy slides down the hill. Suppose now that the velocity of the bird should be about 30 miles an hour, this would account for the whole phenomenon of soaring on an upward current of only 1½ miles an hour. With an upward current of 2 miles an hour, the bird would rise, as relates to the earth, one-half a mile an hour while actually falling through the air at the rate of 1½ miles an hour.

There is no doubt that a bird, by some very delicate sense of feeling and touch, is able to ascertain whether it is falling or rising in the air. In all probability the numerous air cells which are found in the body of a bird are provided with delicate nerves, which operate in a similar manner to those of the swim bladder of a fish, so that as the bird is moving forward through the air it is able to take advantage of a rising column of air. As a whole, we may consider that the rising columns of air would be half of the total area of the earth's surface, so that a soaring bird would always have a rising column of air which would serve as a support. Referring to the eagles which I saw in the Pyrenees, on one occasion I observed five of these birds about 500 feet above the peak of a mountain, and they were balancing themselves in a stationary position on an ascending column of air produced by the wind blowing over the peak, and seemed to be as much at ease as if they were roosting upon a tree. As a ship passes through the air, the air is divided exactly in the same manner as water would be, and as it comes together again at the stern of the ship it produces an upward current, and it is on this ascending column of air that the albatross and the seagull find a resting place and follow the ship for days at a time without any apparent exertion; but whenever they find themselves in front of the ship or at one side where there is no ascending column of air they have often to work their passage very much as other birds do.

But all birds do not soar. Ducks, geese, partridges, and pheasants are types of birds which are provided with comparatively small wings. They only remain on the wing for a short time and while in the air exert an enormous amount of energy and move at a high velocity. They do not seem to have the power to take advantage of ascending columns of air, but move in a straight line quite independent of air currents, and it is these birds we should seek to imitate in our attempts to navigate the air.

* Hiram S. Maxim, in the North American Review.

The Laurel and Sassafras.

Few of the forest trees of eastern North America are more beautiful at this season than this member of the laurel family when its large variously formed leaves have turned to delicate shades of yellow and orange, sometimes tinged with red. The fruit, which, as a rule, is sparingly produced, is abundant in some years, and as it ripens in September and October, it adds much to the beauty of the tree at this season, being dark blue and surrounded at the base with a bright scarlet calyx tube and raised on a thick scarlet stalk. The birds relish its aromatic flavor, however, and they usually eat it as soon as it begins to color. The beauty of the sassafras is not confined to autumn. Its shining green branches in the winter, its drooping clusters of pale yellow flowers in early spring, the red brown and deeply furrowed bark gives the trunk a most picturesque appearance. The sassafras ranges from the shores of Massachusetts Bay to Florida and west beyond the Mississippi, and reaches its maximum size in southern Arkansas and the Indian Territory, where trees are not uncommon with trunks six or seven feet through and eighty feet high. Large individual trees are often seen much farther north, and on page 215 of vol. vii we gave the portrait of a tree on Long Island which has a diameter of forty-three inches at two feet from the ground. Although it is so common, like many other native trees, it is much neglected by planters, notwithstanding its usefulness. It is easily raised, too, for if the seeds are planted as soon as they are ripe, they will germinate next spring, and the suckers, which are often produced in great abundance, can be easily transplanted. To many persons the sassafras is interesting from its relationship to such trees as the bay, the cinnamon and the camphor, and perhaps its aromatic flavor helped to give it the reputation for sovereign curative properties which made it so eagerly sought for by Europeans for two centuries. Thoreau, who found poetry about him everywhere, wrote in his journal, "When I break a green twig of sassafras as I go through the woods in February I am startled to find it as fragrant as it is in summer. It is an importation of all the spices of an oriental summer into our New England woods, and very foreign to the snow and the brown oak leaves."—Garden and Forest.

A New Water Supply Project for London.

Mr. T. H. W. Idris, the chairman of the Special Water Committee of the London County Council, accompanied by several members of the committee, and Mr. A. R. Binnie, the engineer to the council, have visited a number of localities which it was believed might fairly be regarded as available sources of water supply for London; and the chief engineer has prepared an elaborate report.

The aqueduct required would be 150 to 170 miles in length. The engineer has so designed the works that the total quantity of 415 million gallons a day can be conveyed to London in two separate and distinct aqueducts, which can be carried near to and parallel to each other, or, if thought more desirable for safety, can be many miles apart.

The sources of supply are in Wales, at altitudes above 600 feet, extending to 2,800 feet above sea level at the head waters of the Usk, Wye, and Towy, in the counties of Cardigan, Brecon, Radnor, and Montgomery. On these highlands, the rainfall, as compared with that of the Thames valley (27 inches) is very heavy, varying from 45 inches up to 75 inches or more per annum; consequently from a total area of 312,400 acres, or 488 square miles, 415 million gallons a day can be obtained after making full allowance for dry years and evaporation, and giving due compensation in water to the streams and rivers from which the supply is derived, as compared with 300 million gallons a day without compensation from the 3,542 square miles in the Thames valley above Molesey.

For a gross supply of 415 million gallons a day to provide for all contingencies for a period of 50 or 60 years, the estimate is £38,800,000, at the rate of £93,494 per million gallons.

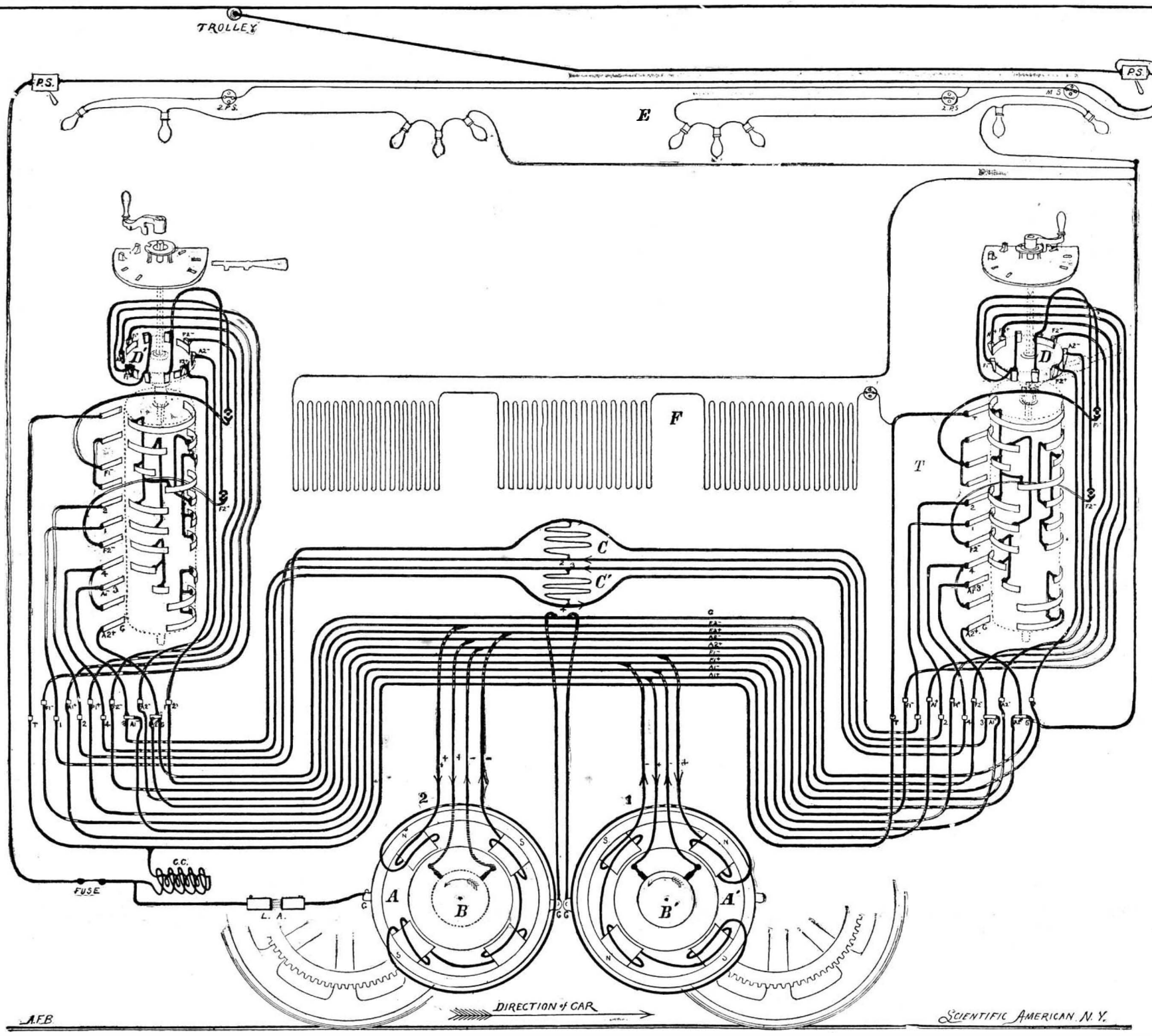
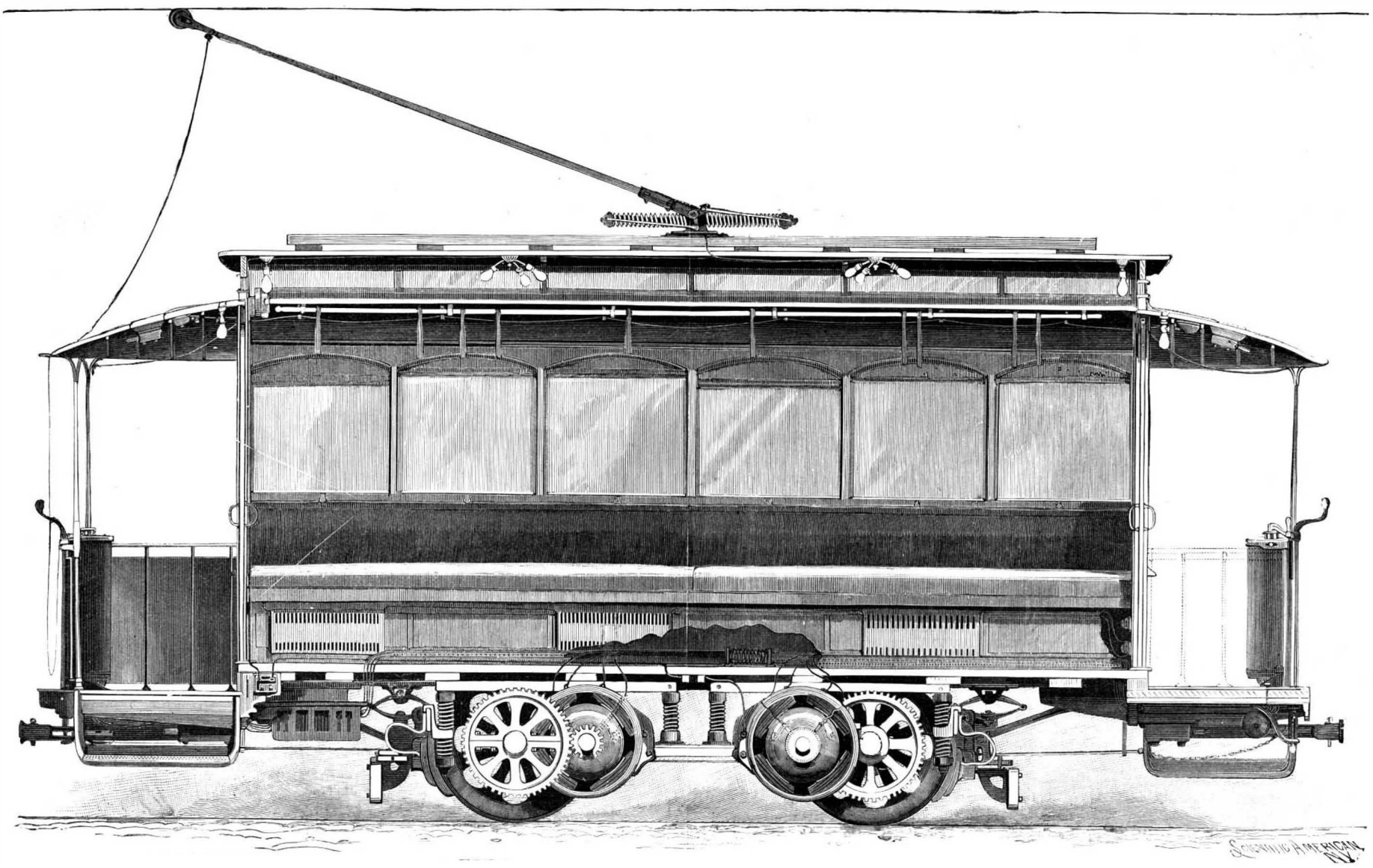


Fig. 2.—DIAGRAM OF THE ELECTRICAL CONNECTIONS OF A TROLLEY CAR.



FAIR HAVEN AND WESTVILLE ELECTRIC RAILROAD.—Fig. 1.—LONGITUDINAL SECTION OF A TROLLEY CAR.

THE FAIR HAVEN AND WESTVILLE RAILROAD PLANT.

In our last issue we described the power station and much of the detail of the lines of the Fair Haven and Westville Railroad plant. We now give details of the electric wiring of a trolley car and other items of interest connected with the railroad.

