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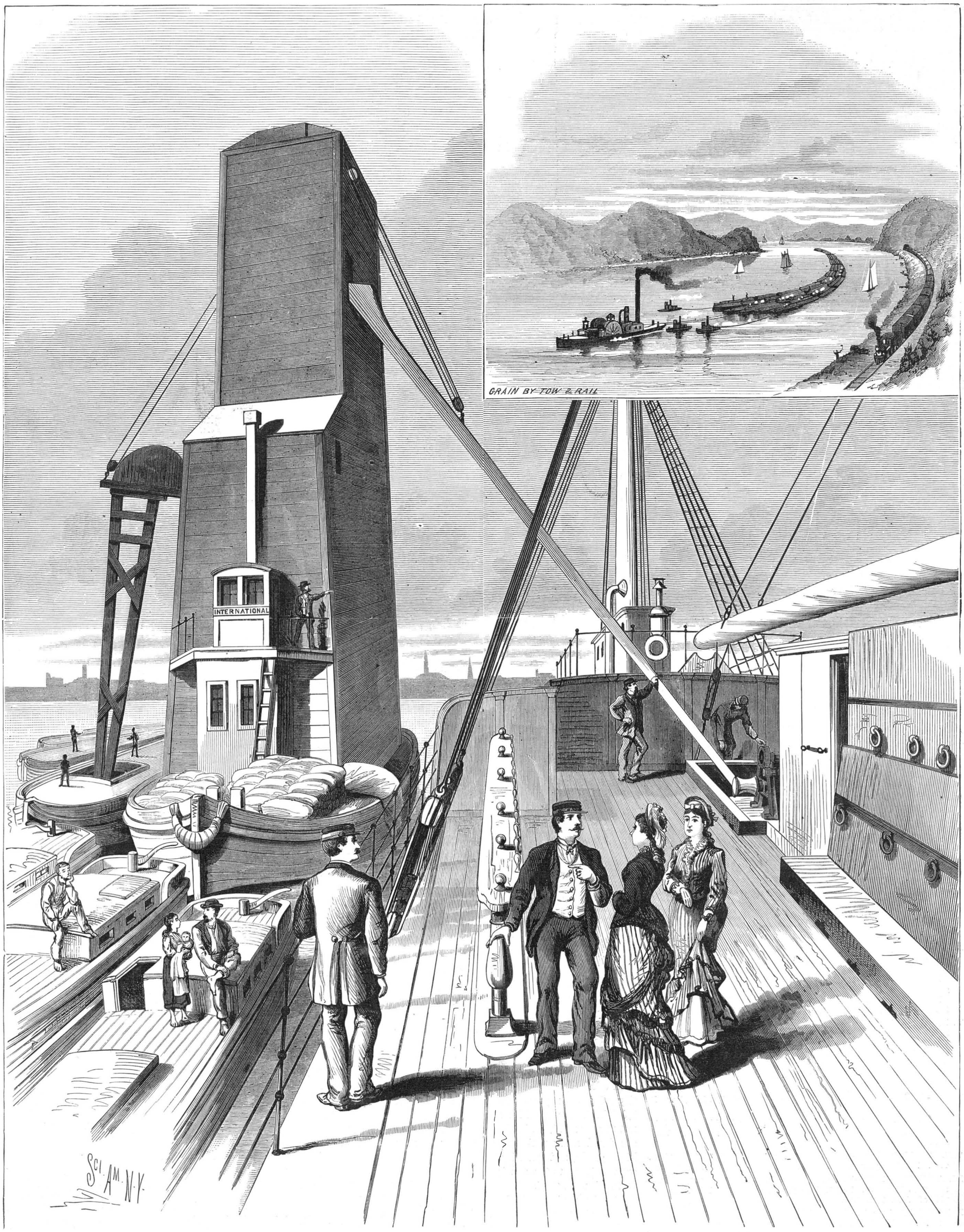

TRANSFER OF GRAIN BY ELEVATORS TO OCEAN STEAMERS NEW YORK HARBOR.—[See page 208.]

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 4, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 196,

For the Week ending October 4, 1879.

Price 10 cents. For sale by all newsdealers.

THE GRAIN TRADE OF NEW YORK.

One cannot cross either of our river ferries, still less circumnavigate the city or take a few hours' sail up the Hudson, without being amazed at the movement of breadstuffs visible on all sides. On the Hudson River Railroad, and all the other iron thoroughfares converging upon this city, long trains of grain cars are almost constantly in sight, while on the river vast rafts of grain laden canal boats more than rival the railway trains in carrying capacity. It is no uncommon thing for one of the large towing steamers to bring down the river fifty, sixty, or more canal boats, each carrying from eight to fourteen thousand bushels of wheat, corn, or other grain. In single file, one of these vast tows would make a continuous line of canal boats more than a mile in length; while an equivalent tonnage in cars would require twenty-five or thirty 40-car trains, or from six to seven miles of cars, according to the nature of the grain.

Not unfrequently four or five ocean steamers, and a fleet of other shipping, may be seen about the great railroad elevators at 65th street, receiving cargoes of grain and cattle. At each of the piers of the numerous European steamship lines, floating elevators are busy transferring grain from canal boats; others are at work in midstream alongside ocean steamers and sailing ships at anchor; and at the extensive warehouses along the shores, permanent or floating elevators are similarly engaged in the rapid handling of the staff of life, brought to their doors either in canal boats and barges, or in cars floated, on boats made for the purpose, from the piers of the Erie and other railways.

The magnitude of this grain trade of New York may be judged from a few statistics. During the week ending September 6, the receipts at this port were: Flour, 112,124 barrels; wheat, 2,271,492 bushels; corn, 1,327,014 bushels; oats, 279,355 bushels; rye, 139,886 bushels; barley, 1,100 bushels—about as much as was received at all the other seaboard ports together. During the same week the exports of breadstuffs from New York included 113,224 barrels of flour, 2,519,409 bushels of wheat, 914,623 bushels of corn, 2,996 bushels of oats, 103,701 bushels of rye. At the last date named, September 6, the amount of grain in our city granaries and afloat in our harbor embraced in round numbers, 3,750,100 bushels of wheat, 3,100,000 bushels of corn, 810,000 bushels of oats, 160,000 bushels of rye, and 26,000 bushels of barley. The grain of all sorts in store at New York was 6,332,035 bushels. The storage capacity of the port is about 12,000,000 bushels, but the present active demand for grain for foreign shipment, due to the general deficiency of European crops, prevents any large accumulation here. Indeed, the bulk of shipping devoted to the transportation of grain from this to foreign ports is at this season something unprecedented in the history of the world. During the week ending September 10 (six days), the clearances of flour and grain for Europe alone embraced eighty-five vessels (45 barks, 30 steamships, 4 ships, 5 brigs, 1 schooner), carrying a grand total of 78,112 barrels of flour, 1,942,248 bushels of wheat, and 1,249,092 bushels of corn. The promise for the current week is still greater.

During the year 1878 the receipts of grain alone at this port were, by canal; 63,663,049 bushels; by vessels coastwise, 1,090,236 bushels; by rail, 63,960,486 bushels—a total of 128,613,771 bushels. Changing flour and meal to their equivalents in bushels, the receipts of grain, flour, and meal were, during the year, 152,862,170 bushels. During the same period the export of cereals from New York amounted to 107,819,044 bushels, the exports from all the other Atlantic ports together (including Montreal) being 104,678,187 bushels—evidence enough that our city still holds the lion's share of this trade. To describe in detail the manner in which the grain trade is conducted here would require a volume. A rough outline of it will have to answer.

As already indicated, the vast stream of life-sustaining wealth flows to us through channels of two distinct sorts—by water and by rail. The inflow coastwise is too small, relatively speaking, to demand especial notice. The Erie canal, with the Hudson river on one side and the railways on the other—chiefly the New York Central and Hudson River Railroad, the Erie road and the Pennsylvania Central—divide the traffic about equally. And the grain received by each route has, speaking generally, its particular treatment. That which comes by rail is graded according to rules agreed upon by the New York Produce Exchange, and is sold by grade, the identity of the grain being lost. The grain received by water, on the contrary, is chiefly handled without grading, the identity of lots being preserved. In the latter case the consignee receives the identical grain shipped to him, say from Buffalo or any point farther West; in the former, he receives not the grain billed to him, but a certificate for so many bushels of wheat, corn, or other grain of a specified grade, his particular shipment being, for economy in warehousing and handling, mixed with other receipts of the corresponding kind and grade after it has been officially inspected, graded, and weighed. The quantity of grain represented by each certificate is limited to 8,000 bushels, except for oats, for which the certificates are not to exceed 10,000 bushels each. These certificates, which are dated and numbered consecutively, state in detail the kind, grade, and quantity of grain represented by them, and are furnished to the consignee before noon of the same day, at which time the business of the Produce Exchange begins. On the floor of the Exchange all ungraded grain is sold by sample, the various samples being exhibited on their proper tables, in small paper boxes duly labeled, the amount of the lot, and the place where it is stored or afloat, being fully set down. The graded grain is represented by type samples, so that dealers can see exactly what their certificates call for. A buyer purchases for exportation from various sellers, say, 100,000 bushels of No. 1 white winter wheat, or any other of the dozen different grades of winter wheat. He handles no grain, but receives instead certificates representing that amount of grain of the specified kind. On the presentation of such certificates to the railway company or companies issuing them, freight and accrued charges being paid, the companies deliver the grain out of their general stock of that grade, at such point in the harbor as may be designated.

A vast amount of loading is done at the elevators at 65th street and North River. A larger amount is transferred by floating elevators, which draw up alongside the great steamers as they lie in their accustomed slips, receiving or discharging their freight. Our illustration gives a general view of an elevator of this sort, of which a fleet of twenty or more are constantly employed in our harbor. There are besides numerous stationary elevators belonging to large grain dealing firms, at the lower end of New York island and along the Brooklyn shore; and the Erie Railroad Company are building at the Jersey City terminus of that road an elevator which promises to more than rival those of the New York Central.

The speed at which grain is transferred at these elevators is amazing to one not familiar with their management. A shaft inclosing an endless chain of buckets is thrust into a laden car or canal boat, and instantly the grain begins to travel up the long incline to be delivered on the opposite side at a rate often exceeding fifty bushels of wheat a minute, or a larger quantity of lighter grain.

The report of the Produce Exchange for 1878 shows the authorized charges for handling grain at this port to be, per bushel: weighing, ½ cent; elevating from canal boats, ½ cent; for delivering on board single deck ocean vessels, including trimming, $7 a thousand bushels; ditto, double-decked ocean vessels, $8; on ocean vessels in bags, $6.25; on coastwise vessels, $2.50. The expenses on grain to shippers by rail from the interior are: for inspection, 25 cents a car; elevation, ½ cent a bushel; half weighing, ¼ cent a bushel; storage, ¼ cent a bushel. At the New York Central elevator the charge for bulking grain with storage (10 days) is ¼ cent a bushel. The Erie and the Pennsylvania Central Companies charge, for holding grain on storage in lighters, ¼ cent a bushel for each ten days. The charge for delivering afloat ungraded grain in railroad lighters, including elevation from boats, ranges from 3 cents to 1½ cents a bushel, according to the bulk of the lots handled. The authorized charge for towing laden canal boats about the harbor ranges from $5 to $11, according to distance. The freight tariff from the great grain distributing point of the West, Chicago, varies with the season, the style of carriage, the degree of competition between the railways, or between water and rail carriage. In the winter, when the lakes, the Erie canal, and the Hudson River are closed, the rate rises as high as 25 cents a bushel. On the opening of the water routes the rates fall, dropping at midsummer as low as 8 or 9 cents by rail and 6 cents by water. The average rate by water during 1878 was 7¼ cents; by all rail routes, 12 cents. As an important link in the water route, the Erie canal is of infinite importance. The existing railways alone would be incompetent to do the carrying required at the time required (assuming the foreign demand unimpaired); besides, by having the monopoly, their rates would not only be made higher than now obtains, but possibly so high as either to destroy the possibility of our competing in price with Russian wheat in Liverpool, or to make competition possible only at the sacrifice of all profit to our wheat growers. It is worth noting in this connection that during the present year the average cost of transporting wheat from Northern Minnesota to New York—26 cents a bushel—is less than was the cost of the carriage of wheat by lake and canal from Chicago twelve years ago.

FORMER EXTENSION NORTHWARD OF SOUTH AMERICA.

In his report to the Superintendent of the Coast Survey, describing the past winter's dredging operations of the Coast Survey steamer Blake, Professor A. Agassiz shows that the soundings taken, together with those previously known, make it possible to trace with tolerable accuracy the outline of the land masses which anciently united the West India Islands with the continents. After describing the geography of the 100-fathom line, Prof. Agassiz says that, on examining the 500-fathom line, Jamaica is found to be the northern spit of a gigantic promontory which once extended toward Hayti from the mainland, reaching from Costa Rica to the northern part of the Mosquito coast, and leaving but a comparatively narrow passage between it and the 500-fathom line encircling Hayti, Porto Rico, and the Virgin Islands, in one gigantic island. The passage between Cuba and Jamaica has a depth of 3,000 fathoms, and that between Hayti and Cuba is not less than 873 fathoms, the latter being probably an arm of the Atlantic.

The 500-fathom line connects, as a gigantic island, the banks uniting Anguilla to St. Bartholomew, Saba Bank, the one connecting St. Eustatius to Nevis, Barbuda to Antigua, and from thence extends south so as to include Guadeloupe, Marie-Galante, and Dominica. This 500-fathom line thus forms one gigantic island of the northern islands, extending from Saba Bank to Santa Cruz, and leaving but a narrow channel between it and the eastern end of the 500-fathom line running round Santa Cruz. As Santa Cruz is separated from St. Thomas by a channel of 40 miles, with a maximum depth of over 2,400 fathoms, this plainly shows its connection with the northern islands of the Caribbean group, rather than with St. Thomas, as is also well shown by the geographical relations of its mollusca. The 500-fathom line again unites, in one gigantic spit extending northerly from the mouth of the Orinoco, all the islands to the south of Martinique, leaving Barbadoes to the east, and a narrow passage between Martinique and the islands of Dominica and St. Lucia. At the time of this connection, therefore, the Caribbean Sea connected with the Atlantic only by a narrow passage of a few miles in width between St. Lucia and Martinique, and one somewhat wider and slightly deeper between Martinique and Dominica, another between Sombrero and the Virgin Islands, and a comparatively narrow passage between Jamaica and Hayti. The Caribbean Sea, therefore, must have been a gulf of the Pacific, or have connected with it through wide passages, of which we find the traces in the tertiary and cretaceous deposits of the Isthmus of Darien, of Panama, and of Nicaragua. Central America and northern South America at that time must have been a series of large islands with passages between them from the Pacific into the Caribbean.

These results furnish an intelligible and at the same time trustworthy explanation of the peculiar geographical distribution of the fauna and flora of the West Indies. Instead of showing, as might naturally be assumed from their proximity to Florida, an affinity in their fauna and flora with that of the United States, the island of Cuba, the Bahamas, Hayti, and Porto Rico show unmistakable association with that of Mexico, Honduras, and Central America, while the Caribbean Islands show in part the same relationship, though the affinity to the Venezuelan and Brazilian flora is much more marked. The former geographical connections thus indicated are made certain by the Blake soundings.

THE FUTURE OF ORGANIC CHEMISTRY.

Berthelot has estimated the possible number of compounds of acids with alcohols at 1,400,000,000,000,000. With such a future before them ambitious young chemists need not despair of finding new compounds for centuries to come. The number of new bodies prepared annually will probably not exceed 1,000, but each year will see these numbers grow. Of all these new products less than 5 per cent have any so-called practical—*i. e.*, commercial—value. A majority, in fact, are never seen again outside of the laboratory where they are discovered, are never heard of after the first description has gone the rounds of the chemical journals, and been finally registered in the big year book, or Jahresbericht, into which are annually posted abstracts of all the minor entries that have been made in the various daybooks and blotters throughout the world. Yet each little discovery, insignificant though it may appear, every new body, useless as it may seem, is valuable. They are the bricks and stones from which a grand and imposing edifice is to be built, and while they may be allowed to lie for years in the rubbish heap, they will one day be sought out to fill their destined place in the structure. It is one man's place to provide the material, another to arrange them in position. As yet the outlines of the building are scarcely discernible; here a tower and there a pinnacle, then an ugly gap. In one place an imperfect foundation is settling and threatening ruin to the stories above; portions of it will need rebuilding; new corner stones are needed here and there; the glittering pinnacles have been misplaced, an overhanging turret threatens the passer-by. Future architects will change the plans, attempt new designs, but complete success is possible only after all the material is on the ground. Let no investigator feel that his little contribution is of no value; it may yet occupy a far more important position than those which for the present serve as capstones and cornice.

Aside from the theoretical value which attaches to these soon-to-be-forgotten compounds, it is worth while to prepare them and to study their properties carefully; it is impossible to prophesy what technical value they may possess or to what they may lead.

The question is often asked, Shall we ever be able to make the valuable alkaloids, particularly quinine? It is too soon to answer this question. A few years ago the synthese of coniine was announced, but it proved to be an isomeric body, a paraconiine. The next trial may give the real article, and then other alkaloids may follow. The recent success of an American in Paris, who prepared the glucosides synthetically, marks an important epoch in synthetical chemistry. The synthesis of cane sugar will probably follow, and who can say where this will lead to? Since the day when Woehler first made artificial urea, many useful forms of synthesis have been devised. Of these the most important commercially was the manufacture of artificial alizarine. Agriculture as well as technical industry was affected by it. Kolbe's synthesis of salicylic acid has proved a boon to suffering humanity. Tiemann's synthesis of vanilline, although much talked of, was necessarily of less importance from the relative small consumption of this flavor. Bäyer's recent synthesis of indigo is of no importance to the dyer at present, because his method is too circuitous and expensive, but it is no less the great achievement of a master mind. Another may modify his method and make it profitable.

The first step in the successful imitation of a natural product is to ascertain with certainty its constitution, into what products it is most easily separated, and how these again break up into simpler ones already known. Kolbe knew that salicylic acid could be readily converted into carbolic acid, carbonic acid being liberated. He reasoned, then, that if he could make carbonic acid act upon and combine with carbolic acid, salicylic acid would probably result. By the intervention of metallic sodium the reaction was accomplished, but sodium is too expensive a metal for such a purpose, hence he sought and found a cheaper one in caustic soda; what the latter lacked in energy was compensated for by simply raising the temperature.

The conversion of cane sugar into grape sugar (glucose) is a very simple affair, and has long been understood. The operation seems to consist in the abstraction of the elements of water. Could we not add the elements of water to grape sugar and convert it into cane sugar? As yet it has not been accomplished. The grape sugar has no desire to enter into a partnership with water on such terms as to form cane sugar. Carbon is a queer element, and we cannot always comprehend its idiosyncrasies. Anybody can convert a diamond into charcoal; no man has yet converted charcoal into diamonds. Yet why, we do not know.

Bäyer's synthesis of indigo blue furnishes a most instructive example of reversed operations. It had long been known that when indigo is oxidized with nitric acid *isatine* is formed. So Bäyer reasoned from this that he must be able to reduce isatine to indigo blue, and in this he succeeded by the aid of phosphorus and chloride of phosphorus. The next step was to prepare the isatine. *Oxindole* can be made from isatine, therefore Bäyer thought he could make isatine from oxindole, and after a few unsuccessful efforts he finally succeeded in making isatine. This completed his research, for he had already made oxindole from phenylacetic acid, which in turn is made from some of the coal tar products. The synthesis is complete, although tedious.

In addition to the wide field of pure synthetical chemistry, where coal tar is converted into true imitations of nature's own products, a field as yet but little cultivated, there is another scarcely yet explored—the conversion of one natural product into another and more valuable one, through purely chemical means. The conversion of starch into sugar, and that again into alcohol, is one which nature suggested and in which she assists. Sawdust is converted into oxalic acid and old rags into sweet sirups; but there are still other problems awaiting solution. Stearic acid is much more valuable than oleic. Who will convert the latter into the former? Oil of turpentine is isomeric with oils of bergamot, lemon, and lavender. Who will transpose the first into the others?

It cannot be denied that men have spent years—nay, a lifetime—on fruitless experiments; but the time is near at hand when *intelligent* work is sure to bring some reward, and although few secure great fame or wealth, still fewer go unrewarded. He who makes no experiments is sure to make no discoveries.

THE USE OF THE JEW'S EAR FUNGUS IN CHINA.

