SCIENTIFIC AMERICAN

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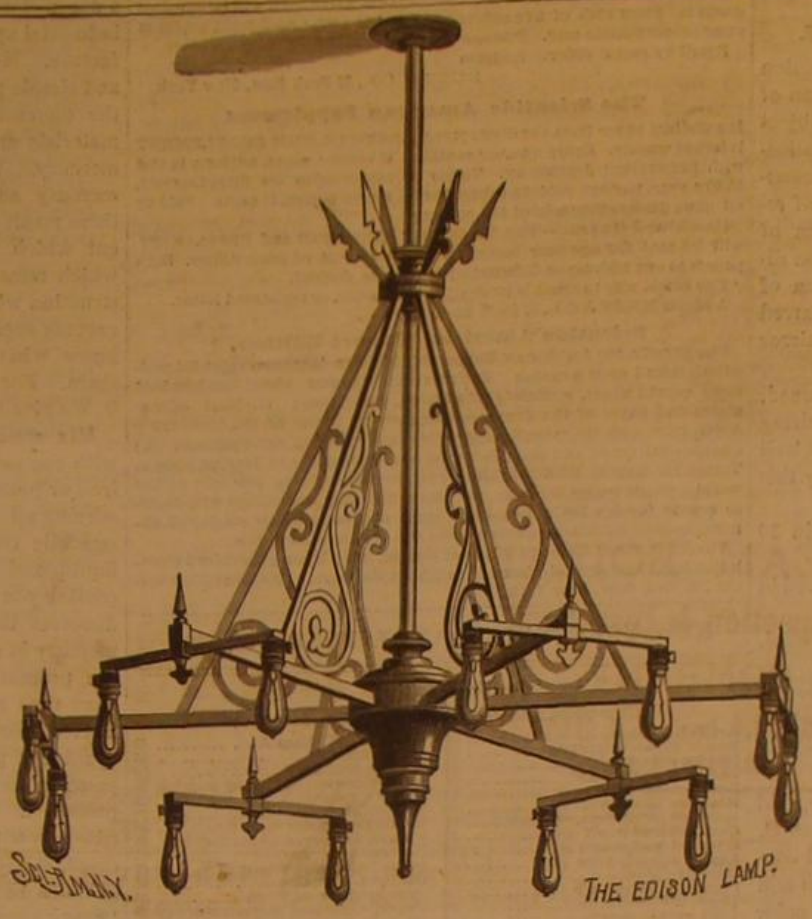
EDISON'S NEW DYNAMO-ELECTRIC MACHINE.

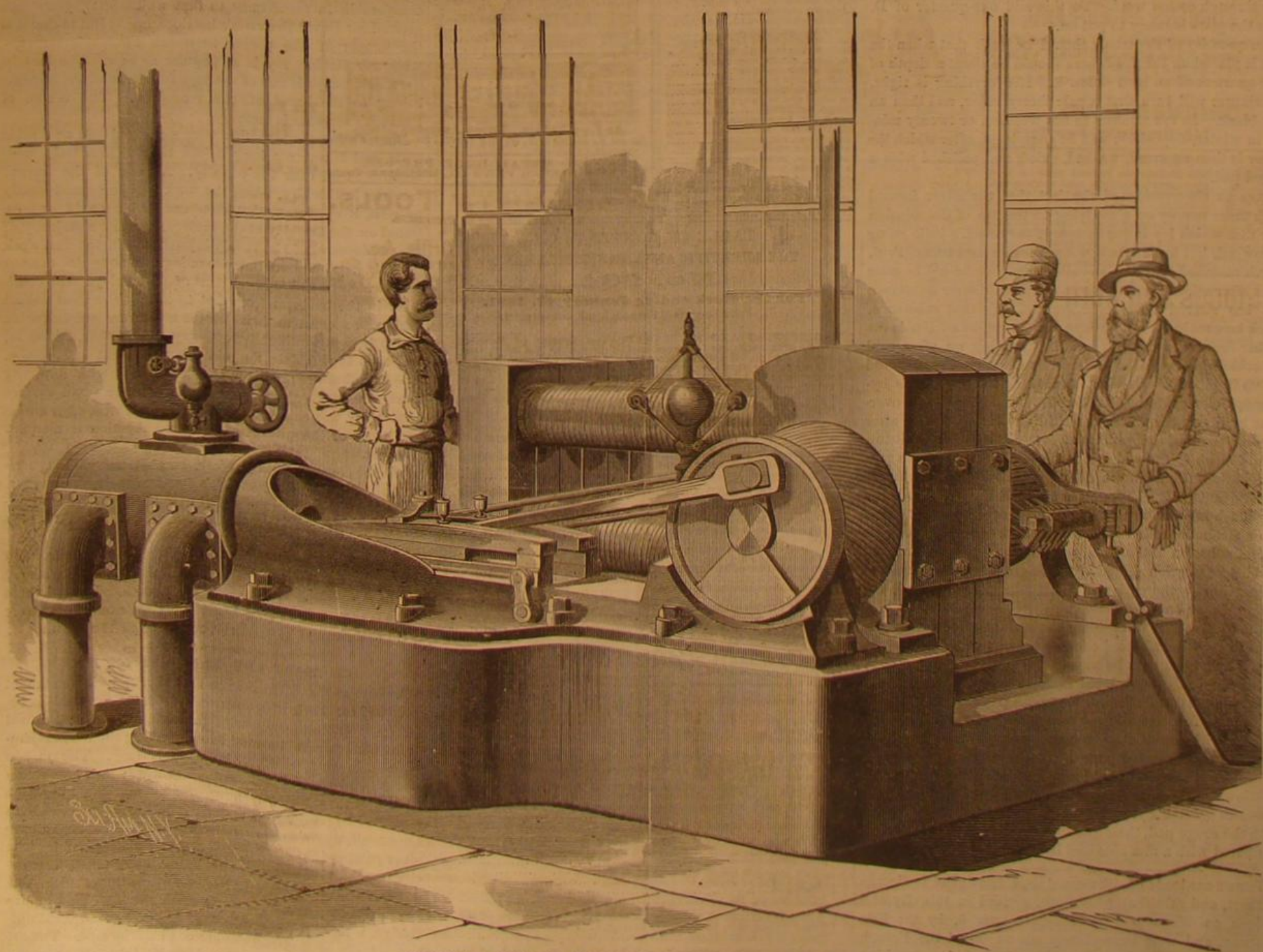
The remarkable activity prevailing at the Menlo Park laboratory and machine shop, and the evidences of the enormous outlay of capital which one sees at these works on every hand, are convincing proofs of the good faith and thorough earnestness of Mr. Edison and his co-laborers and supporters. The great work of perfecting a complete system of electric lighting in all its details is necessarily a very slow operation, however much the work may be urged, as time-tests of the endurance of lamps, perfection of the insulation of the underground conductors, and a hundred other time-consuming operations must, of necessity, be gone through with.

As it is Mr. Edison's determination that his system of electric illumination shall not be presented to the public until it is complete and commercially practicable to the smallest detail, the would-be-users can afford to wait patiently for the perfected thing, rather than be subjected to the trouble and possible disappointments attending the perfecting of the system while it is in public use, as is commonly the case with great inventions.

Besides carrying to a successful issue the grand experiment of illuminating a large out-of-door area with incandescent lamps, Mr. Edison has practically demonstrated that the highest economy in the conversion of power into electricity can be reached only by the use of very large machines, and by the direct application of the power to the armature without the intervention of belts or other means of transferring power.



Our engraving represents a gigantic dynamo-electric machine approaching completion at Mr. Edison's machine shop, and designed to replace sixteen of the largest machines of this kind previously made. The dynamo and the driving engine are both mounted on a massive cast iron bed, 8½ by 7 feet and 2 feet deep, very heavy and strongly ribbed, the entire machine weighing 8 tons. Near the middle of the bed is mounted the dynamo-electric machine, which, we believe, is the largest ever constructed. Its field magnets, three in number, are 6½ feet long. The armature is 21 inches in diameter and 28 inches long, and weighs 1½ tons. The engine is 100 horse power, of the Porter-Allen type, built especially for this purpose at the Southwark Foundry, Philadelphia. Its stroke is 10 inches. The internal diameter of its cylinder is 9 inches. The crank disk is placed on the end of the armature shaft. Steam pressure, 120 lb. per square inch. The engine cuts off at one-fifth of the stroke and makes 600 revolutions per minute. The working pressure of the dynamo is 140 volts; the resistance of the armature is one two-hundredth of an ohm.



EDISON'S STEAM DYNAMO-ELECTRIC MACHINE.

The current is taken from the commutator cylinder by twelve brushes, six on either side, either one of which may be removed without disturbing the others. These brushes are supported by an arm capable of being rotated on an axis coincident with the axis of the armature, so that they may be made to approach or recede from the neutral point, and in this manner control the current.

This machine will furnish a current to eight hundred incandescent lamps. According to the most recent estimates as to economy, as obtained by indicating his present engine with 500 lamps, three and a half pounds of coal burned under the boiler per hour will generate a nett current sufficient for 8¾ incandescent lamps of 16 candles each, or 16 lights of 8 candles each.

IMPROVEMENTS IN THE SILVERING OF MIRRORS.

Astronomers, and all who are interested in the production of mirror surfaces for optical purposes by the deposition of silver upon glass, will learn with pleasure that this subject has been receiving practical attention at the hands of a painstaking experimentalist, Professor Piazzi Smyth, the Astronomer Royal for Scotland. Convinced of the great value of reflecting over achromatic telescopes for certain phases of astronomical research, Professor Smyth has lately been directing his attention to the eliminating from the film of deposited silver certain objectionable features which marred its usefulness when applied to the reflector or glass mirror of large reflecting telescopes.

Subject to slight improvements to be afterward mentioned, the quickest, best, and most reliable method of depositing silver on glass, and that by which large glass specula as well as flat reflectors for a heliostat have been prepared by this astronomer, is the following:

Solution A.—175 grains nitrate of silver dissolved in 10 ounces of distilled water.

Solution B.—262 grains of nitrate of ammonia dissolved in 10 ounces distilled water.

Solution C.—1 ounce of caustic potash, purified by alcohol, in 10 ounces distilled water.

Solution D.—Half an ounce of sugar candy and 32 grains tartaric dissolved and boiled for ten minutes or so in 5 ounces distilled water. When cold add 1 ounce of alcohol, and make up to 10 ounces with water.

To Mix.—Put one-quarter of A into a glass beaker, add one-quarter of B, and then, gradually, one-quarter of C. Stop if it gets cloudy and add a drop or two of B, and continue with one-quarter of C until it is all got in. Then add a drop or two of A till the mixture has a slight brown color that will not dissolve in a couple of minutes; let it settle, or filter through cotton wool. To this add one-quarter of D, when the glass is ready to put on.

The quantity of the whole should be such that when the glass is placed on the fluid there should be about a depth of three-quarters of an inch below it. If everything is right, the mixture will turn first a pale sherry color, and then an inky black. In ten minutes in hot weather, or twenty minutes in winter, deposition will be completed, after which the mirror is then removed, washed, dried, and polished with a rouged pad.

From an observation of the fact that the silver formed much more readily on glass lying on the top of the solution than that which lay in the bottom of the vessel, a little going downward, but by far the greater portion ascending, Prof. Smyth reasoned that the so-called silver could not be pure silver after all, but must be combined with some substance that has altered its specific gravity. To that substance, which he concludes is potash in some form, he attributes the further fact that a damp warm thaw coming on after cold will sometimes cause the polished film to leave the glass and rise up in blisters. By what means, therefore, was this hygroscopic element to be eliminated? All difficulties are overcome by lifting the mirror from the silvering bath, and after allowing some of the solution to drip off, transferring it to a bath of alcohol, into which it is allowed to remain, with gentle agitation, till no more coloring matter is given off. A great advantage is also found in the substitution of soda for the potash in solution C, using much less of it. The effect of the alcoholic bath is noteworthy and valuable. A more perfect adhesion to the glass, with consequent freedom from the blisters mentioned, added to the greater smoothness and amenability to the action of the rouge polishing pad, are among these advantages.

An effective way of cleaning the surface of the glass previous to its being silvered consists in rubbing it with nitric acid, which must then be wiped off with a cloth, followed by an application of powdered Spanish whiting, to which is added enough distilled water to make a paste. This is rubbed over the surface and allowed to become quite dry, when, by rubbing with cotton wool, it is all removed. On being seen to be dry and clean the plate is gently lowered, face downward, into the solution, taking care not to sink it so low as to allow the back to get wetted. The film thus obtained possesses great body, solidity, and luster after being rubbed with the rouge pad, these qualities being very apparent when compared with a film obtained by the older processes.

THREE car loads of silkworms' eggs, consigned to George Carhart, and valued at $1,000,000, arrived in this city at 6 o'clock on Wednesday morning, January 5, by the Erie Railway, and were immediately put on board the French line steamer for France. They came from China, reaching San Francisco on the 28th ult.

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NEW YORK, SATURDAY, JANUARY 22, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

Artificial indigo 53
Bench plane, improved* 50
Blocks, concrete 57
Boiler, novel, steam* 51
Bottle cock, improved* 51
Brass, to blacken (24) 58
Brussels exhibition, another 51
Cement, acid proof (34) 59
Chemistry of plants 56
Cigars, flavoring for (23) 58
Concrete blocks 57
Copying pad and ink (35) 59
Dead, the, restoring 52
Drill, radial, new* 54
Dikes, broken, in Holland 49
Dynamo-electric mach., Edison's* 47
Egyptian obelisk now in N. Y. 51
Egyptian obelisks 51
Electric exhibition in New York. 50
Electric illumination 49
Electric light good for the eyes 49
Engineering inventions 56
Fog horn, steam, improved* 54
Fresh water medusæ* 55
Grapes, large yields of 51
Hornets, domesticated 54
Ice roads and railways on ice 48
Indigo, artificial 53
Ingenuity, impromptu 57
Ink, indelible (12) 58
Inventions, engineering 56
Inventions, mechanical 51
Inventions, miscellaneous 54
Inventions, new 52
Inventions, recent 51
Knife for cutting tobacco leaf* 50
Lead, pure, to obtain (26) 58
Leucoderma, a case of 52
Lighthall, William A. 49
Magic mirrors* 53
Meteor, brilliant* 52
Meteorological observ. by telgr'ph 56
Mirrors, magic* 53
Mirrors, silvering of 48
Mould for plaster casts (22) 58
Natural history, curious fact in* 55
Natural history notes 55
Obelisk, Egyptian, now in N. Y. 51
Obelisks, Egyptian 51
Paper pulp from wood 56
Paper, wrapping, manufacture of 50
Parhelia, magnificant 52
Parhelia, the* 52
Patents, cheap, national value of 57
Patents, decisions relating to 57
Percolation, upward, apparatus* 50
Pharaoh's serpents 48
Phylloxera, volcanic ash for 49
Plants, chemistry of 56
Plants, influence of light on 55
Radial drill, new* 54
Riveting machine for boilers* 50
Serpents, Pharaoh's 48
Ship railway, Tehuantepec 49
Shoe bottoms, to finish (10) 58
Should a baby be fat? 49
Silver chloride, to make (33) 59
Society of Engineers, American 56
Steel, to anneal (3) 58
Stewart, Charles B. 49
Tobacco leaf cutting knife* 50
Toys, dangerous 48
Water press, loss of in hose pipe. 56
Weather prophecies, value of 49
Wormwood as an insectifuge 50

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 264.

For the Week ending January 22, 1881.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—New System of Movable Dam, with Swinging Wickets and Trestles, at La Mulatière, Lyons, France. A notable improvement on the Chanoine system. 9 large figures (sections). Transverse section.—Mode of lowering and raising uprights.—Maneuver of the swinging wickets or flutter valves.—Maneuver of the trestles.—Up-stream elevation.—General plan.—Longitudinal sections of the double step hurter.—View of a portion of the navigable pass of the dam 4199
A Water Power Railway 4201
New Dynamometric Brakes. 4 figures. Carpentier's Dynamometric Brake. Vertical section and elevation.—Deprez's Dynamometric Brake. Plan and elevation 4202
Crematory Furnaces. 6 figures. Crematory Apparatus at Milan. The Siemens Crematory Furnace 4202
The Livadia 4204

II. TECHNOLOGY AND CHEMISTRY.—Manufacture of Salts of Soda 4208
Artificial Citric Acid 4208
Doctored Wines 4208
Bread Colored Blue by Rhinanthin 4209
Oil of Coffee 4209
A Destructive Fire Caused by Sulphuric Ether 4209
Chlorophenols 4209
Precipitation of Manganese Hydrate by Ammonia 4208
Gelatine 4208
Coffee Tree Saccharine Matters 4208
Antiseptic Inflation 4208
The Pharmaceutical Exhibition at Breslau. Mineral waters.—Vegetable drugs.—Pharmaceutical preparations.—Capsules.—Plasters.—Odors.—Petroleum preparations.—Bottles, etc 4210
Determination of Theine in Tea 4211

III. HEAT, LIGHT, ELECTRICITY, ETC.—Specific Heat 4204
New Thermopile. Professor Langley's 4205
Tracing the Pendulum 4206
New Air Thermometer 4206
Lightning Rods on War Ships 4206
Improvement of the Bunsen Battery 4206
Electric Lighting. Lecture by J. W. Swan, Newcastle-on-Tyne. 4206
A New Relay. 1 figure. Vyle's improved telegraph relay 4207
Photophonic Transmitter. By EMILE BERLINER. 1 figure 4207
Action of Light Upon Coloring Matters 4207

IV. PHYSIOLOGY, MEDICINE, ETC.—Determination of Sex and the Mental and Physical Inheritance of Children. By J. MORTIMER GRANVILLE, M.D. 4210
Temporary Deafness. By H. AUGUSTUS WILSON, M.D. 4211
The Virtue of Magnetic Sand.—Apparatus of M. EDARD 4211
Distinctions Between Human Blood and Animals' Blood 4211
Ptomaines 4211
Botanical Nature of Whooping Cough 4211

V. NATURAL HISTORY, ETC.—Rare Animals in the London Zoological Collection. 3 figures. The musk-deer.—The Japanese wolf.—The tufted umbrette 4212
New Points in the Production of Milk 4213
Small Fruits. By W. D. PHILBRICK 4213
Peonies 4214
The Balsam Fir 4214

VI. ART, ARCHITECTURE, ETC.—Gate from the Inclosure of the Tabor Promenade in Rennes, Bretagne. 1 large illustration.—Design of J. B. Martenot 4206

VIII. BIOGRAPHY.—William Lassell, LL.D., F.R.S. Sketch of his life and labors in connection with astronomy and the construction of telescopes. By WILLIAM HUGGINS 4212

PHARAOH'S SERPENTS—ARE THEY DANGEROUS TOYS?

Serpents' eggs, or, as they were at first called, "Pharaoh's serpents," are much more easily produced than their extraordinary properties and the high-toned sound of the name, mercurous sulphocyanide or sulphocyanide of mercury, would indicate. For this mercurous sulphocyanide is a very fine, white, soft-feeling powder, and when wet up with weak gum water may be kneaded or moulded into any desired form. In early days the standard form was a cone about one-third of an inch high, and the conical masses, after drying, were covered with tin foil. Of late the pill form is the fashion.

But the mercurous sulphocyanide is not a commercial article, and perhaps there are not in all the world half a dozen stores where it is kept in stock; probably its only industrial application is to be found in the serpent manufacture. Moreover the raw materials, which, by a direct and simple process of mixture, result in the production of the mercurous sulphocyanide, are not commercial; these materials are sulphocyanide of potassium and nitrate of mercury. When solutions of these salts are mixed, the mercury and potassium change places, and immediately there result mercurous sulphocyanide, the serpent constituent, which precipitates, and nitrate of potash (saltpeter), which remains in solution. The foregoing is all the instruction which a chemist should require to understand and execute successfully the serpent making process; he should know what materials to start with and how to manage them. For tyros and others who may be concerned to know it, we give the complete process from the beginning:

Mix intimately two parts of yellow prussiate of potash with one part of sulphur; carefully melt this mixture in an iron or porcelain vessel at a gentle heat, far below redness, stirring all the time with an iron rod. The melting is successfully completed when the mass has become a tranquil liquid and will not throw up any more gas bubbles. On cooling you will have a black, brittle mass, from which water dissolves the sulphocyanide of potassium. Next dissolve mercury in diluted nitric acid, taking care that at the end of the process there shall still be undissolved mercury; you have then a solution of protonitrate of mercury. Dilute filtered solutions of the nitrate of mercury and of the sulphocyanide of potassium are to be prepared and to be mixed by pouring the former into the latter as long as a precipitate is produced. This precipitate is the mercurous sulphocyanide (the serpent substance), which is to be collected, washed, dried, etc.

When these marvelous serpent toys were invented, about twenty years ago, they were admired and talked about all over the world; there was a popular enthusiasm over them comparable in earnestness to that which sixty years ago greeted Sir David Brewster's kaleidoscope. But to-day it is the temper of the people to scotch Pharaoh's serpents, while Sir David's toy is as popular as ever. The fact is, the kaleidoscope is one of the joys forever, and the serpents belong to the breed of the venomous. The venom of Pharaoh's serpents is mercury.