A passenger on an electrically propelled car, unless he happens to be an electrician, has very little idea of the maze of wiring and the intricacy of the switches necessary for the complete control of the current used on a car. The current, which is taken from the trolley wire above by the mere touch of the trolley wheel, and is delivered to the track, which, in connection with the ground and return wire, forms a return circuit, must be able to develop as much as 50 horse power for starting the car, for grades, for overcoming obstructions, and for towing a trailer or a disabled motor car, and it must also be controllable to any extent so as to produce any desired power from the fraction of a horse power up to the full capacity of the motor or motors. In addition to this the current is utilized for lighting and heating the car.

To cause the car to stop or start, to go forward or backward, slow or fast, and to permit of operating it from either end, there is placed on each platform a box known as the "controller," having two hand levers at the top, one for reversing the motor, the other for varying its speed and stopping. The controller contains insulated contact springs forming the terminals of the various wires, and also a cylinder carrying a number of metallic segments for forming the various connections of the wires by contact with the different springs.

Fig. 1 is a longitudinal section of a trolley car, showing a motor connected with each axle, the controllers on the platforms, the electric heaters under the seats, the incandescent lamps under the roof of the car, and the trolley pole with its trolley wheel held in contact with the trolley wire by the pressure of the springs on the turntable on the top of the car at the lower end of the pole.

The connections, as shown in the diagram, Fig. 2 (which represents the wiring of a car), are arranged for starting the car, i. e., with all the windings of the field magnets in series with the two armatures and the two resistances, C, C'. These connections can be traced by starting at the power switch, P. S. Between the power switch and the motors are located the fuse and the choke coil, c c, which latter is designed to impede a lightning discharge so as to cause the lightning to pass to the ground through the lightning arrester, L A, ground connection, G, motor box, car wheels and truck, rather than through the motors.

The current passes to the wire, T, which is open at the rear controller, but which in the front controller touches the upper segment which communicates through wire 2 with resistance, C, thence through

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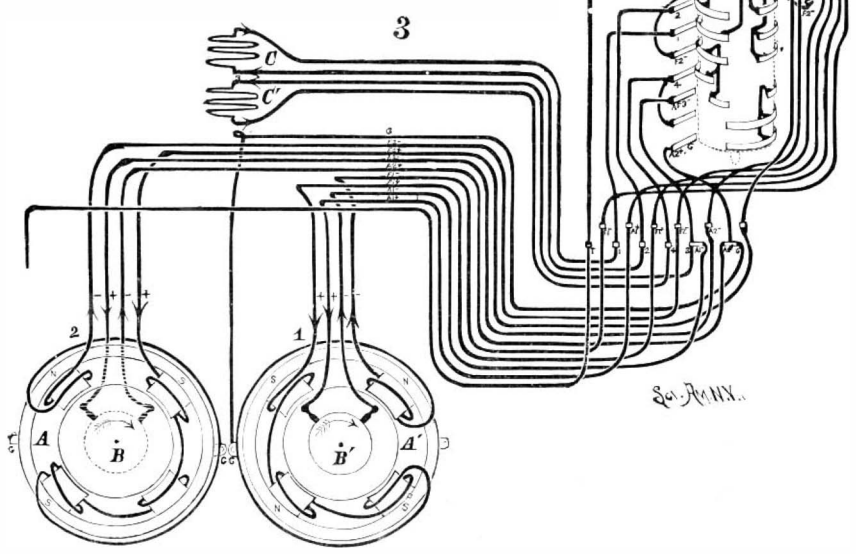

AN ARRANGEMENT OF THE CIRCUIT FOR REVERSING THE MOTOR.

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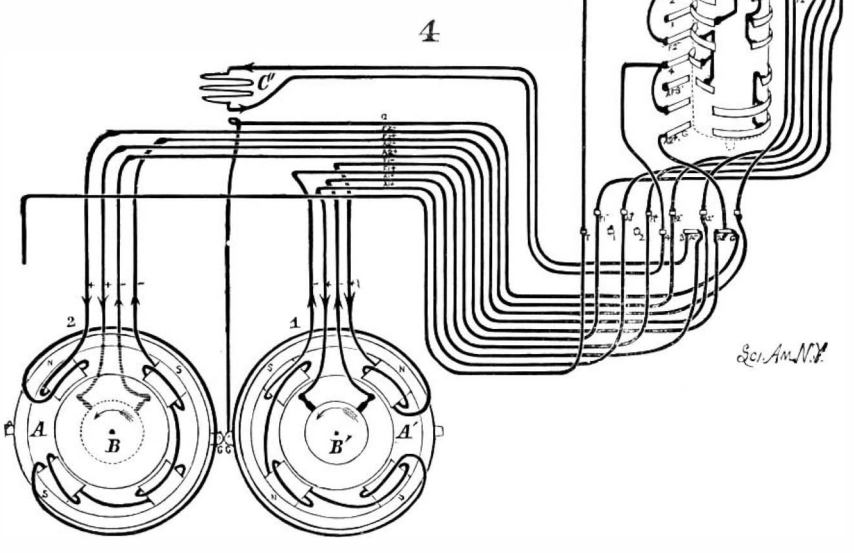

THE CIRCUIT WITH ONE-HALF OF THE RESISTANCE CUT OUT.

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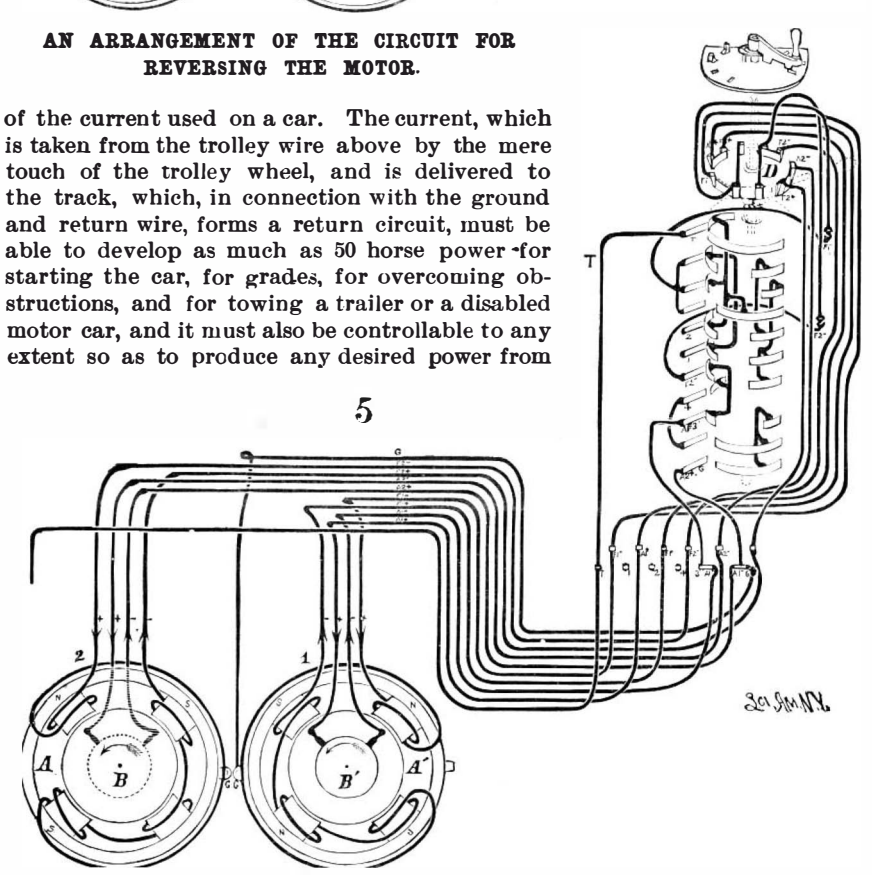

THE CIRCUIT WITH ALL THE RESISTANCE CUT OUT.

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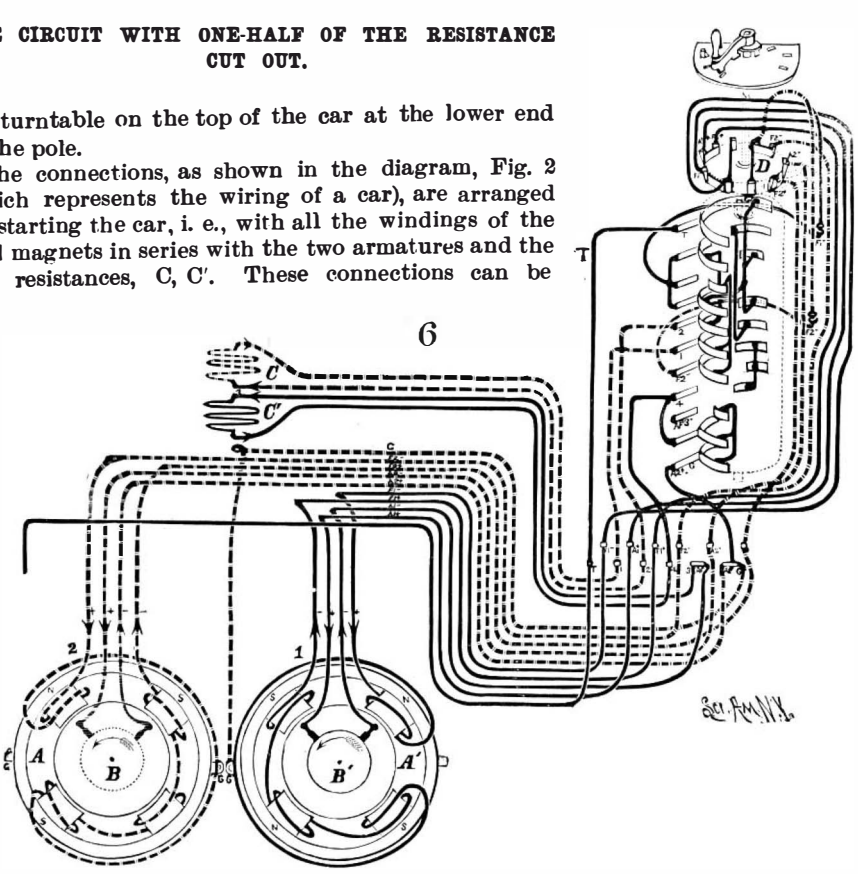

THE CONNECTIONS WITH MOTORS IN PARALLEL AND IN SERIES WITH THE RESISTANCE.

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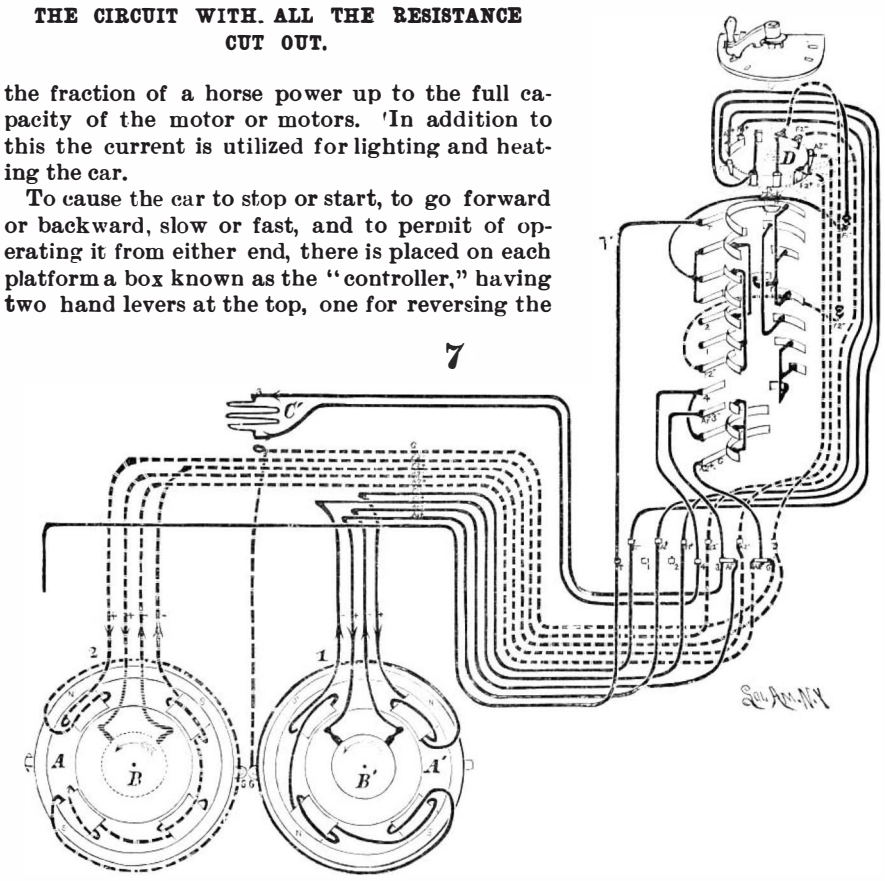

BOTH MOTORS IN PARALLEL AND IN SERIES WITH HALF THE RESISTANCE.