According to a paper recently read before the Philosophical Society of Wellington, New Zealand, it appears that a large trade is carried on between that colony and China in the fungus known as "Jew's ear." This trade is practically restricted to a single species, *Hirneola polytricha*, Mont., which is very abundant on decaying timber in all the forest districts. Small quantities only of this fungus were exported before the year 1872; in that year, however, the amount declared at the various ports in the colony was 57 tons 14 cwt., of the estimated value of $9,635; in 1877 it had increased to 220 tons 5 cwt., valued at $16,590, the total amount exported during the seven years ending 1878, being 838 tons, of the value of $189,060. The declared value of this fungus is about $220 per ton, or more than four and a half times the nominal price of one penny per pound paid by the merchant to the collector. As no process is required to prepare the fungus for market, the only outlay connected with it is the cost of collection and spreading in the open air or in sheds for a few days to allow of the evaporation of the moisture, and even this is rarely necessary in the summer, so that in round numbers the sum of about $40,000 represents the actual remuneration of the collectors, while the merchants' profit is represented by the disproportionate figure of $145,000. China is the sole market for this fungus. The use to which the Chinese apply it is as a medicine for purifying the blood, administered in the form of a decoction. It is also used on fast days, with a mixture of vermicelli and bean curd, instead of animal food. It seems to be likewise largely used in soups as ordinary food, and is sold at retail at about 25 cents per pound. An allied species, the common Jew's ear (*Hirneola Auricula-Judæ*), which also occurs in the colony, is decidedly rare as compared with the preceding one. Another species of *Hirneola* is collected in Tahiti, for export to China, and a larger species, found in northern China, is said to be extensively collected for home use. The paper above noted points out "the singular phenomenon of a product utterly useless in the country where it is found, being utilized by one of the least progressive people on the face of the earth, thus reversing the ordinary condition in which the civilized race utilizes the products of others less favored." The fungi mentioned in this paper belong to a section of the order in which the whole plant is of a gelatinous nature, becoming horny when dry, but swelling out again to its original form on the application of moisture. One of the species, *Hirneola Auricula-Judæ*, is widely distributed throughout Europe and the United States, and, a century ago, had much reputation in England as a strong purgative and topical astringent, and even now has some repute abroad, inasmuch as it appeared among the medicinal substances sent to the last International Exhibition at London from one of the French colonies. The faculty possessed by the fungus of absorbing and holding water like a sponge has resulted in its use as a medium for applying eye water to weak or diseased eyes, and similar purposes. Medical writers many years ago declared its internal use to be dangerous, and it was therefore rejected by the Edinburgh and London Colleges, and expunged from the pharmacopœias. The curious name that the plant bears is due to the ear-like form which it often assumes.

THE COST OF RAILWAY CARS.

Under examination by the State Committee on Railway Affairs, a leading member of one of our largest car building companies, Mr. Gilbert, testified that the average price of box cars is from $400 to $450. In 1872 they were as high as $1,200. A milk car costs about $100 more than an ordinary box freight car, that is, when the box is not changed. A baggage car truck and a passenger car truck are about the same. The price of a baggage car varies from $2,000 to $2,500. The cheapest style of Wagner's drawing room cars may be made for $8,000; the usual price is $12,000. This includes all the furnishing. The cheaper drawing room cars, four wheels, are made for $10,000. The ordinary mail car costs from $2,000 to $3,000; distributing cars more. Cars for the New York Elevated Road cost from $2,500 to $3,000. The last ordinary passenger cars built cost $4,200; the last built for the Hudson River road cost $5,400, including a heater and some extra fixtures. Small cars for carrying ore cost $200. Mr. Gilbert had never made coal cars or tank cars for oil.

Oliver Sarony.

Oliver Sarony, one of the pioneers in photography, and withal a successful and distinguished artist, recently died in Scarborough, England, in his sixtieth year. Mr. Sarony was born in Quebec, in 1820, and at an early age was thrown upon his own resources by the death of his father. With his brother Napoleon, so widely and favorably known as a photographer in this city, Mr. Sarony came to New York soon after his father's death. Becoming interested in the work of a daguerreotypist the two boys learned the art. In 1843 Oliver went to England, where he practiced photography with success and profit. In 1857 he settled in Scarborough, establishing branch offices in other large towns.

Professionally, Mr. Sarony's especial delight was to induce a customer to order an oil painted enlarged picture when his original purpose was to sit for a dozen cards. We have seen him engaged in such an enterprise, remarks the London *Photographic News*, and watched his almost child-like delight in the success of his efforts. Selecting the most pleasing of two or three negatives which had been taken, it was handed into a distinct department fitted up for rapidly producing transparencies. A transparency obtained, it was placed in a magic lantern kept ready, and a life-size image was thrown on the screen. Mr. Sarony had, in the meantime, invited the sitter and his wife into a gallery of life-size portraits well painted in oil, and handsomely framed. These, of course, elicited admiration, and eventually Mr. Sarony led his visitors into the room, where a fine portrait of the gentleman was presented life-size on the screen. The effect, as all photographers know, is very striking, and fully admits of a little eloquent talk on its fitness for painting. Mr. Sarony talked well and gracefully, with a frank candor that won belief; and on the occasion in question he took an order for an "oil" at sixty guineas.

The American Institute Fair.

The fair of the American Institute in this city opened on September 17. As usual very few of the exhibits were completely ready. The number of exhibitors this year is large, many applicants having to be turned away for lack of space, and there is promised an unusually full and interesting exhibition. A notable feature is an elaborate display of American china ware, under the direction of the National Pottery Association. The large exhibition of Agricultural machinery includes several novelties. Wood-working machinery is also well represented. The elevated railways have naturally called out many inventions for reducing noise and preventing accidents. The safety steam motor for surface roads, lately adopted by the Third Avenue Railroad, is exhibited, with the method of producing and applying steam power; also the compressed air motor of the Winters Improvement Company. A display of fruits, flowers, and vegetables is promised during October.

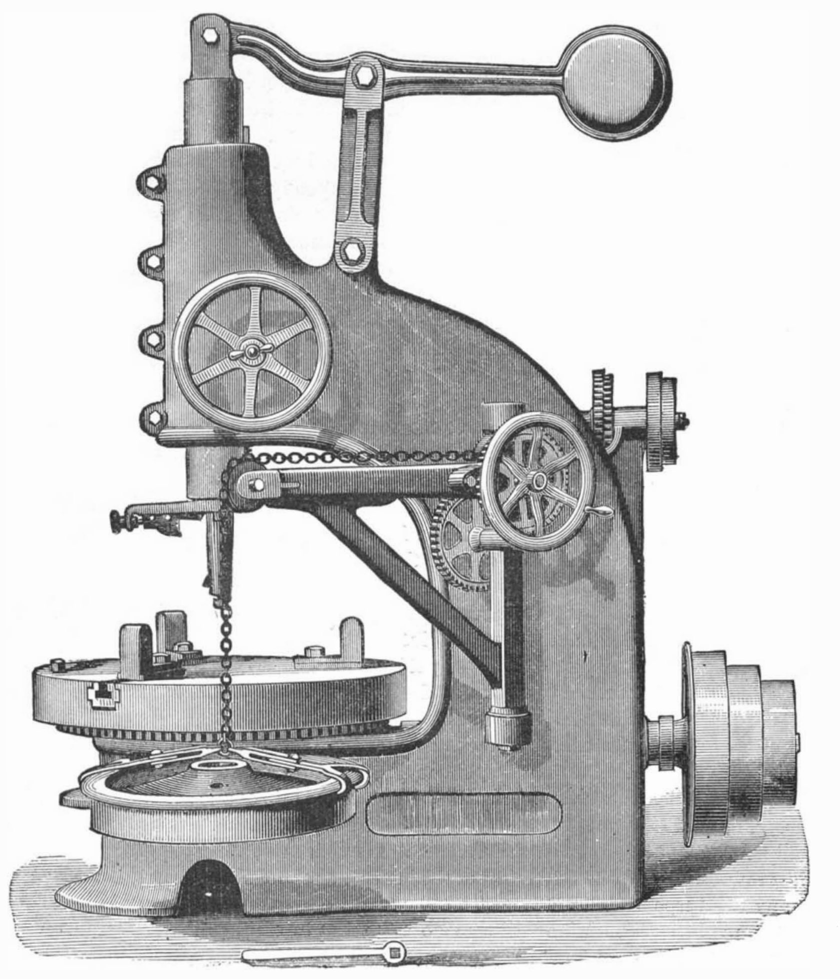
The Suez Canal.

One thousand five hundred and fifty vessels passed through the Suez Canal in 1878. Of these 1,227 were British, 89 French, 71 Dutch, 44 Italian, 38 Austrian, 22 German, 21 Spanish, 8 Egyptian, 8 Japanese, 6 Danish, 5 Swedish and Norwegian, 4 Portuguese, 3 Turkish, 2 Belgian, 1 American, and 1 Zanzibar. The total tonnage was 2,178,316 tons, of which 1,726,946 tons were British.

KEEP THE MOUTH SHUT.—The influence of nasal respiration on the ear is illustrated by Mr. George Catlin, in his history of "The North American Indians." Among two million Indians he found not one who was deaf or breathed through the mouth, except three or four deaf-mutes; and in the memory of the chiefs of 150 tribes, not one case of deafness could be remembered to have occurred. This is explained by the mother always closing the mouth of the child whenever it attempted to breathe through it.

VERTICAL CAR WHEEL BORER.

The vertical car wheel borer, shown in the accompanying engraving, is made by the Putnam Machine Company, of Fitchburg, Mass. It is of heavy construction, combining with good proportions the proper strength for the work it has to perform, and its capacity includes all sizes of wheels from fifteen to forty-eight inches in diameter. The work is held by a four-jawed chuck, the jaws of which, while having independent adjustments to an accurately graduated scale on the slide, are set up or tightened on the work by means of a wrench giving a simultaneous or universal movement. The bearings upon which the chuck revolves are of the form of a double parabola with the concave faces turned in as the journal, while the seat or lower bearing is lined with Babbitt metal, producing an excellent bearing and distributing the pressure over a large area, thus, when properly lubricated, preventing contact and wear of the metal and reducing the running friction to a very small amount. These journal bearings are surrounded by and attached to a rigid circular case, which admits of adjustment for boring either straight or tapering, without changing the vertical line of the boring spindle. The chuck spindle is hollow and allows chips to fall into the interior of the frame, from whence they may easily be removed. The boring spindle is of large proportions, is counterbalanced, and is raised or lowered by a rack and pinion in the back, giving a very quick motion. The feed has four changes, two by belt and two by gears, and the latter admits of being changed instantaneously, independently of the former, for roughing out and finishing operations, by means of a stop rod, while the machine is in motion. The cutter mandrel is of steel, three and one half inches in diameter, and has a taper bearing in the spindle, twelve inches long. An independent head for squaring the hubs of truck wheels is quickly adjusted to, or removed from the spindle as required. A powerfully geared swing crane is attached to the side of the machine, and provided with chain and grappling irons for lifting and swinging wheels on and off the chuck. The driving cone is large and has three changes of speed, and by the arrangement of the countershaft pulleys, admits of two speeds for each cone shift without change of belt.

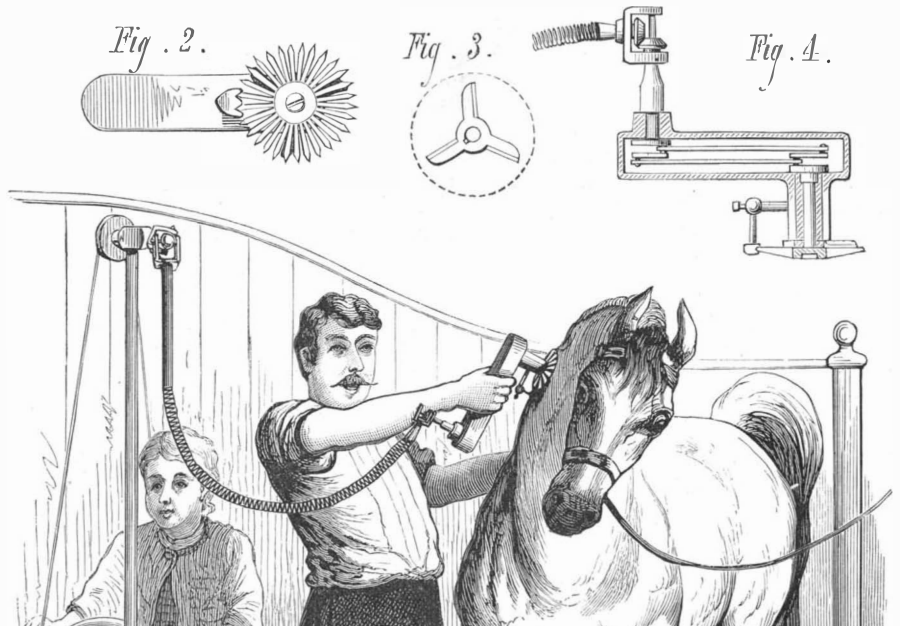


VERTICAL CAR WHEEL BORER.

NEW HORSE CLIPPING MACHINE.

The engraving represents in several views an improved horse clipping machine, recently patented by Mr. Peter Casey, of Providence, R. I. This machine works without noise, and may therefore be used about the head and ears of a horse without frightening him. The driving portion of the machine is connected with the clipper by a shaft having at one end a universal joint, and at the other a flexible portion, which permits of turning the clipper in any required direction. The flexible end of the shaft carries a bevel wheel, which meshes into another bevel wheel on the driving shaft of the clipper.

The construction of the clipper will be understood by reference to Figs. 2, 3, and 4. Fig. 2 shows the side that comes into contact with the skin of the horse; Fig. 3 shows the form of the knife; and Fig. 4 is a longitudinal section of the clipper, showing the connections between the driving shaft of the clipper and the knife spindle. These connections consist of two cranks, placed at right angles to each other, on each shaft, and connected by two links or connecting rods. Underneath the revolving knife there is a guard having radial arms, between which the hair is held and against which it is cut.



CASEY'S HORSE CLIPPING MACHINE.

How India-Rubber is Obtained.

A correspondent of the Boston *Commercial Bulletin*, writing from the Amazon river, Brazil, gives the following account of the method of gathering rubber, as lately observed by him. The process, in many respects, resembles the method of obtaining sugar from the maple trees in Vermont:

"At last we arrived at the encampment, which seemed to be on an island in a vast archipelago. Though the Indians divided the water into river, creek, and lagoon, the latter formed by the overflow in the rainy season, I could not perceive the distinction. In some instances the lagoons appeared to have a current, while the rivers had none, but I accepted their names.

"There were abundant groves of rubber trees in all directions, and men, women, and children were engaged in collecting the rubber, with more method in their labors than I should have expected among such a rude and savage people. Each one had a certain number of trees allotted to him, which he bored with an auger. He then inserted in the hole a piece of hollow cane. To the bark of the tree he fastened with mud a shell of the terrapin, or of a large clam, found in some of these rivers. These serve to catch the liquid. When it drips from the cane it is white as milk, but thicker or with more body.

"A trough dug out of a log is stationed in a central point, and when the trees are all tapped, the man goes his rounds, watching the shells and pouring the contents, when full, into the trough. Toward sunset a fire is made of leaves and twigs, upon which is thrown the fruit of a certain kind of palm, which gives forth a dense smoke.

"A small round-bladed paddle, like those used in the canoe, is dipped into the milk, and turned over once or twice. It is then drawn out, covered with the coating of the liquid gum, and held at once in the smoke of the fire, which hardens and also darkens the coating. It is again plunged into the milk and again smoked, and this process is kept up until the blade of the paddle is covered an inch to an inch and a half in thickness. A knife is passed along one edge of the blade and the mass removed. It appears in shape like a shoemaker's lapstone with a sort of nozzle on one side. In this state it is shipped. From one of these lumps of commercial gum the different coatings may be readily detached."

In this connection we may state that the New York Belting and Packing Company, No. 38 Park Row, New York, have lately placed in their show window a large and splendid living specimen of the rubber tree. The plant is in vigorous condition and attracts much attention.

MISCELLANEOUS INVENTIONS.

An improvement in bottle stoppers, patented by Mr. William Beardsley, of Beacon, Iowa, consists in combining a stopper provided with shoulders, a tubular extension, an orifice, a flanged plug with a bottle neck having a straight bore, and a counterbore for receiving a packing ring and spiral spring.

An improved refrigerator, patented by Mr. Cyrus B. Shaw, of Brooklyn, N. Y., is constructed so as to use less ice than refrigerators made in the usual way, and it can be more easily kept clean and sweet, and may be more easily repaired.

Mr. William Roush, of Yates Center, Kan., has invented an improvement in lanterns which relates to the construction and arrangement of a lamp chimney and frame in a lantern. The object of the invention is to enable the parts to be put together or taken apart easily and quickly, so that the parts can be combined into a lantern adapted for immediate and general use, or the lamp can be taken out and used for ordinary domestic purposes.

Mr. Allen Blewett, of Brookville, Miss., has patented an improved toy pistol, having the barrel and stock or handle made in one piece, the barrel having a slot in its under side, which extends its whole length, to receive the slide, and the stock having a recess in its under side to receive the trigger. In this pistol a rubber spring is used to propel the projectile.

Mr. Joseph H. Stratton, of Beloit, O., has patented an adjustable support for carriage bodies, coffins, and other similar articles while undergoing painting, varnishing. It is arranged so that they can be set in any desired position to accommodate them to the position of the workman. The invention consists of a table or stand provided with devices for holding the body, and pivoted to the end of a lever fulcrumed between two uprights or standards, and with arrangements for securing it in different positions.

An improvement in stiff hat flanges has been patented by Messrs. Lewis L. Smith, Frederick L. Knable, and Henry F. Smith, of Orange, N. J. The flange is made in two parts, with the lines of division at the front and rear, and with the end edges of the one part convex and the end edges of the other part concave, to adapt the flange to be withdrawn from the hat without changing the shape of the hat brim.

Mr. Edmund Kuhn, of New Albany, Ind., has invented an improved grate, which consists of one or more cylindrical revolving grates pivoted horizontally in the lower part of the firebox, and made to shake out the ashes and agitate the fire by turning on their axes.

Mr. John G. Hess, of Guttenburg, N. J., has patented an improvement in spigots or faucets for drawing liquids from barrels. The invention consists in a packing ring of elastic material contained in an annular recess in the spigot around the plug, the aperture of which is concentric with the axis of the plug.

An improved fish trap, patented by Mr. William J. Henderson, of Valdosta, Ga., consists in combining a transparent bottle with a rat trap, so that the fish or animal may be caught without consuming the bait.

Mr. August Buermann, of Newark, N.J. has invented an improvement in spurs, which consists of a stay plate in combination with the heel band of a spur made of two bars and having their rear ends projecting to the rearward, and parallel with each other, to serve as a rowel holder.

PRACTICAL EXPERIMENTS IN MAGNETISM, WITH SPECIAL REFERENCE TO THE DEMAGNETIZATION OF WATCHES.—No. 2.

BY ALFRED M. MAYER.

Experiments which show Something about the Nature of a Magnet.—Take the piece of steel wire, six inches long and one sixteenth of an inch in diameter, mentioned among the articles required in our experiments; score this piece of wire at short distances apart, by filing it around with a sharp file. Now heat the wire to a cherry red, and then plunge it vertically into water. It will now be quite hard, and may be readily made into a magnet by drawing it over the pole of your rat tail file magnet. Paste a small piece of paper around one of the ends of the steel wire before you magnetize it, and then, if you draw the wire over the N. pole of the magnet, from the papered end to the unpapered end, the papered end of the wire will have north polarity, as may be shown by applying the wire to the magnetometer. The magnetic condition of the wire having been found out, we begin by snapping the wire into small pieces, which is readily done, for the scores on the wire determine where it will break. Place each piece on the table as it is separated from the wire, and with its ends pointing in the same direction which they had when it formed part of the wire. Examine each of these pieces in succession. They will be found to be perfect magnets, with N. poles turned all one way, their south poles turned in the other direction. This examination may be made by means of the magnetometer. The fact that each piece is a magnet may also be readily shown by rolling it in iron filings, when it will be found that the filings adhere to the ends of the piece of wire just as they did to the large magnet. See Fig. 11.

23.

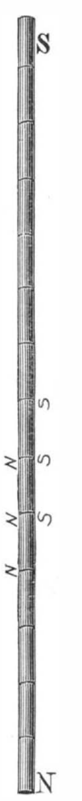


Fig. 23 gives a view of the pieces of wire placed end to end just in the position they had when they formed parts of the steel wire. We see that each piece is a perfect magnet, and that the north poles of these pieces all point to the right and their south poles all to the left. But each of these little fragments may be broken into two, and so on; and as far as the subdivision may be carried, it has been found that each minute fragment is a perfect magnet, with one of its ends a south, and the other a north magnetic pole. In imagination we may conceive of this subdivision carried so far that one of the particles thus reached may be invisible to the unaided eye. Indeed, nothing prevents us from logically assuming that even if a molecule of the steel should be reached it would be found to be a perfect magnet.