Pharaoh's serpents at first were made and sold on a great scale, and it was not long before their vicious traits were manifested all over the country. At one of the serpent factories in this city, where the work was performed mostly by girls, it was found that about one in ten would be prostrated on the first day at the factory, and that a majority of the employes would be visibly injured within the first week of their stay by mercurial poisoning. Among the curious cases which turned up was that of an employe who continued in the business from first to last in the most robust health; he seemed to thrive on the mercurous sulphocynide which he was continually, one way and another, taking in, and thus to elucidate the old adage of meat and poison. We have known a person who could not with impunity touch mercury or remain in a room where a small surface of mercury was exposed to the air. When the eggs are ignited one of the products of the combustion is mercury in vapor.

We are constrained, therefore, emphatically although regretfully, to condemn Pharaoh's serpents as dangerous toys. Perhaps they may be permitted among the brilliant experiments of the chemical lecture, but for children to play with—not at all.

These remarks are suggested on reading a letter from an esteemed correspondent who thinks that the serpents may not be dangerous. He says he has made hundreds of them and has suffered no evil. If all the dangerous things were fatal, there would be no survivors to sound the warning.

ICE ROADS AND RAILWAYS ON ICE.

As soon as the St. Lawrence River is firmly frozen about Montreal the work of constructing winter ice roads is begun to connect the city with the mainland. As described in the local papers the method of making the roads is simple, and in frosty weather the work is easy. The track is first marked out by lines of small bushes; then the rough surface of the packice is hewn smooth and the fragments cemented by pouring on water. There are two roads to Longueuil, one rounding the corner of Ile Ronde and the other passing the eastern end of St. Helen's Island. The city pays half the cost of maintaining the lower road, while it constructs and maintains one-half of the upper road. The Laprairie road, which passes beneath the piers of Victoria Bridge, is located and constructed by the Laprairie authorities, the city of Montreal paying one-half the cost. The St. Lambert road is constructed and maintained jointly by the

city and St. Lambert, each paying one-half the cost of maintenance. The iron road or the ice bridge railways between Hochelaga and Longueuil, is a much more difficult and expensive affair. The surface has to be carefully leveled, then the sleepers are securely frozen in, and the track laid in the usual way. Last winter the Northern Pacific Railway used an ice road across the Missouri River for construction trains, transporting in this way a vast amount of material for the road beyond. During the present season the Russians have adopted the same plan for a freight railway on ice between Oranienbaum and Cronstadt.

ELECTRIC ILLUMINATION AT MENLO PARK

To subject his system of electric lighting by incandescence to the crucial test of actual outdoor use on a large scale, Mr. Edison has set up at Menlo Park a plant embracing five hundred lamps distributed over an area one mile long and half a mile wide. His laboratory stands upon a gentle eminence from which the lines of lamps extend half a mile to right and left, the entire area under illumination being, from the slope of the land, easily visible from the central station.

The lamps are in a circuit comprising seven miles and three-quarters of wire, and are supplied by a current generated by nine dynamo-electric machines driven by one engine. The lamps are of sixteen candle-power, equal to an ordinary street gaslight, and are absolutely steady, shining with a mild and serene effulgence, which is exceedingly pleasing to the eye. The division of the current is complete and economical, and the entire system of lights can be turned up or down, off or on, as easily as one can regulate the flow of gas in an ordinary burner.

Simply as an exhibition of perfect illumination under perfect control, covering a vast area, this array of lamps presents a most remarkable and delightful sight, and is alone well worthy of a trip to Menlo Park. As a demonstration of the perfected working of a great and novel system of illumination, sure to become in a little while a potent contributor to the comfort and economy of city life, it is a spectacle which cannot fail to impress powerfully the mind of any observer.

The lamps have been but slightly modified in form and construction, since they were figured and described some months ago in this paper. In principle they are unchanged. The present appearance of the lamps is clearly shown on our front page; the plan of suspending the lamps as in the chandelier, serves particularly well in elevated lights, since the shadow of the fixture is thereby avoided. Three sizes of lamps are made, one-third, one-half, and full size, or equivalent to 5½, 8, and 16 candles respectively. Unlike other electric lamps the incandescent lamp requires no attention; there are no carbons to change, and need not be touched save to keep the outer globe free from dust, during the entire period of its existence, which covers several months. In case a lamp is broken by accident of internal defect, another can be put in its place as easily as a candle can be set in its socket. The suspension of one lamp has no effect whatever on the others in the circuit. According to the latest tests, to supply the current for one lamp of 16 candle power, for one hour, requires the consumption of two-fifths of a pound of coal. Still greater economy of power is expected by the use of the large generator now approaching completion.

THE TEHUANTEPEC SHIP RAILWAY.

The prompt and cordial acceptance by the Mexican people of the feasibility and the entire practicableness of Mr. Eads' plan of a ship railway across the Isthmus of Tehuantepec is probably without parallel in the history of nations, as it is in the history of great undertakings. Scarcely less remarkable is the generous spirit with which the Mexican Government has welcomed the enterprise. The liberal concession which it has granted to Mr. Eads gives him the right to construct a ship railway on the plan illustrated and described in the SCIENTIFIC AMERICAN of Nov. 13, 1880, on any line that he may select, the work to be begun within two years from the date of the grant and completed within twelve years. He is to have a right of way across the Isthmus half a mile in width, with an additional half mile of width where stations are required; also a subsidy equal to 1,000,000 acres of public land, to be located on the Isthmus or elsewhere, toward the construction of a harbor on the Pacific Ocean.

The grant gives, further, the right to acquire the Tehuantepec Railway, now building, and to improve such rivers and harbors as may be of use to the ship railway service, collecting tonnage dues from vessels entering them. Liberal tariff charges are allowed for transporting ships over the road and for auxiliary service; and the enterprise is exempted from all export and import duties on money and material during the entire period of the grant, ninety-nine years. At the end of this time the government is to take possession of the works, paying therefor two-thirds of their value. Permission is given for the United States Government to lend its aid, thus making our Government practically a partner with Mexico in carrying out the enterprise.

The length of the Tehuantepec route is 112 miles; the estimated cost of the proposed road is $75,000,000. The great advantage of the route over the Panama route—aside from its superior healthfulness—lies in the saving of distance for American shipping and the avoidance of the unfavorable winds and calms of the lower latitudes, the Panama route lying 1,200 miles further south. Ships from New York to San Francisco would save 1,500 miles by way of Tehuantepec; while 2,300 miles are saved over Panama between New Orleans and California.

At Mr. Eads' request an expedition comprising about fifty individuals—engineers, assistants, laborers, and soldiers—to assist him in making a survey of the Isthmus to determine the most practical route for the ship railway, has been prepared by the Mexican Government and sent to the Isthmus. This commission is under the direction of the eminent civil engineer, Francesco De Garay, who is in charge of the drainage of the Valley of Mexico, and who was commissioned to represent the Mexican Government at the Paris Canal Convention. He is directed by the government to assist the engineers of Captain Eads in the instrumental survey of such routes as he may designate. Messrs. Williams and Corthell will direct the survey during the absence of Capt. Eads, who has returned to Washington. It is thought that a large saving in the length of the railway can be made by taking advantage of the Coatzacoalcos River and its tributary, the Usuparapa.

SHOULD A BABY BE FAT?

While there is a measure of truth in the assertion that fat babies are not necessarily healthy, the following much quoted extract from a physician's letter to a Boston paper is likely to do mischief by its extravagant condemnation of fat. Speaking of fatty degeneration the physician says:

"Most infants do become thus diseased before they are three months old. This stops the growth and leaves the poor deceived parents nothing but increase in weight to boast of; and when the poor little victim to his own greed and his parents' folly gets to the end of his tether he melts away like butter in a hot oven, and then it is seen how poor (in flesh) he has been all the time. Few comprehend the broad difference between flesh and fat. The first is lean meat—muscle—the result of growth; while fat—I don't care how hard and solid it may be—is the product or accumulation of unexcretial excess. This is why no one bets a dollar on a fat horse or a fat man—they are 'soft' and 'can't stay.' It is every whit as true of a fat baby. The only wonder is that any infant lives sixty days from birth. Fed before birth but three times a day, he is after birth subjected to ten or twenty meals in the twenty-four hours. Before birth he grows at the rate of about ten pounds per year, after birth he is permitted to fat at the rate of fifty pounds per year until chronic dyspepsia or some acute disease interferes. Feel of a kitten, calf, colt, or a young robin—they are and remain while growing but little more than skin and bones and fur or feathers, because unable to get enough to fatten them, and they never die—rarely have any sort of disease. Children are never fairly 'out of the woods' until they reach the lean age and have pipe-stem legs and arms, with no rolls of fatty tissue anywhere about them. Could they be kept so from birth and not permitted to over-indulge, so that their appetites would always be reliable for plain food, they would have no infantile diseases to enrich our pockets."

Why should the kitten, the colt, or the young robin be taken as a model of infantile health, rather than the puppy, the bear cub, the pig, or the young pigeon?

It is the nature of some young animals to be lean and healthy; of others to be fat and healthy; and there is as marked a difference in the natural tendency of young children. Infants of the same parentage and fed at the same breast will differ in this respect, and both be healthy. Fat laid on at the rate of "fifty pounds a year" is quite another matter, and one not liable, we take it, to be a common cause of anxiety. Injudicious feeding is more apt to show itself in lack of fat, and lack of proper muscular tissue as well. That sort of leanness is much too common in young humanity.

The Value of Weather Prophecies.

Professor Cleveland Abbe, of the Signal Service, was recently interviewed by a Washington correspondent of the Boston *Herald*, who asked the following pertinent questions:

Has the weather bureau paid any official attention to Mr. Vennor's prognostications? A.—To test the accuracy of his work, we have occasionally compared his predictions as published in the newspapers, which accounts, of course, contain telegraphic and typographical errors for which Vennor is not responsible, with the real facts. We find that one-quarter of his predictions are verified, if they are intended for the St. Lawrence valley. If they are meant for this locality, as those who would give him credit for predicting the recent storm here must believe, then not ten percentum of his prophecies come true. In view of his continued failures, one or two brilliant successes would not justify us in adopting his system of foretelling the weather.

Q.—Upon what are his methods of announcing the weather based? A.—He keeps his system a secret to himself. There are, however, a few ways in which a comparatively truthful guess can be made at the weather months ahead. The first is by observing the average weather during each month for a long period. If we find that, for several months, the average has been wet or cold, it may be predicted that, during the immediate succeeding months, the weather will be the reverse, that is, dry or warm. Then we can get at the matter in another way. When January, February, and March have certain characteristics, the latter part of the year, October, November, and December, will have corresponding characteristics. Thus the weather may be foretold, in a general sense, some months ahead. But no man in the world has ever devised a plan which will foretell special storms on certain days, or which will offer a genuine prediction for a long period in advance. We are sometimes asked to give the weather several days in advance in the case of festival occasions. Under favorable conditions we can do this, with a very good chance of successful prediction. For instance: The chances are that the last few days of August will be clear, because the records show that this is the case five times to one. This, of course, relates to a particular locality, and cannot be made to cover the whole country. I suppose all Mr. Vennor's predictions are made by these methods.

Q.—Have you watched the weather predictions of the New York *Herald*, which are cabled to Europe? A.—Yes, sir. During the first months of that service I very thoroughly and carefully compared their predictions with the weather in Europe, and am satisfied that there is not more than 17 per centum of verifications in the predictions made by the *Herald* bureau. There are about 25 per centum of cases that might be considered doubtful, making a little more than 40 per centum of predictions which come near the truth. A perfectly independent investigation was made by the director of the London meteorological office, and he arrived at precisely the same figure, 41 per centum. This is really no better than could be done by guesswork.

ELECTRIC LIGHT GOOD FOR THE EYES.

When the electric light first began to be used in our shops, factories, and places of amusement, it was confidently asserted by its opponents that so dazzling a light must be injurious to the eye. The objection seemed plausible at least, although the light when diffused seemed to have the quality of bright moonlight, which is the reverse of irritating. People would persist in looking at the source of the light, and as the early lamps were far from steady, the observer's eyes suffered both from the intensity of the light and the sudden and large variations in the quantity of it. It appears, however, from the experiments recently made by Professor Cohn, of Breslau, whose name is so familiar in connection with the investigation of color blindness and other optical defects, that our eyes will be benefited rather than hurt by the new method of lighting, and it is obvious that with incandescent electric lighting the advantages will be still more marked.

While testing the influence of electric light on visual perception and the sense of color, Dr. Cohn proved, he thinks, that letters, spots, and colors were perceived at a much greater distance under electric illumination than by gas light, or even daylight. Compared with daylight, the electric light increased the sensation of yellow sixtyfold, red sixfold, and green and blue about twofold. Eyes that in daylight or gaslight could perceive and distinguish colors only with difficulty were much aided by the electric light, and the visual perception was much strengthened. In all cases of distant signaling, Dr. Cohn believes that the electric light will prove exceedingly and especially useful.

William A. Lighthall.

William A. Lighthall, the oldest designer and builder of marine engines in this country, and inventor of the widely used surface condenser for ocean steamers, died in Brooklyn, N. Y., January 4. Mr. Lighthall's connection with steam engineering began with the engines of the Claremont, the first steamer plying on the Hudson River; and for many years he was engaged as superintendent and constructing engineer for river and ocean lines of steamers. He was State Inspector-General of steamboat hulls and boilers in California for three years. From 1847 to 1862 he was inspector of steamboats and boilers in this State. Of late years he has been engaged in the manufacture of surface condensers.

Volcanic Ash for Phylloxera.

It is reported that a Neapolitan gentleman residing at the foot of Mount Vesuvius has cleared his vineyard of phylloxera by the use of volcanic ashes. Seeing that the soil of the country about Vesuvius is largely composed of volcanic ash, it is hard to reconcile the existence of the vine pest there with the alleged inability of the insects to endure its presence.

Charles B. Stewart.

The eminent civil engineer, General Charles B. Stewart, died in Cleveland, Ohio, January 4. General Stewart was engaged in the construction of the Philadelphia, Wilmington, and Baltimore Railroad, one of the first railroads in the country built for passenger service. Subsequently he constructed the Brooklyn dry docks, displaying therein an ability which secured his appointment as Engineer in Chief of the U. S. Navy. His volumes on naval architecture, the construction of dry docks, etc., attracted wide attention at home and abroad, and gained him much distinction at the hands of foreign authorities. He was for one term State engineer of New York, and deserves much, if not most of the credit for the first Niagara suspension bridge. His title was gained during the late war, in command of a regiment and afterwards a brigade of engineers.

BROKEN DIKES IN HOLLAND.—A break in the embankment of the river Maas, between Nieukuik and Vlymen, Holland, December 29, resulted in the submergence of eighteen villages. The whole country called the land of Heusden and Altena was inundated.

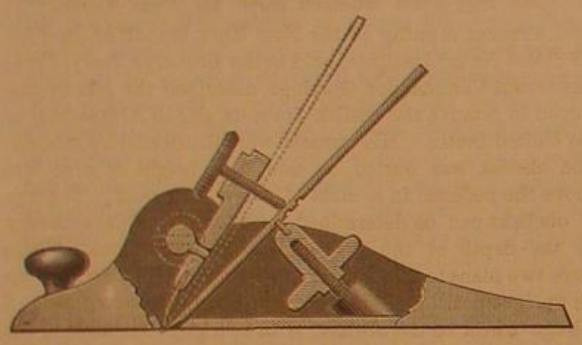
Wormwood as an Insectifuge.

In a communication to the French Academy (*Comptes Rendus*, p. 607), M. Poirot attributes to the wormwood (*Artemisia absinthium*) extraordinary properties as an insectifuge. He states that among the plants of this species that cover the vast plains of North America, he has never seen flies, ants, or any other kinds of insects; and to these he adds worms, scorpions, rattlesnakes, and other serpents. He proposes to use this property in the extinction of the phylloxera, as he believes this pest would not be able to go through the necessary metamorphoses in a soil manured with the leaves and stalks of the plant.

IMPROVED BENCH-PLANE.

The engraving shows a device by which the knife or "iron" of the plane is adjusted to various inclinations and secured in any position to suit the various degrees of hardness and grain of the different kinds of wood on which it may be used. The cap or back iron is adjusted to suit the required angle of the knife, and at the same time the back iron serves the double purpose of both holder and back-iron or cap as ordinarily used.

In planing soft wood the plane will be adjusted as shown in the engraving, but when it is desired to use it on hard wood, the thumb-screw above the iron is retracted, and the nut below the iron is unscrewed from the threaded stud until the iron touches the cap as shown in dotted lines, or the iron may be placed in any intermediate position. The nut upon which the back of the plane iron rests carries an eccentric pin which engages one of three or four slots in the back of the iron, and serves to regulate the distance the iron projects from the face of the plane.



STEERS' BENCH-PLANE.

A shaft extending across the plane has a pin which projects into a hole in the cap; by turning this shaft the cap is moved in one direction or the other as may be required.

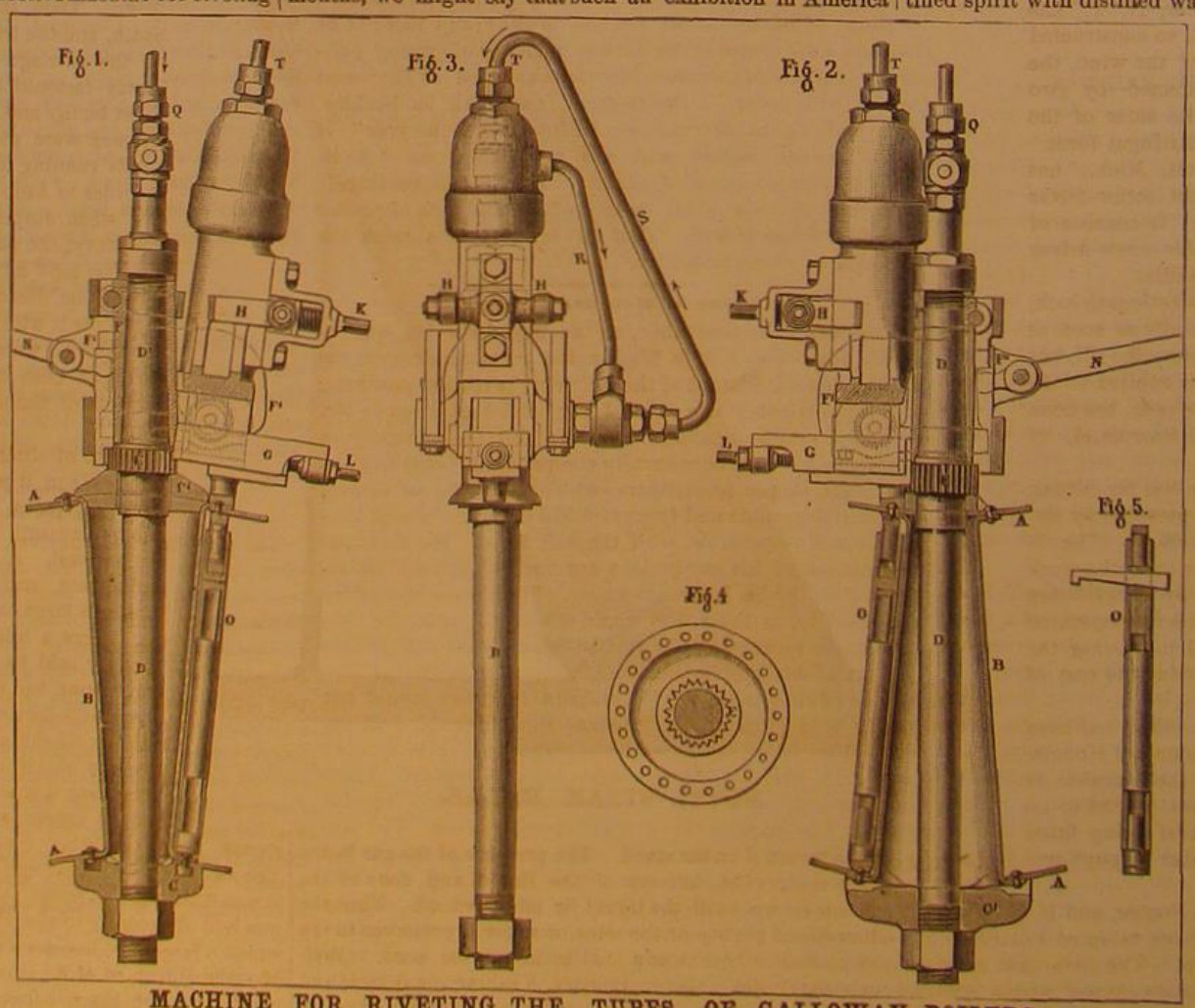
When all of the parts are in the required position they are made fast by turning the thumb-screw that bears upon the back of the iron.

This invention has been patented by Mr. William Steers, of Sherbrooke, Canada.

MACHINE FOR RIVETING THE TUBES OF GALLOWAY BOILERS.

Messrs. Galloway & Beckwith, of Manchester, England, have constructed a simple and effective machine for riveting the conical tubes of the Galloway boiler.