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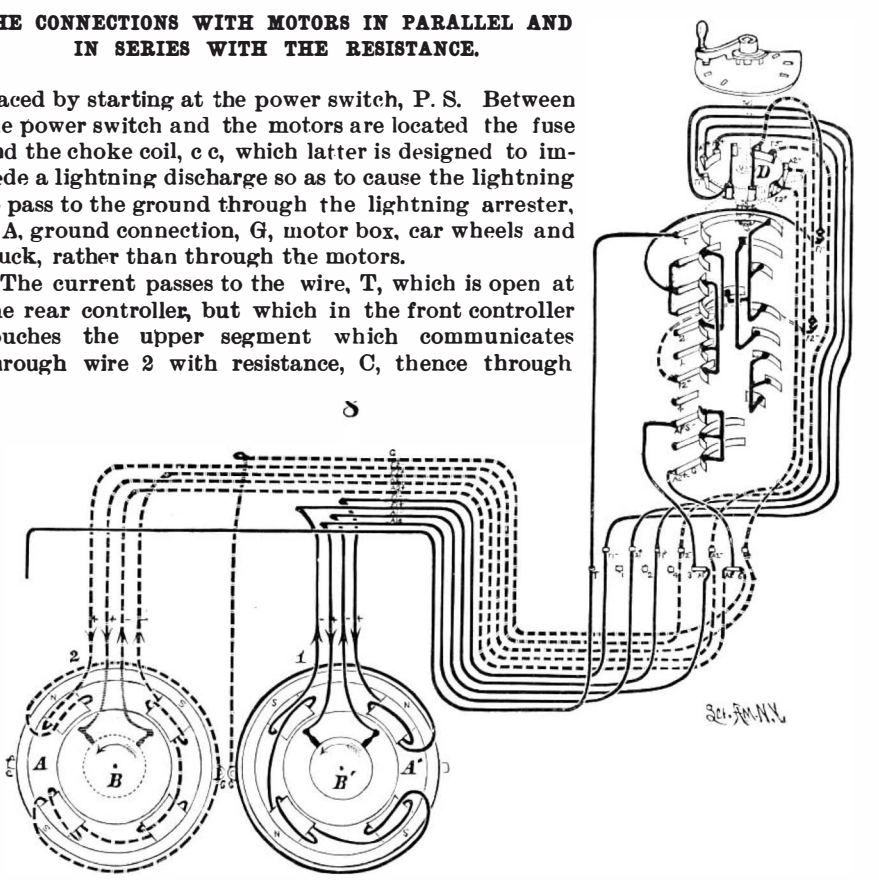

MOTORS IN PARALLEL WITH ALL THE RESISTANCE CUT OUT.

FAIR HAVEN AND WESTVILLE ELECTRIC RAILROAD.

wire 1 and the segment with one of the contacts in the reversing switch, D. The current flows thence to the field magnet of the motor, B', through the wire, F'—, and returns to the reversing switch through the wire, F^1+, thence through the wire, A'+, to the armature of the motor, B', through the wire, A'—, to the resistance, C', thence back to the spring, 4, of the controller, thence to the spring, F^2—, through the reversing switch, wire, F^2—, to the field magnet of the motor, B, returning through the wire, F^2+, to the reversing switch, thence to the armature of the motor, B, by the wire, A^2—, returning by the wire, A^2+, to the ground wire, G, which communicates with the ground through the motor box, car truck, car wheels and rails.

Fig. 3 shows the arrangement of the controller and reversing switch when the motors are reversed. The current enters the trolley connection, T, as before, passing to spring, 2, thence to the resistance, C, spring, 1, to the wire, F'—, thence to the reversing switch, D, and wire, F^2+, to the field magnet of the motor, A'; thence back to the switch, D, thence by the wire, A'+, to the armature, B', of the motor, A', thence to the resistance, C', to spring, 4, through the segment of the controller to spring, F^2—, thence by the wire, F^2—, to the reversing switch, D, thence by the wire, F^2+, to the field magnet of motor, A, thence to the switch, D, and back to the armature, B, of the motor, A, thence to the ground connection, C.

It will thus be seen that while the current remains the same in the armatures of the motors, it is reversed in the field magnets; this causes the armatures of the motors to revolve in the opposite direction.

When the controller lever is at the first notch the current is fully on, with both the field magnets, armatures and resistances in series, as shown in Fig. 2. When it is at the second notch the resistance, C, is cut out, as shown in Fig. 4. With the controller lever at the third notch both resistances, C C', are cut out as in Fig. 5. At the fourth notch the motors are in parallel with each other and in series with the resistance (Fig. 6).

When the controller is arranged as shown in Fig. 7, the two motors are in parallel and in series with half the resistance. When the controller is arranged as in Fig. 8, both motors are in parallel, the resistances being cut out. Circuits shown in dotted lines are in parallel with like circuits shown in full lines.

These various changes in the circuit give all the gradations of power required for starting and for running at different speeds.

The heating apparatus, F, which consists of a series of wire coils arranged under the seats behind gratings, is in parallel with the electric lighting apparatus and the motors. Enough current is taken from the supply wire to maintain a comfortable temperature in the car. There are two lamp circuits on the car, each including five 100 volt lamps, the lamps of each set being in series.

At suitable intervals on the various branches of the road there are telephone boxes, shown in Fig. 9, by means of which the engineer or electrician at the power station can be notified of anything occurring on the lines, and by which the dispatcher is informed whenever an emergency arises calling for more than the usual number of cars.

Much of the perfection of this trolley system is due to the efforts of Mr. Francis G. Daniell, electrical engineer for the company, who has kindly furnished us with the data here presented.

Proposed Amendments of the Patent Law.

At the recent Detroit meeting of the American Bar Association the report of the special committee on unification of the patent law was adopted. The committee comprised the following well known lawyers:

Edmund Wetmore, Wilmarth H. Thurston, Charles E. Mitchell, Frederick P. Fish, Francis Rawle, James H. Hoyt, Paul Bakewell, Arthur Stuart, Charles E. Foster, Joseph C. Fraley, E. B. Sherman, James H. Raymond and George H. Lathrop.

In their report they propose five general amendments to the patent law, as follows:

1. At present an applicant for a patent has two years to take action on his application for a patent after he has received notice that the Patent Office has received his application. This accounts for the notice on many devices that "patent has been applied for." It permits the use of devices exclusively for years at times before a patent is issued, and makes abuses possible. The committee recommends that the period be made six months, as that is ample time for any person living in any portion of the country to get his application to the Patent Office at Washington.

2. That the law be amended so that if a patent has been issued or published for two years in any foreign country before application has been made in the United States that patent here be barred. This is urged because an invention may be well known in Europe and be in general use, but may not have been patented here. This may be discovered and some thrifty individual making first claim to discovery can get a patent and get a royalty from an old idea. Foreign inventors, too, having no real conception of the value of their inventions, may come in late and get patents after their device is in general use.

3. To have a statute of limitations for patents, providing that no suit may be begun for an infringement of a patent dating six years or more prior to the commencement of the suit.

4. To so amend the law that the granting of a foreign patent to an American inventor shall not affect the American patent unless the inventor shall have made application for the foreign patent seven months in advance of his application for the home patent.

5. The law requires that assignments of patents shall be in writing, but there is no provision whereby an acknowledgment may afford prima facie proof of the execution of such instruments.

To remedy this the committee propose that a certificate of acknowledgment of these instruments before a proper officer shall be prima facie evidence of execution.

At an evening session of the section on patent laws, an able and exhaustive paper was read by Judge Robert S. Taylor, of Indiana, on "Some Reflections Suggested by the Creation of a Patent Law Section in the American Bar Association."

"It is a respectful form of speech," said the speaker, "to ascribe the wisdom of judical decisions to the courts, but we know that in fact the judges imbibe most of their wisdom from the bar, and are the most unblushing plagiarists in the world. So that when we get at the final truth, it comes to this, that the despised and rejected fraternity of patent lawyers are in reality the authors of the present system of patent law in America. Whether we consider the magnitude of the interests committed to their keeping, or the

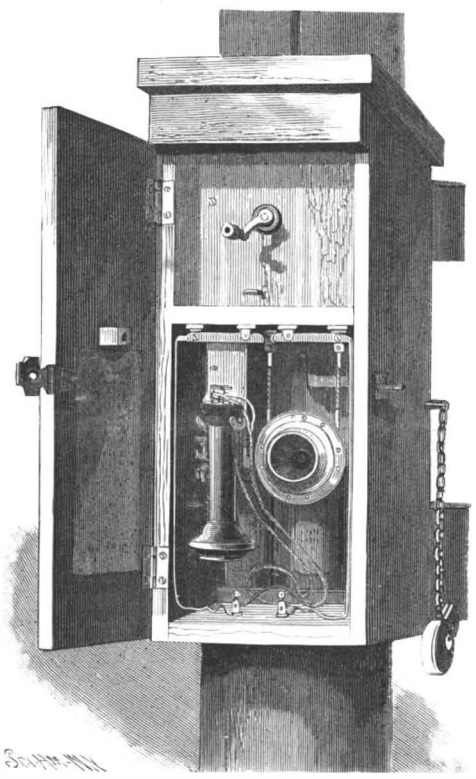

Fig. 9.—TELEPHONE BOX FOR COMMUNICATION WITH THE POWER STATION.

nature of the questions which arise in respect to those interests, it must be affirmed that no department ought to outrank that of the patent law in dignity, honor and usefulness to the public welfare. It is a question whether or no the marvelous development of invention would have been possible without the stimulus of the patent system. The rewards which the patent law offers are of a kind to spur human nature to its best. It is not the manufacturer who has adjusted his machinery, wages and prices to the condition around him, nor the merchant whose interest, his profits, nor prices; nor the customer, who rarely knows the history of the cost of what he buys, or bothers himself with speculation as to whether it could be cheapened or not, that gives to society its labor saving invention, but the solitary dreamer, looking at the world from his garret window, burning with the thought that to achieve an invention may be wealth, honor to him."

. . . . . .

"There are some respects in which the patent practice needs reformation as well as the law, and in which this section will, no doubt, interest itself at the right time. One of these is the length and cost of records. I doubt if the rules of evidence are as grossly disregarded elsewhere as in taking proofs in patent cases.

"Throughout his career the patent lawyer should never cease to be a student of the law at large. Be an all-round lawyer in heart, sympathy and aspiration and as nearly that in fact as the conditions of your life will permit. Buy a new book occasionally, if only to smell the leaves."

A TELEPHONE wire is carried a mile and a half without support over Lake Wallen, between Quinten and Murg, in the canton of St. Gallen, Switzerland.

THE TRANSSIBERIAN RAILWAY.

A work of prime importance is now being accomplished in Asia, silently and without parade—the construction of the Transsiberian Railway. When finished, this line will exceed in length any of those that exist upon the globe. In fact, its length, from Tcheliabinsk, its initial point, to Vladivostok, its terminus, will be 4,536 miles, while the length of the Transcanadian, which is alone worthy of being compared with it, reaches, between Montreal and Vancouver, but 2,760 miles.

On another hand, the Transsiberian will have a grave influence upon the economical and political relations of the states of Europe, Asia and America. This grand enterprise is worthy of fixing our attention, and the direction line of the road, the work that its construction will necessitate, like the motives that decided the Russian government to undertake it, ought to bespeak instant consideration. Since the year 1579, in which the Cossack Yermak, at the head of 850 adventurers of various origins, Russians, Cossacks, Germans and Poles, advanced victoriously as far as to the Obi, and gave final satisfaction to old Ivan the Terrible, in adding a new kingdom to his preceding conquests, the Russians have gradually seized the whole of Siberia, by a slow but sure march, that was finished only in 1858 by their taking possession of the regions bathed by the River Amoor.

This immense domain was neglected by the government of the czars for a long time. Its situation as a penal colony gave it a sorry reputation among the Russians, and the few free colonists who took the risk of emigrating thither established themselves among the aborigines. Far from raising the population by which they were surrounded to their own level of civilization, they descended to theirs and fell into barbarism. Nevertheless, fifty years ago, this country began to attract more attention, and it soon became evident that the creation of a great way of communication connecting it with Europe was the one condition of its development. The "trakt," that coachable route that unwinds from Perm to Kiakta, upon the Chinese frontier, was already doubtless contributing to the prosperity of Siberia, but it was the opinion of all those who were interesting themselves in the future of the country, Count Moravier, General Bogdanovitch, Merchant Lioubimor, etc., that this route ought to be replaced or rather doubled by a railway.

Many Transsiberian projects have been put forward within the last thirty years. Finally, on February 21, 1891, Czar Alexander III adopted the direction line that is now being executed. The Transsiberian is connected at Tcheliabinsk with the Russian system of railways. It prolongs the Moscow Riazan-Riajsk-Samara-Oufa line. It runs first directly toward the east in crossing the plains watered by the Tobol, the Irtych and the Obi. Starting from Krasnoiarsk, the line curves toward the southeast to reach Irkutsk (Fig. 1). It is afterward to pass around the southern extremity of Lake Baikal, run for a certain distance along its eastern shore, and then take a northeast direction. It will then follow the valleys of the Ingoda, Chilka and Amoor. But the topography of these regions is as yet too little known to allow of a definite direction line being decided upon. At Khabarovka, the line will leave the valley of the Amoor to ascend that of the Oussouri and reach Vladivostok. It will be remarked that the line does not leave Russian territory. There was some thought of making it run for a certain distance upon Chinese territory. The great curve described toward the north, starting from Lake Baikal, would thus have been avoided. As very friendly relations exist between the court of St. Petersburg and that of Peking, it was thought for a while that the great Asiatic railway would be partially Russian and partially Chinese; but strategical considerations finally prevailed, and as this railway is capable of serving some day for the reinforcing of the Russian garrisons, it was preferred to establish it solely upon Russian territory.

It will be observed, too, that the line does not divide Siberia into two equal parts. It is situated wholly in the southern part. An important section even runs along the Chinese frontier. This direction line was adopted because it is especially in the south of Siberia that the mining districts are met with. But there was still another reason. In the greater part of the country, the ground remains frozen for almost the entire year. In summer, it is true, the upper stratum thaws and the hard and unbreakable crust softens; but it then becomes converted into a muddy mass. To have tried to lay ties upon ground in so poor a physical condition would have constituted a grave imprudence.