An Experiment with a Magnet formed of Steel Filings Packed in a Paper Cylinder, is interesting when studied in connection with the experiments just made, and will serve to give us further information as to the nature of a magnet.

Take a piece of letter paper, and having wrapped it several times around a lead pencil, paste the free edge of the paper on to that wrapped around the pencil. After the paste has dried you may draw out the lead pencil, and you will then have a tube made of paper. Cork one end of this tube, or you may close it by doubling over the paper at its end and gluing. Fill this tube with steel filings, and then close the other end of the tube. This tube, filled with steel particles, may be formed into a magnet by drawing it over the pole of your rat-tail file magnet. After you have performed this operation several times, present the tube to the magnetometer, and you will find one of its ends is a north, while the other is a south pole. Having thus satisfied yourself that it is really a magnet, shake the tube so that the positions of the particles of steel filings are changed. On testing the tube at the magnetometer it will be found that much, probably all, of its magnetism has gone from it. If it has not all disappeared it can be made to do so by repeated shaking of the tube. This experiment shows that not only must each particle or even molecule of a steel bar be a perfect magnet, but it also shows that these magnetized particles must be arranged in a definite order, that is, with all their N. poles pointing in one direction and their south poles in the opposite direction, so that the body, as a whole, may obtain and retain its magnetic polarity. Before the year 1600, when William Gilbert, the physician to Queen Elizabeth, made the celebrated experiment of breaking a magnet into many parts and testing the polarity of each piece, it had been thought that all of the north polar magnetism was contained in one end of the magnet, while the other end of the magnet held the south polar magnetism.

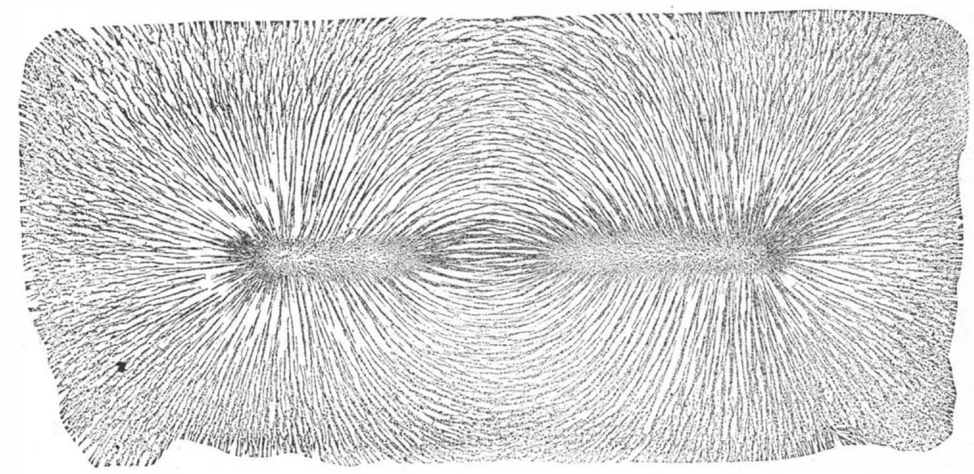


FIG. 24.—MAGNETIC CURVES AS SHOWN BY IRON FILINGS.

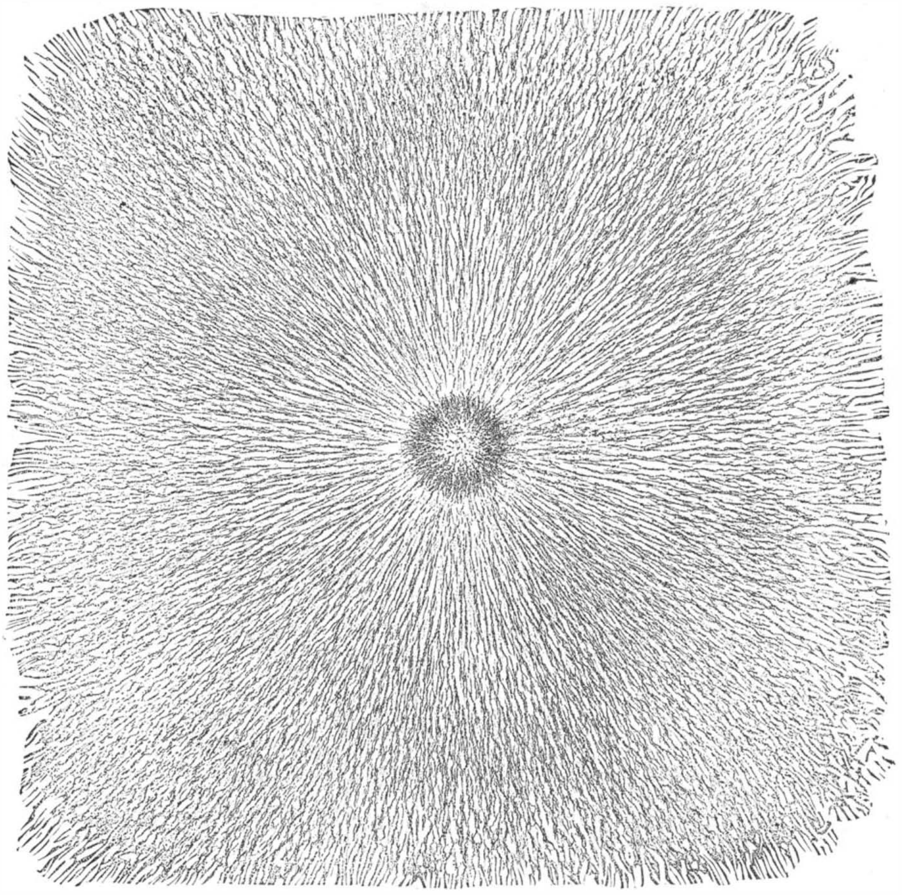


FIG. 25.—ARRANGEMENT OF FILINGS OVER THE END OF A ROUND MAGNET.

Interesting Experiments may be made with magnets acting inductively on a great number of iron grains spread on a surface placed over the magnet. We may thus form an idea of how this magnetic influence extends itself into space.

Take a piece of cardboard about one foot long and six inches broad. Support this at its corners on blocks of wood a little thicker than the diameter of your rat-tail file magnet. Place the latter under the cardboard. Now lift the cardboard off its supports and place it to one side on the table. Through a fine sieve sift soft iron filings evenly, and not too thickly, over the cardboard. Lift it up carefully and place it over the magnet. A slight bristling of the filings is all that you will observe of the action of the magnet; but on vibrating the cardboard, by letting fall vertically on it a piece of copper wire, or by tapping it gently with a lead pencil, you will observe curious motions among the grains of filings. They will finally arrange themselves over the magnet in the curves shown in Fig. 24.

Fig. 25 shows the arrangement taken by the iron filings when they are placed on a card and vibrated over the end of a round magnet, the magnet being held in a vertical position under the cardboard.

Fig. 26 are the lines formed over the end of a magnet. Figs. 27 and 28 respectively show the actions of magnets with their unlike and like poles opposite each other.

Fig. 29 is interesting, showing the arrangement of the lines of filings produced on a surface when under it a magnet, 216 millimeters long and 12 millimeters in diameter, is acting inductively on a cylinder of soft iron, 32 millimeters long and 10 millimeters in diameter. In April, 1871, I published in the *American Journal of Science* a method I had invented for permanently fixing these lines of iron filings (or *magnetic spectra*, as they are often called) on plates of glass. When thus permanently attached these plates were used as negatives from which a series of photographs were printed, exactly as a photographer prints from an ordinary photographic negative. The admirable engravings of magnetic spectra given in this article were made by a photo-engraving process directly from the glass plates made by me in 1871. These glass plates carrying the magnetic spectra I have also used for several years as slides in the lantern, in order to exhibit them before large audiences and college classes.

The following is the method of permanently attaching these magnetic figures to glass. A clean plate of thin glass is coated with a film of hard varnish by flowing over it the spirit varnish used by photographers in coating their negatives. If this is not handy, then a solution of shellac in alcohol will do nearly as well, only the latter requires more heating to cause the iron filings to adhere to it. The varnish is poured on one end of the plate, and then caused to cover the entire plate with an even film, by tilting and draining the plate just as a photographer does when he coats his plate with collodion. After the varnish has dried to a hard film the plate is placed, varnished side up, over the magnet or magnets, with its ends resting on slips of wood, so that the under surface of the plate just touches the magnet. Fine iron filings obtained from Norway iron, which has been repeatedly annealed, are now sifted uniformly over the plate, and then the magnetic curves are developed by letting fall on the plate vertically at different points a piece of copper wire. The vibrations of the plate momentarily detach the filings from its surface, and at these moments the magnet arranges them in obedience to its inductive action on them. The plate is now lifted from the magnet, being careful to hold it always in a horizontal position, and either placed with its ends resting on bricks over a hot stove, or it is heated over a gas stove. The film of varnish is thus melted, and the filings sinking into it are permanently fixed there after the varnish has cooled. If any filings should remain unattached, they are removed from the plate by letting its edge fall squarely on the table.

The lines forming these magnetic spectra were called "lines of magnetic force" by Faraday. He also devised the term "magnetic field." *A magnetic field* may be defined as any space at every point of which exists a finite magnetic force; while *a line of magnetic force* is a line drawn through a magnetic field in the direction of the force at each point through which it passes. Before the time of Faraday natural philosophers were satisfied with the mere statement that magnets acted at a distance, and followed generally the same law as ruled in the action

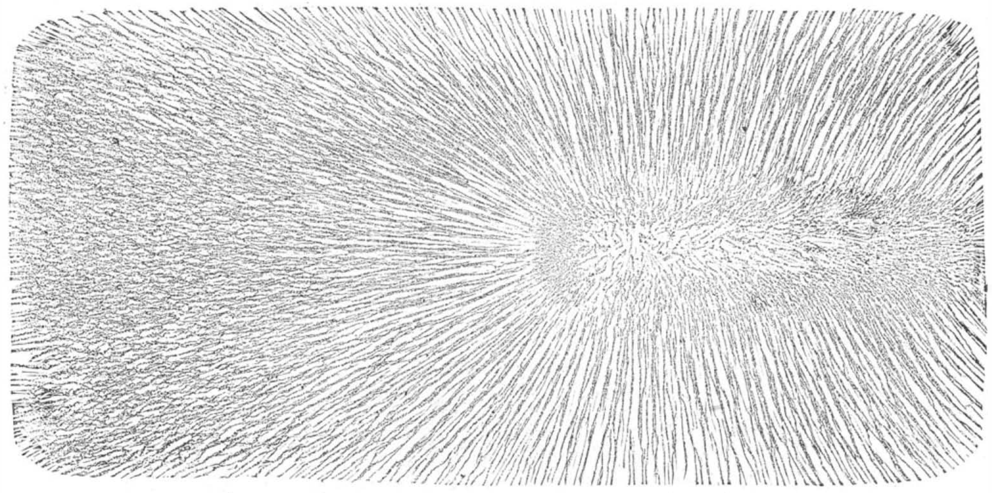


FIG. 26.—LINES FORMED OVER THE END OF BAR MAGNET PLACED PARALLEL WITH ITS PLATE.

of gravitation throughout the celestial spaces, that is to say, that the intensity of the magnetic action decreased inversely as the squares of the distances from the pole of the magnet; but Faraday, in the words of Professor Maxwell, "in his mind's eye saw lines of force traversing all space where the mathematicians saw centers of force attracting at a distance; Faraday saw a medium when they saw nothing but distance; Faraday sought the seat of the phenomena in real actions going on in the medium; they were satisfied that they had found it in a power of action at a distance impressed on the electric fluids." Faraday discovered the general laws which rule the behavior of bodies in the magnetic field. When the magnetic field is uniform—that is, when the lines of magnetic force are parallel—magnetic bodies place themselves in the direction of the lines of force; but when the magnetic field is not uniform, magnetic bodies (like iron, nickel, cobalt, etc.) tend to go from weaker to stronger places of magnetic action, while diamagnetic bodies (like bismuth, borate of lead, etc.) tend to go from stronger to weaker places in the magnetic field.

The conception of the lines of force and the magnetic field, and the statement of the laws ruling the action of bodies in field of a magnet, ' formed," says Sir William Thomson, "one of the most brilliant steps made in philosophical exposition of which any instance exists in the history of science. . . . Mathematicians were content to investigate the general expression of the resultant force experienced by a globe of soft iron in all such cases; but Faraday, without mathematics, divined the result of the mathematical investigation, and, what has proved of infinite value to the mathematicians themselves, he has given them an articulate language in which to express their results. Indeed, the whole language of the magnetic field and lines of force is Faraday's. It must be said for the mathematicians that they greedily accepted it, and have ever since been most zealous in using it to the best advantage. Indeed, much of the scientific work of Thomson, and nearly all of Maxwell's celebrated 'Treatise on Electricity and Magnetism,' may be regarded as translations of Faraday's conceptions into the language of mathematical analysis."

Let us now make a few experiments on these lines of magnetic force. We will thus be led to some remarkable results. Form a small magnet of a piece of sewing needle about one quarter of an inch long. Suspend this with a filament of the floss silk. Having formed a magnetic spectrum, and with the magnet remaining undisturbed under the cardboard or glass, bring the little magnet over one of the lines traced out by the filings. Move the suspended magnet over this line, and you will observe that the length of the needle always lies in the direction of the line, no matter where the needle may be placed over this line. Faraday, from this fact indeed, gave his definition of a line of magnetic force as "that line which is described by a very small magnetic needle, when it is so moved in either direction correspondent to its length, that the needle is constantly a tangent to the line of motion."

"The Earth itself is a Great Magnet." These are the words which may be said to form the text on which the illustrious William Gilbert wrote his work "De Magneto," or "On the Magnet," in 1600; and he certainly gave proofs of the truth of his statement, which, when viewed in the light of the knowledge which he himself discovered, forms an era in the history of the experimental sciences. If the earth be a great magnet, then it also must have its lines of force surrounding it and stretching out into space. At first sight it would seem difficult to prove this, for its proof seems to require the existence of some immensely extended, light, movable and luminous matter surrounding the earth, on which its magnetism can act, and by this action render manifest the direction of its lines of force. Now it so happens that such evidence is not wanting. All of our readers, I imagine, have seen those luminous and movable columns which form the aurora borealis. They appear to start from some level above the northern horizon, and stretching upward appear to converge at some point high up in the heavens. Sometimes this point is higher, sometimes it appears lower, according to the latitude of the observer.

Now we have seen that the magnetic needle always places itself in the direction of, or, more correctly speaking, at a tangent to a line of magnetic force, and it has been often observed that a magnetic needle, when suspended so that it can place itself in any position, either up, down, to the right or to the left, always places itself parallel to those luminous columns. This observation has been repeatedly made in various latitudes, and its general truth is established. The vast luminous rods, which are often 500 miles and over in length, actually trace out in space the earth's lines of magnetic force.

That the earth is a great magnet, you may at any time show to yourself and your friends by a few simple but very charming experiments.

Take the piece of iron, one foot long and three eighths of an inch in diameter (which I mentioned among the things required in our experiments), and heat it to a dull red heat in the fire, and then allow it slowly to cool in the hot ashes. In cooling the rod it should be placed with its length in an east and west direction. After the rod is cold paste a piece of paper around one of its ends. Take it carefully in the hand and avoid letting it fall or giving it a blow. Bring the papered end of the rod up to the needle of the magnetometer, and point it at right angles to the length of its needle and directly toward its center. You will observe that the needle remains stationary as long as the iron rod points *in a horizontal direction* toward its center. This is so because the iron is devoid of magnetism, and hence attracts the north end of the needle with a force equal to that with which it attracts the south end of the needle.

Now observe what takes place when we slowly lift up the end of the rod furthest from the magnetometer. The south pole of the needle at once swings around toward the iron rod. This cannot be owing to the inclined position of the iron, because, even in this inclined position, it is symmetrically placed in reference to the needle, and should not on this account cause the latter to turn. Evidently the iron rod has become magnetic from this change of position. The mere tilting up of its end has made it a magnet. A temporary magnet, it is true, for on slowly lowering the iron into a horizontal position the needle slowly turns into the magnetic meridian, and is then apparently indifferent to the presence of the iron rod.

Now bring the unpapered end of the rod up to the magnetometer and repeat the above experiments. The needle again turns its south end toward the rod when the latter is tilted upward. This shows that the magnetism of the rod depends alone on its position, and that end which is down is always of north magnetic polarity. It has also been found—and you can prove it for yourself—that when the rod is held inclined in the meridian, with its upper end leaning away from the north, so that it is at an angle of about 76° with the horizon, it has the most powerful magnetism that can be given to it by this means.

All of the above curious facts are explained if we consider the earth itself as a great magnet, with its south magnetic pole situate somewhere near the north geographic pole, and with its north magnetic pole placed somewhere near the south geographic pole. If you carry your small suspended magnetic needle over the length of a magnet, you will observe that the north end of the needle will point downward when it is over the south pole of the magnet, and that the south end of the needle will point downward when it is over the north pole of the magnet; while, when over the center of the magnetic bar, the needle takes up a horizontal position. In the same manner acts a freely suspended magnetic needle when carried over the surface of the earth along a meridian. In a far northerly latitude, on the western coast of Boothia, Sir James Ross, in 1831, found that the magnetic needle pointed directly downward, with its north pole toward the center of the earth. He inferred that he then stood on the termination of a line drawn from the earth's center through its magnetic pole to his feet. Subsequently this bold mariner undertook another voyage of discovery in search of a similar point on the southern hemisphere, and in 1841 succeeded in reaching south latitude 76° 12′, on Victoria Land, when the south end of the needle pointed downward and made an angle of 88° 40′ with the horizon. He concluded from this and other observations that the position where the needle would be vertical was about 160 nautical miles distant. From these and other magnetic observations made in the Antarctic seas, it is supposed that the magnetic pole of the southern hemisphere must be somewhere about south latitude 70° and near the meridian of 125° east of Greenwich. This would bring the position of the magnetic pole somewhere on the territory discovered by our countryman Wilkes. The exact position of this point, however, is not known, for no explorer has ever reached it. Also, it has been well ascertained that along an irregular line, situated on the equatorial belt of the earth, the needle has a horizontal position, just as it has when placed midway between the poles of an artificial bar magnet. This irregular equatorial line is called the earth's magnetic equator.

These facts are all explained by conceiving the earth as a huge magnet, and if the earth be a magnet, it also follows that the soft iron rod, when held upright in the southern hemisphere, will have its lower end of south magnetism; while the same end in the northern hemisphere, we have ourselves found, is always of north magnetic polarity. We cannot travel over the earth and test this conclusion for ourselves, but I once found in the Transactions of the Royal Society of London a paper headed "*On the tendency of the Needle to a piece of Iron held perpendicular, in several climates. By a master of a ship, crossing the Equinoctial Line. Anno* 1684." Let the mariner give his own account of his experiments, and we will see that his statements show that when you cross the magnetic equator the lower end of the upright iron rod changes from north to south magnetic polarity: "All the way from England to 10° north latitude, the

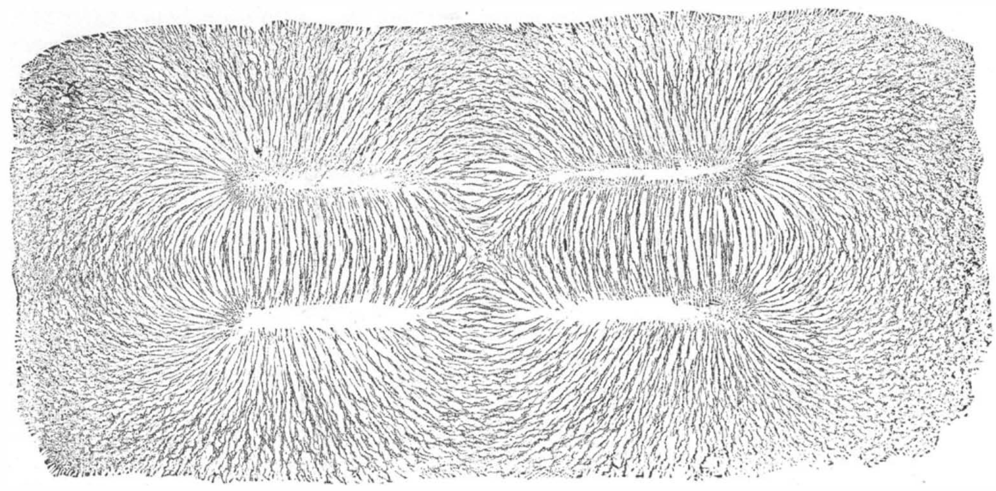


FIG. 27.—MAGNETIC CURVES UNLIKE MAGNETIC POLES OPPOSITE EACH OTHER.