In the engravings, from *Annales Industrielles*, the walls of the boiler are indicated by A, and the tubes to be riveted thereto by B. Through the cast iron blocks, C and C', at the ends of the tube, the shaft, D, passes, held at the top by the gear wheel, E, at the bottom by a nut. The conical extension of the shaft, D', is surrounded by a cast iron sleeve. By the lever, N, the sleeve can be locked in any desired position. A hydraulic riveter is pivoted between the jaws, F and F', at the lower end of the sleeve, the upper end of the riveter being held by the rods, H, pivoted at the upper end of the sleeve. The inclination of the riveter can be varied at will by means of the screw, K. Since the die must be adjusted to the diameter of the tube to be riveted it is not attached to the piston, but slides in the box, G, and is held in any desired position by the screw, L. The die rest, O, carries a die at each end, and is placed in proper position by a workman within the boiler, the lower die being set over a rivet at the bottom of the tube, and the upper so as to hold the head of a rivet to be completed. The water reaches the piston, J, after passing through the rotating joint, Q, and the tubes, R and S.



MACHINE FOR RIVETING THE TUBES OF GALLOWAY BOILERS.

TOBACCO-LEAF CUTTING KNIFE.

The principal objection to the ordinary cigarmaker's knife is that after using it for a short time a gummy substance collects on the blade near its cutting edge, and unless this is frequently removed, the wrapper-leaf, while being trimmed, is liable to adhere to the blade, and the leaf is often torn in cutting, and rendered useless as a wrapper. The common way of removing this gum is by drawing the blade horizontally between the lips. This method is not only inconvenient and unpleasant, but its necessarily frequent repetition is a great waste of time and no doubt injurious to the health.

TOBACCO-LEAF CUTTING KNIFE.

The invention consists of the ordinary cigarmaker's knife-blade, attached to a hollow metallic handle closed at the end by a movable cap; the handle and a small tube extends from the handle along the back of the blade to within a short distance of the end. Near the end of the tube there is a small opening on each side of the blade.

The handle is filled with water and then closed by the cap The simple motion of the knife, when in the act of cutting, will force sufficient water from the small perforations in the tube to keep the blade wet, and thus prevent the accumulation of sufficient gum to interfere with the cutting. The blade in this manner is kept in order as long as any water remains in the handle.

This invention was lately patented by Mr. S. M. Dougherty, of Lancaster, Pa.

Manufacture of Wrapping Paper.

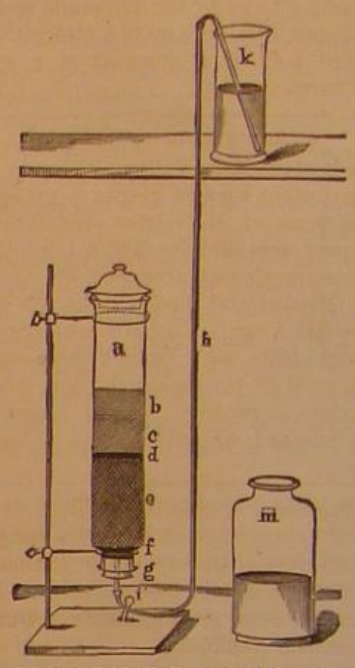
Nearly three thousand tons of wrapping paper were made in the month of October by the fifty-one mills included in the report of the Western Wrapping Paper Manufacturers' Association—an increase of one hundred and sixty-eight tons over the previous month's work. The amount on hand at the end of the month, however, was *less* than that of the month preceding—a fact which shows a healthy and active trade.

Electric Exhibition in New York.

The Operator, a paper devoted to telegraphic matters, suggests to American scientists, in view of the forthcoming exhibition of electricity in Paris, that arrangements be made for a similar exhibition in this country, at an early day, subsequent to the Paris Exhibition. America has, long ago, taken the lead in electrical research and invention, and such an exhibition in this city, the metropolis where Morse lived and died, or in Philadelphia, the home and final resting place of the immortal Ben Franklin, would be peculiarly appropriate, and, we believe, profitable. The quadruplex, the telephone, the phonograph, the microphone, and the photophone have all been invented, or have come into use, since the Centennial Exhibition, only four years ago, and, with the wonderful possibilities of even the next twelve months, we might say that such an exhibition in America would be not only a patriotic expedient, but an absolute necessity for the proper appreciation of the progress of electrical science.

IMPROVED APPARATUS FOR UPWARD PERCOLATION.

Mr. William Elborne, in a paper entitled "The Recovery of Residual Tinctures from Marcs by Upward Displacement with Water," in pointing out the various processes heretofore proposed for the preparation of tinctures, draws attention to the objections which have been raised against the displacement of the residual tincture in the marc by pouring water upon it. He says: "It will be convenient to allude to these objections, as the result will show that they tend favorably in support of the process which I am about to bring forward: First, the specific gravity of water being higher than that of rectified or proof spirit, it naturally permeates down into the spirit, which at the same time has a tendency to rise into the water, thus materially assisting the diffusion or mixing of the two liquids; secondly, vegetable tissues, possessing a greater affinity for water than for spirit, the latter is readily liberated from them and rendered free to rise in the water. Having mentioned the disadvantages of this process, I arrive at that which forms the leading feature of this paper, namely, upward displacement or the removal of the residual tincture retained in a marc by means of water (the heavier liquid) rising from below.



ELBORNE'S APPARATUS FOR UPWARD DISPLACEMENT.

Working on this principle, the objections above mentioned are inapplicable, and the results are fairly satisfactory. One impediment, however, is the slight diffusion which takes place at the line of contact, but this may be partially remedied by using a modification of the menstruum. Of the group of tinctures prepared by maceration and percolation, the following proof spirit tinctures were made: Tr. aurantii, calumbæ, cinchonæ, cinnamomi, lupuli, rhei; and with rectified spirit: Tr. aconiti, and zingiberis (fortior). The quantity prepared of each was one pint, and in those made with proof spirit, spec. grav. 0·920, I used spirit having the spec. grav. 0·915, made by diluting the requisite quantity of rectified spirit with distilled water to 19 ounces instead of 20, and adding 2½ drachms extra of rectified spirit, thus allowing for the contraction of volumes, and for use of the mixture immediately. My mode of procedure is to powder the ingredients and macerate them with the whole of the spirit, spec. grav. 0·915, for the specified time with occasional agitation; the supernatant liquid is then drawn off, the dregs stirred up and transferred to a cylindrical percolator, and allowed to drop until the liquid passes clear and bright; the receiver is then attached, and both the turbid and supernatant liquids returned to the percolator. Instead of tying a piece of muslin over the bottom of the percolator, as is usually done, a cork is inserted with a hole bored through the center capable of admitting a piece of ordinary glass tube, above which is put an inch layer of coarsely pounded glass to prevent the orifice becoming choked. Percolation being complete, another half inch layer of glass is placed on the top of the marc to prevent the floating of solid particles. Having removed the receiver and supported the percolator on a retort stand, the open end of a piece of glass tube two inches long is inserted in the cork, the other end of the tube being previously drawn out in the flame so as to leave only a capillary opening. To this end

is attached about a yard of India-rubber tubing communicating with a vessel placed above, containing distilled water, the pressure of a column of water being thus obtained. The India-rubber tube being filled with water and adjusted to the percolator, the wire clamp attached to the lower portion of the tube is removed, when a slow and steady flow of water commences; after the lapse of an hour and a half, sufficient displacement will have been effected, the water having risen considerably above the marc, and with it will have been removed the retained tincture, which forms a dense stratum upon its surface. On dipping a glass rod into this upper stratum and applying it to a flame, the displaced tincture burns nearly as readily as the percolated portion, indicating its comparative strength of spirit. Nevertheless, diffusion will have taken place to a slight extent, and is perceptible by the gradual shading off of the highly colored tincture into the water beneath it. To finish off the tincture, its measure was brought up to 19½ ounces by the addition of the requisite quantity of surface liquid from the percolator, the product filtered, and made up to a pint with proof spirit. Thus having measured the product of percolation, I know exactly how much surface liquid to draw off to bring the measure up to 19½ ounces, which is done by means of a glass siphon, and having mixed the two products, filtered by the automatic method through a thin 3-inch paper, and made up to a pint with proof spirit, I have produced a tincture prepared at a comparatively small loss.—*Pharm. Journal.*

Large Yields of Grapes.

The vineyards of the Napa Valley, California, averaged the past year about eight tons of grapes to the acre. In one instance three acres of Malvoisies yielded ten tons to the acre. The grapes were sold for $25 a ton. Twenty-eight acres in San Joaquin County produced 300 tons of grapes, of two sorts, Mission and Black Prince, the average price of which was $27 a ton. Choice grapes grown on mountain sides brought $30 a ton. In both these cases the vines were old. A yield of ten tons to the acre from three-year old Sultana vines is reported in one instance in Solano County. The Sultana is a seedless grape, in high repute for raisin-making.

ANOTHER BRUSSELS EXHIBITION.—It is stated that in consequence of the great success of the Belgian National Exhibition, two projects are now under discussion—one for holding at Brussels in 1883 or 1884 a Universal International Exhibition, and the other for organizing a Universal International Educational Exhibition.

NOVEL STEAM BOILER.

The special feature of the new boiler shown in the accompanying engraving consists in the transverse water tube in the fire box. Its obvious effect is to aid materially the raising of steam of high pressure in a short time. The boiler may be set vertical or inclined, the latter position being preferred This boiler is the invention of H. Berchtold, of Zurich, Switzerland. The illustration is from the *Allgemeine Zeitschrift für Textil-Industrie.*

NOVEL STEAM BOILER.

MECHANICAL INVENTIONS.

Mr. John F. Garatt, of Spencer, N. Y., has patented an improved windmill, so constructed as to adjust itself to the force of the wind, the automatic adjustment being effected by two weights at diametrically opposite sides of the wheel which are acted on by centrifugal force.

Mr. Gavin Telfer, of Detroit, Mich., has patented a combined hammer and screw-driver which is simple and convenient. It consists of a hammer containing an adjustable screw-driver in the lower end of its hollow handle.

An improved sash lift and automatic sash lock, which locks the sash automatically as soon as the same has been lowered to rest on the sill, but unlocks it as soon as pressure is applied to the lift for the purpose of raising the sash, has been patented by Mr. William W. Sweetland, of Edwardsburg, Mich.

An automatic attachment to lathes for cutting rubber and other rings has been patented by Mr. Joseph T. Ridgway, of Trenton, N. J. The object of this invention is to make the lathe work more quickly and accurately by substituting automatic mechanism for mechanism operated by hand, thereby increasing and improving the product of the lathe and diminishing the cost of the product.

An improved water and steam wheel has been patented by Mr. Thomas R. Simmons, of Houma, La. The inventor uses a wheel that consists of a hub provided with wings that extend to an outer inclosing cylinder, the wheel being fitted on a shaft contained in a chamber through which the fluid passes.

Messrs. T. H. Scott, A. G. De Pontee, and H. E. Wyman, of Crown Point Center, N. Y., have patented a machine for cutting wood fiber for paper pulp. The invention consists in a novel knife and the combination thereof with a revolving head for cutting wood fiber to be used in making paper pulp.

An improved electric alarm, which is designed to be set off to give a continuous warning by the breaking of an electric circuit, has been patented by Mr. Lambert F. Fouts, of Greenfield, Iowa.

BOTTLE COCK FOR EFFERVESCING LIQUIDS.

In using aerated water, champagne, or other effervescing liquids, especially in sick rooms where small quantities are

IMPROVED BOTTLE COCK FOR EFFERVESCING LIQUIDS.

required in frequently repeated doses, it is undesirable to open a fresh bottle every time, and quite impossible to preserve for any length of time the briskness of an opened bottle. To meet such cases the simple apparatus shown in the annexed engraving has been devised. It consists of a hollow corkscrew mounted upon a little stand, and so arranged that the outlet may be opened by a slight pressure on a lever. The corkscrew is passed through the cork and the bottle inverted on the stand. The pressure of the gas in the bottle insures the delivery of the liquid, and none of the gas can escape until the liquid is all drawn off. Thus the effervescent quality of the wine or water is preserved to the end no matter how slowly the liquid may be used. Obviously the device is also serviceable in saving the trouble and waste incident to the common method of uncorking bottled liquids of this character.

RECENT INVENTIONS.

Mr. William C. Beattie, of Taunton, Mass., has patented an improvement in butter dishes, which is applicable to all kinds of analogous covered dishes, such as pickle casters, jewel cases, sugar dishes, baking dishes, etc. The object of the invention is to provide a neat and tasteful means for raising and suspending the cover in elevated position above the dish.

In an improved boot heel, patented by Messrs. Riley D. Plunkett and Jason P. Rollins, of Little Rock, Ark., the heel is made detachable and attachable. Both the sole and heel have heel plates, which connect by dovetail tongue and groove, and are maintained in mutual engagement by a single screw.

An improved gatherer and ruffler for sewing machines has been patented by Mr. James B. Farrar, of Wilmington, N. C. It gathers a piece of fabric either at its edges or throughout its entire surface, or will gather or shirr a piece of fabric on a ground work, or gather one piece of fabric to another, and at the same time attach a ribbon, tape, or braid, at the seam, all in a single operation.

Egyptian Obelisks.

There are thirty of them at the present time scattered over Europe. Rome has eleven, four of which are higher than our New York obelisk. The highest of the Roman obelisks, which is also the highest in Europe, stands before the Church of St. John Lateran. The obelisk in the piazza of St. Peter's is 82 feet 9 inches high. Both of these were mounted on high pedestals. The pedestal of the St. John Lateran obelisk is 44 feet high, making the entire height of obelisk and pedestal 150 feet. The pedestal of the St. Peter's obelisk is a trifle less than 50 feet high, making the whole height of the monument 132 feet 2 inches.

The Egyptian Obelisk now in New York.

At a recent meeting of the New York branch of the United States Naval Institute, held at the Brooklyn Navy Yard, Lieutenant Commander Gorringe described the means employed to remove the obelisk from its site in Alexandria to the United States. His remarks were illustrated by models. The obelisk was buried, he said, to a height of nine feet above the pedestal in a mass of *débris* and sand. The age of obelisks can be determined with considerable accuracy by the depth of the surrounding accumulations. There were two plans to choose from in removing the obelisk from its upright position. One was by securing the segment of a huge wheel to the obelisk, with two guys fastened to the shaft behind. Then the obelisk would be tilted so as to throw the weight on the guys, and excavations being carried on under the base it would slowly turn over. This was the simplest plan, but as the nature of the ground was unknown, and as rocks would very likely render the excavation difficult or impossible, the idea was adopted of mounting the obelisk like a cannon upon a kind of gun carriage. This carriage was made in Trenton and taken to Egypt in pieces. The obelisk was carefully incased in timber, and four derricks were erected. The iron plates of the trunnions, weighing six tons each, were hoisted into place on the sides of the obelisk and bolted together by bars running across, being also supported by rods running up and down. Then the carriage was placed underneath, and the trunnions just fitted into the rests on the carriage. The different parts were securely fastened by bolts, then the obelisk was lifted bodily and turned over of its own weight. Trusses were placed on each side, with steel bands running to the heel and end of the shaft, in order to keep the obelisk from breaking in two when suspended by the middle. It was top-heavy, the part above the trunnions weighing four tons more than that below, and therefore came down upon the high cradle prepared for it with a tremendous crash. Some of the timbers were broken, but special preparation had been made for this, and a kind of cushion of timbers was ready to receive the shaft.

Stacks of timbers were placed under the obelisk. When it was recumbent it was lifted by hydraulic jacks, and the timbers were taken out one by one until it was lowered to the level of the pedestal. A deep pit or canal had been dug underneath, and a huge box or caisson was in readiness large enough to float the obelisk out to sea. Here a mishap occurred which has been wrongly said to have been maliciously caused. The caisson had to go 210 feet to reach the sea. It went 20 feet and then stopped. For the remainder of the way it had to be pushed by a pressure of 120 tons inch by inch to the sea. Afterward it was found that between the ways and the cradle were several pieces of iron and stones, which probably found their way in accidentally. The sea was very rough, and once the obelisk was sunk, but it was finally towed seven miles and put in a dry dock. It was laid diagonally to the keel of the ship, in the side of which a large port had been opened. By the aid of a kind of railway formed of 6 inch channel iron and 5¼ inch cannon balls the obelisk was moved forward, being turned when half way into the ship so as to go parallel with the keel, and

it finally lay upon a bed on the very top of the keel. Then the port was closed up. The weather was good except for three days of the voyage. No danger at all was apprehended; in fact Mr. Gorringe considered that such a rigid body rather strengthened the ship.

NEW INVENTIONS.

An improvement in mowers has been patented by Mr. Peter P. Coler, of Clyman, Wis. The object of this invention is to furnish mowers so constructed that they may be readily adjusted as front cut or rear cut machines.

A vehicle spring, patented by Mr. Fred. Schelp, Jr., of Baldwin, Mo., consists in the combination with the side-bars and cross-springs of a side-bar wagon of a median longitudinal spring passing under the front and rear axles, and connected with the body by stay-rods, whereby a more elastic, easier running, and stronger spring gear is secured.

An apparently important improvement in well-boring apparatus has been patented by Mr. Edgar P. Watrous, of Moravia, N. Y. The invention relates to wells which are formed by sinking metal tubes. The tube is provided with a cutting edge at the lower extremity, and is made to penetrate the earth by rotation on its vertical axis, being fed to its work by means of a screw-feeding arrangement. The rotation is accomplished by a hollow crank joined to the top of a tube section through which water is forced, the water being discharged from the upper part of the tube section, to which is attached a small chamber and spout.

In a machine for packing bran, patented by Wm. L. Williams, of San Diego, Cal., a series of stamps are fitted within a vertical cylinder in which they are reciprocated, while at the same time the entire series is revolved on its vertical axis to pack the bran in a bag attached to the lower end of the cylinder which is open. The bran is fed to the bag through a feed-pipe obliquely joining the side of the cylinder.

By novel and very simple details of construction a reclining chair, patented by Mr. Phillip Herbold, of Galion, Ohio, may be adjusted in different positions.

An improved aerial apparatus has been patented by Mr. Frederick W. Brearey, of Maidenstone Hill, Blackheath, London, Secretary of the Aeronautical Society of Great Britain. The inventor makes use of a vessel or apparatus the body of which is long and narrow, with tapering ends, and of the greatest sectional area at or near the center of gravity, in order to present the least possible resistance to the air, and at the same time furnish suitable space for containing the motive power and other requisite machinery and also accommodation for passengers. Two or more lever arms are attached and jointed to the longitudinal body at or near the front thereof, and the said arms are vibrated by suitable power, and give motion to flexible fabric, whereby the apparatus is sustained and propelled. Mr. John F. Mackenzie, of 16 Hawley street, Boston, Mass., represents this invention in the United States.

In a speaking-tube, mouth-piece, and bell-lever patented by Mr. William R. Ostrander, of New York city, speaking-tubes and bell-levers for operating bell wires are combined in one apparatus, which effects economy in construction and convenience in use. The bell lever is pivoted on the mouth-piece, and both are secured to the wall by a single attachment.

Mr. William Winegar, of Chambersburg, Ill., has patented an invention which avoids the necessity of special supports for the wheels of grain drills, and provides that each wheel shall maintain a constant position relative to the bottom of its tooth for all changes in the position of the tooth by an automatic adjustment. He combines with the hollow drill tooth a pronged wheel attached directly to the side of the tooth and carried by the latter, which clears the drill teeth of straw or other obstructions instead of arranging such wheel between the teeth of the drill as has heretofore been done.

Correspondence.

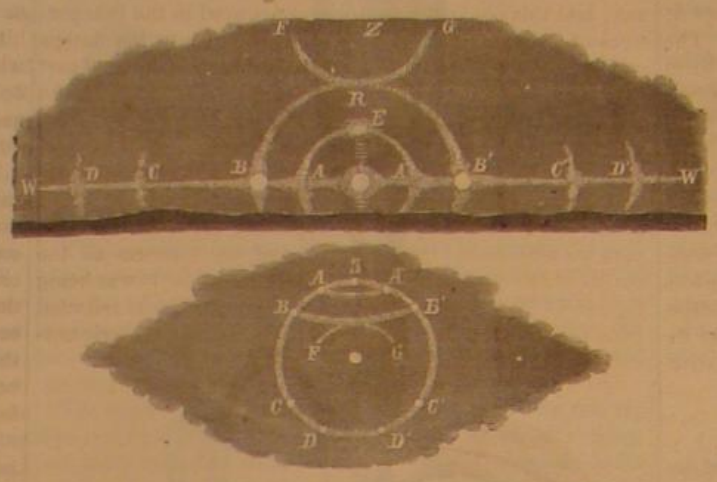
A Remarkably Brilliant Meteor, as Seen at Bloomington, Ind., December 30, from 8 o'clock to 11 o'clock.

The night of the 29th and 30th was very cold (—15° by Six's thermometer) and windy. The thermometer at 8 o'clock A.M. —6°. The sky slightly hazy.