It was absolutely necessary to establish the line upon ground that was at once more friable in winter and more solid in summer, that is to say, to the south of the border of the ground perpetually frozen.

Many difficult and costly bridges will be indispensable. The Transcaspian railway necessitated but one very important bridge, that of Tchardjoui, over the Amou Daria. The construction of the Transsi-

berian will be much more difficult. It will have to cross several large watercourses, the Tobol, Irtych, Obi and Tchoulym. These rivers drain the southern slopes of the Altai and of the Saiansk Mountains. When the snow melts, heavy freshets ensue, and bridges of large dimensions will therefore be necessary. The crossing of the chains of the Saiansk Mountains, at right angles with the direction of the line between Krasnoiarsk and Irkutsk, will present many obstacles. The nature of the Chilka and Amoor, whose banks are converted into lagoons over a wide space at the time of freshets, will likewise prove the origin of serious difficulties.

The work was begun at the end of 1891, and was simultaneously undertaken at the two extremities of the line. The western part was finished as far as to Omsk at the end of 1894. The eastern part, between Vladivostok and Grafskaia, is upon the point of being finished.

It is not proposed to continue the construction of these two fragments methodically and push them toward each other; but it is desired to establish provisionally a route half fluviatile and half rail. Sections of railway will connect the Siberian rivers at the points where their navigable affluents approach each other more closely. Thus, the section upon which work is being most vigorously pushed is that of Atchinsk, upon the Tchoulym, an affluent of the Obi, at Krasnoiarsk, upon the Ienissei. The two great rivers will thus be united. Other processes will afterward be employed. From Irkutsk, for example, a line will reach Lake Baikal, and then steamboats will carry passengers and freight along the east shore.

During the four months in which the lake is frozen, a light railway will be established upon the ice.

The Transsiberian line will be a single track one. In a distant future, if the increase in transit requires it, the track will be doubled. The cost is estimated at 350,210,500 rubles, say $165,105,250. The charges are assumed, not by a private company, but by the government itself.

The motives that decided the Russian government to undertake this colossal work were both political and economical. The Crimean war demonstrated in a general manner the inadequacy of the railways in the empire. Had the regiments going toward the south not been blocked along the roads, the blockade of Sebastopol would probably have been raised. The destruction of the arsenals of Petropaulosk in the peninsula of Kamtschatka, upon the Pacific, by the Franco-English fleets, showed in particular the danger that its isolation caused eastern Siberia to run. The recent events in the far East prove that the Russian statesmen have been well inspired in deciding upon the construction of this railway. For the instant, the Chino-Japanese conflict is terminated; but, if the occasion presents itself, the faculty of rapidly bringing masses of men into eastern Siberia will permit Russia not to figure as a supernumerary in these military pieces, but to play a leading role therein.

Alongside of the strategic reasons, there were also others that pleaded in favor of the construction of the railway. Siberia is one of those still intact countries of which the soil contains resources of every kind. To use a philosophical expression, they are in power therein. It is for man to extract them. From the southern frontier, as far as to 59° of latitude, extend the cereal districts. Beyond, and as far as to the Polar circle, is situated that immense forest of conifers that Nordenskjold called "the vastest of the globe." Metalliferous deposits are distributed on every side, ores of iron, of argentiferous lead, of copper and of platinum. We know also that a notable part of the gold annually put into circulation upon the globe (about a fifth) comes from the Siberian provinces. The quantity extracted in 1890 amounted to 66,000 pounds. Finally, coal mines have been discovered in several places. One of these is under exploitation in the valley of the Sutchan, situated at fifty miles to the north of Vladivostok. It was discovered in 1888, since which it has been regularly worked. It furnishes fuel for the Russian fleet of the Pacific. The vessel upon which Czarevitch (now Czar) Nicolas made his grand voyage in 1891 started from Vladivostok with her bunkers full of coal extracted from this mine.

The Transsiberian will infuse life into all these industrial centers. It will permit of the importation of the machines and instruments necessary for the extraction of the ore, and which are now often too greatly lacking. It will also remedy a dearth of population, the great trouble of Siberia, which, as well known, is one of the most thinly peopled countries upon the face of the globe. It possesses the same number of inhabitants as Holland, while its area is three hundred and seventy times greater. Various efforts have already been made to increase the figure of the population. Since 1882, in particular, colonists have been grouped every year at Odessa by the exertions of the Russian government. They embark with Vladivostok as their destination and are installed in the provinces of Oussouri.

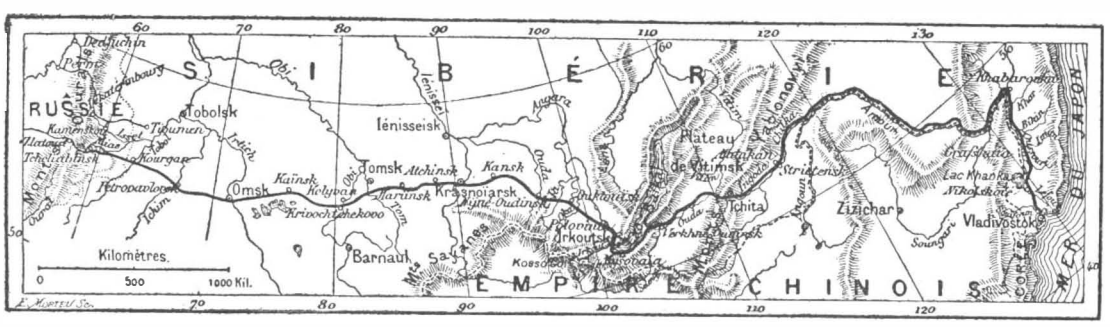

Fig. 1.—MAP OF THE TRANSSIBERIAN RAILWAY.

This official colonization has already had good effects, but others still and far better ones are anticipated from the Transsiberian. The two sides of the line will be peopled, and, in a certain measure, there will occur the same phenomena as in the far West of North America, where the establishment of railways in the solitudes of the prairie have caused the sudden springing up of what are called "mushroom cities," to explain in a word the rapidity of their growth. But it will not only contribute to the prosperity of Siberia; its reach will be more general. It may be anticipated that it will transform the conditions of the commerce of the far East. The preponderant situation of the English in China will be menaced. They export silk and tea and import cotton, thread, fabrics and wool. Now, all such merchandise, seeing the small bulk of it and its great value, can easily support carriage by rail. The English also import metals, which will be easily replaced in the Chinese market by those that are extracted from the mines of the Ural and of Siberia. Finally, the Transsiberian will form the shortest route from Europe to the far East. If the trains run at the very moderate speed of 19 miles an hour, Vladivostok will be reached from Tchaliabinsk in ten days, Japan in fifteen, and Shanghai in twenty. With the Transcanadian, the Transsiberian will complete the iron girdle that surrounds the globe, and will worthily terminate the great works of the century.—La Nature.

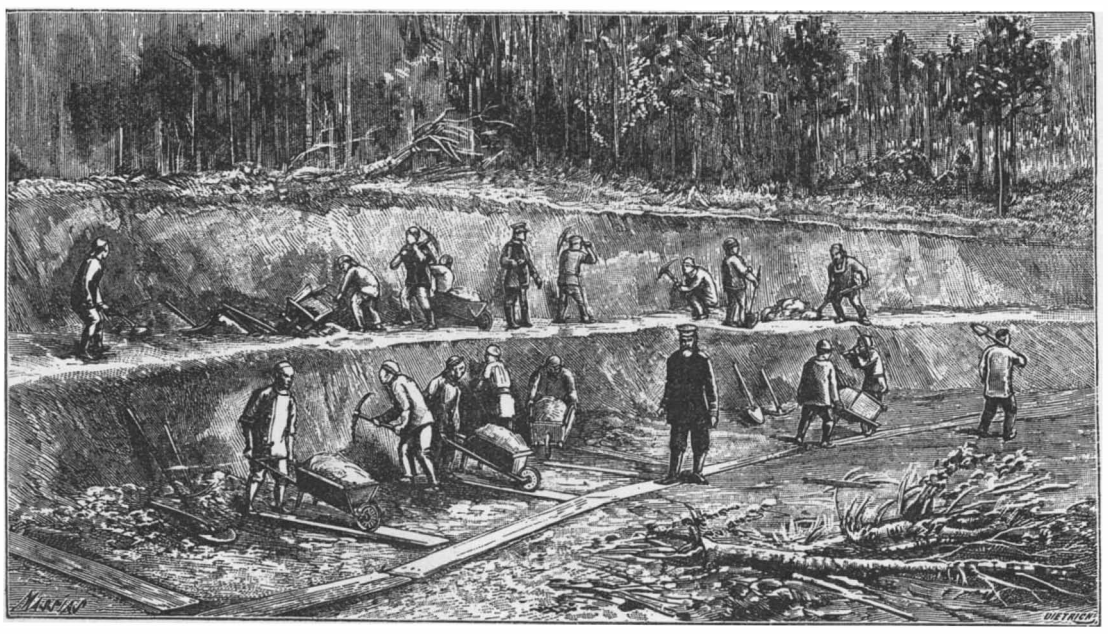

Fig. 2.—CHINESE AT WORK ON THE TRANSSIBERIAN RAILWAY.

Absorbable Tissue for Wounds.

J. Lustok has patented a process in Germany under which the muscular coating of the intestines of animals is divested of both the interior and exterior layers of mucous membrane, and then digested in a pepsin solution until the muscular fibers are half digested. This is then treated with tannin and gallic acid. The result is a tissue which can take the place of the natural skin, and which, when laid on the wound, is entirely absorbed during the healing process.

The Latest in Fast Railroading.

The Lake Shore and Michigan Southern, emulating the example of the New York Central and the English roads, made a fast trial trip from Chicago to Buffalo on October 24, and succeeded in breaking the world's record, covering 510·1 miles from 100th Street, Chicago, to Buffalo Creek, Buffalo, the outskirts of both cities, in 7:50:20, or 470⅛ minutes, excluding stops; an average, excluding stops, of 65·07 miles an hour.

The fast train left Chicago at 3:29:27 o'clock and was composed of an engine, tender and the drawing room cars Madagascar, Esmeralda and Ellsmere, the total weight of the train being 488,500 pounds.

The run from Erie to Buffalo Creek, 86 miles, was made at an average speed of 72·9 miles an hour.

The Lake Shore officials are jubilant over their success in beating the time made on the recent run of the New York Central's fast train, which was as follows: New York to East Buffalo, 436½ miles, in 407⅜ minutes, an average of 64·26 miles per hour.

The New York Central's Empire State express brought into the Grand Central Station at 10:15 p. m. of the same day several of the party that left Chicago on the Lake Shore fast train. Some of the party visited the theater. This is a feat never before accomplished—to leave Chicago in the morning, travel 980 miles, and attend the theater in New York the same evening.

Military Bicycling.

Lieuts. W. C. Davis, Fifth Artillery, and A. W. Chase, Second Artillery, recently made a very interesting tour of the battlefields of the Army of the Potomac, leaving Fortress Monroe August 1 and returning August 26, having ridden over 1,000 miles on their bicycles. Crossing the James River at Jamestown, they took the old stage route from Surrey Court House to Petersburg, where they visited the old Union forts and the "crater" and examined the Confederate lines of defense. Crossing the Appomattox at Ettrick, they rode through Amelia Court House, Jetersville, Burkeville, and Farmville to Appomattox, where they spent two days on the old "Surrender Grounds." From there they went by way of Lynchburg, the James River Gap, and the Natural Bridge to Lexington, where they visited the homes and tombs of Lee and Jackson, the Washington and Lee University, and the famous Virginia Military Institute. Continuing down the Shenandoah Valley through Staunton and New Market, they rode through Massanutten Gap to Luray, thence to Front Royal and Winchester. They spent two days on the ground of Sheridan's famous victories, visiting Tom's Brook and Fisher's Hill by train. Riding by way of Martinsburg and Shepherdstown, they spent two days at Antietam and then went to Gettysburg by way of Hagerstown and the Monterey Pass. They spent three days on the field of Gettysburg, taking sixty photographs, showing every part of the battlefield and all the surrounding country. The object of the ride was to traverse the routes made famous by war marches and to familiarize themselves with the country fought over. To make after study easier, they took over 300 views en route, showing the terrain and principal features of the fields, the nature of the roads, etc.

Returning home by way of Baltimore and Washington, they visited the battlefields of Manassas, Mine Run, the Wilderness and Chancellorsville, Fredericksburg, Spottsylvania and the series of fields fought over by Grant in his stubborn advance on Richmond.

By keeping a careful journal of the ride, they have gathered much useful information in regard to the military value of the roads passed over in the four States visited, and their photographs alone will make an interesting study of the battlefields. They rode 35 pound wheels and carried twenty-five pounds of luggage, and although they made no effort to make records, they found it easy to ride eighty miles a day over ordinary country roads.

THERE are seven hundred golf clubs at present in Great Britain, with about 35,000 players.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

LOCOMOTIVE BELL RINGER.—Daniel Ochse, Oneonta, and John A. Malone, Albany, N. Y. This is a device operated by compressed air or steam to ring the locomotive bell continuously when required, without the attention of the engineer or fireman. A valve is arranged with spring-actuated sections in a compressed air or steam cylinder, the sections of the valve controlling inlet and exhaust ports, and a piston working in the cylinder is connected with a bell crank adapted to ring the bell, there being an operative connection between the piston and valve.

CAR FENDER.—John Landau, Brooklyn, N. Y. This improvement consists of a fender scoop or basket mounted to swing downwardly on striking an obstruction in the path of the car, the scoop descending in such manner that a person on the track must necessarily fall into the basket, and there being also a connection between the basket and the brake shoes by means of which the brakes are applied when an obstruction passes into the basket. The scoop is normally held a little distance above the track. The gripman or motorman can manipulate the brake shoes in the usual way, when the car is to be stopped, without interfering with the position of the fender.