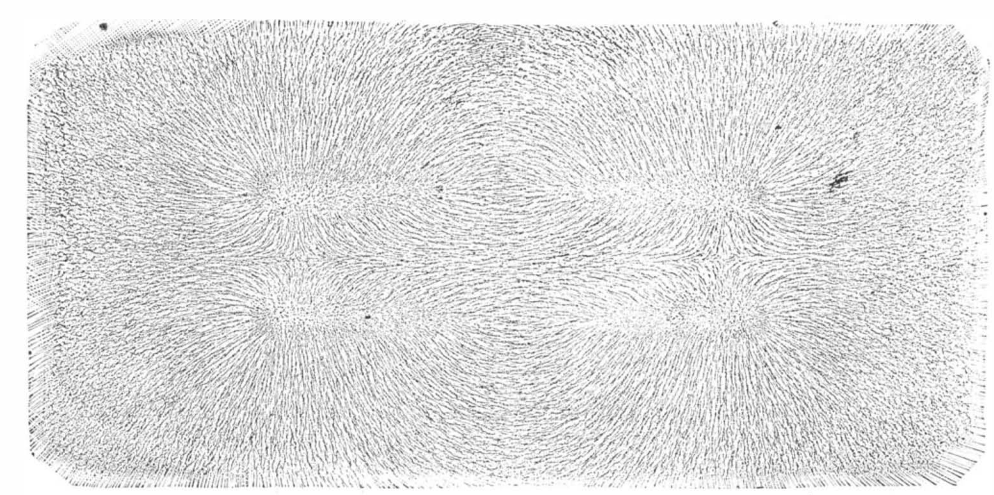


FIG. 28.—MAGNETIC CURVES LIKE POLES OPPOSITE EACH OTHER.

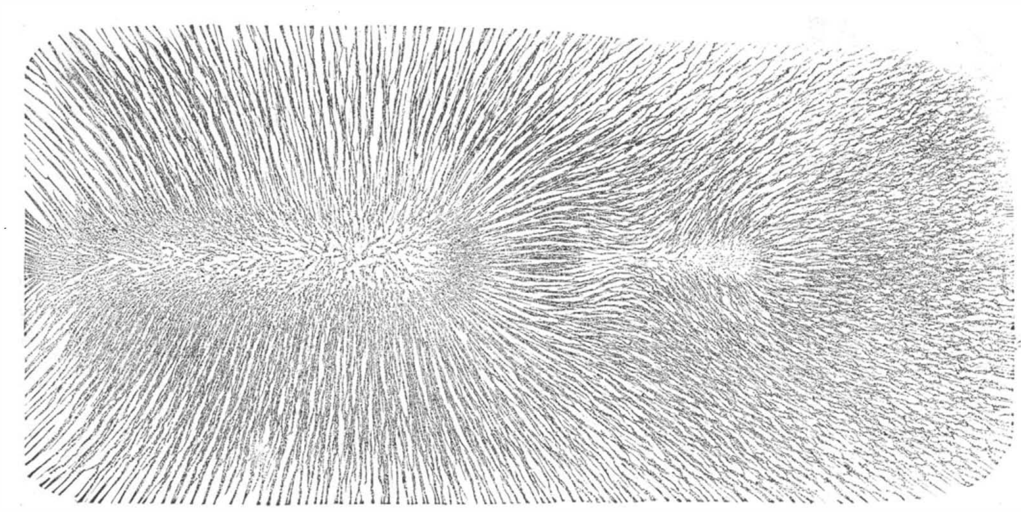


FIG. 29.—CURVES SHOWN BY A MAGNET ACTING INDUCTIVELY ON A CYLINDER OF SOFT IRON.

north end of the needle tended to the upper end of the iron, and the south point to the lower end, very strongly. . . . In latitude 8° 17′ south, and meridian distance from the Lizard 17° 35′ west, the north point of the needle would not respect the upper end of the iron; but the south point would still somewhat respect the lower end. . . . In latitude 29° 25′ south and 13° 10′ west, from the meridian of the Lizard, the south point of the needle respected the upper end of the iron, and the north point the lower end strongly."

On the "Magnetic Neutral Line."—There has recently appeared much discussion about the existence of a position of neutrality near a magnet. That a region of that kind, where there appears a break in the continuity of the magnet's attractive and directive force, exists, I have no doubt; but I cannot agree with those who have declared for the existence of a line, or plane, of neutrality in the sense in which Mr. Gary and others have put it. Indeed one hundred and twenty years ago a neutral line was discovered by the celebrated John Robison, Professor of Natural Philosophy in the University of Edinburgh. He is the man of whom James Watt said, "He has the clearest head of any man I know." Having such good indorsement for clearness of head, I cannot do better than let him describe his own experiments:

"Amusing myself in the summer of 1758 with magnetic experiments, two large and strong magnets, A and B (Fig. 30), were placed with their dissimilar poles fronting each other and about three inches apart. A small needle, supported on a point, was placed between them at D, and it arranged itself in the same manner as the great magnets. Happening to set it off to a good distance on the table, as at F, I was surprised to see it immediately turn round on its pivot and arrange itself nearly in the opposite direction. Bringing it back to D restored it to its former position. Carrying it gradually out along D F, perpendicular to N S, I observed it to become sensibly more feeble, vibrating more slowly; and when in a certain point, E, it had no polarity whatever towards A and B, but retained any position that was given it. Carrying it further out, it again acquired polarity to A and B, but in the opposite direction, for it now arranged itself in a position that was parallel to N S, but its north pole was next to N and its south pole to S.

"This singular appearance naturally excited my attention. The line on which the magnets, A and B, were placed had been marked on the table, as also the line, D F, perpendicular to the former. The point, E, was now marked as an important one. The experiments were interrupted by a friend coming in, to whom such things were no entertainment. Next day, wishing to repeat them to some friends, the magnets, A and B, were again laid on the line on which they had been placed the day before, and the needle was placed at E, expecting it to be neutral. But it was found to have a considerable verticity, turning its north pole toward the magnet, B, and it required to be taken further out, toward F, before it became neutral. While standing there something chanced to joggle the magnets, A and B, and they instantly rushed together. At the same instant the little magnet, or needle, turned itself briskly, and arranged itself, as it had done the day before, at F, quivering very briskly, and thus showing great verticity. This naturally surprised the beholders; and we now found that by gradually withdrawing the magnets, A and B, from each other, the needle became weaker, then became neutral, and then turned round on its pivot and took the contrary position. It was very amusing to observe how the simply separating the magnets, A and B, or bringing them together, made the needle assume such a variety of positions and degrees of vivacity in each.

"The needle was now put in various situations, in respect to the two great magnets; namely, off at a side, and not in the perpendicular, D F. In these situations it took an inconceivable variety of positions which could not be reduced to any rule; and in most of them, it required only a motion of one of the great magnets for an inch or two, to make the needle turn briskly round on its pivot, and assume a position nearly opposite to what it had before.

"But all this was very puzzling, and it was not till after several months that the writer of this article, having conceived the notion of the magnetic curves, was in a condition to explain the phenomena. With this assistance, however, they are very clear and very instructive.

"Nothing hinders us from supposing the magnets, A and B, perfectly equal in every respect. Let N H M, N E L, be two magnetic curves belonging to A; that is, such that the needle arranges itself along the tangent of the curve. Then the magnet, B, has two curves, S G K, S E Q, perfectly equal and similar to the other two. Let the curves, N H M and S G K, intersect in C and F. Let the curves, N E L and S E Q, touch each other in E.

"The needle being placed at C would arrange itself in the tangent of the curve, K G S, by the action of B alone, having its north pole turned toward the south pole, S of B. But by the action of A alone it would be a tangent to the curve, N H M, having its north pole turned away from N. Therefore, by the combined actions of both magnets, it will take neither of these positions, but an intermediate one, nearly bisecting the angle formed by the two curves, having its north pole turned toward B.

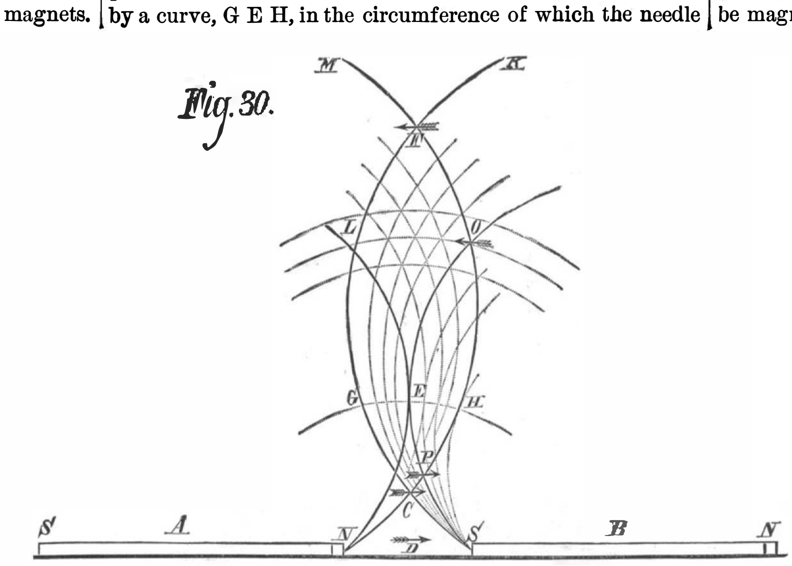
"But remove the needle to F. Then, by the action of the magnet, A, it would be tangent to the curve, F M, having its north pole toward M. By the action of B, it would be a tangent to the curve, K F G, having its north pole in the angle, M F G, or turned toward A. By this joint action, it takes a position nearly bisecting the angle, G F M, with its north pole toward A.

"Let the needle be placed in E. Then, by the action of the magnet, A, it would be a tangent to the curve, N E L, with its north pole pointing to F. But, by the action of B, it will be a tangent to S E Q, with its north pole pointing to D. These actions being supposed equal and opposite, it will have no verticity, or will be neutral, and retain any position that is given to it.

"The curve, S E Q, intersects the curve, N H M, in P and Q. The same reasoning shows that when the needle is placed at P, it will arrange itself with its north pole in the angle, S P H; but, when taken to Q, it will stand with its north pole in the angle, E Q M.

"From these facts and reasonings we must infer that, for every distance of the magnets, A and B, there will be a series of curves, to which the indefinitely short needle will always be a tangent. They will rise from the adjoining poles on both sides, crossing diagonally the lozenges formed by the *primary or simple* curves, as shown in Fig. 30. These may be called *compound or secondary* magnetic curves. Moreover, these secondary curves will be of two kinds, according as they pass through the first or second intersections of the primary curves, and the needle will have opposite positions when placed on them. These two sets of curves will be separated by a curve, G E H, in the circumference of which the needle

Fig. 30.



LINES OF MAGNETIC FORCE.

will be neutral. This curve passes through the points where the primary curves touch each other. We may call this *the line of neutrality* or inactivity.

"We now see distinctly the effect of bringing the magnets, A and B, nearer together, or separating them farther from each other. By bringing them nearer to each other, the point, E, which is now a point of neutrality, may be found in the *second* intersection (such as F) of two magnetic curves, and the needle will take a subcontrary position. By drawing them farther from each other, E may be in the *first* intersection of two magnetic curves, and the needle will take a position similar to that of C.

"If the magnets, A and B, are not placed so as to form a straight line with their four poles, but have their axes making an angle with each other, the contacts and intersections of their attending curves may be very different from those now represented; and the positions of the needle will differ accordingly. But it is plain, from what has been said, that if we knew the law of action, and consequently the form of the primary curves, we should always be able to say what will be the position of the needle. Indeed, the consideration of the simple curves, although it was the means of suggesting to the writer of this article the explanation of those more complicated phenomena, is by no means necessary for this purpose. Having the law of magnetic action, we must know each of the eight forces by which the needle is affected, both in respect of direction and intensity, and therefore able to ascertain the single force arising from their composition.

"When the similar poles of A and B are opposed to each other, it is easy to see that the position of the needle must be extremely different from what we have been describing. When placed anywhere in the line, D F, between two magnets whose north poles front each other in N and S, its north pole will always point away from the middle point, D. There will be no neutral point, E. If the needle be placed at P or Q, its north pole will be within the angle, E P H, or F Q I. This position of the magnets gives another set of secondary curves, which also cross the primary curves, passing diagonally through the lozenges formed by their intersection. But it is the other diagonal of each lozenge which is a chord to those secondary curves. They will, therefore, have a form totally different from the former species.

"The consideration of this compounded magnetism is important in the science, both for explaining complex phenomena, and for advancing our knowledge of the great desideratum, the law of magnetic action.

(*To be continued.*)

THE force of the Light-house Board of the Treasury Department has been reduced by the dismissal of eleven clerks.

Electricity as a Motive Power.

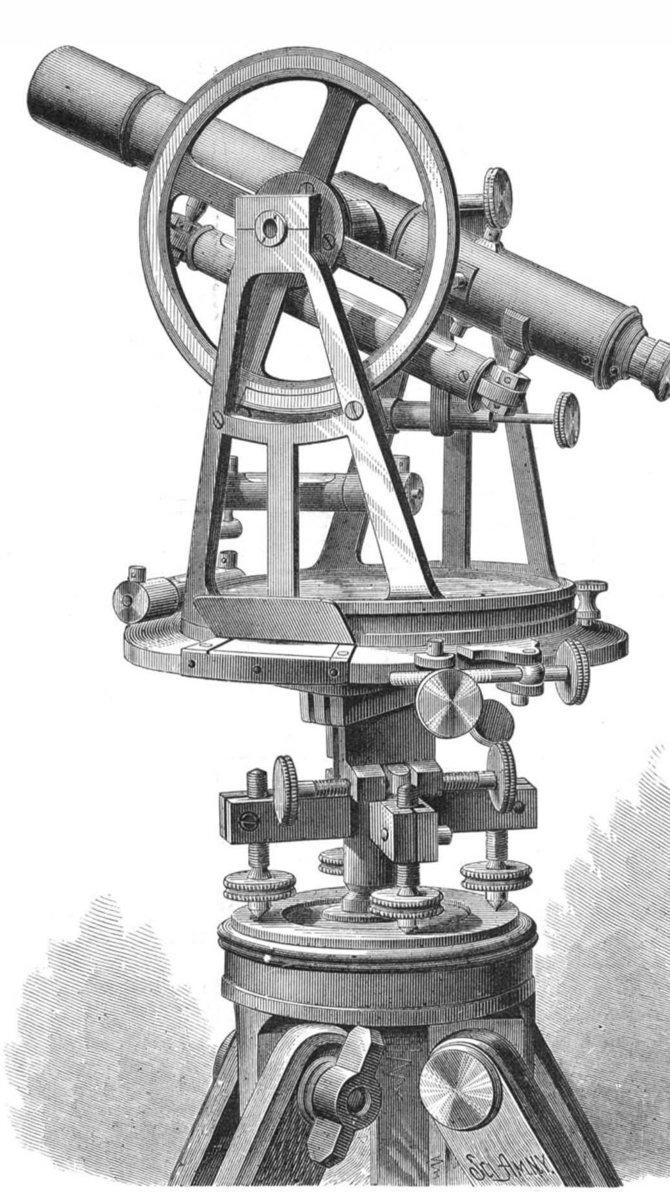
At a recent meeting of the British Association, Professor W. E. Ayrton delivered a lecture on "Electricity as a Motive Power," and interesting illustrations were given, including machinery in motion, driven by power derived from a distance.

The lecturer stated that in any generation of electricity there was a certain property called the electro-motive force, which meant its tendency to send a current, and which was analogous with the head of water in a reservoir, inasmuch as the product of the quantity of electricity flowing per second, multiplied by this electro-motive force, measured the amount of energy furnished by the generator per second, and which could be reproduced as motive power elsewhere if there were no friction. The loss of energy due to electrical friction in the wires was equal to the square of the current flowing per second multiplied by what was called the resistance of the wire—a number depending on the length, the diameter of the wire, the material of which it was made, and the temperature. The most efficient way to transfer energy electrically was to use a generator producing a high electro-motive force, and a motor producing a return high electro-motive force, and by so doing the waste of power in the transmission ought, he considered, to be able to be diminished with the best existing dynamo-electric machines to about 30 per cent. It would be impossible to increase indefinitely the speed of revolution of the cylinder of an induction machine, since, apart from mere mechanical friction, the iron constituting the core of the revolving part had to be magnetized and demagnetized very rapidly as it revolved. Now, there was a physical limit to the speed with which this could be done, and, in addition, this rapid change of magnetism heated the iron very much. But experiment showed that at the ordinary speed of revolution of dynamo-electro-machines—700 turns per minute—the electro-motive force was proportional to the speed. They were, therefore, very far yet from the limit of speed. Consequently it would be well for the transmission of power to attempt first, a considerable increase of speed in the generator combined with so light a load on the motor, that its speed would be also very high. When this began to fail as larger and larger amounts of power were transmitted, then they might begin increasing the amount of wire on the revolving coils of each; but this, of course, had the objection that the loss of power from a given current would then become somewhat larger. As they had seen that by the use of electricity properly employed, the waste of power in transmission could be reduced for any distance to about thirty per cent of the whole power absorbed at the generator, it followed that the employment of steam engines of vast size at points outside Sheffield would be by far the most economical mode of extracting the energy out of coal. For it was at least four times as expensive to produce power with a small steam engine as with a large one; therefore, including the waste of power in electric transmission, the cost of production of power in small workshops would be little more than one third as dear as if small steam engines were used, and similarly the waste of power in any large mill or factory in its transmission from the large steam engine at its base to all the floors and machines on each floor would be very much diminished. But they would say that in advocating the employment of electricity he was advocating a total change in our mode of producing and transmitting power. Was the probable gain worth the expense of the necessary change? To answer this question they must consider what would be the probable minimum annual gain by the proposed change in Sheffield alone. In making this calculation they must remember that not only could electricity produce motive power, but also heat and light, and electric heating and lighting had this great advantage that no chimneys were required. For example, with the electric current sent to that hall from Messrs. Walker & Hall's works, he could heat a long coil of iron wire white hot, so that when put into a vessel of water, the water in a short time would begin to boil. Various calculations had been made as to the relative cost of lighting by burning coal to produce gas, or by burning coal to work dynamo machines for producing electric currents, and it seemed to be pretty certain that if a large amount of light be required in one place, the electric light was at least twenty times as cheap as coal. Sir William Thomson, the eminent electrician, went so far as to say that it might be made 133 times as cheap. And certainly that there was a great saving in expense in electric lighting was seen from the actual result obtained at the Albert Hall, London, which was an example, and perhaps the only example, in connection with electric lighting, where the science of putting a brilliant light high up had been allowed to ride over the precedent of putting a number of feeble glimmers all over a building. The actual cost, including labor of men, allowance for wear and tear of machinery, etc., was only one-third of that of the former inferior gas lights, and thus a saving of about 30s. an hour had been effected. Lighting streets by electricity had not been so successful economically, for the simple reason that instead of giving a large bright light, at a considerable height, reflected downwards, as in the Albert Hall, London, English conservatism had prevented the authorities from grasping the possibility of using for street illumination anything differing from an ordinary iron lamp post. But there could be little doubt that if a few large electric lights, high up, were used for street illumination, the same sort of result as has been obtained at the Albert Hall would be arrived at. The cost of using gas in Sheffield for lighting large halls, such as the one they were now in, factories, and the streets, could be halved if electric currents, generated by water engines, worked by hill streams, as well as by very large steam engines, were substituted for gas. It was not necessary for him to tell them how he proposed to employ the electric light to illuminate private rooms, if only he could get people to throw away the notion that to light a room they must have something with a globe on it, like an oil lamp; nor was it necessary for him to remind them that by whitewashing the walls—yes, by whitewashing even the very machines themselves—in some of the Paris factories, the supposed strong shadows cast by the electric light had been less than the strong shadows cast by another bright light, one that we not only put up with, but one that from the force of habit we were tolerably contented with, namely, the sun. At present he was concerned with the pounds, shillings, and pence question, which had more than usual weight in these days of slack trade. Assuming that the cost of gas for lighting the large buildings, factories, and the streets of Sheffield could be halved, also that where it was used for heating purposes the expense could also be halved, by substituting electric currents generated by very large steam engines at certain points, and by turbines driven by falling water out of the town; then they would save per year about £45,000. Supposing, also, that the cost of producing motive power could in the same way also be halved, this represented an annual saving of something like £60,000. In reality, he believed this last economy would be larger, since not only could power be produced so much more economically than by small steam engines or even by a large engine, when a large proportion of its power was, as now, wasted in driving the shafting alone in their factories; but, in addition, much hand work could be economically replaced by machine work. And, lastly, supposing the consumption of coal in Sheffield for heating their metals and for heating their houses could also be halved, then there was another saving of about £300,000 a year; or, altogether, the annual saving that might be produced in this town alone, by substituting electricity for coal, would be something like the large sum of £400,000.