The mock suns, A, A¹, were very large and bright, rivaling the sun in splendor, and they cast into the room well defined shadows, and their light on the wall was rather yellowish compared with the white light of the sun. These parhelia were at the intersection of the inner halo, A E A¹, and the horizontal circle, W W. This halo was very distinct, somewhat brighter at its summit, E, than on each side of it. The diameter of the inner halo, as roughly estimated from the shadows cast by the sun and one of the parhelia, was 42° or 43°. The second halo, B R B¹, was not so bright; it was surmounted by a brilliant colored arc of about 120°, with its convexity toward the sun. We could easily distinguish the red, orange, yellow, and blue colors. The center of this arc was in the zenith. The parhelia at the intersection of this halo and the horizontal circle were perfectly distinct—as bright as those usually seen on the inner halo. The parhelia, C C¹, were perfectly white and somewhat fluctuating, C¹ the brighter of the two. D and D¹ were mere blurred and faint patches of light, apparently about as far from a point diametrically opposite the sun, as A and A¹ were from the sun. The cross in the inner halo, as represented in the figure, added much to the beauty of the phenomenon. The haloes were seen till nearly noon, when they disappeared, then they appeared again between 2 and 3 o'clock P.M., nearly as splendid as in the morning, but lasting only a short time. T. A. WYLIE.

Bloomington, Ind., Dec. 30, 1880.

[In addition to the above, we have received letters and sketches from other correspondents widely separated from Mr. Wylie and from each other, who observed this splendid phenomenon. Mr. J. Mahr, of Suel, Minn., saw it first at noon, and says it was visible throughout the greater portion of the afternoon. Mr. C. Petri, of Hannibal, Mo., saw it. Rev. W. M. Richards, of Berlin, Wis., writes that he observed a similar phenomenon on the 26th ultimo, which surpassed anything he ever witnessed of the same nature; and to assure us of the correctness of his dates has written a second letter stating that the display observed by him should not be confounded with that seen on the 30th ultimo.]



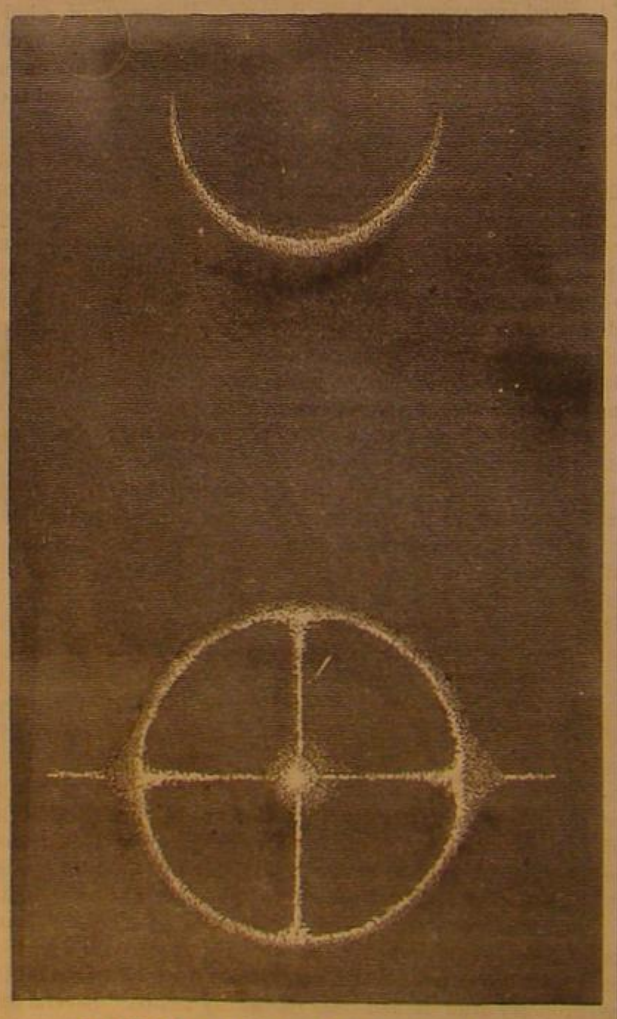
METEOR SEEN AT BLOOMINGTON, DEC. 30, 1880.

The Parhelia.

To the Editor of the Scientific American:

On the morning of the 30th ult., at about 10 A.M., a very beautiful atmospheric phenomenon was observed at this place, such as I never before witnessed, or ever found wholly described in any written work on the subject. I made a sketch of it on the spot, as faithfully as possible, and herewith send you a rough though true copy thereof, the relative dimensions and distances being preserved as correctly as possible. The night preceding was intensely cold, the mercury falling to 20° below zero.

There appeared, at the hour above stated, two very brilliant mock suns intersected by a well defined, slightly iris colored, bright circle, having the sun at its center. This circle was divided into quadrants by four brilliant rays of white light, radiating apparently from the sun, two horizontally and two vertically; the horizontal rays intersecting the mock suns, and extending some distance beyond, as shown in the diagram.



PARHELIA AS SEEN AT JERSEYVILLE, ILL.

The most remarkable part of this interesting phenomenon was the appearance of a brilliant inverted crescent near the zenith, subtending from cusp to cusp an angle of about 14°. The colors were disposed in prismatic order and as brilliant as those of the most beautiful rainbow I ever saw; the red outside, toward the sun; the violet inside. The mock suns were also strongly tinged with red on that side farthest from the sun.

This beautiful celestial spectacle, which almost every one turned out to see, reached its maximum brilliancy about noon, and gradually diappeared about 3 P.M.

I am aware that the crossed circle and mock suns are not new, for I remember having noticed a description of an appearance of this kind in either the SCIENTIFIC AMERICAN or its SUPPLEMENT, some years ago, but the beautiful and brilliantly colored crescent that so much enhanced the splendor of the spectacle is, to me, new.

I should be pleased to know whether this phenomenon was seen from other places, and whether the like has been before observed.

F. S. DAVENPORT.

Jerseyville, Ill., January 1, 1881.

Magnificent Parhelia.

To the Editor of the Scientific American:

At about 10 o'clock this forenoon quite a number of our citizens observed a very strange, magnificently grand spectacle, never before seen by any of the spectators. It consisted of two mock suns, an arc of a rainbow inverted, and a halo of wonderful beauty.

The wind last night was nearly northwest. Yesterday morning the thermometer indicated 25° below zero, and averaged 15° all day yesterday; to-day, at the time of seeing the parhelia, it indicated 2° below. The sky this morning was clear, and the air sharp and crisp, with quite a slight breeze.

The parhelia or mock suns were bright and distinct and in the usual places, namely, in the two intersections of a strong and large portion of a halo, with an imaginary circle parallel to the horizon passing through the sun. Each parhelion had its tail of a varied yellow, red, and white color, and in apposition to the true sun, that toward the east being 20 degrees long and that toward the west 15 degrees, both narrowing to a point at the remote ends.

The mock suns were quite red toward the sun, but pale or whitish at the side, as was the halo also. Still higher in the heavens was an arc of a curiously inverted rainbow about the middle of the distance from the top of the halo and the vertex. The arc was as marked and distinct in its colors as the common rainbow, yet somewhat wider.

The red color was on the convex and the blue on the concave of the arc, which seemed to make 180 degrees in length, its center being in or near the vertex. On the top of the halo was a kind of an inverted bright arc. This brilliant scene was visible for more than half an hour.

Although it is recorded that quite a number of parhelia have been seen, both in ancient and modern times, yet I can find an account of but one similar in its appearance to the one seen here to-day, from which I have copied largely in my description, as they seemed so nearly alike.

The other spoken of is found on page 329, of volume ii., of the *Family Magazine*, published in New York in 1835, by Redfield & Lindsay. It is there stated that they were seen at Lyndon, in the County of Rutland, England, at 11 o'clock in the morning on the 22d day of October, A.D., 1721, and were seen the following day, and again on the 26th.

J. IVOR MONTGOMERY.

Sandwich, Ill., December 30, 1880.

Restoring the Dead.

Professor Fort has presented the question of premature interments to the French Academy in a paper on artificial respiration. One fact he mentions is, that he was enabled to restore to life a child three years old by practicing artificial respiration on it some four hours, commencing three hours and a half after apparent death. A similar case is reported by Dr. Fournol, of Billancourt, who reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water ten minutes, and the doctor arrived one hour after asphyxia. Professor Fort advocates also the utility of artificial respiration in order to eliminate the poison from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia may be said to be several hours.

A Case of Leucoderma.

Dr. J. H. Thompson, of Goshen, N. Y., writing to the *Medical and Surgical Reporter*, states that there is a negro of quite advanced age living in that village, whose case gives an affirmative answer to the question, "Can the Ethiopian change his skin?" He furnishes a unique example of the rare skin affection known as *leucoderma*, or *achroma*. The transformation has been in gradual progress for several years, until, at the present date, the man, formerly of typical negro blackness, has become of fair Caucasian whiteness in at least half extent of surface. He is, as always happens in leucoderma, piebald as regards transformation. As an extraordinary specimen of a dermatological lesion the individual is a decided curiosity.

ON MAGIC MIRRORS.

BY MM. BERTIN AND DUBOSQ.

The people of the far East, the Chinese and the Japanese, in bygone times were only acquainted with metallic mirrors; and even to-day they make only these. They are made of speculum metal, of various forms and sizes, but always portable. One of the faces is polished and always slightly convex, so that its reflection gives images which are reduced in size; the other face is plane or slightly concave, and always has cast on it ornaments which are in relief. Among the many mirrors thus constructed there are a few which possess a wonderful property: when a beam of the sun's light falls upon the polished surface and is reflected on to a white screen, we see in the disk of light thus formed the image of the ornamentation which is on the back of the mirror. The Chinese have long known of these mirrors and value them highly; they call them by a name which signifies *mirrors which are permeable to the light.* We, of the West, call them *magic mirrors.*

Magic mirrors are exceedingly rare. We only find mention of them four times in the *Comptes Rendus* of the French Academy of Sciences. The first was presented to the Academy by Arago, in 1844; the second and the third were brought to the notice of the Academy in 1847 by Stanislas Julien and by Person, and the fourth was exhibited before that society in 1853 by Maillard. It is true that even so far back as 1832 Brewster gave a theory of the phenomena of magic mirrors; but his explanation was made on the basis of the description of one of these mirrors which came from Calcutta, but which Brewster had never seen. Finally, in 1864 and 1865, M. Govi read before the Academy of Turin two papers on very beautiful experiments which he had made with three magic mirrors; this brings to seven only the number of these mirrors which, up to that date, had been seen in Europe since men have begun to observe facts in a scientific manner. Therefore very few persons had seen magic mirrors till the month of last April, when an English physicist, Mr. Ayrton, professor at the Polytechnic School at Yeddo, exhibited several of these mirrors, which he had brought with him from Japan. He experimented with them, and very successfully, before a small audience in the laboratory of M. Carpentier. He then left for London, and it will probably be a long time before we again have the privilege of seeing these marvelous mirrors.

In the meantime I received a visit from M. Dybowski, my former pupil, who had returned from Japan, where for two years he had been the colleague of Professor Ayrton. He brought back with him as objects of curiosity four *temple mirrors*—that is to say, antique mirrors; these are far superior to mirrors of modern production, for the manufacture of these mirrors has been nearly abandoned by reason of the introduction of the silvered mirrors of Europe. We tried them together; three were circular, and the thinnest of them, which is a disk of 15·3 centimeters in diameter, was found to be slightly magic.

To try such a mirror we reflect a sunbeam from its polished surface on to a white cardboard, about one meter distant. But to obtain the very best effects we must illuminate the mirror with a diverging pencil of light; this pencil is made still further divergent by reflection from the mirror, because its reflecting surface is convex. We can now receive the reflected rays on a screen at a greater distance, and we at once see distinctly the magnified image of the ornamentation on the back of the mirror. These raised designs appear on the screen in white on a dark ground. The image thus made by our mirror was confused, because the mirror was not a good one; it would have been sharply defined had the mirror been properly made. I then knew of no means by which I could make it give better effects.

The means by which the mirror could have been improved were first pointed out by M. Govi in the second of his two papers to which we have referred. It is a consequence of the true theory of magic mirrors. The theory was not reached at once.

Stanislas Julien has found in the writings of a Chinese author of the twelfth century of our era an explanation of the wonderful effects of these mirrors. The author supposes that the designs in relief on the back of the mirror are reproduced by deep engraving on the front, and then a finer and more highly reflecting metal is poured into the lines of this engraving. On polishing the face of the mirror the magic effect is produced in the image by the greater reflecting power of the finer bronze.

The theory of Brewster does not differ substantially from that of the old Chinese. The polishing of the mirror effaces traces of the operation of engraving, rendering the surface the same throughout when inspected by ordinary light, but this engraving is developed when the sun's rays are reflected from the face of the mirror. But Brewster, who proposed this explanation, was not aware that this reflecting surface was really amalgamated.

This very ingenious theory was not known in France when they began to take interest in magic mirrors; if it had been it might have misled those who sought an explanation of these curious phenomena. The first French physicist, Person, who had the opportunity of experimenting with one of these mirrors, at once gave the true explanation of its action. He satisfied his own mind, by direct experiments, that the polished surface of the mirror was not regularly convex. It was so in all parts except those corresponding to the design on the back of the mirror. "The rays," says he, "reflected from the convex portions diverge and give but a feebly illuminated image; while, on the contrary, the rays reflected from the plane portions of the mirror preserve their parallelism and appear on the screen as an image by reason of their contrast with the feebler illumination of the rest of the image."

This irregularity of surface of these mirrors is brought about by the peculiar process adopted in working them, and which was explained to us by Professor Ayrton.

The mirror comes from the mould as a disk with a plane surface, and before it is polished this surface is scored in all directions with a pointed tool, and naturally it offers more resistance in the thick than in the thin parts. This operation tends to make a slightly concave surface, but the reaction of the elastic force of the plate makes this surface slightly convex; and this convexity is more pronounced in the thin portions of the plate than in those corresponding to the design on the back of the mirror. This irregularity of form of surface cannot be detected in diffused light, but it may, in the case of thin mirrors, produce the magic effect by the reflection of a very bright light, like that of the sun or of an oxyhydrogen jet. This is, indeed, the case with all badly wrought metallic mirrors; thus a plate of silver may give good reflected images, but on reflecting from it the sun's rays we will see on the image formed on a screen all the marks of the hammer which it received when it was being flattened. It is really a true magic mirror, only its reflected image is irregular and confused, while that of the magic mirror is regular like the design on its back.

THE MAGIC MIRROR.

The experiments of Govi were made to overthrow the theory of Brewster and to establish that of Person. Though these experiments are very interesting, I shall not here describe them, because they have already been extensively published in the annals of science; I will only recall the last and the most curious of his experiments, that in which he heats the back of the mirror. The thin portions should heat more rapidly than those in relief; they will become more convex, the irregularities in the form of the surface will become more pronounced, and the magic effect will be increased; it may even be thus produced in mirrors which, without such treatment, are devoid of magic properties.

When I became acquainted with the papers of M. Govi, I proposed to M. Dubosq to associate himself with me, in order, first, to repeat the experiments of the learned Italian, and then to study generally the interesting phenomena of magic mirrors, in the hope of being able eventually to reproduce them in his workshops. At first we had at our disposal only the mirror brought from Japan by M. Dybowski, and which gave confused images with the reflected solar rays. These images became very sharply defined when we had heated the back of the mirror with a gas lamp, and the mirror gave very magic effects.

We then made a mould and reproduced this mirror, not in Japanese bronze, but in ordinary gun metal. The first copy was roughly worked on the lathe, after the Japanese manner, in order to render it magical, but this was broken. The second was worked carefully on an optical grinding tool; the surface was then polished and nickel plated, but it was not magical; but it acquired this property in a high degree when it was heated, and it even retained traces of this property after it had been repeatedly heated. Several Japanese mirrors which we have procured have given analogous results.

We then engraved letters on the back of little rectangular Japanese mirrors. On heating these the letters appeared in black in the reflected image. When we cut lines around the design on the back of the mirror, heat rendered them very magical, for the design stood out framed in the black lines which bordered the figures.

Thus it is seen that heat is very efficacious in rendering mirrors magical; but it is not without its inconveniences. First of all, it injures the mirrors, which thus lose their polish, especially when they have been amalgamated; also, the mirror is often not heated equally and the images are deformed. It occurred to us that the change of curvature which was required could be obtained more uniformly by means of pressure. M. Dubosq therefore constructed a shallow cylinder of metal, closed at one end by the metallic mirror, and at the other by a flat plate of brass, having in its center a stop cock, which we could attach by means of a rubber tube to a little hand pump. This pump could be made either to condense or rarefy air. If the rubber tube was attached to the pump, arranged as a condenser, a few strokes of the piston sufficed to compress sufficiently the air in the shallow cylinder; the mirror became more and more convex, the cone of reflected ray became more and more open, and in the image on the screen the design on the back of the mirror became more and more distinct. Our Japanese mirror, when thus treated, gave very fine images, and the copy which we had made, and which gave no result as ordinarily experimented with, now became a magic mirror as perfect as any of those which Professor Ayrton had exhibited before us. A mirror in brass, nickel plated, on whose back was soldered tin plate figures, around whose borders were cut lines, became very magical by pressure, and gave the design on its back in light surrounded by dark borders.

This is what I call the *positive image.* We can also obtain the *negative image,* or the inverse of the preceding one, by rarefying the air in the shallow box. To do this we have only to attach the rubber tube to the pump arranged as an ordinary air pump. On now working the lathe the air in the shallow box is rarefied, the mirror becomes concave, the cone of the diverging reflected rays close up, the image of the design is reduced in size, changes its appearance, and becomes an image of the design on the back of the mirror; but this now shows in shade bordered with bright borders.

These experiments require an intense light. A jet of coal gas is insufficient; but the oxyhydrogen light is sufficiently intense. We intercept it with a screen perforated with a small hole, so that the diverging pencil which falls on the mirror may not spread too much. The mirror is mounted on the top of a column, so that it can be made to face in any required direction. The effects are most brilliant and the best defined when we experiment with the rays of the sun. When we expose the mirror to the beam of the porte-lumière it is generally not entirely covered by the light; in this case it is best to use a diverging beam obtained by means of a lens placed between the porte lumière and the mirror.

Thus we have seen that we can now make copies of the Japanese mirrors, some of which may be magical, but all may be rendered so by making them covers of the shallow box containing either compressed or rarefied air. This pressure box and its mirror, made in the Japanese style, certainly forms one of the most curious pieces of apparatus which is to be found in the cabinet of physics.

We shall not, however, stop here. One of these days, while our mirror is magical under the influence of pressure, we will take a cast of its surface, and then reproduce this by means of galvano-deposition. This surface will have all the irregularities of that of the magic mirror, and will produce by its reflected rays the image of a design which no longer exists on its back.—*Journal de Physique.*

Artificial Indigo.

Mr. Adolph Baeyer, of Munich, has discovered that by the action of sulphuric acid upon orthonitrophenylpropiolic acid a new product may be obtained which is capable of being converted into new coloring matters, or a dyestuff which he calls "artificial indigo."

The author says: "I take orthonitrophenylpropiolic acid, and in the cold I mix the said acid with sulphuric acid—say, for instance, with from about ten to twenty parts, by weight, of sulphuric acid of about 1·84 specific gravity to every one part, by weight, of orthonitrophenylpropiolic acid employed. In effecting the said mixture care is to be taken to avoid a considerable rise of temperature above, say, 20° Centigrade. The mixture thus obtained quickly assumes a bright yellow or orange color, and the reaction is allowed to proceed in the cold until a sample of the mixture, upon being tested for the presence of orthonitrophenylpropiolic acid by means of glucose and alkalies, no longer contains any appreciable quantity of the said acid. The sulphuric acid mixture thus produced is then submitted to the action of suitable reducing or deoxidizing agents in order to effect the conversion into artificial indigo.

"In practice I have found a great number of substances belonging to various classes of chemical compounds which act as deoxidizing agents upon the above-mentioned new product, and I may specially mention ferrous sulphate (green vitriol, copperas).

"As an example of the manner in which I prefer to conduct the aforesaid operation, I take the orange colored mixture resulting from the treatment of one part, by weight, of orthonitrophenylpropiolic acid with about from ten to twenty parts sulphuric acid, as above described, and I mix the same with a solution containing about five parts, by weight, of ferrous sulphate. The mixture is then allowed to stand at the ordinary temperature until the blue color, which it quickly assumes, is fully developed, and the dyestuff or coloring matter thus produced may be separated out of the mass by diluting the result of the operation with water, by which the new dyestuff is precipitated, and may be filtered and washed. The dyestuff is then ready for use.