CAR COUPLING.—John E. Thomas, Richmond, Va. This coupling is of the twin jaw type, having one fixed and one pivoted jaw or knuckle, the latter with a shank to be locked by the coupling pin. The shank is curved, and at its free rear end has a tapered lateral extension forming a cam which engages a shoulder on the coupling pin to automatically raise it. The drawhead has an overlapping portion, whereby, in case it is pulled out of the car, it will be supported by the drawhead to which it is coupled, and thus prevented from dropping onto the track.

CAR VENTILATOR.—Benjamin F. Hughson, Cold Spring, N. Y. According to this improvement an elongated flue is arranged to lie flat against the side of the car roof, the flue having flaring ends and box-like extensions with end openings communicating with the flue from the inside of the car. In the boxes are valves by means of which the foul air may be readily removed from a car in motion, the air current being easily regulated and the valves adjusted from inside the car.

Electrical.

ARC LAMP.—Charles Beseler, Jersey City, N. J. An improved feed for arc lamps employed in magic lanterns has been devised by this inventor, the feed permitting the operator to readily bring the light to the desired position. A lever fulcrumed on the lamp-carrying base has at one end pins resting on a fixed part of the lantern, the other end being provided with a screw resting in a step in the base, giving an inclined position to the base when the screw is turned. A removable pronged cap is provided for the lower carbon holder, and a spring-pressed lever supports the carbon and presses it in contact with the prongs.

Mechanical.

GLUE MAKING MACHINERY.—Peter Cooper Hewitt, New York City. Three patents have been granted this inventor for machines in which the process of making glue may be carried on continuously, and by means of which the drying nets may be unstacked, loaded with sheet glue and stacked ready for transportation to the drying room; also for mechanism for taking the stack of nets containing the dried glue from the drying room, unstacking the nets, removing the glue, restacking the nets, and delivering the net stack to a car which conveys it away, one invention providing also for a sheet spacer by which the glue sheet will be supported during its entire travel and in its transfer from one conveyer to another, contiguous sheets being separated and spaced while passing through the spacer. The improvements form parts of a system and method of glue making, comprising apparatus for cooling glue and forming it into sheets heretofore devised by the same inventor, the improved system being designed to supersede the former custom of setting the glue in moulds and forming cakes to cut into sheets which are spread out on nets by hand, thus doing away with manual labor in this and the succeeding operations.

GANG BAND SAW MILL.—Thomas T. Rainford, Tacoma, Washington. This mill is especially designed for cutting a log or piece of timber, at one forward movement, into any desired number of boards of equal or of different thicknesses. The mill has a main driving shaft carrying a series of main saw band driving wheels, there being a frame for each driving wheel supporting saw band wheels in vertical alignment with each other and in alignment with the main driving wheels.

GRINDER AND PULVERIZER.—Richard D. Langley, Brighton, South Australia. This is a rotary machine for working wet or dry ores, and the invention provides for utilizing the weight of the upper part of the machine to give greater attrition in the action of the lower set of rollers, which need not, consequently, be made so heavy. An upper and a lower pan and the accompanying rollers are worked by a vertical shaft, and the upper pan is supported by legs or brackets resting upon the axles of the lower rollers, the pan encircling the main shaft, and being free to slide up and down, but being held by a key or feather to rotate with the shaft. The rollers of the upper pan are supported upon axles which have no radial motion, but are free to slide up and down in guides, and the lower rollers are moved round in grooves of the lower pan, which is stationary, by axles attached to the central vertical shaft.

GRINDER.—Amos Hartley, Ottawa, Kansas. Above a suitable supporting bed, according to this invention, is supported a tool-carrying mandrel adjustable vertically and laterally, and also adapted to turn in a vertical plane, and a grinding wheel attachment is held to move on the bed adjacent to the tool carrying device. The improvement affords a simple grinder which may be readily adjusted to bring a tool to be ground to the exact position required.

POWER PUNCH CONTROLLING DEVICE.—Gustavus L. Stuebner, Long Island City, N. Y. This device provides for allowing the punch to approach without entering the article to be punched, in order to enable the operator to see that the punch is properly centered, the punch-controlling mechanism being then thrown into gear with the power mechanism, when the punch continues its movement to punch the metal and return therefrom.

Miscellaneous.

STREET SWEEPER.—William S. Kindle, Philadelphia, Pa. In this machine a series of brooms is supported to be driven by the wheels of the vehicle, to sweep the dirt and dust obliquely across the path of the vehicle into the boot of an elevator at one side, the elevator being also driven by the wheels to carry the dirt and dust upward into a collecting chamber.

VENTILATING ATTACHMENT FOR HEATERS.—William Miller, New York City. According to this improvement a valved connection is made between the fire pot of the heater and an air flue connected with branch pipes leading from the rooms to be ventilated, a smoke pipe also having valved connections with both the heater and the air flue, there being means for controlling the valved connections in such a way that the vitiated air is drawn from the apartments to be ventilated in a uniform manner.

KNIFE SHARPENER.—Peter M. Thompson, Anaconda, Montana. For conveniently and quickly sharpening table and other knives, this improvement consists of a frame made in two sections, having on their adjacent faces seats to receive cutters arranged at angles to one another, screws extending through the sections and bearing on the cutters. The cutters cross each other to form a crotch at their cutting edges, and the knife is sharpened by drawing the cutting edge of the blade once or twice through the crotch.

KNIFE CLEANER AND POLISHER.—Horace T. Field, Boston, Mass. To thoroughly and quickly clean and polish table knives, this machine has been devised, operated by a hand crank. It has a shaft carrying unconnected spokes, at whose outer ends are wood blocks where adjacent sides have leather linings between which knives of various thicknesses may be held as the shaft is rotated. Some of the spokes carry powder boxes instead of the wood blocks, the powder being thrown out of nozzles onto the polishing blocks and knives as the wheels are rotated.

VEHICLE SPRING.—States D. Palmer, Marshalltown, Iowa. This invention relates to a road cart spring formed as a double ended coil, and provides a novel nut lock for the ends of the coils, by which the nuts are placed in the coils and shaken to their locking position at the ends, to enable the eyebolt to be screwed in without allowing the nuts to turn, the nut being also permanently locked, so that it cannot come off accidentally and holds the eyebolt in place with a tightly clamped and noiseless connection.

BOTTLE OR JUG FILLING APPARATUS.—J. J. Hagins, Rock Hill, S. C. For filling molasses, sirup and other viscid liquids into bottles, etc., this invention provides an apparatus of which the funnel portion is arranged to hold measures, the funnel being suspended on a frame to fill vessels by triculation, or pouring through space. A governor device opens or closes the discharge opening according to the weight of contents in the funnel, and directs the stream or drip to one point, to avoid gorging in the mouth of the vessel being filled.

HOOK AND EYE.—Josephine C. Carstarphen, New York City. The hook and eye, according to this improvement, are each formed of a single wire, the hook having an inward bend to form a retaining lug, and each having terminal fastening prongs with serrated edges whereby they may be quickly attached to dresses and other garments without having to be sewed on.

TOY SAVINGS BANK.—Florian J. Bohn, Philadelphia, Pa. This device is based on the principle of a vending or slot machine, and is arranged to deliver a small measured quantity of candy or some substitute therefor whenever a coin is dropped into the bank, on the turning of a key or crank.

Designs.

WOVEN FABRIC.—Halbert E. Parkhurst, Fitchburg, Mass. This fabric also has elongated tuft-like figures raised from the surface in an irregular manner and of varying lengths and thicknesses.

VEHICLE STEP PAD.—Jacob Hummel, Elkhart, Ind. This pad has elongated arms projecting from two adjacent sides, the opposite sides having projecting hook-like devices.

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

NEW BOOKS AND PUBLICATIONS.

THE MANUFACTURE OF EXPLOSIVES. A theoretical and practical treatise on the history, the physical and chemical properties and the manufacture of explosives. By Oscar Guttmann. New York: Macmillan & Company. 1895. Pp. 782+xlix. 8vo. 147 illustrations. 2 volumes. Price $9.

This work is a valuable addition to technical literature, giving as it does the latest processes employed in the manufacture of modern explosives. Most of the illustrations are drawn to scale—a valuable feature in a work devoted to technology. The work begins with a history of explosives, then follows an account of the prime materials and ingredients of explosives, followed by the properties of explosives. Black powder and dynamite, Schultze powder, explosives derived from sugar, guncotton, nitroglycerine, picrates, fulminates, blasting gelatine, smokeless powders, and the Sprengel explosives are fully treated. The chapter on the apparatus for the examination of explosives gives some interesting details of the elaborate methods used in making accurate determinations. There is also a chapter on explosive factories in general, which contains tables showing the safe distances from the works for magazines or other buildings.

THE MODERN WEBSTER PRONOUNCING AND DEFINING DICTIONARY OF THE ENGLISH LANGUAGE. By Edward Thomas Roe, LL.B. Chicago: Laird & Lee. 1895. Pp. 432. 18mo. Illustrated. Price, full leather, gilt edge, indexed, $1; silk cloth, indexed, marbled edge, 50 cents; silk cloth, red edge, not indexed, 25 cents.

This little work presents in compact form nearly all of the words sanctioned by good authority which are in everyday use. It is printed in clear type and the system of indexing is handy. It contains supplements giving abbreviations and phrases from classical and foreign languages.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES. New York: H. V. & H. W. Poor. Pp. 1800. Price $7.50.

The 1895 volume of this standard work, forming its twenty-eighth annual number, well sustains the reputation it had previously established as a most compact and complete compendium of information relative to the railroad business of the country. The book has come to be indispensable to all who are seeking knowledge in this line, for it is known that the vast array of statistics it presents comes almost entirely from official sources, which the compilation and arrangement make it easy for one to find the figures bearing upon points where information is specially desired. The tables showing the progress and results of the operations of the railroads of the country for a series of years exhibit at a glance the magnitude of the system. The manual is also now made to cover the entire field of investment in the United States, the financial condition, indebtedness, sources of income, assets and population, of every State, county, city, and town, issuing obligations for any purpose, as well as the various industrial enterprises or trusts.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

OCTOBER, 1895.—(No. 120.)

TABLE OF CONTENTS.

1. Plate in colors of a handsome cottage at Rochelle Park, New Rochelle, N. Y. Two perspective elevations and floor plans. Cost $9,000 complete. Mr. H. S. Rapelye, architect, Mount Vernon, N. Y. A pleasing design for a suburban residence.
2. Cottage at Kennebunkport, Me., recently erected for B. S. Thompson, Esq. Perspective elevation and floor plans. A very attractive residence in the English style of architecture. Mr. Henry P. Clark, Boston, architect.
3. A cottage at Flatbush, N. Y., recently erected at a cost of $4,000. Perspective elevation and floor plans. John J. Petit, architect, Brooklyn, N. Y. An attractive design.
4. An all shingled cottage at Mount Vernon, N. Y. Perspective elevation and floor plans. A neat design in the Colonial style. Mr. Louis H. Lucas, New York City, architect.
5. A suburban cottage at Flatbush, L. I., recently erected at a cost of $8,000 complete. Perspective elevation and floor plans, Messrs. Rowe & Baker, New York City, architects. An attractive design in the Colonial style.
6. A dwelling at Glenwood, Yonkers, N. Y. Perspective elevation and floor plans. Messrs. D. & J. Jardine, architects, New York City. A most unique design.
7. Three perspective views and floor plans of a residence at New Rochelle, N. Y. Architects, Messrs. Stephenson & Greene, New York City. A well treated design.
8. A Colonial residence at Mountain Station, N. J. Two perspective elevations and floor plans. Mr. H. C. Pelton, architect, New York City.
9. A house at New Haven, Conn., recently erected at a cost of $3,500 complete. Two perspective elevations and floor plans. A modern economical cottage design. Architects, Messrs. Stilson & Brown, New Haven, Conn.
10. A Colonial cottage at Bronxville, N. Y., recently completed at a cost of $4,600. Perspective elevation and floor plan. Mr. W. H. Rahman, architect, New York City.
11. Miscellaneous Contents: Buff brick.—Tower tanks for water works, illustrated.—An old Baltimore firm.—Compo-Board instead of plaster—Translucent fabric, a substitute for glass.—Ventilation and heating of school buildings.—Ornamental glass.—A light and strong lifting jack, illustrated.—An improved circular saw, illustrated.—An improved wood working machine, illustrated.—Stamped steel ceilings, side walls and wainscoting, illustrated.—Spring hinges.—Mallory's standard shutter worker and fly screen.—An improved nail set, 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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(6646) W. I. writes: Kindly decide the following: A says 60 pounds of steam in a small boiler has as much pressure as one twice its size. B says 60 pounds steam in a small boiler (provided it can be kept at 60 pounds) is as powerful as 60 pounds in that of a much larger one. Does 40 pounds steam produce as much heat as 80 pounds? A. The size of a boiler has no relation to its pressure, which is always quoted as the pressure per square inch of surface of the containing shell or tubes. The gross strain on the metal is in proportion to the size. The thickness of the shell is increased in large boilers. The power of a boiler is not alone due to its pressure; the volume of steam that a boiler can furnish at a rated pressure is the measure of its power. The heat of steam when confined is a measure of its pressure, and the reverse. Steam in the boiler at 80 pounds pressure is 37° Fah. hotter than steam at 40 pounds pressure; but as much heat may be obtained from the low pressure boiler, for ordinary purposes, as from a high pressure boiler, but a larger volume of steam must be used.