Last year, two French engineers, MM. Chretien and Felix, at Sermaize (Marne), actually plowed fields by electricity, the electric current being produced by two dynamo-electric machines of a form invented by M. Gramme. These machines were usually worked with a steam engine at some convenient place three or four hundred yards away in an adjoining road, and the electro-motors were also two Gramme machines, one on each side of the field, with their coils revolving of course backwards. Through one of these the electric current was sent alternately, so that motion was given to one or other of two large windlasses, one on each of the wagons containing the electro-motors. In this way the plow, which could be used going in either direction, was first pulled across the field, making a furrow, and then back again, making another parallel furrow. If electricity were produced in large quantities at certain centers, then one difficulty that would of course be met with would be that of distributing it properly, since, just as in the case of water or gas, if a large branch pipe in a main be suddenly opened then the supply going on to the other branch pipes in the same main would be diminished, a result causing serious inconvenience in the case of electric lighting. But just as automatic governors had been devised for water and gas, to keep the supply constant, so automatic "electric current regulators" had been devised by M. Hospitalier and by Dr. Siemens, to keep the current constant. One of those invented by Dr. Siemens was on the table before him, and the general principle of its construction was easily understood. As the current passed through the regulator it heated a very thin ribbon of steel, which consequently expanded. The effect of this expansion was to introduce coils of wire into the circuit, the extra resistance of which diminished the strength of the current. Consequently the stronger the current the more was it automatically resisted, and the weaker it became the less was it resisted, and so it remained practically constant at any desired strength for which the regulator was previously adjusted. In conclusion the lecturer said there was a time when "not only in the villages around old Sheffield," so said the historian of Hallamshire, "were the file makers' shops or the smithy to be seen, with the apprentices at work; but even on the hillside in the open country, at the end of the barn, would be the cutler's shed, while in the valley below, by the river, was the grinding stone ready to sharpen the tools that had been manufactured." And why not now? Why should not that mountain air that had given the workmen of Hallamshire in past times their sinew, their independence, blow over their grindstone now? Why should not division of labor be carried to its end, and power brought to them instead of them to the power? Let them hope, then, that in the next century electricity might undo whatever harm steam during the last century might have done, and that the future workman of Sheffield would, instead of breathing the necessarily impure air of crowded factories, find himself again at the hill side, but with electric energy laid on at his command.

IMPROVED ENGINEER'S TRANSIT.

The two instruments shown in previous numbers, made by Fauth & Co., were purely astronomical ones. We now illustrate an instrument familiar to most of our readers—an improved engineering transit. This is the standard instrument as furnished by Messrs. Fauth & Co. to the government department that are using this class of apparatus, and it is rapidly gaining favor with railroad engineers and surveyors. The instrument is constructed so as to give great strength with little metal. Instruments of this construction have not sustained serious injury by heavy falls. The telescope standards, which in the old form are merely held on the plate by means of screws, are in this instrument cast on a common base and radiate out from the center, giving the superstructure a firmness which cannot be secured by any other method. A glance at the engraving will give a clear idea of the construction and arrangement of the various parts, and we will only add that the graduations are on silver; the telescope is powerful, and has an achromatic objective. The compass needle is 5 inches long, and the whole is made with a view to economy in first cost as well as to the quality of the instrument.



FAUTH & CO.'S ENGINEERING TRANSIT.

For further particulars address Messrs. Fauth & Co., Washington, D. C.

MECHANICAL INVENTIONS.

Mr. Peter Cooper, of New York city, has recently patented an improvement in propulsion of railway cars, which consists in a combination of well known mechanical powers, by which trains of cars can be propelled at any desired speed by means of an endless chain or wire rope. The endless chain or rope is to be borne up in its entire length by being fastened firmly to the outside and in the center of as many sets of cars as there are stopping places on the whole line of the road. The stopping places are to be all of equal distances apart, and there will be bearing trucks between the different sets of passenger cars to prevent the chain from dragging or rubbing against anything in its passage around the circuit. The endless chain or rope, with the attached cars, is made to pass around a large drum wheel placed at each end of the line, which is to be of sufficient strength and operated by sufficient power to move the whole line of cars By having stopping places at equal distances apart the rails can be so elevated as to use up the momentum of the cars in their ascent of the elevation at each stopping place. The elevation will be sufficient to bring the cars to rest and hold the power ready to be given out at once by all the cars going over the ascent at the same time. This will give back all the power consumed by forcing the cars up the ascent, and will reduce the necessary propelling power to that required on a dead level.

Mr. William H. Ellis, of Brooklyn, N. Y., has patented an improved umbrella drip cup, which consists of two conical cups connected together at the base, the outer one joined at its smaller end to a tube, into which the lower end of the umbrella stick is entered and secured so that the cup is just under the umbrella; by this means, when the umbrella is folded up, the water runs down and is caught and retained in the chamber between the two cups, from which it slowly runs out through the perforations in the connected base of the cones when the umbrella is again lifted or reversed.

Charles E. Fox, of Mount Pleasant, Mich., has invented an improved washing machine, which consists of one or more rollers arranged transversely in relation to the corrugated face of the wash board, and having a crank and gear attachment, the parts being mounted in a suitable frame, which is attached to the wash board, and adapted to yield so that the rubbing rollers act on both small and large fabrics.

Mr. David L. Towslee, of West Salem, O., has invented an improved drag sawing machine, so constructed that it may be worked by the operator with both hands and feet, or with either his hands or his feet. It is simple in construction, easily operated, and apparently effective in operation.

Mr. Martin Williams, of St. Johnsville, N. Y., has invented an improved thrashing machine, that runs steadily and easily and effects a thorough separation of the grain from the straw.

An improved device for lighting a fire automatically, at any given time, has been patented by Mr. Eibe H. Doescher, of Homestead, Ia. The invention consists in the combination of devices that cannot be readily described without an engraving.

A simple and effective device for automatically regulating the height of water in a steam boiler, has been patented by Mr. John Bridges, of Leon, Iowa. The invention consists of a novel construction and arrangement, in connection with a boiler, of a float, valve, and pipes, and their connections, with a feed pump.

Thaddeus C. Histed, of Junction City, Kan., has invented an improvement in that class of washing machines in which beaters are employed in connection with a rotated tub; and consists in the peculiar construction and arrangement of mechanism by which the work is thoroughly done.

Mr. Sylvanus A. Fisher, of Geneseo, Ill., has invented an improved wire stretcher, which consists in a lever fitted with a cam-acting holding jaw, by which the wire is securely held and from which it may be readily released.

An improved washing machine has been patented by Mr. Melvin A. Tinker, of Fairfield, Ill. The invention is an improvement in the class of washing machines composed of rolls held in yielding contact by means of springs, the bed rollers being arranged in the arc of a circle and inclosed or covered by an endless apron.

Mr. Soren Andersen, of Stronach, Mich., has patented an improved saw grinder for grinding saws down to as thin a gauge as they will work at, thereby rendering the waste in sawing as small as possible. It saves power; and by means of this combined grinder and gummer, saws can be used until they are actually worn out or worn down too small for use.

An improvement in smoke stacks has been patented by William F. Cosgrove, of Jersey City Heights, N. J. It consists in providing the stack with an inclosing jacket, in the double conical head of which is supported an inverted perforated cone and a screen for deflecting the products downward, where they fall upon an inclined collar surrounding the stack which leads them to a spout, whence they are conveyed by a pipe to a chamber formed in an extension of the boiler shell.

Messrs. George Coombs and Charles S. Blakeslee, of Chariton, Ia., have patented an improvement in car couplings. This is a simple and effective self coupler for cars, but it cannot be described without engravings.

Photographic Illustration of Mental Operations.

Professor Huxley illustrates his argument respecting complex impressions which are more or less different from each other by reference to composite portraiture, thus: "This mental operation may be rendered comprehensible by considering what takes place in the formation of compound photographs—when the images of the faces of six sitters, for example, are each received on the same photographic plate for one-sixth the time requisite to take one portrait. The final result is that all those points in which the six faces agree are brought out strongly, while all those in which they differ are left vague; and thus what may be termed a *generic* portrait of the six, in contradistinction to the specific portrait of any one, is produced."

THE HOLLOWAY SANATORIUM.

We present herewith a view of the noble institution, the "Holloway Sanatorium," erected at Virginia Water, Egham, at the sole expense of Mr. Thomas Holloway, the prince of English pill makers. It is intended for persons of the middle class afflicted with mental disease. It is designed for the accommodation of one hundred male and the same number of female patients. The building, of which Mr. W. H. Crossland was the architect, is constructed of red brick, with Portland stone dressings, and in the Gothic style, richly decorated. It stands just facing the Virginia Water station of the Staines and Wokingham Railway, on an eminence, and presents a façade of 640 feet, with a depth of 250 feet. There is a central tower 150 feet high, also turrets 60 feet high at the back of each wing, and a portico, with two tiers of pillared arcades, at the chief entrance. In front is a terrace 45 feet wide. The whole exterior has a very stately aspect. The adjacent grounds extend about twenty-five acres, laid out for an agreeable promenade.

The interior is arranged with great care and skill for the use of the institution. The center block, which divides the male from the female side, contains the administrative department, including the rooms for the staff and the visiting rooms; also the general dining hall, 54 feet by 30 feet; a grand recreation hall, 84 feet by 38 feet, and 50 feet high, which is handsomely decorated; libraries and billiard room. There are thirteen day rooms for each sex, all spacious and convenient, 30 feet long, 20 feet wide, and 12 feet high. Twelve dormitories, of the same dimensions, are provided for the men, and as many on the other side for the women; besides fifty rooms, 12 feet by 10 feet, for single patients. The delay in opening the Holloway Sanatorium has been mainly caused by the length of time required to complete the decorations of the recreation hall and dining hall, and those of the principal entrance and staircase, as well as to finish the building. It will have cost Mr. Holloway more than £200,000.

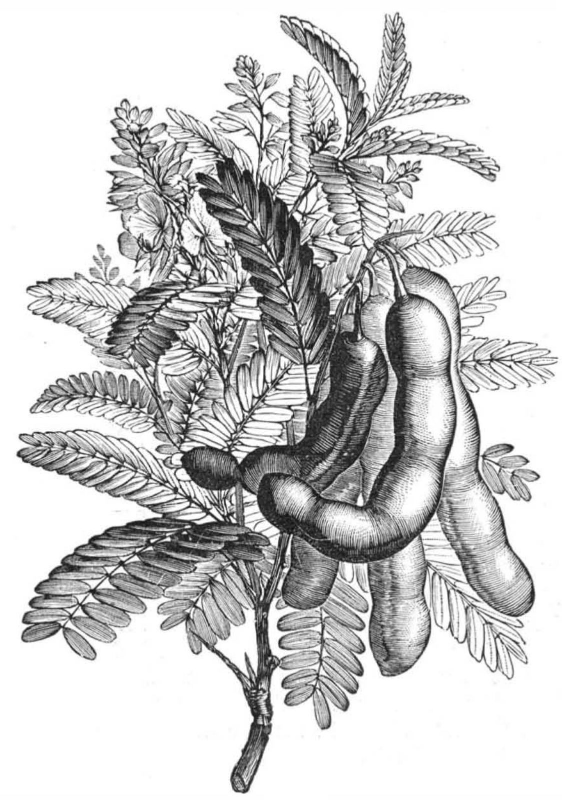
The London *News*, from which we take these facts, also says the announcement has recently been made of another magnificent institution, a college for women, to be erected on the Mount Lee estate, at Egham, at a cost of more than a quarter of a million sterling, by the liberality of this munificent public benefactor. Mr. Holloway has further promised an endowment fund of £100,000 for the support of this college; and the building, designed by his architect, Mr. W. H. Crossland, of Leeds, under his personal direction, will be constructed within the next four years.

Antidote to Poison Ivy.

Dr. J. M. Ward, in the *Medical Record*, makes another addition to the already extensive list of remedies for poisoning by *Rhus radicans*, or "poison ivy." He recommends the profession to use, in all cases of poisoning by this plant, Labarraque's solution of chloride of soda. "The acid poison," he remarks, "requires an alkaline antidote, and this solution meets the indication fully. When the skin is unbroken it may be used clear three or four times a day; or in other cases diluted with from three to six parts of water. After giving this remedy a trial no one will be disposed to try anything else. It is one of the most valuable external agents known to the profession, and yet seldom appreciated and but rarely employed. It will sustain its reputation as a local application in erysipelas, burns, and scalds."

THE TAMARIND.

This tree is indigenous in various parts of Africa and India, and it grows wild in several of the East Indian Islands. It is completely naturalized in the West Indies and in portions of Brazil and Mexico. It is a handsome tree, 60 to 80



TAMARIND.—*Tamarindus Indica.*

feet in height. Its compound leaves of ten to twenty pairs of small oblong leaflets form a dense foliage. The flowers are white when they first open, but they soon turn yellow. The fruit is an indehiscent legume or pod, 3 to 6 inches long, straight or somewhat curved, and with a hard, brittle exterior shell. The seeds, from 4 to 12 in number, are each surrounded by a tough, papery membrane, outside of which, between it and the shell, there is a firm, juicy acid pulp, traversed by strong woody fibers, which start from the fruit stalk. The ripeness of the fruit is known by the brittleness of the outer shell.

In the West Indies its fruit is picked, deprived of its shell, and packed in casks, and boiling sirup is poured over them until the vessel is full; when cool the package is headed up and is ready for market.

A better kind, rarely found on sale, is prepared by packing the shelled fruit in stone jars with alternate layers of sugar.

The pulp has a brisk acid taste, modified more or less by the amount of sugar used; it contains tartaric, citric, and other acids, and some principle not well ascertained, which gives it a laxative property. Tamarinds are used in tropical countries to prepare a refreshing drink by pouring boiling water over the fruit. This drink is also used as a laxative and refrigerant in fevers. The wood is useful for timber and makes a fine charcoal. The shell of the seed contains tannin, and the kernels are used as food in India in times of scarcity.

White Willow Hedges.

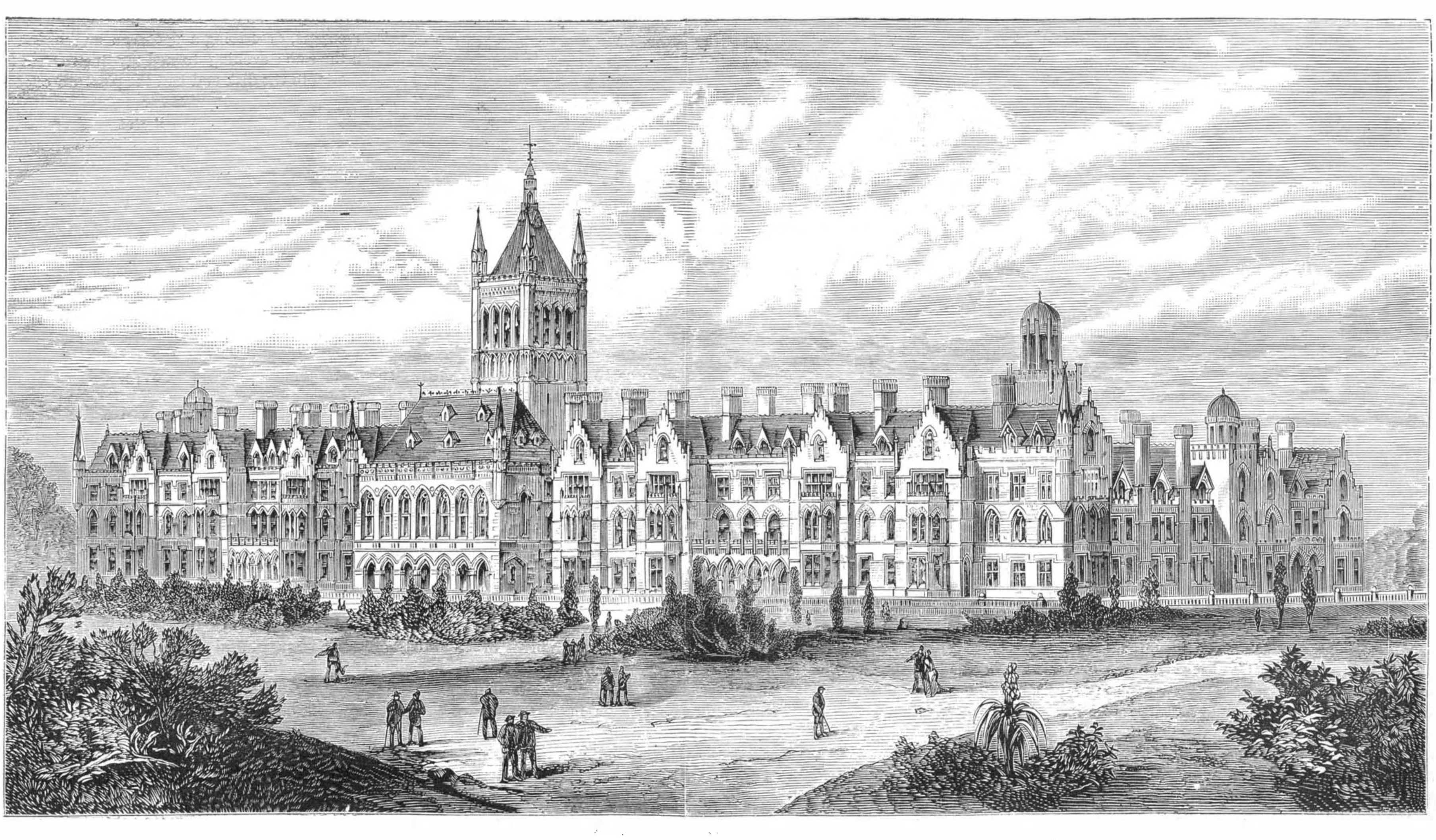
J. W. Myers, of Hampton, Iowa, says, in the "Iowa Horticultural Transactions," that after many trials there are two trees which have endured the ordeal of northern hedging, and have not been found wanting in any particular. These are the honey locust and the white willow. The best management of the willow is to take none but good strong shoots of last year's growth, cut ten inches long and sharpened, assorted as to size, and tied in bundles of twenty-five each. Place them, sharp ends down, in a shallow pond or other water for ten or fifteen days, and if the points are stuck in the mud they will be held in position. Plow the ground deep and harrow well. With a buckskin glove on the right hand, thrust the cuttings, slanting, eight inches into the mellow soil, ten inches apart. Then keep the ground perfectly clear of weeds; cultivate two more years with the shovel plow, and the hedge may be "left alone in its glory," and it will make a good barrier. But if cut to the ground early in spring when two years old, it will be much better. It will be best of all by "laying" or bending the trees down in a horizontal position at three years, and tying them in a line with short pieces of wire. The strong outgrowing shoots may be cut back every few years for fire wood. The simplicity of this method and its perfect success are said to be "astonishing."

The honey locust is similarly treated after the hedge has been planted and has attained a height of eight feet. The plants, however, are set in the row two feet apart, to prevent killing one another out. In laying down, the thorns are avoided by using a plank to bend the trees down, one end against the tree and the other on the ground, the operator sitting on it while tying the trees. The honey locust is more easily kept within bounds than the willow.

The Chemical Reaction of Blossoms.

According to the reports of Frémy and Cloez all red and pink blossoms show an acid reaction, whereas all blue blossoms are neutral and occasionally show an alkaline reaction. In order to examine the validity of these statements, Mr. A. Vogel examined 100 blossoms, of which 39 were blue, 44 red, 6 violet, 8 yellow, and 3 white.

He states that the acid reaction was not equally intense in all cases, but, on the contrary, varied considerably. The bright red, white, and yellow blossoms showed the most intense acid reaction. The acid reaction of the blue and violet blossoms was much weaker than that of the red blossoms, but was nevertheless perceptible. Of the blue blossoms only 10 were neutral or of a slightly alkaline reaction, as 3 violet and red blossoms were likewise. Among the latter were the



THE HOLLOWAY SANATORIUM AT VIRGINIA WATER.