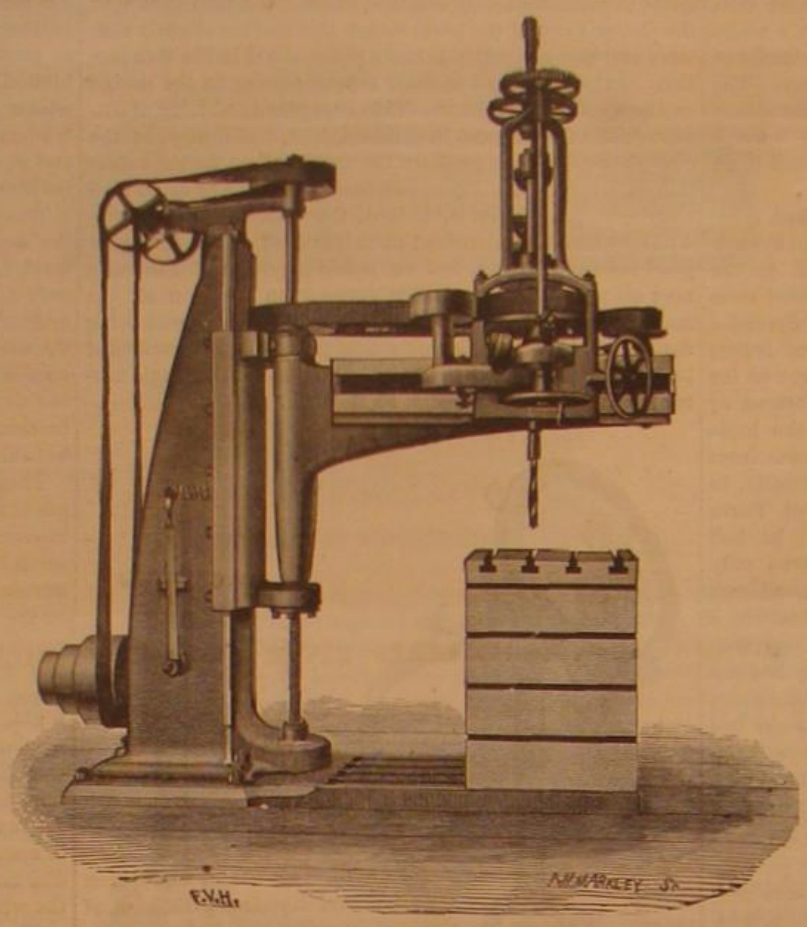
"The characteristics of my new dyestuff or coloring matter, prepared according to my above-described process, are the following: The dyestuff or coloring matter resembles in appearance vegetable indigo, and it can be used in dyeing in a manner similar to it; but it is in a great part soluble in aniline at an ordinary temperature, and also in an aqueous solution of sulphurous acid."

NEW RADIAL DRILL.

We present an engraving of a radial drilling machine recently perfected by Messrs. Wm. Sellers & Co., Philadelphia. In this machine they have utilized the plan of belt driving so successfully employed on their other forms of vertical drilling machines. They claim a gain of from 15 to 20 per cent in the amount of work done by a belted spindle machine as compared with radial drills in which the power is conveyed to the spindle through a long train of gears; and drills, too, are said to last longer, to be less likely to break, owing to the smooth motion imparted by the belt as compared to that by gearing. The swinging arm carrying the drill spindle is hung, crane fashion, to a long saddle; this saddle slides on the face of a stout upright—is, in fact, so long and so well fitted as not to need clamping when the drill is in place. This saddle and arm is raised and lowered by power, the mechanism for this purpose being operated by a hand lever at the side of upright. The saddle carrying the spindle is moved out and in on the swinging bar by a diagonal shaft operating a spiral pinion gearing into a straight rack after the manner so well known in the planing machines built by Wm. Sellers & Co. The spindle which carries the drill passes entirely through its driving sleeve, and hence has always the same length of bearing; it is also very close to the face of the swinging arm; it has a quick hand motion and an adjustable feed by power. This feed is novel and has many advantages; it is stopped and started instantly by a simple motion of a lever above the hand wheel in front of the drill spindle. The feed obtained from one of the guide pulley shafts is also adjustable through a wide range of gradations, in two series, one for small drills, and a coarser series to be used when the back gear is employed, as when using large drills or when boring. The spindle, although belt-driven, for all sizes of drills under say 1½ inches, is provided with back gearing for larger sizes; in this respect it corresponds and acts as any back-geared lathe head used for the same purpose. The back gearing of this machine is in a convenient position on the saddle and within easy reach of the workman. The spindle is counterbalanced up.

The great advantage claimed is in the raising and lowering of the swinging arm as compared to those machines in which this arm is fixed at one length, and to which the work must be set. In this machine the work to be drilled can be clamped to a table, provided or rested on the bed plate or adjusted on trestles; in any case the work, when placed within range of the machine, has the spindle quickly moved to it by power and the drilling done with the least loss of time possible.

We learn that the makers claim many new features in this machine, which they will protect by letters patent. They make two sizes, one with 4 feet 6 inches and the other with 6 feet radius, each with power in proportion.



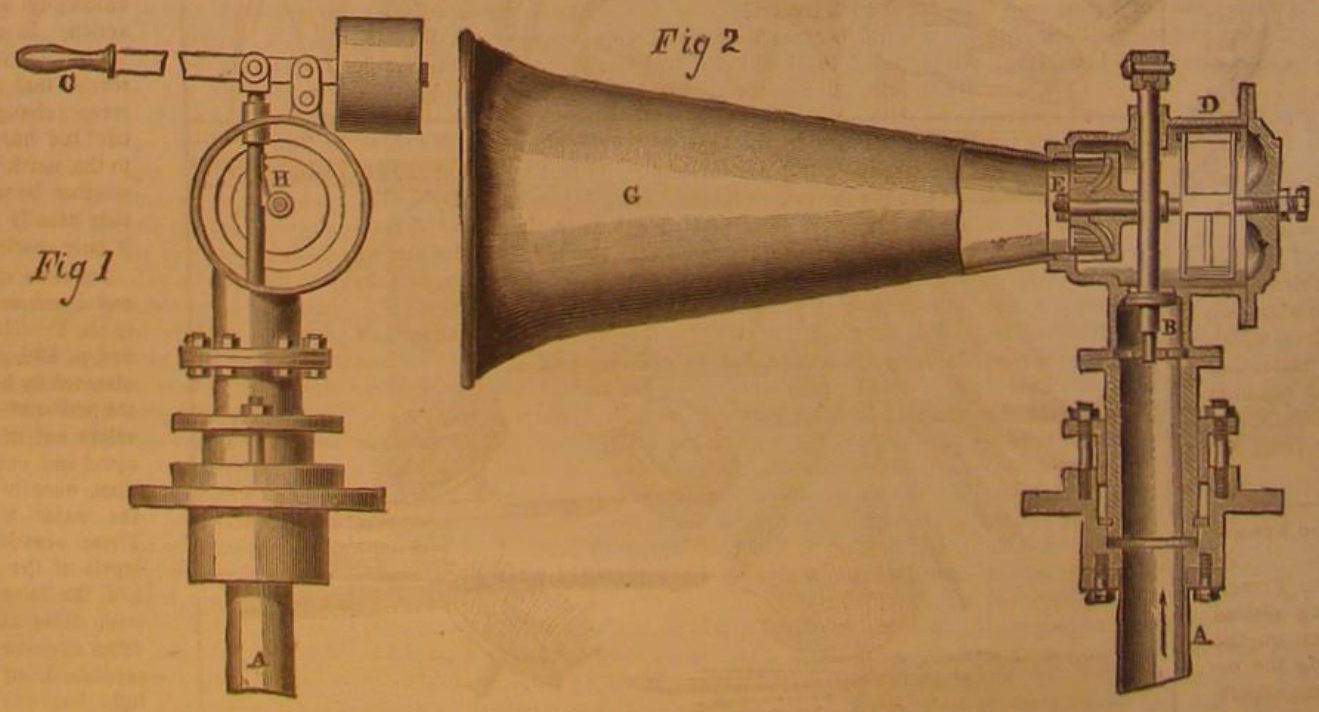
WM. SELLERS & CO.'S RADIAL DRILL.

IMPROVED STEAM FOG HORN.

The improvements in the fog horn, shown in the engraving herewith, were suggested by Professor Holmes, their object being to secure greater force and regularity to the action of the siren and greater penetrating power to the sound emitted.

It may be operated by compressed air or steam, which enters by the tube, A. The valve, B, is operated by the lever, C, admitting the steam or air into the chamber, D. At E are two slotted disks composing the siren, one rigidly attached to the shaft, the other loose. In its passage from the chamber to the large horn, G, the air or steam gives a rotary motion to the free disk, thus interrupting the current and producing the sound. This instrument is said to be very powerful.

It is made by Messrs. Sautter, Lemonier & Co., of Paris, and has been adopted for use on the French line of steamers from New York to Havre.



STEAM FOG HORN.

Domesticated Hornets.

A Western farmer has adopted an efficient but slightly risky method of ridding his house of flies. He has hung from the ceiling of his parlor a nest of hornets, transferred bodily from the woods. The removal of the nest did not seriously displease the hornets, and as they found the house well stocked with flies for food, they soon became familiar and harmless, devoting their energies to the extermination of the flies.

MISCELLANEOUS INVENTIONS.

Julia A. King, of Sherman, Texas, has patented a cough medicine consisting of a decoction of Indian pleurisy root (*Asclepias tuberosa*), saltpeter, honey, and brandy.

Mr. Walter Savage, of Crookston, Minn., has patented an improved snow plow for removing snow from railroad tracks. This plow is designed to be made of wood clad with iron to increase its weight, strength, and durability.

An improved cylinder for thrashing or hulling has been patented by Mr. James I. McClung, of Sidney, Ohio. The invention consists in constructing the cylinder with rabbeted and recessed lugs to receive the teeth, and in constructing the teeth with tenons or tongues, so that the teeth may be reversed and replaced.

A combined cradle and carriage has been patented by Mr. George F. Doyle, of Boston, Mass. The invention consists in combining with the rockers of a cradle the axles of a carriage, the axles being concaved to receive the rockers, so that the rockers and axles may be readily attached and detached.

A hat ironing machine, so constructed that the shell can be readily guided to all parts of the sides and crown of a hat body, has been patented by Messrs. R. S. Hedden and L. A. McCormick, of Newark, N. J.

An improved wagon brake has been patented by Messrs. W. L. Whitman, of Ringgold, Ga., and J. D. Igon, of James County, Tenn. This invention is an improvement upon the automatic wagon brake for which letters patent No. 196,406, dated October 23, 1877, were issued to W. L. Whitman and E. Manes.

A buckle, especially adapted for fastening and securing rolled cloths and other goods that are put up in rolls, has been patented by Mr. Calvin W. Polen, of Hazel Dell, Ill. The buckle is made of wire, bent so as to form a rectangular frame, having two square loops and a central crossbar that has two downward curved hooks, and it has a double-pointed and barred wire tongue placed on the central crossbar of the buckle, the tongue points being pointed in the direction opposite to that of the frame hooks.

Mr. Louis W. Ott, of Indianapolis, Ind., has patented an improved bedstead lounge which is readily opened and closed and is not liable to get out of repair.

An improved neck yoke has been patented by Mr. John W. Barton, of Emporia, Kan. The object of this invention is to provide an elastic support within the neck yoke for securing and holding the tongues of all kinds of vehicles, including reapers, mowers, and other machines.

Mr. Henry Thompson, of Brooklyn, N. Y., has patented a ventilated can in which milk or other liquid may be filtered and from which it may be drawn free from impurities.

A bath box for the use of photographers and others, by which the escape of poisonous gases, to the injury of the operator, is prevented, has been patented by Mr. James C. Macurdy, of Boonville, Mo.

An improvement in patterns for close-fitting sleeves for dresses has been patented by Mary A. Taylor, of New York city. In order to obtain the required fullness for the elbow, sleeves have heretofore been made in two pieces with a seam on the outer curve; but difficulty is experienced in joining the seam neatly on account of the fullness that has to be gathered in the seam. The object of this invention is to obtain a proper fit with the requried fullness for the elbow by a pattern that can be readily sewed up at the seams. The invention consists in a sleeve pattern made in a single piece and formed with a dart extending from one side toward the center to form a short seam that extends from the lengthwise seam of the sleeve to near the point of the elbow.

Mr. George P. Cole, of Johnstown, N. Y., has patented a composition for cleansing marble, etc., consisting of lime, whiting, sal soda, soft soap, fine salt, emery dust, fish oil, and water.

Mr. Thomas Wherritt, of Cynthiana, Ky., has patented an improved fire escape which consists in a swinging frame carrying a windlass having reel heads, a rope wound between the reel heads and of a length sufficient to reach to the ground, a set of friction straps fastened to the swinging frame and wrapped once or twice around the windlass on each side of the reel, and connected at their lower ends to a sleeve encompassing the rope, which sleeve is provided with an adjustable friction device, which, binding with the rope as it pays out, regulates the tension or brake action of the friction straps.

Messrs. F. Parker and F. Dumont, Jr., of Jersey City Heights, N. J., have patented a case for key and stem winding watches, the object being to produce light and inexpensive cases.

An improvement in the class of fire escapes adapted to be suspended from a window of a building, has been patented by Messrs. Robert Quintaville and Theodore Lindberg, of Brooklyn, N Y. It is more particularly an improvement upon such apparatus as consists of a frame that is designed to be attached to a window sill, and is provided with a curved standard, from which a basket or other receptacle for persons and goods is suspended by means of a rope running through a sheave or pulley block.

An improved wrapper for glass bottles for the purpose of obviating the danger of breakage, and also for protecting the labels from abrasion or other injury by contact of the bottles with each other or with other objects while being handled or shipped, has been patented by Mr. Martin V. Kacer, of St. Louis, Mo.

An improved hopple of the kind used for fettering animals to prevent their straying away, and to restrain their

movements so that they may be easily caught in the field, has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Territory. The improvement consists in fetlock bands connected to the ends of a chain by simple and durable connection.

CURIOUS FACT IN NATURAL HISTORY.

BY C. F. HOLDER.

Our illustration represents the American iguana crossing a river, the Chagres, as wide as the Harlem at High Bridge, upon the surface of the water, without sinking below it. This wonderful performance was witnessed by Mr. John G. Bell, the well known naturalist and former companion of Audubon. Mr. Bell states that as he was approaching the river he came suddenly upon the reptile, and alarmed it so that it sprang into the river, but instead of sinking, to his surprise, it rushed along over the water, making its claws go like lightning, so that he could not see them, and thus keeping the whole body above the water. It made quite a foam behind, and in about two minutes was over the river, up the bank, and out of sight. When it is remembered that this animal weighs from five to ten pounds, and has slender claws fitted for tree-climbing, the wonderful character of the performance will be appreciated. It is from four to five feet long, and its general color is green shaded with brown. It has a strong and distinct crest running along the whole length of the back and tail, and a large dewlap or pouch under the throat, the edge of which is attached to a cartilaginous appendage of the bone of the throat. The tail is very long, slender, compressed, and covered with small, imbricated, keeled scales. It has a very formidable look at first sight, and when irritated it puts on a very menacing appearance, swelling out its throat pouch, erecting the crest on its back, and lashing its tail about with great violence. It is, nevertheless, a harmless creature, unless laid hold of, when it bites with considerable force. Altogether the occurrence is a most remarkable one and entirely antagonistic to the supposed habits of the animal.

IGUANA CROSSING CHAGRES RIVER ON THE SURFACE.

FRESH-WATER MEDUSÆ.

Our engraving represents the *Limnocodium sowerbii*, the fresh-water medusa, recently discovered in the Victoria Regia tank at Regent's Park, by Mr. Sowerby, the Secretary of the Botanical Society. Our scientific readers will observe in the structure of this unique jellyfish the exceptional characteristics which distinguish it from other medusæ, as pointed out by Dr. E. Ray Lankester in his report to the Royal Society, at a recent meeting of the Society; where also Mr. Sowerby showed a number of living specimens which he had kept in confinement, and mentioned some of their peculiar habits. If the water is not kept up to a temperature of about 85° Fah., the animal falls to the bottom of the water and remains torpid until the temperature is raised, when it again becomes active. He has also observed the medusæ feeding on the daphnia, which abounds in the same water.

The diameter of the disk of the medusa does not exceed one-third of an inch. Dr. Ray Lankester, to whom we are indebted for the sketch from which our illustration is engraved, states that it is the only medusa which inhabits fresh water, and must have been introduced with tropical weeds from the West Indies.—*Graphic.*

FRESH-WATER MEDUSÆ AT THE BOTANICAL GARDENS LONDON.

Influence of Light on the Transpiration of Plants.

The *Comptes Rendus* of the French Academy gives the following *résumé* of a paper, by M. H. Comes, on the transpiration of plants, being the results reached after numerous experimental researches:

(1.) The emission of aqueous vapor which takes place in plants is submitted not only to the action of the physical agents which influence the ordinary evaporation from a free surface of water, but also to that of light. Consequently, under equal conditions, a plant transpires more under the action of light than it does in darkness.

(2.) The action exerted by light on the transpiration of plants augments in proportion to its intensity. Consequently, under equal conditions, transpiration reaches its maximum shortly after midday.

(3.) Light favors transpiration only in the portion which absorbs it through the coloring matter of the organ. Consequently, under equal conditions, the organ which has the deepest color transpires most, and transpiration is most active in that part of the spectrum in which the light is most absorbed.

(4.) The luminous rays which are absorbed by the coloring matter of an organ alone favor the transpiration of such organ. Then, conditions being equal, the transpiration of a colored organ will reach its minimum under the influence of a light of the same color as the organ, and its maximum under the influence of a light of complementary color.

NATURAL HISTORY NOTES.

Digestion in Plants.—Dr. Lawson Tait has recently been investigating anew the structure and digestive principles of plants. While he has obtained complete proof of the existence of a digestive process in *Cephalotus, Nepenthes, Dionæa*, and the *Droseraceæ*, he entirely failed with *Sarracenia* and *Darlingtonia*. The fluid separated from one of the sundews (*Drosera binata*) he found to contain two substances, to which he gives the names "droserin" and "azerin." Dr. Tait confirms Dr. Hooker's statement that the fluid removed from the living pitcher of *Nepenthes* into a glass vessel does not digest. A series of experiments led him to the conclusion that the acid must resemble lactic acid, at least in its properties. The glands in the pitchers of *Nepenthes* he states to be quite analogous to the peptic follicles of the human stomach; and when the process of digestion is conducted with albumen, the products are exactly the same as when pepsine is engaged. The results give the same reactions with reagents, especially the characteristic violet with oxide of copper and potash, and there can be no doubt that they are peptones.

How Flying-fish Fly.—*Apropos* of an article on this subject in the *American Naturalist*, Prof. D. S. Jordan, the well known ichthyologist, gives the following statement in regard to the behavior of the large flying-fish *Exocœtus californicus*: This fish flies for a distance sometimes of nearly a quarter of a mile, usually not rising more than three or four feet. Its motions in the water are extremely rapid, and its motive power is certainly the movement of its powerful tail in the water. On rising from the water the movements of the tail are continued for some seconds until the whole body is out of the water. While the tail is in motion the pectorals are in a state of very rapid vibration, and the ventrals are folded. When the action of the tail ceases, the pectorals and ventrals are spread, and, as far as can be seen, held at rest. When the fish begins to fall, the tail touches the water and the motion of the pectorals recommences, and it is enabled to resume its flight, which it finally finishes by falling in the water with a splash. When on the wing it resembles a large dragonfly. The motion is very swift; at first it is in a straight line, but this becomes deflected to a curve, the pectoral on the inner side of the arc being bent downward. It is able to some extent to turn its course to shy off from a vessel. The motion seems to have no reference to the direction of the wind.

The Use of Chlorophyl in Vegetable Growth.—This question appears to be as yet by no means definitely settled. Pringsheim, it will be remembered, recently suggested that chlorophyl was chiefly of use as a screen to protect the subjacent cells and their contents from those rays of light which would be adverse to the secondary processes that have been distinguished as growth. But Dr. Gilbert, in his recent address to the Chemical Section of the British Association, points out that the plant may receive abundance of nitrogen, may produce abundance of chlorophyl, and be subject to the influence of sufficient light, and may yet not assimilate a due amount of carbon. He shows that the presence of a due supply of potassium salt and of sufficient available nitrogen is necessary for the proper assimilation of carbon by plants. The amount of carbon assimilated evidently does not depend on the protective power of the chlorophyl alone, nor on its chemical action. In connection with the coloring matter of leaves it has been observed that the leaves of the Virginia creeper change to the well known beautiful red hue sooner on walls exposed to the north and east, and that if the weather be wet during the time when they usually change color the red tint is only sparingly developed.

Influence of Colored Lights on Animal Development.—M. Yung, in a note to the French Academy (*Comptes Rendus*, p. 440), gives some of the results obtained by him in his experiments on the action of colored lights on the development of animals. Eggs of the squid and cuttlefish, laid at the same time, were put into vessels in which the water was regularly renewed. These vessels were placed in glass bowls of the same form, but larger, and the intervening space was filled with different colored liquids. The upper surfaces were covered with thick cardboard, so that the eggs received light that was nearly monochromatic. Under such conditions the eggs developed unequally, as had previously been found the case with the eggs of the frog, trout, etc. The development was stimulated by violet and blue lights, but retarded by red and green. Yellow light, in its action, came nearest to white. In experimenting with the beautiful ascidian *Cœna intestinalis*, M. Yung found that those larvæ which were reared in vessels submitted

to violet light grew more rapidly and developed into much more vigorous individuals than those reared under other colored lights. These results, taken in connection with the like ones obtained by M. Serrano-Fatigati on infusoria, seems to show one general character for aquatic animals. It now remains to be seen whether terrestrial animals are influenced in the same way.

TRANSACTIONS OF THE AMERICAN SOCIETY OF ENGINEERS.

The above named publication for the month of November contains some important papers.

The subject of

"WEB STRAINS IN SIMPLE TRUSSES WITH PARALLEL OR INCLINED BOOMS,"

is ably discussed in a paper read by Mr. Elnathan Sweet, Jr., at the twelfth annual convention of the society, held May 25, 1880. Mr. Sweet, in this paper, aims at greater directness and simplicity in the treatment of the subject than has hitherto been attained; and he asserts that the handbooks hitherto published base their solutions of the problems relating to this class of trusses upon a false assumption. This assumption is, that as a moving load passes over the panels of a truss, each panel is fully loaded before the adjacent triangle in advance bears any part of the load.