(6647) W. L. B. asks: What pressure per square inch does the wind exert on a perpendicular surface held at right angles to wind when wind is blowing 15 miles per hour, and how do you figure same for different velocities? A. The force of the wind is usually computed for square feet, which, by dividing by 144, will give the pressure per square inch. The rule is square of velocity in miles per hour, multiplied by 0·005 equals the pressure in pounds per square foot. Thus $15^2=225\times 0{\cdot}005=1{\cdot}125$ pounds per square foot.

(6648) A. M. M. asks for a formula for a mounting paste for lantern slides. A. For attaching lantern slide bindings to the glass nothing is better than bichromated paste, which is used for attaching paper to glass in the manufacture of electric machines, and which is a most useful paste for many purposes in damp climates. It is made as follows: Flour, 2 teaspoonfuls; water, 4 oz.; bichromate of potash, 5 grains. The flour must be rubbed to a smooth batter with the water, then placed in a saucepan over a fire and kept stirred till it boils. Add the bichromate slowly, stirring all the time. Then stand to cool. This paste must be kept in the dark and used as soon as possible. Soak the paper in it, attach to the glass, and then place in direct sunlight for a day. This sets up a chemical change in the bichromate and renders the paste insoluble.

(6649) F. C. B. asks for the formula of Carbutt's new acid fixing bath.

A. Hyposulphite of soda	16	oz.
Sulphite of soda	2	oz.
Sulphuric acid	1	drm.
Chrome alum	½	oz.
Warm water	64	oz.

Dissolve the sulphite of soda in 8 oz. of the water. Mix the sulphuric acid with 2 oz. of the water and add slowly to the solution of soda sulphite; dissolve the chrome alum in 8 oz. of the water, the hyposulphite soda in the remainder, then add the sulphite solution, and last the chrome alum. This fixing bath will not discolor until after long usage, and both clears up the shadows of the negative and hardens the film at the same time. Let remain two or three minutes after negative is cleared of all appearance of silver bromide. Then wash in running

water for not less than half an hour to free from any trace of hypo. solution. Swab the surface with wad of wet cotton, rinse and place in rack to dry spontaneously.

(6650) J. B. W. says: Can you tell me how to make plaster casts hard? A. To a thin milk of lime or lime water add 10 or 15 drops of liquid silicate of soda for every pint of fluid used; this is then thickened with plaster to a thick cream. Plaster thus prepared will set in five minutes or thereabout, according to the thickness of the cream. If too much silicate is used, the soda will effervesce on the surface and spoil the sharpness of the impression.

(6651) B. A. E. asks how to weld together small pieces of tortoise shell. A. Small pieces of good tortoise shell may be joined so as to form one large apparently seamless piece in the following manner: Slope the margins of the shells for a distance of about ¼ of an inch from the edge. Then place them so that the margins overlap one another, and thus arranged put them in an iron press and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be softened in hot water and consolidated by hydraulic pressure in metal moulds. Protracted heating of tortoise shell darkens it, and greatly lessens its beauty.

(6652) R. J. W. says, can you tell me how to make javelle water? A. Javelle water, used for turning white the dirtiest linen and removing stains, is composed of bicarbonate of soda, 4 lb.; chioride of lime, 1 lb. Put the soda into a kettle over the fire, add 1 gall. of boiling water, let it boil from ten to fifteen minutes, then stir in the chloride of lime, avoiding lumps. Use when cool. This is good for removing fruit stains from white underwear.

(6653) H. W. C. asks how to fix paper on drawing boards. A. Take a sheet of drawing paper and damp it on the back side with a wet sponge and clean water. While the paper is expanding, take a spoonful of wheat flour, mix with a little cold water, and make it a moderately thick paste; spread the paste round the edge of the drawing paper 1 inch wide with a feather, then turn the drawing paper over and press the edges down on the board. After this take four straight pieces of deal wood, ¾ inch by 2¼ inch wide; place them on the edge of the drawing paper, and put a large book or heavy weight on each corner to make the paper adhere firmly to the board. In about an hour's time the paper will be straight and even, and quite ready for executing a drawing. When the drawing is finished, take a sharp knife and raise one corner of the paper, then take a scale, run it round the edges, and the paper will come off easily. Turn it over and take the dry paste off with a knife, and all will be perfectly clean, and no paper will be wasted.

(6654) A. D. asks for an improved formula for printer's rollers. A. This composition, by Hawkins and Stacey, London, has an affinity for printer's ink, and is free from glycerine, which is a principal ingredient in roller compositions as usually made, but which repels the ink. A composition prepared according to the following formula has been found to answer well in practice: Glue or gelatine, 1 lb.; water, 12 oz.; linseed or other suitable oil, 1 lb. 8 oz.; molasses or sugar, from 1 lb. to 1 lb. 8 oz.; calcium chloride or potash, ¾ oz.; powdered resin (if required), 2 oz. The glue is first soaked in the water and then melted, and the linseed oil (warmed to a temperature of about 150° F.) is then very gradually added and thoroughly mixed with the melted glue. The sugar or molasses is then added to the mass kept at a suitable temperature, and the calcium chloride then incorporated. If a very tough composition be required, the resin (dissolved by heat in a little linseed oil) is to be added. The composition may be made non-absorbent of water by dispensing with the calcium chloride and substituting a similar amount of bismuth carbonate.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 22, 1895,

AND EACH BEARING THAT DATE.