Campanula sepunculoides (light violet), the *Prismatocarpus speculum* (crimson violet), and the bright red *Pisum sativum*.

There is no doubt that a great difference exists in the chemical reaction of red and blue blossoms, but from the above it appears to be erroneous to attribute an acid reaction to red and an alkaline reaction to blue blossoms. The majority of all blossoms show an acid reaction.—*Chemisches Centralblatt.*

A New Coloring Matter.

Mr. T. L. Phipson, according to a note recently presented by him to the French Academy of Sciences, has succeeded in extracting from the little blood-red alga (*Palmella cruenta*) found at the base of damp walls, a new rose-red coloring matter, which exhibits very curious properties. Mr. Phipson proposes for it the name of *Palmelline.* Its color resembles no known color except the coloring matter of the blood—the hæmoglobine of modern chemists. Like the latter, palmelline is insoluble in alcohol, ether, benzine, bisulphide of carbon, etc., but dissolves in water. Like the coloring matter of blood, palmelline is dichromic, consisting of a red matter united with an albuminous substance, and being coagulated by alcohol, heat, and acetic acid added to its aqueous solution. Like hæmoglobine, too, palmelline gives rise to absorption bands in the yellow of the spectrum; but these bands did not seem to Mr. Phipson to occupy exactly the same position as those given by blood. Palmelline in solution, like the coloring matter of blood in solution, readily undergoes putrefaction at summer heat, giving out a strong ammoniacal odor and a smell of rotton cheese. Finally, like the coloring matter of blood, palmelline contains iron. This new coloring substance cannot be extracted from the moist plant, for the vitality of the latter is such that it will not part with its color by the action of water; it has to be first dried in a current of air. At the end of from twenty-four to thirty-six hours the pellicles are usually pretty dry, for the plant and the matters upon which it grows dry quite rapidly in the air. It must not be dried on paper, for the cells would adhere thereto. On leaving the dried plant in a small quantity of water in a covered porcelain capsule, the coloring matter dissolves out, and, on the following day, the clear liquid may be decanted from it. The coloring matter is of a magnificent rose-red by transmitted light, and of an orange-yellow by reflected light.

From the properties above noted, it will be seen that palmelline appears to exhibit considerable analogy with the hæmoglobine of the blood; and, as Mr. Phipson says, it is the first time that a substance of this nature has been met with in the vegetable kingdom.

Colors of Plants.

At the last meeting of the Philadelphia Academy of Sciences the discussions were mostly confined to botanical matters.

Mr. Martindale stated that in a collection of over twenty selected specimens of Habenaria from the vicinity of Newfield, N. J., he had found all shades of color, from the bright buff to the pure white. He had found no difficulty in assigning all the tinted specimens to the species Ciliaris, while the white ones were undoubtedly Blephariglottis, the petals in the former being linear, and in the latter spatulate, or widened toward the tip about one-sixth of their diameter. The tendency of certain flowers to albinism was considered.

Dr. Hunt remarked that the causes of color variation in flowers was entirely unknown to botanists. It could not yet be explained why the same species in different localities were of different color, or why even the same flower presented varying tints at different parts of the twenty-four hours. He was firmly convinced after further studies of habenaria that the distinctions between the two forms mentioned were not specific, as he had actually found both forms on the same spike. Referring to the variation of color in plants, Mr. Meehan called attention to the case of *Gilia aggregata* of the Rocky Mountain region. Toward the north all these plants, which form a striking feature of the landscape, are white. As the traveler proceeds southward he observes that they assume a pink tint, which gradually deepens, until, when found three or four hundred miles farther south, the same species is of a deep crimson color. He believed that the two forms of habenaria were probably of the same species.

Mr. Redfield was of opinion that, had it not been for the difference of color, the two species of habenaria would probably never have been defined. The distinguishing characters having been pointed out, however, he believed that they were sufficiently permanent to constitute valid species.

The discussion was continued by Mr. Martindale, who believed that the two forms were distinct, although the differences, apart from the color, were undoubtedly very slight.

The Proper Diet for Children.

Here is another case of disease of the cornea. This baby is twenty months old. There is a white spot over the center of this little girl's pupil. It is soft-looking, and I therefore know that it is recent. The child has nasal catarrh. It was weaned when six months old, and it is now just cutting its eye teeth. The mother says it is being fed with whatever there is upon the table; that it receives a little tea and coffee, and that it it allowed to suck pieces of meat, all of which is wrong. Do not allow it among your patients, gentlemen. If the good Lord had wished us to eat meat at the age of twenty months, he would have given us a full set of teeth ready for use at that time.

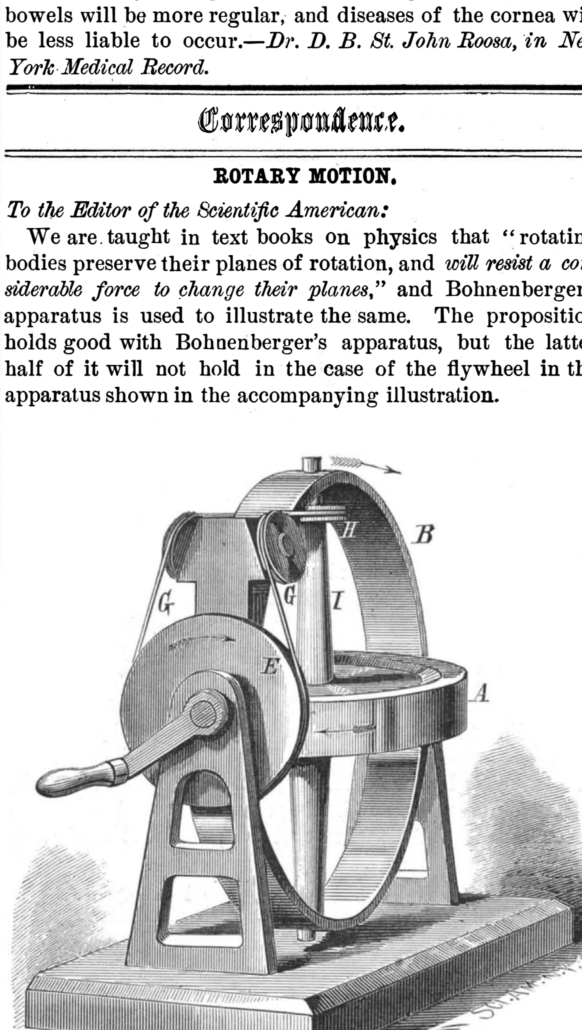
Dr. Leaming, of this city, whom you should all know, has for some years had charge of an asylum in which large numbers of children are received and cared for, and he does not allow one of them to have anything except milk, and substances which can be dissolved in milk, until they are seven years of age. I think your professor of materia medica is equally emphatic upon this question, and now your professor of ophthalmology comes to you and beseeches of you to use all possible influence in the direction of having children reared upon milk alone. Not upon tea, not upon coffee, not upon meat, not upon sweet cake and puddings, but upon milk. Every physician will, under rare circumstances, prescribe beef juice for infants, very much as brandy is prescribed upon rare occasions for small children, and I shall not quarrel with them upon that point. But I have a decided opinion that, under ordinary circumstances, no child should have anything except milk and farinaceous food until it has been provided with teeth with which to prepare other articles of diet for the stomach. Follow nature in your practice in ophthalmic as well as in every other kind of disease. I will engage, if this mother, who is anxious for her child, will listen to what I say about feeding it hereafter with milk, barley, farina, corn starch, hominy, with perhaps a small quantity of sugar, that the teething will be easier, the bowels will be more regular, and diseases of the cornea will be less liable to occur.—*Dr. D. B. St. John Roosa, in New York Medical Record.*

Correspondence.

ROTARY MOTION.

To the Editor of the Scientific American:

We are taught in text books on physics that "rotating bodies preserve their planes of rotation, and *will resist a considerable force to change their planes*," and Bohnenberger's apparatus is used to illustrate the same. The proposition holds good with Bohnenberger's apparatus, but the latter half of it will not hold in the case of the flywheel in the apparatus shown in the accompanying illustration.



APPARATUS FOR EXHIBITING ROTARY MOTION.

The flywheel, A, revolves with its axle, I, in journals in the ring, B. The latter revolves on bearings at right angles to the axle, I. A band, G, passes around the wheel, H, on the axle, I, over the pulleys journaled at the sides of the ring, B, and around the driving wheel, E. The driving wheel, E, is connected with the crank. When the band, G, is removed the ring, B, holding the flywheel is free to revolve on its pivots. If the band, G, is replaced and the crank is held stationary the ring, B, will revolve and cause the revolution of the flywheel; or if the ring, B, is held stationary, and the crank is turned, the flywheel will again be set in motion.

If rotating bodies always resist a force to change their planes of rotation, it will be seen that the fly wheel, A, would tend to hold the ring, B, stationary while the crank was turned, and the flywheel might thus be kept in motion, *provided the overcoming of the resistance of a rotating body to change its plane of rotation does not retard the revolutions of that body.* But there is no resistance whatever in changing the plane of the revolving flywheel, A, as can be seen by disconnecting the band, G, leaving the flywheel in motion. The ring, B, can be turned on its pivots without the slightest resistance, and when set in motion, the ring will continue to revolve the same when the flywheel is rotating as when at rest. When the flywheel is in motion and the band, G, disconnected, if the whole apparatus is revolved on a pivot or any other (the plane of revolution being parallel with the plane of the base of the apparatus, for instance), the rotating flywheel will instantly assume a position in which the plane of *its* rotation will be parallel with the plane of the revolution of the apparatus, that is, parallel with the base. Moreover, if the direction of the revolution of the entire apparatus on the pivot is a right hand motion, the flywheel will have a right hand motion parallel with it; and if the revolution of the apparatus is reversed so that the base has a left hand motion, the flywheel, A, will cause the rim, B, to make a semi-revolution so as to allow A to rotate parallel with the plane of D, and in the same direction, that is, a left hand motion.

As stated before, when the base is at rest and the flywheel in motion (the band, G, being disconnected) there is no resistance against changing the plane of the rotating flywheel; but *if the base,* D, *is revolving at the same time, there is a very decided resistance offered against changing the plane of the flywheel.* So strong is this resistance that if the band, G, is connected, the flywheel may be kept continually in motion by turning the crank, showing that *the overcoming of the resistance of a revolving body against changing its plane of rotation does not retard the motion of that revolving body.*

I do not know that this fact has ever before been demonstrated.

By oscillating the base upon a pivot while the flywheel is in motion the ring, B, can be made to revolve; and if the crank is fastened so that the driving wheel is held stationary, the velocity of the flywheel can be accelerated or retarded and kept in continuous rotation. Motion may thus be imparted to the flywheel still better by rotating the base on a pivot eccentric to its axis, no matter how slight the eccentricity, the base remaining comparatively still; or still better, by keeping a point at the center of the wheel stationary, and oscillating the pivots of the ring, B, in opposite directions, in both cases the crank remaining unmoved.

H. J. M. MATTIS.

The Durion.

To the Editor of the Scientific American:

In the July, 1879, EXPORT EDITION of the SCIENTIFIC AMERICAN, I find, at page 49, the views of a writer in the *Gardener's Chronicle* on "A Tropical Fruit," the durion. The article concludes thus: "It does not succeed well in India, and cannot be grown in the West Indies." This assertion, as regards India, I am not in a position to disprove; but it is decidedly erroneous in respect to the West Indies, as the durion grows most luxuriantly in this island, in proof of which I had purposed by this opportunity sending you one but have been disappointed in its receipt. You may, however, rely on my so doing at an early date.

GEORGE LEVY.

Kingston, Jamaica, September 4, 1879.

Bitten by a Skunk, but Still Alive.

To the Editor of the Scientific American:

I notice in your issue of September 20 an article on skunk bites, in which the writer says that the bite is *always* fatal, sooner or later. Permit me to say that when a youth of 19 I was badly mangled by a skunk which I seized in the dark, believing it to be a rabbit. I am now 55, hale and hearty. I have personal knowledge of two similar cases, and have heard of others, and have yet to learn of the first case of death attributable directly to the bite, or causes arising therefrom.

I am inclined to think that the fatal cases are of the same order as those of the centenarians who die from the use of tobacco (?). JAMES L. HOWSON.

Washington, D. C., September 12, 1879.

The Spot on Jupiter.

To the Editor of the Scientific American:

In your issue of September 12 I noticed a communication from F. S. Davenport, describing a spot seen on the planet Jupiter; and on the same evening turned my instrument (a six inch achromatic) to the disk and had the pleasure of seeing the spot.

When first seen, at 6¾ o'clock P.M., it was nearly central, and occupied nearly 1-3 the breadth of disk from east to west, and with a width from north to south about the same as represented by Mr. D., and passed off to the right in line of the planet's rotation.

The above observation was made with a terrestrial eyepiece. There seem to be some mighty changes going on on the planet, especially in the vicinity of the belts, the nature of which it is impossible to conjecture with any probability of accuracy. R. L. ALLEN.

Providence, R. I.

Note on a Peculiar Case of Corrosion of the Metal Tin.

BY J. W. OSBORNE, OF WASHINGTON, D. C.

The writer exhibited before the American Association a block tin tube, which had been used in the construction of a filter for household purposes, large quantities of water having passed over it for 20 months.

The tube formed one leg of a siphon. It passed through a stratum of charcoal and one of pure sand, the water to be filtered rising high above the latter. The outside of the tube, in that part of it only which corresponded in position to that of the sand, was deeply pitted, oxide of tin having been formed. The difficulty was to explain in what manner the sand determined the oxidation.

An interesting discussion followed the reading of this paper, many members of the section taking part, but no satisfactory solution of the problem was reached.

Action of Aqua Regia on Platinum.

Mr. Edison finds that platinum, after it has been rendered homogeneous under the vacuum treatment, is dissolved with great difficulty in boiling aqua regia. He subjected a specimen of the vacuum-treated platinum to the action of boiling aqua regia for five days without dissolving it.

JAPANESE BRONZE VASES.

We engrave on this page a group of bronze vases, which illustrate in an excellent manner the beauties and oddities of the peculiar artistic methods of the Japanese. As metal-workers, these wonderful people surpass in certain respects their European brethren, and some of their processes are to this day inimitable.

The central piece of this group stands some four feet high. It is composed entirely of bronze, save the panels between the dragon handles, which are damascened with silver and gold. The panel on this side represents a knight doing penance by standing under a cataract, and on the obverse he is seen, his sins washed away, having a quiet cup of tea with a couple of friends. So far the European can trace a meaning in the design; but when it comes to explaining the half human monsters, the dragons, sea serpents, and other animals, it is only possible to suppose that they may be the representations of traditional creatures such as figure in the Arabian Nights, and the like of which learned scientists assure us once walked or crawled upon the face of the earth and swam across the seas. The decoration of the smaller vases, saving the winged beasts that serve as handles, is more easily understood. The panels in these have birds and butterflies copied with wonderful fidelity and spirit after nature, and are really beautiful; and in these pieces, as in all the articles of Japanese manufacture, we see a minuteness of workmanship and finish such as no Christian people can afford the time to emulate.

JAPANESE BRONZE VASES.

The International Dairy Fair.

The executive committee of the International Dairy Fair Association announce that the proposition to hold a second fair at the city of New York, during the year 1879, has been so well received by the trade at large that its ultimate success is already assured, and it only now remains for the dairying interests throughout the country and the different dairy organizations to co-operate with the International Dairy Fair Association, and through their united efforts secure an exhibition worthy of the interests involved, surpassing anything of the kind ever before presented. The experiences gained at the last fair enable the committee to more readily comprehend the necessities of this, and having this in view, the whole of the American Institute Building has been engaged this year, thereby enabling the management to devote a much larger space to the exhibition of goods, and at the same time give that attention to proper display of dairy implements and tests of cream raising which want of space prevented at the last exhibition. Machinery Hall, a part of the Institute not used last year, will be devoted exclusively to this branch of industry, where, having ample steam power and connections, every facility will be afforded for the manufacture of butter and cheese upon a much larger scale than heretofore, and opportunities for displaying dairy implements by hand or power greatly increased. A separate apartment will be arranged with every requirement for making the fullest tests of the different processes for raising cream, and the trial of inventions claiming superiority. Accommodations for a large number of cattle will be provided, and the exhibition of herds, as well as specimen animals, made a feature. From promises already received from owners and breeders, it is confidently believed that an unprecedented number of choice animals will be exhibited, comprising selections from the most celebrated herds in America and Europe. The display of foreign products will be far greater than last year, assurances having been received from the officers of the Association resident and traveling abroad, of extensive preparations being made to send specimens of every kind of dairy products manufactured, as well as some thoroughbred cattle.

Torpedo Boats.

The Admiralty have entered into a contract with Messrs. Yarrow & Co., of Poplar, for the construction of some of their second-class torpedo boats. These little vessels are fitted with Yarrow's patent tubular boiler, by means of which steam can be raised from cold water, and the craft got under way, in six minutes from the time of lighting fires. The system of steering adopted is that introduced by the manufacturers, and which is now recognized as the most suitable for steering this class of vessel. It consists of a drop rudder forward, which is worked in conjunction with the usual rudder aft. These torpedo boats will be completed early next year, and the trials of them on the Thames and at Portsmouth are looked forward to with considerable interest.—*London Times.*

Tape Worms in Eggs.

Various instances have been recorded of the discovery in hens' eggs of minute specimens of the *distoma ovatum*. They appear like a small speck, the size of a millet seed or a pin's head. It is believed by helminthologists that these will develop into one of the varieties of tape worm, and it is wise, therefore, to take eggs hard boiled or otherwise well cooked. A writer in one of the late numbers of *Nature* cites several instances where these parasitic bodies have been found.

International Patent Law.

The following are the resolutions passed at the meeting of the Patent Law Committee of the International Law Association held recently in London. The committee, after having deliberated on the subject, recognize that it seems impossible at the present time to propose one common law upon patents for inventions, on account of the numerous points of contact which the subject presents with divergent civil, commercial, and criminal law in general. Nevertheless, it is advisable to select a certain number of general principles which may be accepted in the laws of all countries. Consequently the committee adopt and propose to the congress of the association the following resolutions:

General Principles.—(1) The right of inventors over their productions is a right of property; the law does not create, it only regulates it. (2) A temporary privilege of sufficient duration to insure the remuneration of their labors and outlay should be accorded to inventors, less in their own interest than in that of industry in general.

Law and Treaties.—(3) Patents for inventions should be the subject of a special and complete law in each country. (4) Foreigners ought, with respect to patents, to be treated in exactly the same way as citizens. (5) Stipulations for the reciprocal protection of patent rights between different countries should be contained in special conventions, independent both of treaties of commerce and of conventions for the mutual recognition of literary and artistic copyright.

Patent Office.—(6) A special department for patents, trade marks, and registered designs should be established in each country. A central depot of patents, etc., should be attached to it for the use of the public. Independently of any other publication the Administration of Patents, etc., should publish a periodical official journal.

Fees.—(7) The fees levied on patents should not be larger than is necessary to cover the expenses of the patent office, and should be levied by periodical payments.

What is Patentable, and by Whom.—(8) All inventions, whether of procedures or of products, should be patentable, except financial combinations or inventions contrary to public order or to morality. In particular, chemical, alimentary, and pharmaceutical preparations should be patentable. (9) In the absence of fraud, the first applicant should be deemed the inventor. (9*a*) No person, except he be engaged in the patent office, should, by reason of his employment, be debarred from obtaining patents for his own inventions.

Provisions as to International Exhibitions.—(10) Provisional protection should be granted to patentable inventions exhibited at international exhibitions, or such as are officially recognized. (11) The term during which inventions are thus protected should not be deducted from the term of the patent. (12) Such provisional protection should extend to all the countries represented at the exhibitions. (13) The fact that an article is an exhibit at an international or officially recognized exhibition should not interfere with the right of seizing it as an infringement.

Provisional Protection.—(14) Provisional protection for twelve months should be granted on the applicant for a patent filing a provisional specification containing an outline description of the nature of his invention, in which no details should be required.

Procedure on Application.—(15) No description of the invention—except its name—should be published before the issue of the patent, except as mentioned in paragraph 19. (16) The deposit of provisional specifications should, if desired by the inventor, be allowed to be made at the authorized local office, and at the consulates of the various nations, and on such deposit at a consulate, and the payment of the patent fees, provisional protection should commence as if the deposit had taken place in the patent office of the country represented. (17) Prior to the expiration of the term of provisional protection, if the applicant desires to complete his patent, he should be required to file a full specification. (18) Where a patent has been applied for in one country, subsequent publication of the invention should not during a period of twelve months prejudice the original applicant's right to patent in other countries.