"In trusses with a single system of triangulation, or those in which the web strains of any panel pass to the abutment through the web members of the adjacent panel, this assumption is obviously erroneous, for the instant the head of the load passes a panel joint of such a truss a part of it is transmitted by the floor system to the adjacent triangle of the same system."

With this proposition in view, the author proceeds to a somewhat abstruse mathematical discussion, in which he adopts as the most natural unit of length the panel length. By this means he is able to simplify the formulæ necessary so considerably as to justify the wisdom of the adoption of the panel length as the unit of length, and to determine the maximum shearing strain at any panel joint by much less complex expressions than have been heretofore required.

A DISCUSSION UPON INTER-OCEANIC CANAL PROJECTS,

referring to former papers which have appeared in the *Transactions*, together with additional information obtained by recent surveys in Nicaragua, by Mr. A. G. Menocal, throws much light upon current questions relative to the problem of communication by means of canals between the Atlantic and Pacific oceans. As an abstract of this paper cannot be given without reference to the papers criticised in it, we can only glance at one or two salient points. One of these is ably taken. In speaking of a canal on the Nicaragua route, the time of transit ought to be estimated not as though the whole distance were canal transit, but the transit ought to be separated into its component parts, to wit: "Canalization, 62 miles; slack water navigation, admitting nearly ocean speed, 63 miles; and lake navigation, admitting ocean speed, 56½ miles;" total, 181½ miles. The time of transit would, therefore, be shortened very much below that estimated by some engineers; indeed, it could be accomplished in 38½ hours, the transit including a lockage of 108 feet.

The practicability of utilizing the channel of the river Grande is another point strenuously urged by the writer in favor of the Nicaragua route.

Minutes of meetings and the annual reports of the Board of Direction, Committee on Finance, the report of a Committee on a Uniform System of Tests for Cements, and a list of members, with additions, changes, corrections, and resignations, complete the contents.

The Committee on Tests for Cements make only a brief report, enumerating an extensive series of papers received from different parts of the world bearing upon the subject, stating that they will commence an interchange of views during the present winter, and announcing that they will endeavor to complete their duties on or before the date of the next annual convention.

Meteorological Observations by Telegraph.

Mr. N. Hoffmeyer, of Copenhagen, observes that "in meteorological prognoses we cannot expect a scientific certainty; these prognoses are based upon empirical suppositions, and are, therefore, subjected to all possible errors which may be caused by that method. So long as the causes and the real nature of meteorological disturbances have not yet been explained, so long as we are only able to know the *how* and not the why of meteorological phenomena, so long a very exact observation only of the storms which by telegraph is transmitted from one coast to another, will be of practical value to the mariner."

This observation, however, is connected with greater difficulties than has been hitherto supposed. Mr. Hoffmeyer has, during a period of 21 months, made the closest investigations in regard to the storms and winds on the Atlantic Ocean, and he maintains that the conditions upon which these meteorological phenomena depend are so highly complicated that the telegraphic reports sent by the "*Herald* Weather Department" from America to Europe—although being a proof of the energy and ability of Mr. Bennett—have an imaginary value only.

It has been proved that the atmospheric disturbances usually move in the same direction across the ocean as across the continents, viz., from west to east, and that about 61 per cent of the storms which we have to encounter on the Atlantic have arrived there from the American continent; but it is also known that 39 per cent of the storms—a number not to be overlooked—are originated upon the Atlantic itself, and that besides only 50 per cent of the storms observed on the Atlantic arrive at Europe. The direction which the atmospheric disturbances show in America, before they arrive at the coast of the Atlantic, can be no secure basis for conclusions regarding the further course of these disturbances and the phenomena connected with them. Even if the observations on the European and American coasts were to be combined, a reliable prediction of what will happen on the ocean will be impossible. If, therefore, meteorological observations shall have a real benefit for our mariners, such observations must not only be made on the coast, but also on the Atlantic itself, and Mr. Hoffmeyer proposes to erect for this purpose a regular meteorological service, the stations of which are situated upon the ocean—*i. e.*, upon islands which lie between the two continents. These stations should be connected by telegraph with the continents, so that Faroe Island, Iceland, South Greenland, and the Azores may be brought into communication with the European coast and the Bermudas with North America.

Although these stations are very distant from each other, the meteorological observations made there will, on account of a meteorological peculiarity of the Atlantic, be of value for predicting the weather and atmospheric disturbances which will occur between these stations.

Mr. Hoffmeyer, by daily constructing synoptical maps, discovered that the barometric minima in the atmosphere which rests upon the Atlantic have a tendency to approach Greenland and Iceland on the one hand, and the Azores on the other, while from the latter to the Bermudas may be usually observed a high pressure of the air and fine weather. Even a slight change taking place at this part of the ocean predicts almost to a certainty great disturbances in the other regions. This barometric maximum, according to Hoffmeyer, forces the depressions of the atmosphere to take a certain direction and influences their velocity of movement in a high degree. Therefore it is absolutely necessary to be acquainted with these atmospheric maxima which prevail upon the ocean, and they can naturally be observed only upon the ocean itself—*i. e.*, upon those islands mentioned; therefore observations made there, in connection with those made on the coast, will be perfectly sufficient for all practical purposes. Mr. Hoffmeyer hopes, proceeding upon this basis, to perfectly transform our meteorological service, and to enable our scientists not only to predict the weather for a day or two, but for a longer period of time. The importance of such predictions for the transatlantic navigation is evident. The synoptic maps will enable the ships leaving the ports to enter regions which are subjected to great atmospheric changes, and to choose those ways which, during a certain time of the year, are the least exposed to danger; they will give important information about the condition of the monsoons near the Azores, which are much more irregular than they are generally supposed to be; and they will be valuable for the owners of vessels in making it possible for them to account for possible delays of their ships.

Mr. Hoffmeyer's labors have been communicated to the meteorological institutions of Europe, and necessary steps will probably be taken to make a practical use of the suggestions of this gentleman, as the resolutions, taken April 3, 1880, at an assembly of the presidents of the German meteorological stations at Hamburg, highly recommend the suggestions made by Mr. Hoffmeyer.

Paper Pulp from Wood.

The following interesting description of the process of making wood pulp is from an account of the opening of the Thorold Pulp Paper Company's establishment published by the Thorold *Post*, Canada:

"The wood, four feet in length and of any thickness, is brought in at the basement, placed in the barking-jack (one stick at a time), where two men, with draw knives, rapidly peel off the bark. It is then conveyed by the elevator to the first floor, sawed in two foot lengths with cross-cut saws, passed on to the rip raw, where it is slabbed (that is, a small portion of wood on opposite sides taken off), to permit it resting firmly in the grinding engine. It is then passed to the boring machine (an upright one and a half inch auger, with foot attachment driven by power), where the knots are bored out. The wood is then placed in racks of the same size as the receptacle in grinding engine and carried out to be ground. The grinding engines are upright, and receive at a filling one-twentieth of a cord of wood. The wood is placed in a receptacle, and by a simple, variable, automatic feed process is pressed flatwise between two outward revolving rolls, composed of solid emery, which are flooded with a spray of water, carrying off the fibrilized pulp in a stream through revolving screens to the tank or stuff-chest in the basement. It is then pumped up into a vat that forms part of the wet machine. In this vat is constantly revolving a large cylinder faced with fine brass wire cloth, which picks up the particles of pulp out of the water and places them on the felt (an endless piece of woolen goods which makes between rolls, for different purposes, a continual circuit of the wet machine). On the cylinder is turning a heavy roll, called the concha; between the two, where they meet, the cylinder leaves the pulp, with most of the water pressed from it. The pulp now makes its appearance on the felt above the concha roll in a beautiful sheet, thirty-eight inches in width, and is carried along in a steady flow a distance of about eight feet, where it passes between (the water here again being pressed from it) but not beyond two heavy rollers, the upper iron, the lower wood; it adheres to the upper roll, which is constantly turning, wrapping it up, and when a sufficient thickness is attained, is cut off by a knife being pressed to the roll, attached to the machine for that purpose. It now leaves the roll in a thick, white sheet, 36 x 38 inches, which is received by the boy in attendance on a table conveniently attached to the machine, and folded into sheets 14 x 26 inches. It is then placed on scales until the weight is one hundred pounds, when it is placed in the press and firmly tied into square compact bundles. It is now ready for shipment to the paper mill to be made into printing and tea paper. The wood paper pulp has been placed in the market and found a ready sale. Last week a contract to the amount of $1,000 was made with one of our large paper mills."

Loss of Water Pressure in Hose Pipes.

The recent engine test in New York city was interesting in many ways, but in none more so than as exhibiting the loss of power by friction in hose. Two hundred feet of Maltese cross rubber hose were laid from the engines, and at the base of the playpipe a gauge was inserted in the line. The steamers were working at from 100 to 120 pounds steam pressure. The following table exhibits the average general pressures taken every three minutes simultaneously:

Engines.	Steam Pressure.	Water Pressure at Engine.	Water Pressure at Pipe.	Loss by Friction in Hose.
Clapp and Jones	110·83	173·55	93·03	80·50
Ahrens	120·33	166·70	88·38	78·32
Amoskeag	101·64	143·14	74·54	68·60

From this it will be seen that the loss of power by friction in 200 feet of hose was very nearly 50 per cent. Had there been 1,000 feet of hose, the loss would have been very much greater, of course. The size of the hose used was 2½ inches. Had it been 4-inch hose, as the *Journal* has advocated for fire service, the friction loss would have been far less. In his little book entitled "Fire Streams," Chief Leshure, of Springfield, Mass., gives numerous valuable tables illustrating the friction loss in hose. He says: "It may be stated as near enough for most practical purposes, that when delivering the same number of gallons per minute, the friction loss in two pipes (or hose) of equal lengths, the diameter of one of which is twice that of the other, the loss in the larger will be one thirtieth of that in the smaller, or the loss in the smaller will be thirty times that in the larger." A better argument for increasing the size of hose for fire service could not be put forth. The weight of the hose need not be materially increased, for the present hose is made unnecessarily heavy to withstand fictitious pressures: that is to say, hose is now made and warranted to withstand anywhere from three to six hundred pounds pressure. When in actual service the pressures seldom exceed those given above. In a 4-inch hose it would be almost impossible to get 200 pounds pressure on the hose at any point in the line, and the hose could be made correspondingly lighter. As a matter of fact, 4-inch cotton hose is now made in large quantities for mining purposes that weighs but 70 pounds to the section, while much 2½ inch fire hose weighs fully as much or more —*Fireman's Journal.*

ENGINEERING INVENTIONS.

An improved rotary engine has been patented by Mr. John H. Newell, of Scottville, Ill. The invention consists in mechanism for operating the valve, and the combination therewith of a variable cut-off.

An improved stock car has been patented by Messrs. James V. Brown and Benjamin R. Neal, of De Soto, Ill. The object of this invention is to construct a car for transporting cattle and other live stock, so that the car can readily be divided into two or more stalls, and the food and water be conveniently transported and fed to the animals.

Mr. Daniel Kunkel, Sr., of Oregon, Mo., has patented an improved car coupling, so constructed that the cars will be coupled automatically as they are run together, also permitting their convenient uncoupling.

Chemistry of Plants.

Dr. S. Ringer, who has for some time past been experimenting upon the physiological action of *Narcissus, Galanthus, Hæmanthus*—genera belonging to the natural order *Amaryllidaceæ*—has recently examined the properties of an alkaloid from the common garden tulip—a liliaceous plant, and communicated his results to the *Practitioner*. It has been found by him that nitrate of tulipine differs almost entirely from the alkaloids derived from the amaryllids, it being a muscle poison which affects the muscles like veratria, but to a less degree. These results are interesting from a botanical as well as a physiological standpoint, as going to confirm the theory that the relationships between natural orders may, to a certain extent, be indicated by the nature of their chemical constituents. The nearer relationship of the *Liliaceæ* to the *Melanthaceæ* seems shadowed forth by the fact that a liliaceous plant has yielded an alkaloid like veratria. In the same manner the position of the Australian genus *Duboisia*, as belonging to the *Solanaceæ* rather than to the *Scrophulariaceæ*, was demonstrated by the elimination of the alkaloid duboisine, and the discovery that its physiological action was analogous to that of the solanaceous alkaloids.

Impromptu Ingenuity.

Some years ago, a Spanish steamer, while crossing the Bay of Biscay in a severe storm, gave such indications, by an unusual noise at the stern, that there was something wrong with the screw propeller or its shaft outside of the ship—that is, in the open space between the stern and rudder posts where the screw revolves. There was no dry dock in any of the ports on the coast where the ship could go to be examined; and on arrival at Vigo it appeared as if there was no alternative but to remove the cargo from the stern, and by placing it forward thus lift the screw propeller and shaft to the surface of the water. The alternative, simple as it was, meant a serious delay and great expense. Before commencing to remove the cargo, another consultation was held. It was then decided to put the stern of the ship over a bed of light colored sand; and as the water was very clear, there might be a possibility of ascertaining the extent or cause of the mishap. For two days after the vessel was so placed, the wind caused a ripple on the water, which effectually prevented anything being seen. It was then suggested by some one on board to try the use of oil on the surface of the water round the stern of the ship. The effect was most satisfactory. The water was becalmed as if by magic, and it was then seen that the wedge or key which keeps the propeller in its place on the shaft had come partly out, and thus left the screw loose on the shaft, which caused the noise. By continuing the use of oil for a few hours the wedge was ultimately driven into its place and secured. Many days of detention and the use of costly appliances and labor were thus saved.

A few years ago an iron bridge of considerable length, the weight being about two hundred tons, was constructed in England, and erected in a remote part of Germany. By some mishap, the bridge, when finished, was found to be some distance "out" to one side, an error which the proprietors insisted should be rectified. To take down and recrect the bridge would be simply ruin to the contractor. But necessity is the mother of invention, and so it proved in this case. It was summer time, and the contractor proceeded to find the amount of expansion which was caused by the heat of the sun over the whole length of the bridge. He next ascertained what contraction took place in the night by cooling. Armed with these data he thought it might be possible to bring the bridge to its proper position in a few days. The bridge, of course, in its ordinary condition, expanded from the center, pushing its two ends outward, or farther apart, and again contracting toward the center. Taking advantage of these conditions, one end was made fast in the morning, and the bridge was forced to expand from that immovable point, instead of from the middle, as formerly. When the iron composing the bridge had expanded to its full extent in the direction intended, that end was released, and the opposite end made fast. The bridge then contracted toward its true position. Thus, whatever was gained by the day's expansion was secured by the subsequent contraction when the metal cooled at night, and the process being renewed day by day, the work was successfully accomplished.

An ingenious application of expansion and contraction in metals was made use of in France, and has frequently been taken advantage of since. The walls of a large building in Paris were observed to be giving way by bulging outwards, and the problem was to bring them back to their vertical position. For this purpose a number of bars of iron having screws and nuts on each end were let through the opposite walls and across the intervening space between them. The nuts and screwed portion of the bars were outside. The bars were now heated by a number of lamps suspended below them until they had expanded as much as possible, and the nuts screwed up against the outsides of the two opposite walls. The lamps were next removed, when the heated bars, in cooling, gradually contracted in their length, bringing the walls very gently, but with irresistible force, into their normal position.

It is well known that in working iron, such as welding two pieces together, and even in its manufacture, hollow places or flaws occur, with merely an outside skin over the defective parts, which any test but a destructive one would fail to discover. Nor would it be difficult to point out numerous examples of disaster thus occurring. To test the homogeneity of the metal, a bar of iron is placed on the equatorial line. A compass with a very sensitive needle is passed along in front of the bar, the needle of course pointing at a right angle to it. If the bar is perfectly solid through its whole length, the needle will remain steady. If, however, there should be a flaw or hollow place in the bar, the needle will be deflected as it passes from the solid to the hollow place, *backward* toward the solid iron; passing on over the hollow place, the needle will come within the range of the solid iron at the other end of the flaw, and will again be deflected *forward*. If the bar be cut through anywhere between these two points of deflection, a flaw will invariably be found. Many thousands of pieces of iron—some prepared for the purpose of testing this method of trial, others in the ordinary course of business—have been operated upon with the same unvarying result.

A striking instance of ingenuity in taking advantage of the resources of nature in an emergency, is found in Sir Samuel Baker's account of his travels in Abyssinia. His stock of soap had become exhausted; and as he possessed abundance of various kinds of fat, including that of elephants, hippopotami, lions, and rhinoceros, he determined to convert a quantity of this grease into soap. For this purpose he required both potash and lime; and how were these to be obtained? The negleek tree, he found, was exceptionally rich in potash; he therefore burned a large quantity, and made a strong lye with the ashes, which he concentrated by boiling. There was no limestone; but the river produced a plentiful supply of oyster shells, which, if burned, produce excellent lime. What was next wanted was a kiln in which to burn the shells, and this he constructed out of one of those great ant hills, which rise to ten feet high, common to those valleys, and which possess a very hard external crust. Two natives hollowed out one of those hills; a proper draught hole was made below from the outside; it was loaded with wood, and filled with some six bushels of oyster shells, which were again covered with fuel; and after burning twenty-four hours a supply of excellent lime was obtained. Then commenced his soap boiling, which was effected in a large copper pot of Egyptian manufacture. The ingredients of potash, lime, and fat were then carefully mixed; and after boiling ten hours, and having been constantly stirred, he obtained excellent soap, of which he had in all about forty pounds weight.

National Value of Cheap Patents.

At the December 6th meeting of the Society of Engineers, London, Mr. Joseph Bernays, President, in the chair, a paper was read by Mr. Frank W. Grierson on "The National Value of Cheap Patents." The author pointed out that inventors, like all other men, did not work for the mere sake of working, but for their own advantage. In obtaining an advantage for themselves, however, they conferred upon the whole nation a much greater advantage. The advantage an inventor sought was secured to him by a patent; patents should, therefore, be granted at as low a cost as possible. A patentee was desirous of providing improved processes and means of doing what had not before been possible; or of doing something in a quicker and more economical manner than had before been possible. Inventions were very seldom "happy thoughts;" they were nearly always the result of much consideration and many experiments, neither of which would be undertaken for the mere love of the work, but which were undertaken in the hope of reward in the form of a successful patent. The patentee had an obvious incentive for getting his invention known and adopted; if it was not an improvement it would certainly not be adopted, but if it was, it would be adopted only in consequence of his persistent efforts, and by its adoption a step in advance had been made.

After referring to the evil of "orphan" inventions, the author gave the details of the stamp duties on British and American patents, from which it appears that the stamp duties on a patent in that country, lasting only 14 years, are 175*l.*, while those on an American patent, lasting 17 years, are only 7*l.* A table was then given of the patents applied for and granted in the United States and in Great Britain during the last ten years, from which it was shown that the 50*l.* stamp duty at the end of the third year kills about 70 per cent of the patents granted, and that the 100*l.* duty destroys very nearly 20 per cent more, leaving only 10 or 11 per cent to complete the full term. The effect of these crushing duties is that while on December 31, 1879, there were in Great Britain only 15,755 patents in force, in the United States there were more than 200,000, not including designs. The United States thus have thirteen times as many patents in force at the same time, and therefore make thirteen efforts to advance for each one that the English make. During the last ten years 22,868 British patents have been crushed by the heavy stamp duties. An American patent, once granted, lasts the full term without further payment. The result of this is seen in an enormous import of American goods of varied description, and in the continued flow of skilled artisans to America. Mr. Grierson then gave the following comparative table of average results for the last ten years:

	British Isles.	United States.
Receipts	158,980*l.*	143,049*l.*
Expenditure	48,063*l.*	125,254*l.*
Profit	110,217*l.*	17,795*l.*
Stamp duties on one patent	175*l.*	7*l.*
Maximum duration of patent	14 years.	17 years.
Average " " "	5 "	17 "
Number of patents applied for	4,496	19,770
" " " granted	2,980	13,355
" " applications refused or abandoned	1,516	6,415
" " grants paid 50*l.* duty	820	
" " " " 100*l.* duty	253	
" " " killed by 50*l.* duty	1,851	
" " " " " 100*l.* duty	436	
Percentage of applications granted	66·28	67·55
" " " refused or abandoned	33·72	32·45
" " grants paid 50*l.* duty	30·70	
" " " " 100*l.* duty	11·18	
" " " killed by 50*l.* duty	69·30	
" " " " " 100*l.* duty	19·52	
" " " lasting full term	11·18	100·00
Population	34,500,000	50,000,000
Number of persons to one patent granted	11,577	3,811
Ratio of amount of duties on one patent	25	1
" " number of patents granted	1	3
" " " " " in force	1	8
Average cost to inventor for one patent, including patent agent's charges	180*l.*	19*l.*
Technical examination of applications	None.	Careful.
Inventions invalidly repatented	Frequently.	Rarely.