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

Acid, apparatus for concentrating sulphuric, E. Dyson ... 548,303
Advertising device, H. Joski ... 548,555
Air brake, Wessels & Lee ... 548,335
Air compressor, J. Stambaugh, Jr ... 548,309
Air compressor, E. Wittmann ... 548,493
Amalgamator, A. C. Rumble ... 548,595
Amalgamator, hydrostatic electric, J. D. McKinnon ... 548,265
Animal trap, M. B. Morris ... 548,578
Antipyrin compound, A. Boeglin ... 548,352
Anvil attachment, W. T. Beck ... 548,423
Axle, railway car, J. A. Mahood ... 548,567
Baker and broiler, portable, R. H. Ashmore ... 548,499
Balance device, scoop, F. W. Taylor ... 548,479
Ballot distributing and registering machine, E. B. Olmsted ... 548,325
Balls, apparatus for moulding golf, W. Hillman ... 548,546
Band cutter and feeder, H. Wappalhorst ... 548,486
Barrel register, automatic, S. C. Wood ... 548,243
Bath. See Shower bath.
Battery. See Dry battery.
Bearing, ball, H. H. Ham ... 548,440
Beers, etc., apparatus for pasteurizing or sterilizing and cooling, P. Puvrez ... 548,392
Belt slide and skirt supporter, L. Sanders ... 548 462
Belt tightener, C. C. Stuart ... 548,404
Bicycle, W. C. Fortney ... 548,187
Bicycle auxiliary seat, C. A. Stokes ... 548,621
Bicycle driving gear, J. Rau ... 548,592
Bicycle lamp bracket, clamp, W. N. Beardsley ... 548,422
Bicycles, adjustable handle bar for, J. Eller ... 548,306
Bicycles, changeable speed gear for, G. G. Powell ... 548,390
Binder, temporary, E. Marble ... 548,615
Binding corn fodder, means for, W. R. Tebow ... 548,237
Bit, F. W. Nelson ... 548,385
Block system, automatic, J. Shoecraft ... 548,469
Bobbin sticks with bobbins, machine for filling, M. & R. F. Halfpenny ... 548,193
Boiler. See Steam boiler.
Boiler attachment, steam, S. J. Geoghegan ... 548,360
Bonding jack, F. T. Walton ... 4,332
Boot or shoe, W. C. Collyer ... 548,427
Boot or shoe uppers, machine for flanging, C. C. Eisenberg ... 548,184
Boring machine, E. W. Harden ... 548,539
Bottle, J. C. Pratt ... 548,457
Bottle, non-refilling, E. Ermann ... 548,307
Bottle stopper, Smith & Sinnickson ... 548,471
Bottle washer, J. Ungvary ... 548,408
Bottles, device for preventing fraudulent refilling of, J. F. Cummings ... 548,428
Bottling table, G. N. Schmidt ... 548,466
Box. See Paper box.
Box strap, E. H. Vogel ... 548,483
Bracket. See Scaffold bracket. Shelf bracket.
Brake. See Air brake. Car brake. Electromagnetic brake. Magnetic brake. Safety and emergency brake. Vehicle brake.
Brick machine, H. C. Barker ... 548,287
Brick press charger, D. W. Cummins ... 548,522
Brush, glue, W. E. Brock ... 548,292
Bubble fountain, soap, S. H. Tacy ... 548,457
Buckle, F. B. Converse ... 548,354
Buckle, H. T. Richmond ... 548,274
Bureau, washstand, and writing desk, combination, J. Ehn ... 548,433
Button and lacing stud, E. Kempshall ... 548,316
Buttonhole moistener, C. Miller ... 548,572
Button making machine, Lippitt & Pope ... 548,564
Buttons, making solid metal, L. A. Bocognano ... 548,351
Cabinet, delivery, Foster & Rison ... 548,534
Cable hanger or clip, W. P. Crockett ... 548,297
Cableway, C. Helman ... 548,441
Calcium carbide process, T. L. Willson (r) ... 11,511
Calculating machine, W. G. Lenker ... 548,563
Calendar, H. C. Fischer ... 548,620
Can. See Milk can. Oil can. Self-sealing can.
Can, H. Schaake ... 548,465
Can heading machine, H. Schaake ... 548,463
Car bolster, W. Case ... 548,294
Car brake, C. B. Oviatt ... 548,219
Car brake, automatic, S. Snell ... 548,474
Car controller, electric street, G. Valley ... 548,599
Car coupling, C. A. Ballreich ... 548,285
Car coupling, G. W. Clayton ... 548,295
Car coupling, J. T. Evans ... 548,248
Car coupling, A. Logendre ... 548,211
Car coupling, B. F. Rider ... 548,275
Car door cleat and fastener, H. Woodruff ... 548,281
Car fender, J. Balmore ... 548,286
Car fender, L. Dulligan ... 548,300
Car fender, street, H. Meyer ... 548,570
Car fender, street, H. Wilson ... 548,339
Car life-guard, street, W. Black ... 548,173
Car replacer, W. A. Selts ... 548,468
Car window, H. V. Herrmann ... 548,544
Cars, automatic device for blocking railway, J. H. Patin et al ... 548,269
Carding machine stripping mechanism, F. A. Flather ... 548,249
Cards, manufacturing playing, S. J. Murray ... 548,216
Carousel, C. E. Norcross ... 548,450
Carpet fastener, W. D. Le Fevre ... 548,444
Carpet fastener, stair, M. T. J. Ochs ... 548,452
Carpet, woven pile, R. B. Loynd ... 548,321
Carrier. See Parcel and cash carrier.
Case. See Match case. Music case.
Casting and handling pig metal, apparatus for, H. R. Geer ... 548,188
Cattle guard, A. G. Dailey ... 548,430
Chain, sprocket, J. Rau ... 548,591
Chair, E. E. Koken ... 548,258
Chalk sharpening machine, J. Guzowski ... 548,252
Cheese knife, Irving & McKay ... 548,315
Cigar lighter, electric, F. W. Schindler-Jenny ... 548,396
Clasp. See Stud retaining clasp.
Clay tempering apparatus, D. W. Cummins ... 548,521
Clippers, mechanism for operating hair, M. G. Gillette ... 548,189
Closet seat and cover, F. G. High ... 548,367
Clothes drier, J. J. Bisel ... 548,507
Clothes pin, W. H. Johnson ... 548,554
Clutch, friction, A. D. Elliott ... 548,528
Cock attachment, gas, F. Kitzler ... 548,370
Coffee roaster, A. F. Teigen ... 548,405
Conduit system, underground, H. C. Burk ... 548,514
Copy holder, Hume & Gresley ... 548,552
Cotton press tramping attachment, T. C. Eberhardt ... 548,304
Coupling. See Car coupling. Pipe coupling. Shaft coupling.
Crusher. See Stone and ore crusher.
Crushing machine, M. G. Bunnell ... 548,178, 548,179
Cultivator standards, means for connecting footpieces to, J. L. Jones ... 548,207
Current regulator, alternating, C. P. Steinmetz ... 548,400
Currents, method of and apparatus for rectifying alternating, J. E. Neher ... 548,217
Curtain fixture, G. H. Groth ... 548,192
Curtain or blind fixture, T. U. Walter ... 548,485
Curtain ring, Bennett & Furlong ... 548,244
Cutter. See Band cutter. Pipe thread cutter. Thimble thread cutter. Vine cutter.
Cyclometer, C. H. Veeder ... 548,482
Decorative films, roll for holding and applying, W. H. Coe (r) ... 11,510
Dental mallet, M. L. Bosworth ... 548,602
Dental mallet, automatic, H. M. Fry ... 548,359
Derrick, O. M. Loveridge ... 548,375
Desk companion, Y. T. Brown ... 548,247
Detector bar clip and link, Miller & Stiles ... 4,323
Differential mechanism, A. Blauvelt ... 548,349, 548,350
Dike, cantalever, W. Flynn ... 548,251
Disinfecting apparatus, C. Herscher ... 548,545
Display cover for barrels, L. C. Hubbard ... 548,199
Doubletree, O. McDermott ... 548,382
Dredger discharge pipe, L. W. Bates ... 548,503
Dredging machine, Wood & Alexander ... 548,242
Drier. See Clothes drier.
Drying and evaporating apparatus, Moller & Pfeifer ... 548,573
Dry battery, F. M. Archer ... 548,415
Dry or earth closet, H. A. Hecox ... 548,543
Drill. See Rock drill. Rock core drill.
Drill, R. Huffman ... 548,551
Duplicating articles, machine for, E. R. Darling ... 548,298
Dust collector, Week & Ideson ... 548,490
Dye and making same, brown, C. Ris ... 548,460
Dye and making same, nitrosonaphthol, Ashworth & Burger ... 548,346
Dye, brown, Ashworth & Burger ... 548,344, 548,345, 548,416
Electric currents to obtain constant effective intensity or voltage, converting or transforming periodic, P. Boucherot ... 548,511
Electric desk light, W. R. Kinsman ... 548,369
Electric light condenser and accumulator, phosphorescent, D. M. Moore ... 548,575
Electric lighting by interruptions, phosphorescent, D. M. Moore ... 548,576
Electric machine, dynamo, E. Thomson ... 548,406
Electric meter, W. H. Scott ... 548,467
Electric motor, I. E. Storey ... 548,401, 548,402
Electric motor controller, McLane & McClintock ... 548,448
Electric motors, regulating, W. B. Potter ... 548,388
Electric snap switch, J. H. McEvoy ... 548,583
Electric switch, J. L. Black ... 548,601
Electric transformers, automatic switch for, A. G. New et al ... 548,266
Electromagnetic brake, J. L. Black ... 548,509, 548,510
Electromechanical lock, W. W. Alexander ... 548,282
Elevator. See Water elevator.
Engine. See Steam engine. Traction engine.
Engine reversing gear, H. L. Wilson ... 548,340
Engines, electric stop motion for, L. St. Peter ... 548,589
Envelope, J. F. Forsyth ... 548,532
Envelope, C. M. Foster ... 548,250
Envelopes, bags, etc., apparatus for fastening, F. C. Lynde ... 548,565
Extension table, C. W. Munz ... 548,447
Eyelet, E. Kempshall ... 548,558
Eyelet tie, shoestring or corset string, E. A. Jordan ... 548,208
Fare register, L. Ehrlich et al ... 548,434
Feedwater regulator and alarm, automatic, J. M. Williams ... 548,240
Felting machine, V. Coq ... 548,183
Fence, J. S. Orr ... 548,267
Fence joint, iron, J. T. Ward ... 548,333
Fence tightener, slack wire, J. Bauer ... 548,420
Fertilizer from night soil, apparatus for making, E. Lamb ... 548,561
Filter, A. Bodesch ... 548,245
Filter, water, J. Mulligan ... 548,381
Filtering apparatus, J. B. C. Krohnke ... 548,209
Filtering apparatus, F. K. Way ... 548,487
Filtering attachment for water faucets, W. A. Williams ... 54,338
Firearm, magazine, W. W. Wetmore ... 548,410
Flour, Bergtold & Van Denbergh ... 548,424
Flower pot attachment, O. C. Bjelland ... 548,508
Flushing device, G. J. Kremelberg ... 548,590
Footwear, rubber soled, C. L. Higgins ... 548,195
Fountain. See Bubble fountain.
Furnace. See Garbage furnace. Smoke preventing furnace. Welding furnace.
Furnaces, bell for blast, Berger & Thompson ... 548,505
Furniture, adjustable support for school, A. Andren ... 548,498
Gage. See Lens gage.
Galvanizing and tempering tank, C. A. Emanuelson ... 548,529
Game device, musical, A. T. Hays ... 548,312
Garbage furnace, W. Horsfall ... 548,254
Garbage, treating, J. Wodiska ... 548,342
Gardening and field implement, convertible, G. W. Biddell ... 548,348
Garment supporter loop, E. S. Smith ... 548,234, 548,235
Gas, means for automatically separating liquids from natural, M. G. Reynolds ... 548,458
Gas meter apparatus, coin-freed, F. Wright ... 548,494
Gas vending machine, coin-controlled, W. Weber ... 548,334
Gate, H. P. Talbot ... 548,478
Gear, driving, F. Hayes ... 548,311
Generator. See Steam generator. Vapor fuel generator.
Glass and manufacturing same, wire, Croskey & Locke ... 548,520
Glass blowing machine, W. S. Bellows ... 548,600
Glass blowing machine, W. H. Chapin ... 548,605
Glass blowing machine, M. J. Owens ... 548,587, 548,588
Glass tombstones, apparatus for making, J. H. Dittmann ... 548,525
Glove, F. Heafield ... 548,541
Glove holder, J. C. Grout ... 548,362
Gold concentrating machine, Sill & Wright ... 548,253
Grain meter, Huber & Miller ... 548,550
Grain or milling products, sorting and cleaning machine for, A. Schnetzer ... 548,328
Grindstone dressing and pecking machine, H. B. Robischung ... 548,272
Hame, W. Irvine ... 548,368
Harmonica, mouth, M. Messner ... 548,214
Harness, appliance for suspending drop, A. Ripley ... 548,459
Hatch door, Coe & McBride ... 548,606
Hay loader, A. Westman ... 548,491
Hay rake and loader, W. H. Kadel ... 548,257
Hay rake attachment, Rehart & Bernard ... 548,594
Heater. See Steam heater.
Heating apparatus, N. E. Frost ... 548,436
Hedge, plashed, D. W. Aylworth ... 548,500
Heel compressing machine, Glidden & Heys ... 548,438
Hinges to box lids, machine for applying, W. S. Ivins ... 548,204
Hook. See Lacing hook.
Hoop driver and fastener, Marsh & Hight ... 548,213
Horseice creeper, G. F. Brintnall ... 548,353
Hydraulic systems, automatic pressure controlling mechanism for, J. H. Hubbell ... 548,549
Ice house, M. B. Eaton ... 548,356
Igniting device, W. White ... 548,492
Inductance coils, method of and means for temperature adjustment for, O. B. Shallenberger ... 548,230
Injector, oil feed, H. R. Frisbie ... 548,609
Jack. See Bonding jack. Lifting jack. Smoke jack.
Joint. See Fence joint. Rail joint. Wheel rim joint.
Kiln. See Lumber drying kiln.
Kitchen cabinet, J. Fishero ... 548,531
Knife. See Cheese knife.
Knitting machine, W. R. Johns ... 548,205
Knitting machine, circular, W. R. Johns ... 548,206
Lacing hook, M. N. Bray ... 548,512
Lamp, W. M. Hoerle ... 548,314
Lamp, electric arc, T. E. Adams ... 548,413, 548,414
Lamp globe cleaner, C. H. Green ... 548,537
Lamp, phosphorescent electric, D. M. Moore ... 548,574
Lamp shade, J. Lemay ... 548,373
Lathe, barrel, H. S. Hopper ... 548,548
Lawn sprinkler, traveling, J. B. Fellows ... 548,358
Lead, making white, J. S. MacArthur ... 548,566
Lens gage, J. T. Brayton ... 548,290
Lifting jack, F. I. Joyce ... 548,443
Linotype machine, P. T. Dodge ... 548,432
Lock. See Electromechanical lock. Mail bag lock
Lock, R. R. Ball ... 548,418
Locomotive, electric, W. H. Knight ... 548,371
Loom warp beam, G. F. Hutchins ... 548,442
Lubricant, making a, T. J. Lovett ... 548,376
Lumber drying kiln, H. J. Morton ... 548,445
Magnetic brake, O. S. Walker ... 548,331
Magnetic separator, J. D. McKinnon ... 548,383
Mail bag lock, G. Koch ... 548,318
Mail crane, delivering and receiving, A. P. Hauss ... 548,364
Mail pouch, catch, A. P. Hauss ... 548,363
Match case, H. J. Koster ... 548,553
Measuring and registering liquids drawn from receptacles, apparatus for, W. A. G. Schonbeyder ... 548,276
Measuring curvature of lenses, instrument for, J. T. Brayton ... 548,291
Metal polishing compound, E. M. Harris ... 548,310
Meter. See Electric meter. Grain meter. Water meter.
Metering apparatus, electric, W. S. Barstow ... 548,419
Mica, method of and apparatus for purifying and pulverizing, T. J. Lovett ... 548,377
Milk can, condensed, C. A. Smith ... 548,472
Motor. See Electric motor. Pressure motor.
Music case, T. Ray ... 548,393
Musical instrument string peg device, A. Streicher ... 548,475
Mustache trainer, F. E. Paden ... 548,387
Nailing machine, combined single and duplex, G. A. Ambler ... 548,343
Nut lock, J. F. Humphrey ... 548,612
Nut lock, J. Kaldrider ... 548,556
Nut making machine, S. Vanstone ... 548,617
Oar and oar lock, J. Forbes ... 548,186
Oil can and lamp filler, combined, Atkinson & Miller ... 548,284
Oils, purification of mineral, W. B. Price ... 548,391
Oiling can, illuminated, J. D. Porter ... 548,616
Orange or fruit washer, J. C. Wilson ... 548,341
Ore separator, magnetic, C. G. Buchanan ... 548,176
Oxidizing protosalts of iron to persalts, N. McCulloch ... 548,580
Packing for builders' use, sound-deadening and incombustible, S. Cabot ... 548,515
Padlock, indicator, L. F. Curtis ... 548,523
Pantaloons attachment, J. A. Gendron ... 548,308
Pantograph, Russell & Shilling ... 548,327
Paper box, E. E. Pinkerton ... 548,456
Paper folding machine, C. Erling ... 548,608
Paper holder, toilet, J. Lucas ... 48,260
Paper weight and calendar, combined, R. F. Robinson ... 548,461
Parcel and cash carrier, Merriam & Scott ... 548,261
Penholder, T. Lehmbeck ... 548,259
Phase adjustment, O. B. Shallenberger ... 548,231
Pin. See Clothes pin.
Pipe. See Tobacco pipe.
Pipe coupling, J. P. Dwyer ... 548,302
Pipe coupling, W. S. Haines ... 548,610
Pipe thread cutter, J. C. Cavanaugh ... 548,180
Pipe wrench, G. H. Miller ... 548,571
Planes, shavings guide for carpenters', L. B. McDonald ... 548,582
Planter, potato, F. Gaunt ... 548,437
Planter, pumpkin seed, G. E. Wilson ... 548,241
Pleasure lake and slide course and conveyer therefor, C. A. Idler ... 548,256
Plow, W. S. Chase ... 548,181
Plow, Sinclair & Sellers ... 548,277
Plow, disk, S. D. Poole ... 548,590
Plow, gang, O. T. Owens ... 548,386
Plow stock, R. L. Nelson ... 548,449
Pneumatic apparatus for turning air tubes, F. W. Morgan ... 548,264
Pressure motor, fluid, W. A. Bole ... 548,246
Printer's galley rack, H. B. Rouse ... 548,273
Printing guide, band, L. K. Scotford ... 548,226
Printing machine, Eddy & North ... 548,357
Printing playing cards, S. J. Murray ... 548,579
Printing press, E. H. Wilcomb ... 548,411
Puller. See Stump puller.
Pump, steam, J. W. Templin ... 548,480
Pump vent controlling device, E. W. Monroe ... 548,262
Punch, C. Hood ... 548,547
Quillers, stop motion for ribbon, W. H. Sharp ... 548,232
Racking or transferring carbonized liquids, apparatus for, C. Barus ... 548,502
Rail joint, F. W. Weber ... 548,238
Railway, combined electric and cable, Beach & Kern ... 548,504
Railway safety device, B. C. Rowell ... 548,224
Railway signaling, J. P. Coleman ... 548,426
Railway switch closer, automatic, A. Keiser ... 548,557
Railway, three-wire electric, W. B. Potter ... 548,389
Railway train safety stop, B. C. Rowell ... 548,223
Railways, electric block signaling instrument for, A. C. Fraser ... 548,435
Railways, metallic roadbed construction for, C. J. Griffith ... 548,439
Railways, underground conduit for electric, R. Uren ... 548,481
Rake and hay loading machine, combined, Rehart & Bernard ... 548,593
Rake. See Hay rake.
Recorder. See Time recorder.
Refractometers, double prism for totally reflecting, E. Abbe ... 548,495
Register. See Barrel register. Fare register.
Regulator. See Current regulator. Feedwater regulator. Thermostatic regulator.
Ring. See Curtain ring.
Road machine, H. Poucher ... 548,271
Roaster. See Coffee roaster.
Rock core drill, Duggan & Bullock ... 548,607
Rock drill, H. B. McCabe ... 548,324
Rule, key seat, F. Stemmerich ... 548,329
Saddle pad, A. H. Larkin ... 548,372
Safe, fireproof, M. Mosler ... 548,446
Safety and emergency brake, F. McDermott ... 548,581
Sash bearing, window, J. M. Oliver ... 548,218
Saw frame, F. W. Otis ... 548,453
Saw set, A. Holecek ... 548,197
Sawstretching machine, E. B. Rich ... 548,394
Scaffold bracket, C. E. Heeter ... 548,315
Scale, weighing, A. R. Beal ... 548,421
Scows, launching table for dumping, S. Webber ... 548,489
Scraper for unloading cars, etc., G. T. Dixon ... 548,527
Screen. See Window screen.
Seal, D. J. Arnold ... 548,170
Seal, car, A. G. Malmstrom ... 548,568
Self-sealing can, W. Dunn ... 548,301
Separator. See Magnetic separator. Ore separator.
Sewing machine lap seam attachment, C. F. Lord ... 548,212
Shaft coupling, W. Griscom ... 548,191
Shafts, fastening device for securing heads to, N. W. Condict ... 548,182
Shank stiffener machine, N. C. Ruberg ... 548,225
Sharpener for rotary plows, G. W. Hoyman ... 548,198
Shelf bracket, T. Corscaden ... 548,296
Shoe, J. P. Nealon ... 548,384
Shower bath, portable, O. F. Grant ... 548,190
Shutter fastener, C. Barbarow ... 548,501
Signal box, non-interference, W. H. Kirnan ... 548,317
Siphon, Montgomery & Ramond ... 548,215
Skirt, F. A. Johnson ... 548,613
Slat and wire fabric, machine for making, E. Berninghaus ... 548,506
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Smoke preventing furnace, W. S. Hazelton ... 548,253
Soap holder, C. S. Stevenson ... 548,236
Sodium carbonate, apparatus for making, J. A. Bradburn ... 548,174
Soldering apparatus, gun, H. Schnake ... 548,464
Sole cutting machine, A. N. Miller ... 548,379
Spacer or spacing gage, J. H. Foster ... 548,533
Spinning or twisting machine spindles, ball bearing for, E. Maertens ... 548,378
Spring. See Windmill spring.
Sprinkler. See Lawn sprinkler.
Staple machine, G. H. Ryan ... 548,596
Steam boiler, J. Pierpoint ... 548,455
Steam engine, A. K. Mansfield ... 548,322
Steam generator, multitubular, Normand & Sigaudy ... 548,451
Steam heater, W. H. Curtis ... 548,429
Steep tank, W. H. Prinz ... 548,618
Steering apparatus, J. Bonner ... 548,289
Stereotype plates, manufacture of, V. Lowendahl ... 548,320
Stitch separating and indenting machine, J. B. Hadaway ... 548,309
Stone and ore crusher, M. G. Bunnell ... 548,177
Stop mechanism, electric, Wood & Miller ... 548,280
Stopper. See Bottle stopper.
Stove, oil, H. P. Wilder ... 548,337
Street sweeper, C. Hvass ... 548,200 to 548,202
Stud retaining clasp, H. Wild ... 548,336
Stump puller, W. M. Todd ... 548,278
Swaging machine, W. H. Dayton ... 548,431
Switch. See Electric switch. Electric snap switch.
Switch stand, N. O. Goldsmith ... 548,535
Switch stand and lock, B. S. Robertson ... 548,222
Table. See Bottling table. Extension table.
Tableaux vivants, apparatus for exhibiting, E. Von Kilanyi ... 548,279
Tank. See Steep tank.
Telephone exchange apparatus, C. E. Scribner ... 548,227
Telephone receiver support, L. J. Kusel ... 548,210
Telephone switchboard apparatus, C. E. Scribner ... 548,228
Telephone switchboards, keyboard apparatus for, C. E. Scribner ... 548,229
Tent, S. F. B. Biddle ... 548,425
Testing machine diagram attachment, T. Gray ... 548,361
Thermostat, H. A. Tobey ... 548,330
Thermostatic regulator, H. A. Tobey ... 548,407
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Valve gear, locomotive, F. M. Stevens ... 548,597
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Valve, steam, J. Casey ... 548,518
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Vehicle brake, E. Hecht et al ... 548,542
Vehicle draught attachment, T. S. Bailey ... 548,417
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Veterinary mouth speculum, W. L. Vetter ... 548,409
Vine cutter, H. J. Evans ... 548,530
Voting machine, T. D. Stroup ... 548,403
Wagon body, W. O. Shadbolt ... 548,397
Washer. See Bottle stopper washer. Orange or fruit washer.
Washing machine, R. P. Brooks ... 548,293
Washing machine and concentrator, dry, Dickinson & Graves ... 548,299
Watch balance spring, M. Anzelewitz ... 548,169
Water closet, R. D. Rogers, Jr ... 548,395
Water closet, F. A. Wells ... 548,239
Water closet flushing apparatus, J. G. Beattie ... 548,288
Water elevator, W. Hilton ... 548,196
Water meter, L. H. Nash ... 548,585, 548,586
Water meter, disk, L. H. Nash ... 548,584
Welding furnace, O. A. Ames ... 548,496
Well boring and drilling mechanism, W. L. Hardcastle ... 548,538
Welt beating and shoe trimming machine, C. Dancel ... 548,524
Wheat, etc., machine for cleaning or polishing, A. H. Beasley ... 548,347
Wheel rim joint, vehicle, L. Rastetter ... 548,221
Whiffletree, S. T. Moffitt ... 548,380
Whist apparatus, duplicate, H. H. Everard ... 548,185
Whist tray, duplicate, A. H. Howard ... 548,255
Windmill, J. E. Atwood ... 548,171
Windmill spring, O. H. Wallen ... 548,484
Window screen, H. A. Way ... 548,488
Window stile pockets, machine for cutting, F. V. Phillips ... 548,454
Wire bending device, C. C. Morgan ... 548,263
Wire device, V. Lassen ... 548,614
Wire stretcher, W. S. Brown ... 548,603
Woodworking machine, combination, L. F. Parks ... 548,220
Woodworking machinery, Calloch & Delcroix ... 548,517
Wrench. See Pipe wrench.
Wrench, J. W. Cushman ... 548,355
Yoke center, neck, S. Pearson ... 548,326