Examination.—(19) On the filing of the complete specification, or the expiry of the term of provisional protection, if no complete specification has been filed, the provisional specification should be published. After the filing of the complete specification, and previously to its publication, the patent office should examine it, having regard exclusively to the following points: (*a*) Whether the specification is clear. (*b*) Whether the invention is contrary to public morals. (*c*) Whether the invention is wanting in novelty, regard being had solely to prior publications in the patent office of the country. (20) For the purposes of examination, an invention should not be deemed to be wanting in novelty, unless a prior publication be found which comes strictly within one or other of the following conditions: (*a*) It should be not more than twenty-five years old, and be in the form of a full description, identical with the applicant's description. (*b*) If the prior description be more than twenty-five years old, it should be proved that the identical invention as claimed by the applicant has been openly used within twenty-one years last past. (21) Should some parts of the invention come within these objections the applicant should be allowed to amend his specification. (22) Subject to such amendment, the patent should be granted, except in cases of fraud, or when the invention is contrary to public morals. (23) Reports and opinions of examining authorities, as respects applications for patents, should not be open to the public.

Procedure on Grant of Patent.—(24) The complete specification should be published immediately on the granting of the patent. (25) The provisional protection should continue until the final grant or refusal of the patent.

Amendment.—(26) Should it appear, after a patent has been granted, that the claims are too extensive, or that the specification is otherwise open to objection, it should be competent to the patentee to disclaim or amend his specification.

Term.—(27) All patents should be granted for a term of twenty-one years. There should be no prolongation. (28) A patent, whenever granted, should bear date from the deposit of the provisional specification.

Effect of Patent.—(29) All patents should, throughout their whole term, insure to the inventors or their legal representatives or assignees the exclusive right to the patented invention, and not a mere right of receiving royalties from third persons. (30) No one should be permitted, without the leave of the patentee, to produce, use, or sell the article which forms the subject of the invention, the patented machinery, process, or combination, or the article produced by such patented machinery, process, or combination. (31) A patent should have no effect on vehicles or ships, or appliances to vehicles or ships, which come but temporarily within the boundaries of the country, and the owners of which do not carry on business within the country. (32) The patentee should not be prevented from introducing from abroad articles manufactured under his patent. (33) A patent should be held to confer an indefeasible title to the invention described in the complete specification, unless it be proved that there exists a prior patent covering an identical invention, or that the identical invention has been publicly used within twenty-one years prior to the date of the patent, or fully described in a publication bearing date or printed within twenty-five years prior to that date. (34) Where it is proved that the public interest requires that a patent should be worked, and that the holder of the patent is not attempting to meet the demand, and refuses licenses, the legislature should step in to prevent the public injury by a special law in each case. (35) The principle of expropriation for public utility is applicable to patents, but this should only be by virtue of a special law in each case, containing proper provisions for compensation. (36) Patents granted in different countries should be perfectly independent of each other in all respects.

AN esteemed correspondent writes us from the province of São Paulo, Brazil, stating that severe frosts occurred there in August last during several nights, which had so seriously injured the coffee trees that the crop for 1880 will be reduced one half.

To Make Cloth, Paper, etc., Fireproof.

Several preparations for rendering textile and other inflammable fabrics incombustible and practically fireproof have been brought out by MM. Martin and Tessier, of Paris. The compositions are said to be of an inexpensive nature, and capable of rendering incombustible all kinds of readily inflammable substances, such as woven and other fabrics of cotton and other fibrous materials, paper, printed or otherwise, including bills of exchange and other securities, woodwork, theatrical scenery, straw, etc. The first composition, which may be applied to all kinds of fabrics without deteriorating them in any way, consists of:

	Kilos.
Sulphate of ammonia (pure)	8
Carbonate of ammonia	2·5
Boracic acid	3
Borax (pure)	1·7
Starch	2
Water	100

It is simply necessary to steep the fabrics in a hot solution composed as above until they have become thoroughly impregnated, after which they are drained and dried sufficiently to enable them to be ironed or pressed like ordinary starched goods.

A second composition to be used for theatrical scenery (or the mounted but unpainted canvas to be used for this purpose), and also for woodwork, furniture, door and window frames, etc., is to be applied hot with a brush like ordinary paint. It is composed of:

	Kilos.
Boracic acid	5
Hydrochlorate of ammonia or sal ammoniac	15
Potassic feldspar	5
Gelatine	1·5
Size	50
Water	100

To which is added a sufficient quantity of a suitable calcareous substance to give the composition sufficient body or consistency.

A third composition, to be used for coarse canvas or sail cloth, cordage, straw, and wood, is applied by immersing the articles therein or by imbibition, and consists of:

	Kilos.
Boracic acid	6
Hydrochlorate of ammonia or sal ammoniac	15
Borax (pure)	3
Water	100

A fourth composition, applicable to all kinds of paper, whether printed or not, including securities, books, etc., is formed of:

	Kilos.
Sulphate of ammonia (pure)	8
Boracic acid	3
Borax	1·7
Water	100

The solution is to be placed in a vat heated to 50° C. (122° Fah.) at the end of the paper-making machine, and the paper as it leaves the machine is passed through the solution in this vat, so as to be completely impregnated therewith, after which it is dried upon a warm cylinder and then wound on a reel. If the paper be in sheets or printed it is simply immersed in the above solution, heated to 50° C., spread out to dry, and afterward pressed to restore the glaze destroyed by the moisture.

The above compositions are said to insure a degree of incombustibility without precedent as regards the preservation of the materials to which they are applied. The proportions of the several ingredients are given as examples only, and may be varied as found necessary in practice.

The Social Science Association.

The last day's session began with a paper by Frederick Douglass on the exodus of negroes from the South. Mr. Douglass strongly opposed the movement, holding that the South was not only the best place for the negro as a field of labor, but best on the grounds of his political powers and possibilities. The position taken by Mr. Douglass was opposed by Professor T. R. Greener, of Howard University, and President Anderson, of Rochester.

William A. Hovey, of the Boston *Transcript*, read a striking paper on co-operative stores in England and America. Mr. James Samuelson, of Liverpool, England, presented certain schemes for the material advancement of the working classes, and Mr. Joseph D. Weeks, of the *Iron Age*, gave an address on industrial arbitration and conciliation. Debt making and debt paying in American cities was discussed by Mr. William F. Ford, of Philadelphia. In the department of social economy, Mr. F. B. Sanborn, secretary, presented his annual report; and there was read a paper sent by Charles L. Brace, of the Children's Aid Society, discussing the methods of dealing with poor and vicious children. Institution life for children was treated in a paper by Rev. T. K. Fessenden, of Connecticut, and debated by several members. The closing paper was by Mr. Robert P. Porter, of the Chicago *Inter-Ocean*, on the industrial, agricultural, and financial outlook of the West. It presented an array of facts and figures that astonished even those who had a general idea of the rapid industrial progress of the West during recent years.

A Remarkable Pompano.

Mr. C. A. Lewis, at the Washington Fish Market of this city, has recently had on exhibition the largest pompano ever known. It was taken with Spanish mackerel off Norfolk, Va., and weighed twenty-three pounds. Usually these fish range between one and three pounds in weight. A four pounder is rare. Above that weight but one specimen has ever before been brought to this market, and that weighed nineteen pounds. Mr. Lewis' fish was perfect in every particular, though a monster in size. It was sent to the Smithsonian Institution at Washington.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By Judge Clifford.—U. S. Circuit Court—District of Massachusetts.

BOOT AND SHOE SEWING MACHINES.—THOMAS *et al.* v. THE SHOE MACHINERY MANUFACTURING COMPANY *et al.*

1. Reissued patents are presumed to be for the same invention as the original, and will only be adjudged to be void because for a different invention where it clearly appears that the reissue contains some new feature of a material character not described, suggested, nor substantially indicated in the specification, drawings, or Patent Office model.

2. The fact that a reissue patent has been granted is *prima facie* evidence that satisfactory proofs have been given to the Commissioner of such a state of facts as warrant the reissue, even though the patent may contain no recitals that the prerequisites to the grant have been fulfilled.

3. After reissue the Commissioner's decision in the premises *in a suit for infringement* is final and decisive, and is not re-examinable in such a suit in the circuit court, unless it is apparent on the face of the patent that he has exceeded his authority, and that there is such a repugnancy between the old and the new patent that it must be held as matter of legal construction that the new patent is not for the same invention as that embraced and secured in the original.

4. The applicant for reissue cannot interpolate new features not described, suggested, or substantially indicated in his original specification, drawings, or model. Such interpolations in a reissue patent, if material, show that the Commissioner exceeded his jurisdiction; and where that is done it clearly becomes the duty of the court to declare the patent void.

5. The courts will in no case declare a reissue patent void if, by the true construction of the two instruments, the invention secured by the reissue is not substantially different from that embodied in the original patent. Inquiries in such a case are restricted to a comparison of the terms and import of the two patents in view of the drawings and models. If from these it results that the invention claimed in the reissue is not substantially different from that described, suggested, or indicated in the original specification, drawings, or model, the reissued patent must be held valid, as all other alterations and amendments plainly fall within the intent and purpose of the statute which allows a surrender and reissue.

6. Inventions secured by letters patent are presumed to be new and useful until the contrary is shown; and, in the absence of countervailing proof, that *prima facie* presumption is sufficient to entitle the complainant to a decree in a suit for infringement.

By the Commissioner of Patents.

ANVIL.—EX PARTE DUCSH.

The combination of a drill, adjustable standard, and vise with an anvil, as such, is not a legitimate mechanical combination, for the anvil, as such, can make no contribution to any distinct operation of the entire machine. But the combination of a drill, adjustable standard, and vise, by means of a base to which the standard and vise are attached, is a legitimate combination, embracing no supernumerary elements, and, if novel, is patentable.

TIME LOCK.—EX PARTE KOOK & HALL.

When the different forms referable to one genus are such that the substitution of one for another involves invention, the differences are patentable, and the several forms constitute different species of the genus, all subject to one generic patent, but each legally patentable in a distinct and specific patent. When, however, the substitution of one for the other involves no invention, but only mechanical skill, the differences are not patentable, and the forms do not constitute several species of the genus, but are all modifications of the same species.

VEGETABLE LIFE-DESTROYER AND SPROUT-KILLER.—EX PARTE RODGERS.

A decision of the Examiners-in-Chief, lawfully made in any case, constitutes a rule for the Primary Examiner in that case until the decision is overruled by the Commissioner.

METALLIC LINES OR CORDS FOR SUSPENDING PICTURES, ETC.—EX PARTE HOOKHAM.

A claim for an improvement in metallic cords for suspending pictures and other articles may be united in one patent with a claim for an improvement in fastenings for connecting pictures and other articles to cords; but these claims cannot be united with a claim for a reel for holding such cords in stock.

SCYTHES.—EX PARTE ROBY.

The substitution of edge steel enveloped in soft steel, in lieu of edge steel enveloped in iron or other material, in the manufacture of scythes, is a patentable improvement if the scythes in which the soft steel is used have more elasticity, less weight, and take a better polish than those constructed in any other form.

TRADE MARK.—EX PARTE COATS.

1. Minor non-essential elements of a composite symbol of trade, when used in connection with other parts which constitute its main features, cannot be registered as a trade mark; but those parts, when so used as obviously to constitute the main features of the aggregate symbol, are registrable as a trade mark.

2. Two parallel scales of inches and fractional parts thereof, when so used as to be the main features of the entire symbol or device in which they are shown, will constitute a lawful trade mark; but when used as a mere border to inclose ornamental designs or other trade marks of the applicant cannot constitute a lawful trade mark.

By the Acting Commissioner of Patents.

VENT PLUGS.—EX PARTE HICKS.

1. A claim for an article of manufacture cannot be changed by reissue into a claim for a process when the process was but a legitimate function of the particular article, and the article described was indispensable to the conduct of the process.

2. Where an application or a patent is restricted to a description and claim of a particular apparatus, neither the one nor the other can be subsequently enlarged to embrace a claim for a method that would include the same and all other means for producing the same result performed by that apparatus.

Part of One Day's Shipments of Food.

On Saturday, September 13, seven large steamers sailed from this port for Europe laden with American produce.

The Helvetia, of the National Steamship Line, for Liverpool, had on board 1,200 bales of cotton, 84,000 bushels of grain, 800 boxes of bacon, 900 boxes of cheese, 150 packages of butter, 700 sacks of flour, 200 cases of canned meats, 200 packages of sundries, and 45 tons weight of fresh meat.

The Germanic, of the White Star Line, for Liverpool, took out 1,600 boxes of bacon, 31 tierces of pork, 100 barrels of pork, 700 barrels of sugar, 210 barrels of sirup, 2,800 sacks of flour, 1,300 bales of cotton, 48 hogsheads of tobacco, 18,000 bushels of corn, 500 barrels of flour, 450 bales of hops, 11,000 boxes of cheese, 3,000 boxes of butter, and 60 tons of fresh meat.

Among other articles of merchandise the Olympus, of the Cunard Line, for Liverpool, had on board 2,200 bales of cotton, 13,000 bushels of wheat, 12,000 bushels of corn, 100 sacks of flour, 60 casks of skins, 30 tons of leather, 500 boxes of bacon, 400 cases of canned meats, and 500 dried hides.

The cargo of the steamship Oder, of the Imperial German Mail Line, for Bremen, was composed of 8,032 bushels of corn, 5,370 bushels of wheat, 340 hogsheads of tobacco, 550 cases of tobacco, 190 bales of tobacco, 2,200 packages of butter, 1,500 sides of leather, 350 tierces of lard, 50 tierces of grease, 200 barrels of flour, 100 barrels of peas, 75 boxes of bacon, 300 boxes of corned beef, 180 boxes of sausages, and 50 barrels of corned beef.

The Ethiopia, of the Anchor Line, for Glasgow, carried 40,000 bushels of corn, 1,700 barrels of flour, 6,000 sacks of flour, 4,000 boxes of cheese, 20 hogsheads of tallow, 150 tierces of beef, 900 boxes of bacon, 7,000 packages of butter, 900 quarters of fresh beef, and 200 carcasses of sheep.

The Australia, of the Anchor Line, for London, had on board 5,800 sacks of flour, 550 sacks of oatmeal, 4,035 packages of canned goods, 230 boxes of bacon, 125 boxes of hams, 50 tierces of beef, 470 barrels of tongues, 7,800 boxes of cheese, 450 barrels of lard oil, 450 barrels of flour, 8,000 bushels of wheat, 790 quarters of beef, 300 carcasses of sheep, and 125 live bullocks.

The Assyria, of the Anchor Line, for Bristol, took out 32,000 bushels of wheat, 2,000 barrels of flour, 3,000 boxes of cheese, 400 boxes of bacon, 100 tons of tallow, 400 barrels of lard oil, 900 packages of lard, 140 tons of oil cake, and 1,400 bags of flour.

This, it must be borne in mind, includes only the more important shipments by steamers. A vast amount of produce, particularly grain, is exported in sailing vessels.

Ship owners report a rapidly increasing demand for American products in Europe—a demand so urgent that the carrying rates for grain have been raised from thirty to forty per cent above those that obtained three months ago.

A Lady Patent Lawyer.

For the first time in the federal courts of this district a lady practitioner appeared the other day in this city before Judge Blatchford, in the United States Circuit Court, and argued in person a motion for an injunction in a patent suit for the alleged infringement of a patent of her own. The lady is Miss Helen Marie MacDonald, of Boston.

It will be remembered that for the last ten or fifteen years a considerable number of ladies have been employed in the Patent Office at Washington, some of whom have occupied the positions of examiners. In general they have shown activity and ability in the discharge of their official duties, and the experience gained ought to qualify them to serve acceptably as attorneys.

Our Trade with England.

The British Bureau of Statistics report that America is exporting to Great Britain three times as much as Great Britain sends to this country, and that with the rapid increase in American exports there is a correspondingly rapid decrease in British exports. In round numbers, the exports from the United States to Great Britain for the last fiscal year amounted to $333,000,000, while the exports from Great Britain to this country in the same period amounted to about $111,000,000.

American Gynecological Society.

The fourth annual convention of the American Gynecological Society met at Johns Hopkins University, Baltimore, Md., Sept. 17, for a three days' session. Dr. T. G. Thomas, of New York, presided. There was a good attendance, embracing many of the most eminent physicians in the United States.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

ON THE USE OF THE BAROMETER ON SURVEYS AND RECONNOISSANCES. By Lieut. Col. R. S. Williamson. Washington: Government Printing Office.

A compendium (without plates) of Lieut. Col. Williamson's paper on the barometer, professional papers of the Corps of Engineers, No. 15, which puts this useful manual in a form convenient for field use.

A PRACTICAL TREATISE ON LIGHTNING CONDUCTORS. By H. W. Spang. Philadelphia. 12mo, paper, pp. 44.

Advocates Mr. Spang's system of non-insulated lightning conductors, instead of the ordinary insulated lightning rods.

THE ILLUSTRATED SYDNEY NEWS.

The *Illustrated Sydney News* has sent out a special invitation issue, designed to attract visitors to the International Exhibition at Sydney. It is an exceedingly creditable bit of enterprise, the numerous and excellent illustrations making a particularly good impression. There are given besides a four column leader on the Exhibition, descriptions of the buildings and grounds, and a large amount of information as to the climate, geography, population, and products of the colony.

SPONS' ENCYCLOPEDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Edited by G. G. Andre. F.G.S. New York: E. & F. N. Spon, 30 parts, each 75 cents.

Parts 5 and 6 of this Encyclopedia complete the article on potash, and add soda, alloys, alum, alumina, arsenic, asbestos, asphalt, assaying, atomic weights, baryta, and beverages, the last including aerated waters and beer.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. E. M. writes: I am proprietor of a meat market at this place, also a subscriber for your paper. Last night, when going in my cooler, I noticed that a quarter of beef killed the day before gave forth a phosphorescent light, also blood that had dropped to the floor when spread over quite a surface lit the room so that I could distinguish objects for five feet. Can you explain this phenomenon? A. Many organic as well as inorganic substances exhibit the phenomenon of phosphorescence under certain circumstances. The cause is not definitely understood. Consult Phipson's "Phosphorescence in Minerals, Plants, and Animals;" also Becquerel's "La Lumiere, ses Causes et ses Effets." See article on p. 199, Vol. 40, SCIENTIFIC AMERICAN.

(2) A. W. P. asks: 1. Is there an instrument or anything that a man can use to find gold or silver coin that has been hidden underground? If so, please inform me where one can be obtained. A. A pick and shovel answer a good purpose. 2. I have a small engine, cylinder 5x10, makes 200 revolutions per minute: how much lead must I give the cut off valve—it cuts off at full stroke? I use 60 lb. of steam and the engine will pound. The pump piston is made fast to cross head. A. You should give the cut off valve at least 1-16 inch lead, and you may increase it, provided it does not reopen before the main valve closes.

(3) E. R. asks: 1. How does a vacuum rate as an insulator of electricity? A. Electricity cannot pass through a perfect vacuum. 2. What is the best metal to use for ⅛ inch pipe to contain cold drinking water, as cheap as is consistent with regard to health? A. Iron. 3. Are the contributions that you weekly announce under head of "Communications Received" all printed in the AMERICAN, or are part printed in the SUPPLEMENT? A. Some are published in the SCIENTIFIC AMERICAN, some in the SUPPLEMENT, and some not at all.

(4) E. S. asks for the surest method of silver plating large quantities of steel knives. The silver peels. I have no trouble with other metals. My solution deposits beautifully, but in burnishing comes up very blue. What is the cause? A. Your trouble is doubtless due to imperfectly cleansing the work or putting it in the bath before closing the circuit. Clean with hot potash or soda, and with dilute sulphuric acid and pumice stone or fine clean sand if necessary. The whitening bath should not be too strong, and should be worked with an extra cell or two.

(5) E. S. N. asks whether the black oxide of manganese will answer to mix with copper and tin to make the manganese bronze, mention of which was made in a late number of the SCIENTIFIC AMERICAN. I find the metallic manganese is too expensive (costing some $290 per lb.) I find manganese classed among the metals difficult to fuse. Will the oxide melt at the temperature of molten copper? A. Yes; reduce the oxide to an impalpable powder (120 mesh), mix it with an excess of powdered charcoal, and add the mixture gradually to the copper. Under these circumstances the latter will take up the small quantities of the manganese reduced by the carbon.

(6) E. A. E. asks: 1. In the freezing of 25 lb. of water at 60° Fah., how much heat must be given off? A. Sufficient to raise about 22 lb. of water from the freezing to the boiling point. 2. What quantity of crushed ice and salt, mixed in the proportion to produce the greatest cold, will, in passing to the fluid condition, absorb this quantity of heat? A. In practice from 50 to 70 lb. of a mixture of 2 parts ice and one of salt would ordinarily suffice to cool the water to the freezing point.