Mr. Grierson went on to observe that this table showed that in the United States three patents were granted for one there, after allowing for the difference in population, and that the stamp duties on one patent there would pay those on twenty-five patents in the United States. We might, therefore, fairly say that the British inventor was handicapped 25 to 1 in favor of the American inventor. It was to be carefully remembered that in handicapping the inventor they handicapped the nation. The author drew attention to Mr. John Standfield's proposal for reduced stamp duties, which was as follows: On application (to cover cost of provisional protection), 2*l.*; on filing complete specification (to cover cost of printing, etc.), 3*l.*; total, 5*l.*; there should also be an annual tax of 1*l.* Provisional protection to be granted for one year, and the duration of patents to be twenty-one years. After remarking on the advantage of official technical examination of applications, the author pointed out that it was impossible to calculate the enormous indirect loss the nation suffered from the present exorbitant patent stamp duties, which drove abroad and stifled a large proportion of that inventive faculty upon which alone they were dependent for holding their place among the nations, and which might, if not so hampered, save a considerable number of lives now annually lost in preventable accidents, and might give employment to many who are now unable to obtain work, and who in consequence have to be supported in idleness.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Southern District of New York.

MATTHEWS *vs.* SCHONEBERGER *et al.*—PATENT BOTTLE STOPPER.

Blatchford, J.:

1. Every claim of a patent has reference to the descriptive part of the specification, and must be construed as if the words "substantially as specified" formed part of said claim.

2. So where the specification speaks of a part or feature of the patented device as being "an important feature of the invention," and makes it a part of the claim, the omission of such feature from defendant's device saves him from infringing the patent.

3. Where a prior device accomplished the same thing, but not so perfectly as the patented device, the claim to the latter must be limited to its precise construction whereby it accomplishes the results more perfectly, and will not include other means of doing it.

4. A function cannot be claimed. The claim must be either to the physical structure, the combination of devices, or the method of operation.

5. The Codd bottle stopper, consisting of a glass marble inside of a bottle seating against a rubber seat in the mouth of the bottle by the pressure of gases from within, is not an infringement of the Albertson patents for a gravitating stopper consisting of a stem with a rubber valve or skirt around it, which seats on the interior of the neck of the bottle.

This suit was brought on two patents. One of them is a reissue, No. 2,386, granted to the plaintiff October 30, 1866, for an improvement in bottle stoppers, the original patent having been granted to Albert Albertson, as inventor, August 26, 1862. This patent has expired.

The second patent sued on is No. 44,684, granted October 11, 1864, to J. N. McIntire, on the invention of Albert Albertson, for an improved method of stopping bottles.

Bill dismissed.

Concrete Blocks.

In reference to the art of concrete block building, Mr. Imrie Bell, of London, has been much struck by the want of attention paid to the art of producing a fair and finished surface in the exposed faces of the blocks, as exemplified in many of the large engineering works in course of construction in the metropolis and elsewhere, where the exposed faces of the concrete present a rough honeycombed appearance, with the marks of the joints of the timber planks forming the moulds in which the blocks have been formed, or the frames inside of which they have been built *in situ*, in place of showing a fair and smooth surface. The author has given this matter much consideration, and the result of his experience is that in concrete building it is perfectly easy, with a little attention, not only to produce a fair surface, but to form mouldings and panels, and even tracery and ornament, and at the same time make this face work as durable and solid as any part of the block. There are two reasons why little attention has hitherto been paid to this art—one is carelessness or indifference to appearance, the other is that most engineers who have attempted it have done so by "rendering," a most objectionable and dangerous mode of effecting the object; and which, even if successful for a time, is simply veneering, and is subject at any time to decay, the failure generally occurring after wet and frosty weather, which has naturally caused a want of confidence, and stopped a repetition.

The plan which the author has followed, and with complete success and at an inappreciable increase of cost, by which a smooth, uniform, and equal colored face can be obtained (and if wanted, the color of the blocks might be slightly varied by different colored sand), and which, both above and below low water, has stood successfully the test of eight years' exposure to frost, heat, storm, and rain. This plan is simply to have a smooth-planed board for the face of the mould painted previous to commencing the work with a mucilage of soap, and to line inside with a finer concrete or mortar as the work proceeds, so that the mixture placed close to the face boards is carried up with that contained in the body of the block, the whole forming one homogeneous mass, and insuring that the setting process of the whole mass shall progress simultaneously; and in fact this face, like the skin of cast iron, is actually the strongest portion of the block.

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.

Saunders' Pipe Cutting and Threading Machines. See adv., p. 45.

Abbe Bolt Forging Machines and Palmer Power Hammer a specialty. Forsaith & Co., Manchester, N. H.

All makes and sizes of steam hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

Steam Launches built and delivered to any part of the country. Address R. A. Morgan, Noank, Conn.

Toope's Pat. Felt and Asbestos Non-conducting Removable Covering for Hot or Cold Surfaces; Toope's Pat. Grate Bar. Chas. Toope, M'f'g Agt., 853 E. 78th St., N.Y.

Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N. Y., only device in existence automatically removing sediment from boilers by circulation at first cost. Engineers make 10 per cent selling other parties than employers. Circular free.

Protect your steam pipes and boilers with genuine Asbestos Covering. H. W. Johns M'f'g Co., 87 Maiden Lane, New York, sole manufacturers of Asbestos Roofing, Liquid Paints, etc.

List 25.—Descriptive of over 2,000 new and second-hand machines, now ready for distribution. Send stamp for same. Forsaith & Co., Manchester, N. H.

Complete Sets of Castings for 2 x 2 Vertical Engines, with cylinder and slides bored, and small casting brass. Price, $30 each. Photo for stamp. Address J. W. Westwick, Galena, Ill.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

For Machinists' Tools, see Whitcomb's adv., page 28.

Two Patents for sale. R. Munroe, Fitchburg, Mass.

Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are making the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

Eureka Vegetable Boiler Scale Eradicator, strictly vegetable, and perfectly harmless to iron. Warranted to remove scale of any thickness, and to prevent scaling from either fresh or salt water use. Circulars and particulars of G. E. Brinckerhoff, 107 Liberty St., N. Y.

The Sweetland Chuck. See illus. adv., p. 12.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 12.

The I. B. Davis Patent Feed Pump. See adv., p. 12.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 362 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $6. A. H. Downer, 17 Peck Slip, New York.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses, Dies and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 413.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N.J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts. Importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Clark Rubber Wheels adv. See page 29.

Eclipse Portable Engine. See illustrated adv., p. 30.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

Steam Engines, Boilers, Portable Railroads, Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

Peck's Patent Drop Press. See adv., page 45.

Blake "Lion and Eagle" Imp'd Crusher. See p. 45.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 45.

Wren's Patent Grate Bar. See adv. page 45.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For best Indirect Radiators, see adv., page 45.

Eagle Anvils, 10 cents per pound. Fully warranted.

Gear Wheels for Models (list free); experimental and model work, dies and punches, metal cutting, manufacturing, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Machinists' Tools and Special Mach'y. See adv., p. 44.

Soapstone and Empire Gum Core Packing. Special rates to large buyers. Greene, Tweed & Co., New York.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Houston's Four-Sided Moulder. See adv., page 45.

H. A. Lee's Moulding Machines, Worcester, Mass.

New Economizer Portable Engine. See illus. adv. p. 45.

The Student's Illustrated Guide to Practical Draughting. By T. P. Pemberton. Sent on receipt of price, $1. Address T. P. Pemberton, 5 Dey St., Room 13, New York.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Saw Mill Machinery. Stearns Mfg. Co. See p. 45.

Safety Linen Hose; a protection from fire for factories and stores. Greene, Tweed & Co., 118 Chambers St., N.Y.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

4 to 40 H. P. Steam Engines. See adv. p. 45.

Use Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

For Yale Mills and Engines, see page 45.

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. If not then published, they may conclude that, for good reasons, the Editor declines 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) A. H. S. writes: Having heard the statement from old hunters that a rifle ball gains in velocity after leaving the rifle barrel, I wish to ask if it is true; and, if it is, what gives it an increase of velocity? I have stated that the greatest velocity is at the instant the ball leaves the barrel; but several say that a ball will penetrate further into a plank placed at a distance than it would if it were within a few feet. A. You are correct. The greatest velocity is just as the ball leaves the muzzle of barrel.

(2) G. M. J. asks: Is a jacketed steam cylinder containing steam from the boiler direct or live steam a saving or the reverse? A. We believe it is yet a "mooted" question among engineers whether a jacket heated by live steam is a source of economy. Some say it is, but we think the majority consider good felting or other non-conductor quite as economical.

(3) J. V. D. asks how to anneal steel to make it very soft. A. For a small quantity, heat the steel to a cherry red in a charcoal fire, then bury it in sawdust, in an iron box, covering the sawdust with ashes. Let it stay until cold. For a larger quantity, and when it is required to be very soft, pack the steel with cast iron (lathe or planer) chips in an iron box as follows: Having at least half or three-quarters of an inch in depth of chips in the bottom of the box, put in a layer of steel, then more chips to fill spaces between the steel and also the half or three-quarters of an inch space between the sides of the box and steel, then more steel; and lastly, at least one inch in depth of chips, well rammed down on top of the steel. Heat to and keep at a red heat for from two to four hours. Do not disturb the box until cold.

(4) J. Q. asks: If a pipe two inches in diameter is flowing into a cistern, how many pipes, one inch in diameter, are required to carry away the water that will flow through the two inch pipe? The pressure on the pipes is equal and the incline is equal. A. Four, leaving out of the question the friction of the water passing through the pipes.

(5) J. G. writes: 1. I want to make fifteen electro-magnets of about the same strength as common two-inch horse shoe magnets that are sold in the city at ten to fifteen cents each. What sized wire and how much will be required for each magnet (they are to be connected close together)? A. Make the cores of your magnets three eighths of an inch in diameter and one and a half inch long, and wind with six or eight layers of No. 20 magnet wire. 2. How many cells of gravity battery will I need to work them, the battery being also close to the magnet? A. You should allow one cell of battery for each magnet, if you work them all at the same time.

(6) C. R. A. writes: I am making a small yacht, 15 feet long and 42 inches beam and 3 feet depth of hold; engine 2x4, to run at 300 revolutions, and be 1½ horse power; boiler 20 inches diameter by 30 inches in height; supposed to run from eight to ten knots an hour. Do you think that is beam enough? A. Yes; but keep all your weights as low in the boat as you can.

(7) J. H. W. asks: 1. What is the horse power of an engine 20 inch diameter of cylinder, 48 inch stroke, making 55 revolutions per minute, with 70 pounds steam pressure to the square inch? A. See SUPPLEMENT, 253, for rule for calculating horse power of engines. 2. Where can I get some good books on steam engineering? A. Write industrial publishers who advertise in our columns. 3. What was the horse power of the engine that ran the machinery at the Centennial? A. 1,200 to 1,400 horse power, but only one-eighth to one-tenth of this power was used.

(8) J. D. C. writes: I have a gauge connected with a set of boilers, and eighty feet away I have another gauge. The carrying pipe is thoroughly covered, boxed, etc. The pressure on each glass is exactly the same, that is, at boilers 40 lb., eighty feet away 40 lb. Is the temperature of the steam the same at both gauges? A. If there is steam at both gauges, and the pressures are equal, the temperature will be the same; but it is probable that in use you have water and not steam in the gauge which is eighty feet from the boilers.

(9) C. W. asks: 1. How many Bunsen cells, ordinary size, will it take to make an electric light? A. To make an electric light of any considerable power will require 25 cells. 2. If a Knowles steam pump were to be made to run by compressed air at the rate of thirty strokes a minute, and a pressure of 100 lb., and to pump air into the same vessel that it is taken from to run the pump, could you keep the pressure the same, or would it increase or diminish? A. The pressure would diminish.

(10) J. J. asks: How are the bottoms of boots and shoes finished to give them a good bright polish and light color? A. The color is independent of the polish, the latter being made by vigorous work with the rub stick, after the sole has been buffed. All good oak and union leather will make a fair colored bottom, though some tannages are lighter than others, but in many of the hemlock tannages, where the hide is "plumped" by a mineral acid, the color is very dark. Some of the manufacturers stain such hemlock bottoms to imitate oak, but on account of the acid in the leather, the color given is not enduring. One stain much used is made of equal quantities of borax, oxalic acid, and water, with which the sole is dampened, and, when nearly dry, it is rubbed with French chalk or pipe-clay.

(11) E. B. K. asks: 1. When does a gas holder give the greatest pressures, when completely filled or when nearly empty? A. When completely filled. 2. Is it possible to entirely shut off the pressure on the street mains (gas) by the gover.or; that is, so that no pressure will show on the pressure gauge? A. Yes, if pipes, valves and connections are perfectly tight, and the initial pressure in the pipes is relieved.

(12) W. H. asks: What is the composition of the indelible ink used with type by shirt and collar makers? A. Nigrosine dissolved in a sufficient quantity of water. Printer's ink is also used.

(13) W. E. S. asks: 1. How strong will a battery need to be to heat to redness a strip of platinum half an inch long, one-eighth of an inch wide, and one-sixty-fourth of an inch thick? A. Use twenty quart Bunsen or bichromate cells. 2. Can a strip of platinum as above be heated to or nearly to redness while in close contact with glass? A. Yes. 3. I send a sample of shell marble; is it of any value? A. The shell marble is of little value.

(14) C. S. P. asks: Will the addition of say 25 per cent of almond or olive oil, to kerosene oil of 112 degrees reputed fire test, render it practically non-explosive? If not, then what may I add to attain this end? A. Nothing can be added to poor kerosene oil that will effectually prevent the escape of the volatile hydrocarbons which make it dangerous. These can easily be separated, however, by fractional distillation.

(15) A. H. R. says: In the study of chemistry great difficulty is experienced by many students in remembering the formulæ of chemical substances, and the want of a short and concise reference book has been our constant trouble. He suggests the following form. The metal sodium forms a series of salts:

Na_2O	Sodic Oxide,
Na_2S	" Sulphide,
Na_2SO_4	" Sulphate,
$NaCl$	" Chloride,
$NaNO_3$	" Nitrate,
$NaHO$	" Hydrate,

and the metals hydrogen, potassium, and ammonium, form the same series. The metal barium forms the compounds

BaO	Baric Oxide,
BaS	" Sulphide,
$BaSO_4$	" Sulphate,
$BaCl_2$	" Chloride,
$Ba(NO_3)_2$	" Nitrate,
$B(HO)_2$	" Hydrate,

and the metals strontium, calcium, zinc, lead, copper, silver, mercury, form the same compounds. A. There are several recent publications (German) on chemical formulæ in which tables similar to those you suggest are employed. In such books the new system of nomenclature (which is now in almost universal use) should be employed; and in order to make the book serviceable to others besides chemists proper, the various names (older) under which each substance is known to the pharmacist or druggist and in the trades should be added in a "ready reference" and comprehensive form.

(16) W. H. B. asks: Is there a process by which I could nickel-plate faucets myself? also, if I can do it without taking them off while plating them? A. You cannot nickel-plate the faucets without taking them off. See article on nickel plating, p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(17) L. D. G. asks: 1. Is the pressure on the feed pipe the same as on the boiler? A. A trifle more. 2. Is the pressure on the glass water gauge or tube the same as on the boiler? A. Yes. 3. Will dipping a knife in hot water injure the temper? A. Not unless kept there a great length of time.

(18) S. & R. ask: 1. What kind of steel is best for knives for a spoke lathe cutting mostly dry oak timber? A. What is known as "chrome steel" will probably answer your purpose.

(19) L. A. R. writes: I have an iron pipe leading sirup from sugarhouse to refinery. The sirup is slightly acid, and is colored by its contact with the iron. It affects materially the quality of our sugars. The use of a copper pipe would obviate this trouble, but, besides the cost, I consider it unhealthy. What would you recommend? Is there such a thing as enameled pipe? If so, where can I find it? A. That copper is not generally believed to exercise any deleterious action upon sirup may be inferred from the fact of the vessels in some of the largest refineries being formed of that metal. We have seen one of Howard's patent vacuum pans eight feet in diameter, which consisted of a copper pan within which was a worm or coil of copper pipe through which steam was passed for boiling the juice; and in the SCIENTIFIC AMERICAN for November 27, 1880, will be found a description of Deeley's enormous vacuum pan, the coils of which are also formed of copper. Gun metal has also been used for the fittings and scoops in refineries. In some instances moulds of porous clay have been supplanted by others of iron coated either with varnish or glaze, or even painted with white lead paint. The iron pipe in question might be superseded with advantage by one of glazed earthenware or of wood; but the best conduit pipe would be one of iron coated with vitreous enamel of the same nature as the blue colored agate ware now becoming so generally employed for articles in culinary use.

(20) E. V. S. asks: Is there any special publication on potter's glass? A. One of the best and most comprehensive works on this subject is a "Treatise on the Origin, Progressive Improvement, and Present State of the Manufacture of Porcelain and Glass." It is published by Longmans, of London, England, but may easily be obtained through any bookseller.

(21) G. B. inquires: What is methylated spirit of wine? A receipt given to me contains this, and I cannot obtain it at any drug store in our city. A. It is ordinary alcohol adulterated with ten per cent of wood naphtha to prevent its being used for potable purposes, as, with a view to encourage the arts and manufactures, the English government permits it to be sold free of all excise duty. Any attempt to deodorize methylated spirits in that country subjects the experimentalist to severe penalties. Common alcohol may be employed for every purpose for which the methylated preparation is recommended.

(22) J. A. S. asks: 1. What is a gelatine mould for casting plaster ornaments composed of? A. Allow twelve ounces of gelatine to soak for a few hours in water until it has absorbed as much as it can, then apply heat, by which it will liquefy. If the mould is required to be elastic, add three ounces of treacle and mix well with the gelatine. If a little chrome alum (precise proportions are immaterial) be added to the gelatine it causes it to lose its property of being again dissolved in water. A saturated solution of bichromate of potash brushed over the surface of the mould, allowed to become dry and afterwards exposed to sunlight for a few minutes, renders the surface so hard as to be unaffected by moisture. 2. What change does calcined plaster undergo while setting? A. Calcined sulphate of lime, or plaster of Paris, when mixed with water, produces heat and hardens to a solid mass, slightly enlarging its bulk, hence its value in giving a sharp impression. The rapid hardening is explained by the anhydrous burnt sulphate of lime again chemically combining with as much water as it lost during the ignition. Had the heat at which the gypsum was calcined exceeded 330° Fah., it would have lost its affinity for water and consequently would not harden.

(23) L. S. H. asks: What kind of solution may be used by cigar makers to dip the leaves in to give the cigars an agreeable flavor? A. Ordinary cigars may be scented by moistening them with a strong tincture of cascarilla to which a little gum benzoin and storax is sometimes added; or the leaves which are to form the cigars may be soaked for a short time in a strong infusion of cascarilla, and then dried by a gentle heat. A small quantity of camphor, together with the oils of cassia and cloves, are by some added to the tincture mentioned.

(24) W. H. inquires: What is the solution sometimes employed by opticians to stain brass of a black color? A. A solution of chloride of platinum is the stain most commonly used for this purpose. A cheaper preparation is obtained by dissolving the black scales of iron of the blacksmith's forge (proto-sesquioxide of iron), in muriatic acid to saturation.

(25) C. F. A. asks: Is there not a wire screen that you can put to a window in a basement and look out into the street, but through which one cannot look into the room? A. Any wire screen formed with fine meshes will, if painted on the outside, fulfill these conditions. Finely perforated zinc is much employed for this purpose. These, together with flowered white muslin, prevent any one from seeing the interior of a room, while they present no serious barrier in the way of looking out through them.

(26) B. L. G. asks: 1. By what means can I obtain lead absolutely pure for chemical purposes? A. Reduce nitrate of lead with charcoal. The soft lead of commerce is in most instances sufficiently pure for every purpose. 2. How may I prepare chemically pure zinc? A. Granulate commercial zinc (which is seldom if ever pure) by melting and pouring into water, then place in a Hessian crucible with a fourth its weight of nitrate of potash; cover well and apply heat. After deflagration, remove the dross, melt the zinc, and pour into an ingot mould.

(27) R. O. asks how to make a hair dye like that used by barbers. A. Cleanse the hair with dilute ammonia water. Then moisten it uniformly with dilute solution of gallic acid or ammonium sulphide, and go over it with a comb moistened with solution of one part nitrate of silver in nine parts of water, touching the scalp as little as possible. Stains may be removed by applying a little dilute solution of iodine in iodide of potassium dissolved in water, and then with solution of sodium hyposulphite.

(28) L. W. D. asks: Do you know of any material or process by which a fine gloss, white finish, on wood can be obtained without the use of damar varnish? A. You might try spirit copal or shellac varnish, and polish down with pumice stone or rotten stone and oil.

(29) G. W. S. asks: 1. Are not blinds that are used on horses' bridles injurious to their eyes? A. We think not. 2. When Paris green is sprinkled on vegetables will the dew and air draw the poison out so that it will be less fatal if eaten? A. No.

(30) C. C. H.—The "oiled tissue" you send is goldbeater's skin, prepared from the peritoneal membrane of the cæcum, which, as soon as it is detached, is stretched and dried, soaked in a weak solution of potash, and stretched on a frame. While in this position a similar membrane is applied to it so that the surfaces which adhered to the muscular membrane of the intestine come together. They unite perfectly and soon dry. They are then glued to frames, washed with alum water, dried, washed with solution of isinglass in wine to which spices have been added, and varnished with white of egg.