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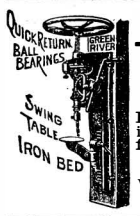

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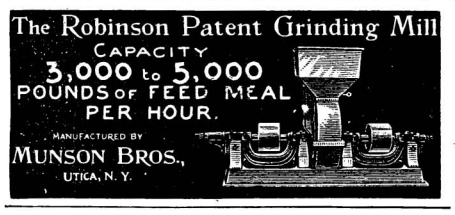

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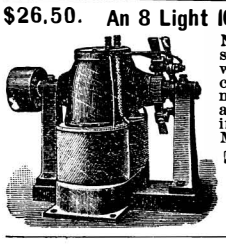

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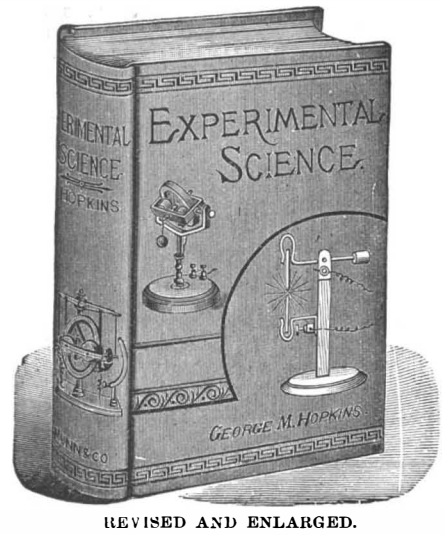

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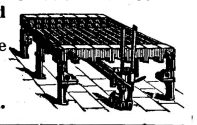

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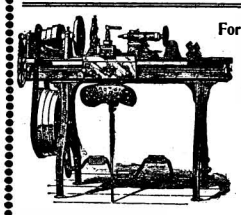

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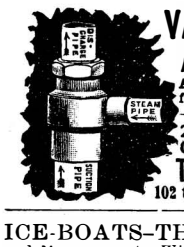

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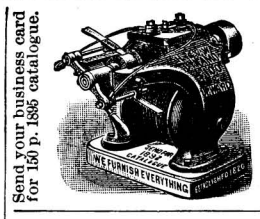

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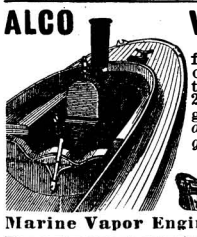

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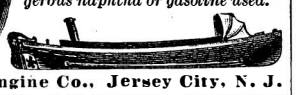

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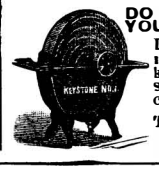

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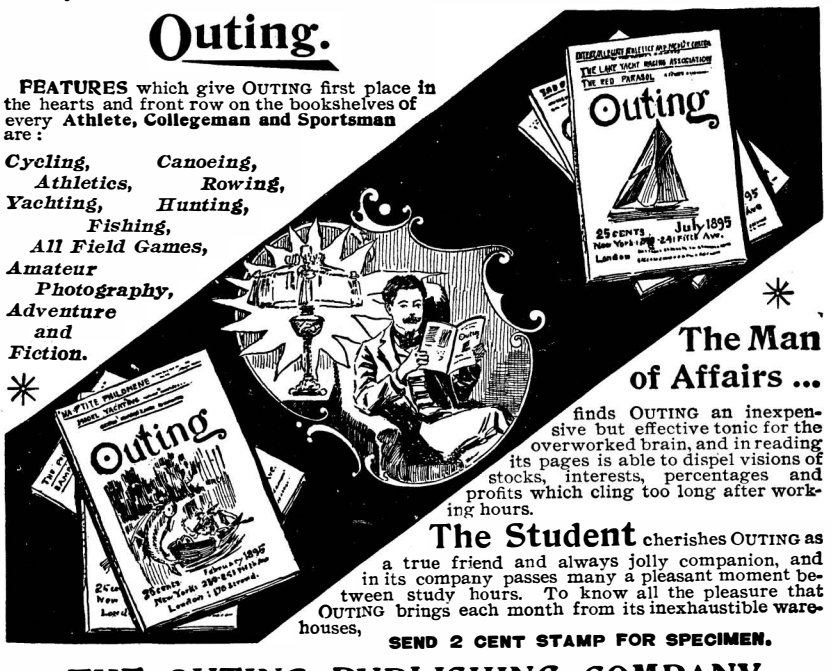

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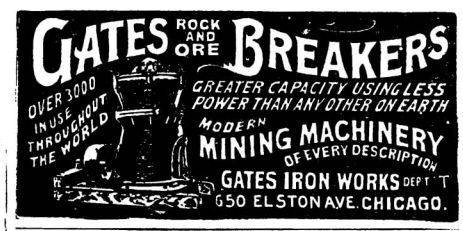

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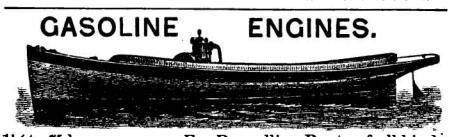

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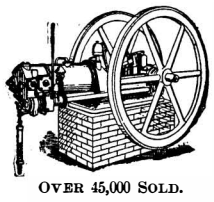

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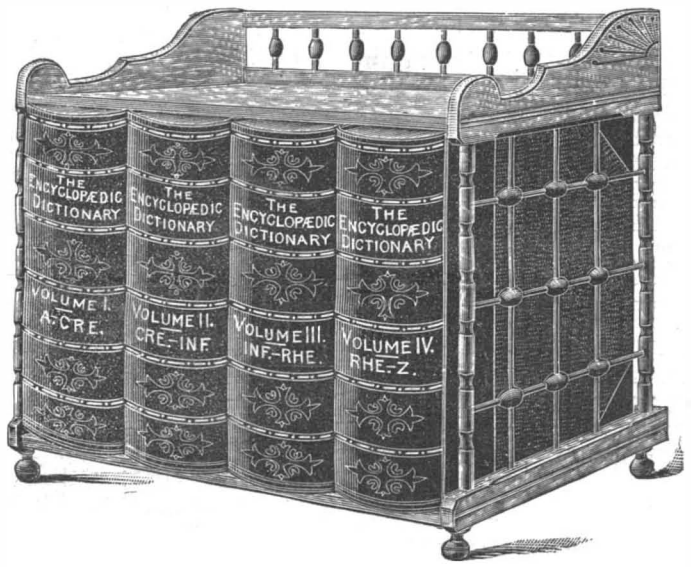

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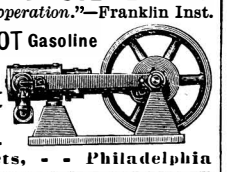

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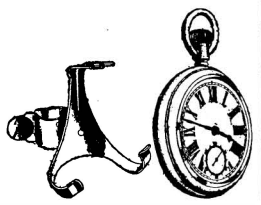

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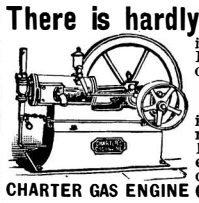

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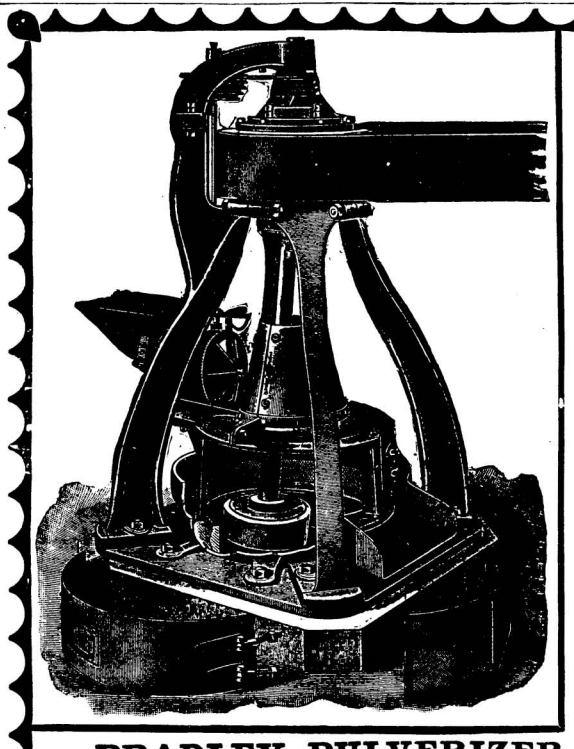

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