(7) B. A. asks: Which is strongest or preferable for general work, a pulley (from 18 to 60 or more inches diameter) with curved or straight arms, and why? A. Formerly pulleys were cast with curved arms, with the idea that they would produce less shrinkage strain, as upon cooling they would yield or spring to the pressure, but the art of proportioning and casting pulleys has been so improved that we think the curved have little or no advantage over the straight arms.

(8) E. F. M. would like to know (1) if ships of medium size are propelled with screw propellers of four blades. A. Yes, from 8 to 14 feet diameter. 2. What size and how long are the blades? A. The length of the blades is the radius of the propeller, less the radius of the hub. 3. What width? A. From 20 to 30 inches. 4. At what angle do they strike the water? A. Generally from 55 to 70 degrees. 5. How wide a space of water would be displaced if turned without any forward or backward movement of the vessel? A. They are assumed to displace a column equal to their own diameter.

(9) O. T. G. writes: 1. In steam engine with 7 inch cylinder, 10 inch stroke, what should be proper dimensions of area of induction ports in square inches? A. ⅝ inch x 4½ inches. 2. Area of eduction ports in square inches? A. 1 inch x 4½ inches. 3. Inside diameter of steam pipes? A. 2¼ inches diameter. 4. What number of revolutions should such engines make with 50 lb. pressure in cylinder. A. It depends upon the amount of work it has; the speed of an engine is generally determined by the character of the work or machinery to be driven. 5. Please give rules for calculating the above. A. The above will give about the usual proportions for engines of this class. There are no rules for proportions applicable to all kinds of engines.

(10) D. & C. ask: 1. Can you tell us of a better way to smooth spokes, as they come from the lathe, than the sand belt? A. No. 2. We have trouble in getting the ground glass to adhere to the ducking belts. If there is no better way than to use the belts, is there a better cement than common glue for fastening the glass or emery to the belts? A. Apply a rather thick coating of good tough glue to your belt; heat the sand to 200° and press the belt into it. This method allows the sand to become deeply embedded in the glue. 3. How can we season oak hubs without their cracking, and the quickest way? We want to season them in three months, if possible. A. They are sometimes seasoned quickly by steaming, but this method cannot be recommended. Dry the ends superficially, and apply a coat of raw linseed oil.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. L. F. & Co.—No. 1. A compact limestone resembling that from the celebrated Solenhofer mines, used extensively for lithographic purposes. No. 2. Quartz. No. 3. Impure crystallized lime carbonate. No. 4. A variety of calcite. No. 5. A fine marble. No. 6. Semi crystalline impure limestone.—C. A. B.—The clay will probably make excellent bricks, but contains too much iron oxide, lime carbonates, silica, etc., to be useful for pottery.—J. W. K.—It is a rich magnetite—magnetic oxide of iron. A valuable ore of iron if free from phosphorus.—S. B. M.—The sample of resinous substance appears to be of vegetable origin. A larger sample would be requisite to properly classify it.—E. C. W.—Galena—sulphide of lead. It probably carries traces of silver. To ascertain the value would require an assay.—A. L. F.—1. Flint containing crystals of feldspar. 2. Similar to No. 1. 3. Feldspar rock with crystals of hornblende. 4. Similar to No. 1. 5. Conglomerate.—T. B. M.—Feldspar, of little commercial value.

COMMUNICATIONS RECEIVED.

On the Aurora. By C. P. L.
On the Amia Calva. By J. S.
On the Columbus Clock. By N. C. R.
Crank Motion. By W. A. D.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 2, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alloy for jewelry, W. W Hubbell 219,097
Alloy metal for metric silver coin and silverware, W W Hubbell 219,265
Alumina, making sulphate of, F. Laur (r) 8,882
Axle, carriage, H Killam 219,160
Axles, device for cutting and screw threading metallic wagon, C S Adams 219,193
Bail ears to sheet metal vessels, attaching, G. W. Knapp 219,275
Barrel trussing machine, M. L Deering 219,228
Bed bottom, spring, J. I. Wheeler 219,190
Bed, cushion, and like stuffings and carpet linings, treating W. M. Blakeman, Jr 219,142
Bed stuffing composition, W. M. Blakeman, Jr 219,141
Bedstead, adjustable cot, Howe & Perry 219,264
Bedstead, wardrobe, M. Dupre 219,078
Beehive, M. Wright 219,134
Bell, electric call, G. L. Anders 219,059
Billiard cue, A. Fitzgerald 219,241
Boiler furnace, J C McNeil 219,106
Bolting screen or sieve, Forney & Bange 219,242
Boot and shoe shank stiffener, G. L. Talbot 219,184
Boot and shoe uppers, lasting, G. W. Copeland 219,224
Bottle stopper, A. F Parkhurst 219,302
Bretzel machine, C. H. Appel 219,196
Brick, E. L. Schieffelin 219,312
Bridge gate, draw, F C Beck 219,119
Bronzing machine, D. Heston 219,094
Brush, fountain, M. J Sunderlin 219,324
Bung bushing, W Johnson 219,099
Butter, tempering, Bacher & McKinnis 219,137
Butter tub, R. R Jones 219,268
Butter worker and printer, W. Weaver 219,329
Button, sleeve, W Bourke 219,204
Button, sleeve and collar, R. M. Tripp 219,325
Calculator, G. Fuller 219,246
Calendar, J. E. Heath 219,156
Cant hook, A. Sanford 219,117
Car coupling, N. F. Brent 219,206
Car coupling, A. W. Cain 219,216
Car coupling, T. A. Palm 219,301
Car coupling buffer head, J. T. Wilson 219,334
Car, postal, C R. Harrison 219,155
Car starter, Gibson & Seeley 219,247
Cars, continuous brake for railway, R. D. Sanders 219,177
Cars, manufacture of king bolt plates for railway, J T Wilson 219,333
Carbureter, W M Jackson 219,158
Carbureting machine, air, E Savill 219,118
Carpet lining, H, A. Stearns 219,182
Cartridge, L. A. Merriam 219,107
Caster, I Leonard 219,104
Caster, L. Morgan (r) 8,878
Castings, device for cooling, H. Wiard *et al.* 219,130
Celluloid, drying, J B Edson 219,235
Celluloid lining for ice pitchers, M. C Lefferts 219,279
Celluloid tubes to taper or other forms, reducing, W B Carpenter 219,218
Chain, detachable link for drive, L. W Stockwell 219,126
Chain, drive, L W Stockwell 219,125
Chain links, die for welding, J. F Busey 219,215
Chain, ornamental, C F. Heckmann 219,091, 219,092
Check book, bank, H H Norrington 219,299
Chimney, fireproof, H. Schreier 219,120
Churn, Minot & Rhoades 219,290
Churn motor, R. C Rice 219,308
Churn power mechanism, M. J. Barrow 219,061
Clamp, S Konz 219,276
Clay dissolver and washer, J S Estlin 219,239
Clocks, back action for striking movements of, W D Davies 219,226
Cloth register, A. Harrison 219,258
Clothes frame, A. Moore 219,109
Coin holder and deliverer, J. W. Meaker 219,287
Coop and crate, chicken, G. J. Cook 219,071
Corn receiver, N. Edwards 219,080
Corn sheller, W. A. Stone 219,123
Cotton and hay press, G Cooper 219,223
Cotton cleaner, M S Hasie 219,259
Cribbage board, C. W Le Count 219,280
Cultivating machine, C E. Sackett 219,115
Cultivator J J Deal 219,227
Cultivator, C. E. Sackett 219,116
Cultivator, I Utter 219,326
Curtain fixture, C A Kellogg 219,270
Curtain fixture, A. F Temple 219,185
Damper and case, stove pipe, A. C. Norcross 219,111
Dead centers, device for overcoming the, J. W. Mullins 219,295
Dental engine, E. T. Starr 219,320
Dental plugger, A M Denham 219,075
Dental use, ribbon gold spool for, H. Morrison 219,293
Desk and sewing machine cabinet, combination writing, J W Hosford 219,263
Distance instruments, altitude attachment for, R. W Burton 219,146
Draught equalizer, D. P. Hershberger 219,260
Drawer, B. A. Armstrong 219,197
Drill sharpener, T. J. Williamson 219,133
Drying apparatus, E. Henderson 219,093
Eave trough hanger, J. R. Baker 219,138
Egg package, folding, W. E. King 219,273
Electric light apparatus, C. F. Brush 219,212
Electric lighting device, C. F. Brush 219,211
Electric machine, dynamo, Houston & Thomson 219,157
Faucet, W. C Coddington 219,070
Faucet, D. A. Dyer 219,079
Faucet and corkscrew, bottle, W. E. Lant 219,101
Faucet attachment, J. P. Gruber 219,254
Faucet holder, safety, H Hunziker 219,267
Feathers, imitation, M. Grodzensky 219,253
Fence, barbed, J. & W M. Brinkerhoff 219,143
Fence, barbed, H. R Burroughs 219,067
Fence, farm, A. R. Sprout 219,319
Fender, H. C Kring 219,163
File, bill, J Bell 219,062
Firearm chamber former, C. O. Wood 219,336
Fishing line reel, E. C. Vom Hofe 219,328
Fuel, liquid, Smith & Munsell 219,181
Furnace bridge wall, J Mailer 219,283
Furnace grate, A. Desgouttes 219,232
Gas apparatus, T G Springer 219,318
Gas retorts, etc., furnace for, G. Liegel 219,165
Gate, A. H Allison 219,194
Gate, W. E Deu Pree 219,231
Gate, B. H. Hickok 219,261
Glass moulds, preparing, H. Feurhake 219,240

Governor and cut-off attach., automatic, I.M.Scott	219,179
Grain binder, W. H. Payne	219,304
Grain binder knot tying device, C. L. Travis	219,187
Grain binder knot tying mechanism, P.F.McClure	219,169
Grinding mill, feed, L. Litchfield	219,166
Harrow, A. Deisher	219,229
Harvester, J. Werner, Jr	219,330
Harvester reel and rake, D. L. Emerson	219,236
Hat and cap sweat band. J. W. Valentine (r)	8,880
Hat tip lining, F. G. Hanson	219,257
Hats, stiffening, H. Partrick	219,303
Hatchway, W. H. Kelly	219,10
Hood and cloak, B. Frankl	219,243
Horse detacher, A. Buckley	219,145
Horse power, Smith & Randall	219,315
Horseshoe blank maker, F. Holub	219,096
Horseshoe pad, G. W. Voelker	219,327
Hub boring machine, A. J. Mougey	219,171
Ice, preserving, etc., Slee & Goss	219,121
Jeweler's settings, die for making, C. Blancard	219,202
Journal cooling attachment for railway cars, C. E. Austin	219,198
Knob alarm, door, A. P. Silva	219,314
Lamp, cigar, L. J. Atwood	219,136
Lamp, elect ic, C. F. Brush	219,208, 219,209
Lamps, carbon for electric, C. F. Brush	219,210
Lamps, regulator for electr c, C. F. Brush	219,213
Latch, C. Doner	219,077
Latch, Smith & French	219,316
Leather, stuffing, H. N. Dodge	219,233
Linch pin holder, B. Goodyear	219,249
Lock face plate, T. Lyon	219,105
Locomotive boiler cleaner, W. Titcomb (r)	8,884
Logs into strips, slicing, J. Naylor, Jr	219,296
Loom shuttle, J. Johnston	219,159
Mail bag, T. A. Dennis	219,230
Match safe, A. F. Able	219,135
Meat, can for preserving raw, A. A. Libby	219,164
Meat cutter, C. Kieser	219,272
Meat, preserving, A. S. Lyman	219,168
Medicinal capsule filler, V. E. Mauger	219,285
Metal tube scourer, W. C. Allison	219,195
Micrometer gauge, J. Richards	219,307
Mines, apparatus for cooling, J. L. & D. H. Coles.	219,222
Mining apparatus, hydraulic, F. P. Fisher (r)	8,876
Mining machine, coal, J. W. Harrison	219,090
Mowing machine, F. H. Bryan	219,066
Mowing machine, J. H. Green	219,251
Muffle furnace, J. O. Stewart	219,122
Music sheet for mechanical musical instruments, E. P. Needham	219,297
Nozzle, spray, G. Yeager	219,337
Oil can nozzle, I. Leonard	219,103
Oil press plate, G. W. Campbell	219,217
Ore washer, W. B. Frue (r)	8,881
Ornamenting metallic foils, S. & H. K. Benson	219,140
Oscillating engine, W. S. Wilkinson	219,331
Package filler and weigher, A. Stearns	219,322
Packing, hydraulic, H. Riesel	219,309
Paint, J. J. Curtis	219,150
Pantaloons, G. T. Keen	219,269
Paper board liner, H. L. Palmer (r)	8,883
Paper pulp from wood, manufacture of, Taylor & Outterson (r)	8,877
Paper stock, disintegrating, J. R. Moffitt	219,170
Pattern cutting machine, E. Braley	219,205
Pencil holder slate, H. T. Cushman	219,151
Pencil sharpener and pencil point protector, M. C. Stone	219,127
Penetrable coupling to permit the passage of ropes, etc., V. Frazee	219,153
Photographic apparatus, J. R. Mote	219,294
Pianoforte action frame adjuster, C.F.T.Steinway	219,323
Picket stake, B. B. Blewett	219,203
Plane, bench, J. A. Traut	219,186
Planter and cultivator, J. M. Brown	219,065
Plow, W. W. Speer	219,317
Plow, Wiard & Bullock	219,191
Plow attachment, C. E. Brown	219,144
Plow, reversible, L. Chapman	219,220
Plow, reversible sulky, L. Chapman	219,219
Portable engine, R. P. Gordon	219,250
Pressure regulator, fluid, G. Ross	219,114
Pressure regulator, steam, C. C. Schmidt	219,178
Printer's inking roller, R. Lanham	219,102
Printing machine, H. G. Canfield	219,068
Puddling furnace, J. Lukens	219,282
Pulley, F. Brown	219,207
Pumps, link for chain, W. A. Root	219,176
Punching nut blank bars, machine for, C. Richards	219,113
Rail joint, W. R. Hardcastle	219,088
Railway switch operator, J. A. Heyl	219,095
Railway switch operator, A. Middleton	219,288
Reclining chair, D. W. Miller	219,289
Refrigerator and ventilator, G. G. Fryer	219,085
Refrigerating apparatus, J. A. Whitney	219,131
Refrigerator, T. Guineau	219,154
Refrigerator, G. H. Hammond	219,256
Rolling mill, J. N. Lauth	219,277
Rotary engine, J. C. Miller	219,108
Rug, G. Crompton	219,074
Safe bolt works operator, E. W. Fowler	219,084
Safety elevator, R. H. Hill	219,262
Sand washing machine, T. R. Williams *et al*	219,332
Saw filing machine, G. R. Huff	219,266
Sawing machine, E. F. Barnes	219,139
Sawing machine, band, F. H. Clement	219,148
Sawing machine, drag, L. L. Maxhimer *et al*	219,286
Scoop and sieve, L. Lotz	219,167
Screens, roller bracket for, J. G. Stewart	219,321
Screws, machine for rolling threads on, E. Croft	219,073
Server, hotel, J. G. Tait	219,183
Sewing and embroidering machine, E. Cornely	219,225
Sewing machine, A. B. Felt	219,082
Sewing machine folder, W. A. Nettleton	219,172
Sewing machine trimmer, L. H. Allen	219,058
Sheet metal pipe elbow, C. F. Henis (r)	8,885
Sheet metal shearing machine, C. E. Kennedy	219,271
Shingle cutting machine, W. Goldie	219,086
Shirt, I. H. Mambert	219,284
Shirt, vest, M. E. Burris	219,214
Shoe and other lacings, fastener for, H. C. Klein	219,162
Shoe lace fastener, H. C. Klein	219,274
Shoe nail, J. M. Estabrook	219,238
Shovel maker, W. Chisholm	219,069
Show box, F. B. Gurney	219,255
Sieve, E. F. O'Toole	219,173
Silver from mixed amalgams by mercury, leaching out, C. Wiegand	219,132
Skylight bar, A. and G. Bickelhoupt	219,063
Sleigh, Vandervoort & Carver	219,189
Sleigh bell, J. M. Ackley	219,192
Sleigh runner, T. E. Price	219,174
Smoothing and polishing iron, R. Reid	219,112
Smut machine cases, stave for, L. Morgan (r)	8,879
Spectacle glasses, etc., grinder, F. J. Noechel	219,298
Spur, T. Beck	219,199
Steam boiler, W. Moore	219,292
Steam boiler, coil, W. S. Salisbury	219,311
Steam engine recorder, G. H. Crosby	219,149
Steam feed and hoisting apparatus, Ansorge & Sommer	219,060
Steam generator, water tube, N. Coombs	219,072
Stone drill, J. S. Swartley	219,128
Stove, coal oil, W. J. Reed	219,306
Stove pipe joint, J. B. Jewell	219,098
Stump extractor, T. Ennett	219,237
Sugar from the juice of beet roots, etc., obtaining, C. Lowig	219,281
Surveying instrument, W. Devault	219,076
Suspender button end, Osborne & Baldwin	219,300
Tablet, rolling pocket, H. T. Cushman (r)	8,875
Telegraph and telephone systems, circuit and signaling apparatus for district, T. N. Vail	219,188
Telephone and telegraph line signal, S.W. Francis	219,244
Thill coupling, W. Quinlan	219,175
Thill coupling, T. Tufts	219,129
Tin can, E. P. Follett	219,083
Tongs, tubing, L. W. Young	219,338
Tool, combination, B. N. Shelley	219,313
Toy pistol, W. J. Shipman	219,180
Truck frames, manufacture of end pieces for cross bars of, J. T. Wilson	219,335
Turn table, C. P. Durel	219,152
Valve, balanced slide, D. B. Kimmel	219,161
Valve, balanced slide, E. Robinson	219,310
Vehicle platform trestle, E. B. Childs	219,221
Vehicle spring, G. B. Hamlin	219,087
Velocipede, C. W. Green	219,252
Vessels, device for preventing the shifting of cargoes in, R. Quintavalle	219,305
Vessels, device for preventing the shifting of grain in, C. Lazarevitch	219,278
Wagon jack, H. B. Hart	219,089
Waiter, automatic table, W. Beeson	219,200
Wash board, S. J. Bradmon	219,064
Washing machine, W. F. Bethke	219,201
Washing machine, W. Church	219,147
Washing machine, B. F. Fuchs	219,245
Watch chain bar and pencil, L. W. Fairchild	219,081
Water wheel and gate, J. C. Montgomery	219,291
Windmill, J. E. Gilchrist	219,248
Window cleaning chair, A. Dormitzer	219,234
Window shade fixture, A. R. Nissley	219,110
Wire rods, reel for coiling, D. C. Stover	219,124

TRADE MARKS.

Chewing tobacco and snuff, R. W. Morgan	7,638
Cigars, J. E. Owins	7,640
Cigars, cigarettes, smoking and chewing tobacco, W. Davies	7,652
Earth working tools, The Collins Company	7,644
Fertilizers, Jarves & Hooper	7,634
India-rubber boots, shoes, and foot coverings, The L. Candee & Co	7,642
Locks, Western Lock Company	7,635
Machinists' tools, The Collins Company	7,643, 7,645
Medicinal preparation for the cure of drunkenness, R. D'Unger	7,639
Mineral waters, O. Zwietusch	7,637
Ointment, T. Holloway	7,647 to 7,650
Pills, T. Holloway	7,646
Pills and ointment, T. Holloway	7,651
Plug chewing tobacco, Allen & Ellis	7,632
Rubber boots and shoes, The L. Candee & Co	7,641
Sarsaparilla beer, Cronk & Kurtz	7,633
Scales or weighing instruments, Chicago Scale Co	7,654
Suitings for men's and women's wear, known as cheviots, J. S. Woodward's Sons	7,636
Umbrellas and parasols, Macy & Molloy	7,653

DESIGNS.

Can for teas, etc., A. Schilling	11,392
Furniture coverings, B. Weiand	11,393
Oil cloth, C. T. & V. E. Meyer	11,389, 11,390
Oil cloth pattern, C. T. & V. E. Meyer	11,391
Pen, G. Bradford	11,388
Toy fulminate exploder, G. W. Eddy	11,394

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GENERAL TABLE OF CONTENTS

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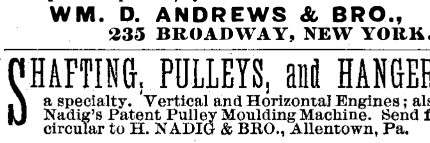

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