(31) A. U. asks: 1. How are opals separated from the matrix? Are there any machines that can be used for that purpose? A. Consult Traill's "Treatise on Quartz and Opal." Emanuel's "Diamonds and Precious Stones," and Byrne's "Handbook for the Artisan." The latter contains a good article relative to the best methods and machinery for such work. Address the booksellers and dealers in machinery who advertise in this paper. 2. Is there likely to be a market for these stones in America? The specimens are very brilliant fire opals, and I have seen pieces two inches in diameter and half an inch thick. A. Yes.

(32) E. M. asks: 1. Can Jupiter's great spot be clearly seen with the telescope described in SUPPLEMENT, 252? A. Yes, when an achromatic objective is used.

(33) C. B. C. asks: How is chloride of silver made? A. Although it may be formed by the direct union of chlorine with silver the easier and better way is to dissolve chloride of sodium (common salt) in water in one vessel, and nitrate of silver in another, distilled water being used by preference for the latter. Now pour the one solution into the other, and instantly there will be formed a dense, white, curdy precipitate. Next pour off the supernatant fluid and add plain water two or three times to wash the chloride free from the traces of the nitrate of soda, the other product of the decomposition. The combining equivalent of nitrate of silver being 170, while that of chloride of sodium is 58·5, these proportions should be adhered to when dissolving the salts. The proportion of water is immaterial.

(34) L. B. F. wishes a receipt for making an acid-proof cement. A. It would have been desirable had particulars of the object for which it is required been given, as acids act so differently upon different substances. A mixture of equal parts of pitch, resin, and dried plaster of Paris is much used as a cement in chemical works where sulphuric acid is prepared. Troughs for holding acids may be effectively cemented by the following: Resin, 6 lb.; dried red ocher, 1 lb.; calcined plaster of Paris, ½ lb.; linseed oil, ¼ lb. These must be incorporated by well stirring together when melted. For smaller purposes an alcoholic solution of shellac, or a solution of bitumen in benzol, answers well. To render this latter less brittle, it is desirable to add a few drops of a solution of India-rubber. Marine glue also resists acids. It may be formed of India-rubber 1 part, digested, with heat, in a covered vessel containing 12 parts of mineral naphtha, to which, when solution is effected, 20 parts of powdered shellac are added. When liquefaction is complete pour out on a slab to solidify.

(35) J. R. S. writes requesting information respecting the recently introduced methods of obtaining reproductions of writing in inks of any desired color. A. Pour into a flat zinc trough, or upon a zinc plate having the edges turned up a quarter of an inch, a warm solution of the following substances: Water, 130 parts; sulphate of baryta, 75 parts; sugar, 30 parts; gelatine, 30 parts; glycerine, 180 parts. This mass when cool becomes stiff and forms the printing surface. The writing to be reproduced is written with any suitable ink, methyl violet being generally preferred; and this, when quite dry, is laid down upon the gelatine film and the hand rubbed over it. By this operation the ink is absorbed. Quite a number of impressions may now be obtained from this gelatinous surface, by laying upon it a sheet of paper and rubbing with the palm or edge of the hand. If the weather be very hot, to prevent the film from becoming sticky the proportion of baryta above given may be increased to 100 parts. By the following modification of this process the plate may be inked like a lithographic stone, and thus be made to yield an indefinite number of impressions in ink of any color. The proportion of water must be reduced, and the ink with which the writing or drawing is made must contain alum. On theoretical grounds the best ink to employ would be a saturated solution of the alum to which was added enough common writing ink to give it color. A wet sponge having been passed over the gelatine surface, the writing is laid down, and after the lapse of a few moments it is removed, when the writing will be found to be eaten into the film as if engraved. A roller charged with printer's ink is now passed over the surface, which, when properly inked, will now yield any required number of impressions. By preference the inking roller should be formed of India-rubber; fresh inking must be had recourse to after each impression has been taken.

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

H. R.—Barytocalcite—$BaCO_3+CaCO_3$.—J. S. W.—No. 1 is dolomite—magnesian limestone. No. 2, datholite—a hydrated borosilicate of calcium.—M. B.—The gravel contains no metals. The bright particles are mica and a little iron sulphide pyrites. The rock is quartzose, carrying a little chalcopyrite—iron-copper sulphide.—P. S.—It is lead sulphide—galena; may contain a trace of silver.—J. P.—It is blast furnace scoria—not a native mineral.—W. T.—A sandstone saturated with petroleum.

COMMUNICATIONS RECEIVED.

On Inventors' Academy. By E. W. S.
On Railroad Rail Binding. By E. A. S.
On a Curious Icicle. By E. M.
On Rainfalls. By J. T. N.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN CHEMICAL JOURNAL.

The number for December contains several very able articles, among them the following papers: "Researches on the Complex Inorganic Acids," by Wolcott Gibbs. "Estimation of Alkaloids by Potassium Mercuric Iodide," by Albert B. Prescott. Contributions from the Chemical Laboratory of Harvard University: "On the Ethers of Uric Acid: Dimethyluric Acid," by H. B. Hill and C. F. Mabery. "Researches on the Substituted Benzyl Compounds: Ortaobrombenzyl Compounds," by C. Loring Jackson and J. Fleming White. "The Constitution of the Tartrates of Antimony," by F. W. Clarke and Helena Stallo. "On the Relative Stability of Certain Organic Salts," by Miles Beamer and F. W. Clarke. "Some New Salts of Uranium," by F. W. Clarke and Mary E. Owens. "Graphite from Ducktown, Tennessee," by W. I. Dudley and F. W. Clarke. "On the Distribution of Arsenic in the Human Body in a Case of Arsenical Poisoning," by S. W. Johnson and R. H. Chittenden. "Synthesis of Salicylic Acid," by Edgar F. Smith.

THEORIE DER GEWOELBE (THE THEORY OF VAULTS). By A. Foeppl. Leipsic: Arthur Felix, 1880. 152 pp.

This work is divided into four chapters, of which the first embraces the "Elementary Theory of Barrel Vaults," their conditions of stability, the graphical calculations for obtaining the pressure line, etc. The second chapter treats of the "Theories of Elasticities" in barrel vaults; the third chapter is devoted to the theory of the pressure and elasticity in domes; whereas the fourth treats of groined arches. This work was not intended for the beginner, as it requires considerable acquaintance with the subject; but for such persons it will be found to be of great value, as it contains a large store of information, especially in regard to modern developments and the elasticity of vaults.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

December 21, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Aerial navigation, J. F. Mackenzie 235,792
Aging and purifying spiritous liquors, apparatus for, F. L. Wood 235,840
Air compressor, E. A. Rix 235,816
Averaging machine, W. S. Auchincloss 235,723
Axle box, R. W. Irwin 235,742
Axle lubricator, T. White 235,717
Baking powder, C. E. Avery 235,615
Ball and socket hanger, N. Stedman 235,711
Boiler furnace, Kilroy & Flick 235,779
Boiler furnace, P. W. Lamb 235,686
Boilers and other vessels, manufacture of, L. S. White 235,834
Boilers, composition for preventing incrustation of, H. Heimann 235,633
Bolt, A. Climie 235,741
Bolts, tool for printing, P. Hartin 235,766
Book, blank, I. Reynolds (r) 9,503
Boot and shoe soles, mechanism for abraiding and polishing, J. A. Ambler (r) 9,504
Boot and shoe toe protector, J. A. Stockwell (r) 9,514
Bracelet, F. Kursh 235,637
Breastpin, L. P. & L. P. Jeanne 235,683
Bridle, S. A. Nolen 235,643
Brush, paint, E. Wright 235,841
Bung, faucet, Reynolds & Shaw 235,653
Button and stud, J. Kennedy 235,634
Calcium, apparatus for the decomposition of chloride of, E. Solvay 235,830
Canister, P. Lehmann 235,789
Canning of oysters, process preliminary to the, J. T. Maybury (r) 9,509
Cans, mechanism for placing and soldering heads in, G. H. Pierce 235,700
Car brake, J. Crollard 235,749
Car coupling, J. N. Blair 235,728
Car coupling, J. H. Quackenbush 235,648
Car mover, F. B. Galloway 235,759
Car wheel, A. Wilbur 235,835
Carriage body loops, device for making, W. Pearce 235,806
Cartridge loader, C. W. Osgood 235,699
Casting hollow ingots, mould and core for, C. B. Morse 235,796
Casting pencil sharpeners, mould for, W. K. Foster 235,636
Centrifugal machine, R. Lafferty 235,638
Centrifugal machine, M. K. Muchin 235,797
Chair head rest, A. Schwaab 235,705
Check receiver, J. Casey 235,740
Chuck for turning polygonal bodies, lathe, T. Weise 235,716
Chuck, lathe, W. H. Wilson 235,836
Cider mill, S. Males (r) 9,508
Cider press, H. A. King 235,685
Cigar clipper, W. H. Gilman 235,678
Clock case, J. Scheina 235,655
Clock pendulum attachment, J. A. Barrett 235,665
Cockle separator, J. W. Collins 235,623
Condenser and feed heater, G. H. Corliss 235,746
Corset, I. W. Birdseye 235,727
Corset, W. A. Nettleton 235,697
Corset parts, folding guide for, J. S. Crotty 235,671
Cultivator, wheel, J. H. Rhamy (r) 9,511
Ditching and embanking machine, Chappell & Ricketts 235,622
Ditching machine, W. H. Hickok 235,768
Drag, sulky, J. M. Wakeman 235,832
Drainage apparatus, house, C. W. Durham 235,754
Egg beater, P. F. Carroll 235,620
Electric circuit closer, automatic, W. H. Shuey 235,817
Elevator, J. B. Atwater 235,664
Evaporating pan, H. O. Ames 235,613
Evaporation of liquids, apparatus for the, O. L. F. Browne 235,618
Fan, C. Prahl 235,808
Feather renovator, W. W. Snyder 235,710
Fence, Smith & Younkin 235,709
Fence, wire, J. Rees 235,650
Fertilizer distributer, J. J. & L. F. Burner 235,738
Filter, T. Guinean 235,764
Firearm, breech-loading, F. Hummel, Sr. 235,771
Firearm, magazine, Tiesing & Kennedy 235,829
Fire extinguisher, B. C. Wilson 235,837
Fire kindler, J. T. Elliott 235,756
Float trap for wash basins, etc., J. W. Groves 235,629
Furnace and boiler, S. W. Underhill 235,659
Gas burners, electric lighting attachment for, C. H. Hinds 235,769
Gleaner and binder, H. N. Johnston 235,775
Grain bin, W. Bailey 235,724
Grain drill attachment, W. W. Winegar 235,838
Grain separator, R. Z. Bushaw 235,739
Grinding grain, feed device for roller mills for, W. D. Gray 235,761
Guns, cartridge feeder for machine, Gardner & Parkhurst 235,677
Hair crimper, H. A. Gray, Jr. 235,680
Hammock support and tent frame, K. C. Price 235,809
Harrow and cultivator tooth, combined, I. H. & S. Reiner 235,651
Hatchway door mechanism, C. H. Mitchell 235,795
Hog catching and holding device, O. Ewing 235,675
Hog scraping machine, J. Bouchard 235,731
Hoisting apparatus for mining shafts, T. H. Histed 235,681
Hoisting machine, H. J. Reedy 235,649
Horse rake, T. S. Brown (r) 9,505
Hose coupling, J. Kenyon 235,777
Hub, C. H. Guard 235,630
Hydrant, D. F. Luse 235,790
Hydraulic elevator, O. E. Merrill 235,696
Hydrocarbon burner, F. W. Carter 235,621
Ice making apparatus, T. L. Rankin 235,814
Ice making apparatus, water tank for, T. L. Rankin 235,813
Incubator, C. L. & H. S. La Barre 235,787
Ink, printing, M. Connelly 235,670
Inkstand, calendar, J. R. King 235,778
Insect guard for windows, G. B. Pullinger 235,810
Insect screen, G. B. Pullinger 235,811, 235,812
Ladder, folding step, P. L. Sylvester 235,827
Lamp, S. S. Newton 235,642
Lamp or lantern, B. Eason 235,674
Lantern globe, T. Walton (r) 9,515
Lantern holder, W. F. Brainard 235,617
Lock, J. Sirugue 235,818
Log tripper, L. Gunter 235,763
Loom shuttle motion, T. A. Weber 235,621
Looms, wire heddle for harnesses of fancy, L. J. Knowles 235,636
Mail bag, J. B. Gathright 235,760
Match splint, G. Hargreaves 235,765
Mechanical movement, R. P. Garsed 235,628
Medical compound, A. Rippetoe 235,704
Mining machine, F. M. Lechner (r) 9,507
Motion, device for reversing, G. B. Brayton 235,732
Music holder, C. W. Millspaugh 235,696
Nail machines, apparatus for feeding, W. Briggs 235,867
Nails, etc., apparatus for retailing, Draper & Bowyer 235,753
Nut lock, J. M. Dakan 235,751
Nut lock, S. S. Smith 235,708
Ore roasting furnace, rotary, J. K. Pardee 235,800
Ore separator, H. Hochstrate 235,770
Packing, metallic piston rod, G. B. Brayton 235,733
Packing, piston, S. M. Brown 235,736
Packing, piston, Williams & Matthews 235,843
Padlock, H. H. Daniels 235,750
Paper boxes, forming the bending lines in, J. E. Stannard 235,821
Paper boxes, manufacture of, C. P. Housum 235,682
Paper, method of and apparatus for corrugating, M. Newton 235,698
Patterns, apparatus for draughting, F. J. Kellogg 235,776
Pen holder, W. H. Sprague 235,656
Pen wiper, G. Lane 235,788
Pencil holder, H. C. Benson 235,726
Pencil sharpeners, machine for making slate, F. Rheydt 235,815
Photographic emulsions, producing, H. W. Vogel 235,831
Piston connection for indicators and pressure gauges, L. F. Lyne 235,791
Planter attachment, corn, R. H. Whipple 235,662
Plastic material, manufacture of articles from, J. Naylor 235,799
Plow, R. C. Meritt 235,639
Plow carriage, J. T. McNorton 235,692
Plow, sulky, W. Hemme 235,767
Plow, sulky, W. A. James (r) 9,501
Pole eyes for carriages, device for making, W. Pearce 235,805
Preserving alimentary substances by means of cold, apparatus for, L. Ribourt 235,702
Pressure and water gauge, steam, E. Jerome 235,774
Propeller, screw, Stevens & Smith 235,657
Propelling row boats, apparatus for, H. N. Staats 235,823
Pulley, portable hoisting, L. T. Pyott 235,648
Pulp, etc., manufacture of artificial stone grinders for making wood, S. M. Allen 235,721
Pump, G. H. Corliss 235,747, 235,748
Pump bucket, Adams & Platter 235,612
Pump for compressing illuminating gas, R. J. & J. Pintsch 235,646
Pump, force, S. Kimble, Jr. 235,782
Pump valve seat, G. H. Corliss 235,747
Railway signaling apparatus, H. Ely, Jr. 235,755
Railway tie, S. F. Seely 235,706
Railway track, portable, T. F. Krajewski 234,786
Refrigerator, J. H. Stiffler 235,718
Rolling mill, W. H. Glover 236,679
Roofs, construction of composite, J. Brokenshire 235,737
Rope making machine, F. Woods 235,839
Rubber with colors, ornamenting the surfaces of hard, F. A. Nickerson 235,644
Sash fastener, A. Hayth 235,632
Sash fastener, D. McCurdy 235,798
Saw mill, gang, J. M. Story 235,824
Saw mill head block, S. White 235,833
Scale, pendulum, J. B. Atwater 235,663
Screw conveyer, H. W. Caldwell 235,619
Seal and tag, E. J. Brooks 235,668
Selenium to increase its electric conductivity, treating, Bell & Tainter 235,616
Sewing machine, H. N. Kjalman 235,783
Sewing machine brake, C. J. & G. F. Danielson 235,752
Sewing machine, button hole, D. Barcellos 235,725
Shafting, flexible, W. H. Kimball 235,780
Sheltering animals, device for, J. O. Austin 235,614
Ship, screw steam, McCarter & Cooper 235,691
Shovel, tongs, and pot hook, combined, W. H. Peyton 235,804
Shutter fastener, M. Fisel 235,676
Sign, changeable, J. F. Ross 235,652
Silver from ores, extracting, G. A. Koenig 235,784
Skate, roller, E. H. Barney 235,666
Smokestack, locomotive, G. S. Strong 235,825
Soap, perforated, H. J. Borie 235,730
Sower, fertilizer, A. Stoler 235,714
Spark arrester, D. Grotsbeck 235,767
Spring saddle clip, T. W. Porter 235,807
Station indicator, W. C. A. Thielepape 235,715
Steam boiler, Kellogg & Kirby 235,684
Steam engines, framing of beam, G. H. Corliss 235,745
Steering row boats, apparatus for, H. N. Staats 235,823
Stocking supporter clasp, S. K. Ellis (r) 9,506
Stove grates, cone for, H. Tuttle 235,830
Stove hearth, J. T. Peet 235,803
Stove or oven, gas, A. W. Morton 235,640
Stovepipe collar, G. Blair 235,729
Stove, vapor, Z. Davis 235,624
Stump puller, W. O. Youngblood 235,842
Swimming apparatus, M. Coloney 235,669
Swing, child's, A. G. Forster 235,758
Taps, well for water main, P. E. Ober (r) 9,510
Telegraph, underground, D. Brooks, Jr. 235,734
Telegraph wires into pipes, method of introducing, D. Brooks, Jr. 235,735
Telegraphy, dynamo-electric, O. Lugo ..... 235,687 to 235,689
Telegraphy, dynamo-electric and inductive, O. Lugo 235,690
Telephone, relay, H. C. Strong 235,658
Telephone transmitter, F. A. Klemm 235,635
Telephone transmitter, G. W. Smith 235,707
Thill coupling, Sanborn & Ferry 235,654
Thill coupling, L. B. Stuart 235,826
Thrashing machine, Hawk & Miller 235,631
Tile for roofs and pavements, illuminating, W. J. Fryer, Jr. 235,677
Time, instrument for computing, H. J. Richardson 235,703
Toy, E. L. Morris 235,641
Traction wheel, J. Allonas 235,722
Truck, J. C. Peatie 235,647
Trunk catch, J. A. Eno 235,757
Tube cleaner, M. L. Metcalf 235,694
Tube testing, apparatus for, S. Myers 235,798
Tube welding machines, apparatus for operating the mandrel bars of, P. Patterson 235,801
Umbrella holder for vehicles, W. S. Thatcher 235,828
Valve gear, steam engine, G. H. Corliss 235,744
Valve, safety, J. E. Crisp 235,748
Vapor burner, J. E. Donovan 235,673
Vehicle running gear, T. F. Krajewski 235,785
Vehicle spring seat, A. B. Smith 235,819
Vehicle wheel, J. A. Pesant 235,802
Velocipede, C. Wittenberg 235,720
Ventilating attachment for funnels, G. M. Wickliffe 235,718
Wagon brake, W. B. Jackson 235,773
Wagon brake, A. L. Withers, Jr. 235,719
Wash boiler trap, H. R. Robbins (r) 9,513
Watch, chronograph, C. H. Meylan 235,794
Water cooler, T. D. Mowlds 235,696
Watering column, J. N. Poage (r) 9,512
Watering stock, apparatus for, J. J. Ray 235,701
Weights, apparatus for raising, W. & W. T. Eads 235,625
Wells, ejector for oil, L. Stewart 235,712
Wheat scouring and polishing machine, W. & C. Currier 235,672
Window screen, J. Ward 235,660
Wire bending machine, I. A. Kilmer 235,781
Wood, preserving, L. S. Robbins (r) 9,512

DESIGNS.

Carpet, W. J. Gadsby 12,067
Carpet, W. L. Jacobs 12,068, 12,069
Carpet, D. McNair 12,070
Check, bank, R. Miller 12,076
Clock stand, H. J. Davies 12,065
Curtain band, B. Dreyfus 12,066
Knitted fabric, C. H. Landenberger 12,072
Knitted mitten, J. Collins 12,064
Jewelry, G. Hartje 12,075
Oil cloth, floor, J. Barrett 12,063
Screw, heads of picture, R. B. Tunstall 12,074
Stool, piano, Archer & Lyon 12,071
Tobacco cutter, O. S. Harmon 12,073

TRADE MARKS.

Baking powder, Sterling Manufacturing Company 8,127
Brooms and wisps, all kinds of, Lang & Shepard 8,123
Cigars, cigarettes, cheroots, and smoking and chewing tobacco, Hirschl & Bendheim 8,122
Cigars, cigarettes, and smoking and chewing tobacco, Poole, Gilliam & Co. 8,124
Clothing, boys', A. Shuman & Co. 8,130, 8,131
Liniment, Thompson & Kerr 8,129
Remedy for catarrh and kindred affections, W. R. Reud 8,126
Sewing machine tables, clothes wringers, fluting machines, and sad irons, S. C. Tatum & Co. 8,132
Sewing machines, Thurston Manuf. Company 8,128
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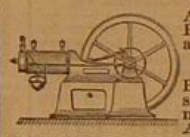

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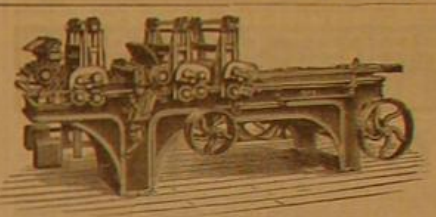

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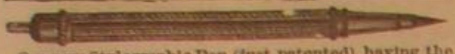

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