SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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ESTABLISHED 1845.] NEW YORK, MARCH 12, 1892. [$3.00 A YEAR.
WEEKLY.

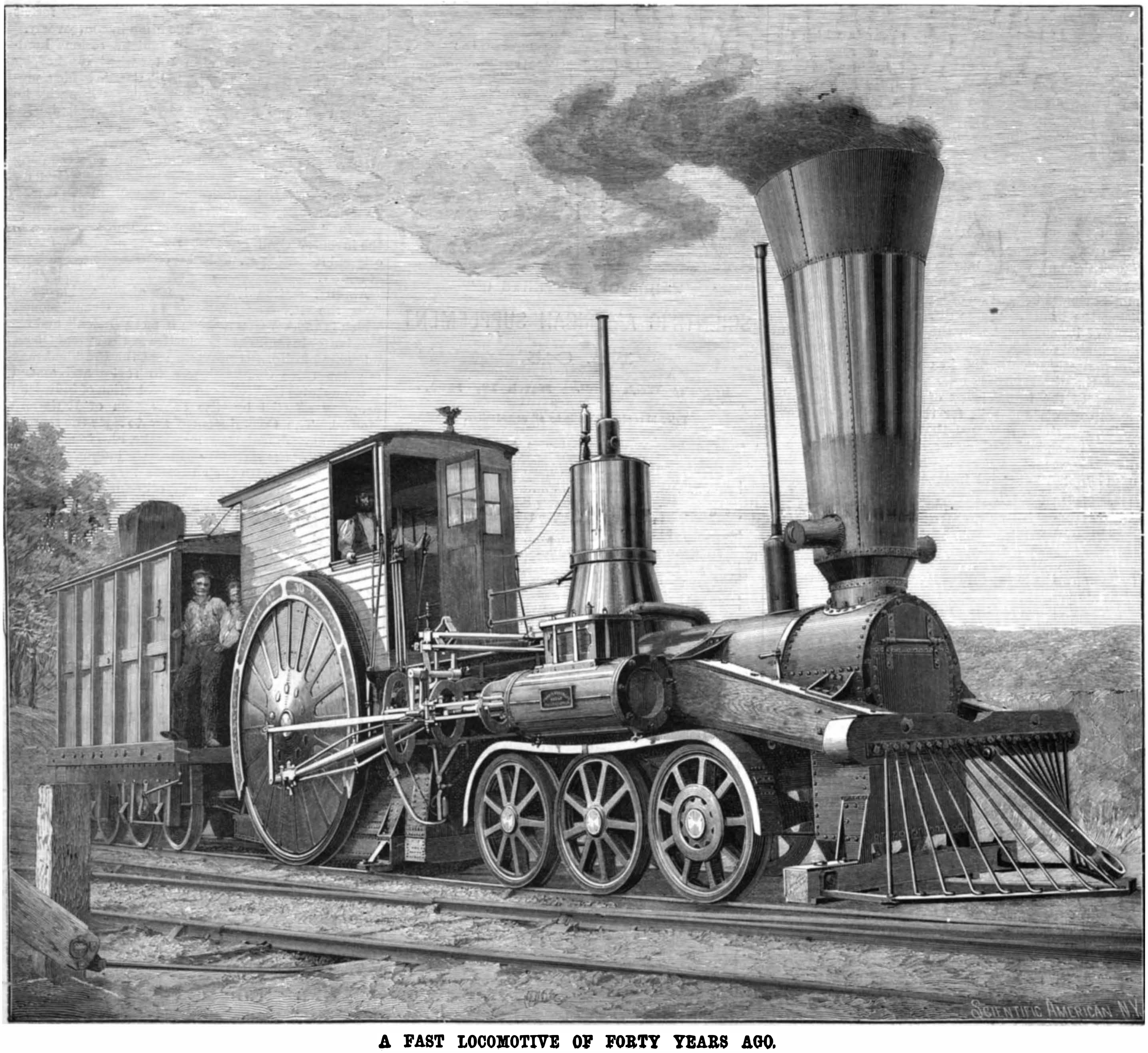
AN OLD TIME FAST LOCOMOTIVE.

The illustration given herewith is a reproduction of an early Talbotype, which was, we are informed, taken in 1848, and which represents a locomotive built at the Norris Works for the Camden & Amboy Railroad. The following particulars are from the *Railroad and Engineering Journal.* "We have not the exact dimensions of this remarkable engine, nor the date when it was built, but believe that the cylinders were 13 in. × 38 in. and the driving wheels 8 ft. in diameter. The general design is shown by the engraving; the forward end of the engine was carried on a six-wheeled truck, and the single pair of drivers was placed back of the fire box. This arrangement required a peculiar position of the cab, which was placed very high, and was apparently built without much regard for symmetry or appearance. In fact, it looks somewhat like a switchman's or watchman's house transferred from the side of the track to the top of the boiler. The same lack of symmetry may be seen in the smoke stack, which was of singularly clumsy pattern. The engine probably burned wood, which was the general fuel for locomotives at that time. The valve motion was all outside, and was the old V-hook motion; apparently there was an independent cut-off valve, working on the back of the main valve, a not uncommon arrangement.

"Some of the peculiar features shown did not belong to this engine alone. The spaces between the spokes of the driving wheels were filled in with wood, an arrangement which was in use on many of the locomotives of the Camden & Amboy Railroad for a number of years. The trussing of the connecting rod was also practised on that road for a long time, and there were locomotives running with side rods trussed in the same way as late as 1873. The high dome could also be found in quite a number of engines on the same road. The covered tender, somewhat resembling a small box car, was the pattern in general use on the road, and survived up to 1865 or thereabout; it was provided with a sort of hood or buggy top on the back end, in which sat a man whose duties were to watch over the train and signal the engineer when anything was wrong, the bell cord passing through his seat.

"We do not know what became of this particular engine, nor do we know whether there are surviving records of any fast runs made by it. Some other engines of the same kind were built a little later, either at the Trenton Locomotive Works or at the Bordentown shops. These were of a little better appearance, and a more modern type; some of them had 13 × 38 in. and some 14 × 38 in. cylinders and 7 ft. or 7 ft. 6 in. drivers. The writer has been told by old engineers on the road that they did some fast running, but had so little weight on the drivers that they could not handle a heavy train; moreover they had an unpleasant tendency to jump the track on the sharp curves which abounded on the old line, which followed the canal bank between Trenton and New Brunswick, and which was abandoned when the present line from Dean's Pond to Trenton was built, about 1863. These later engines were afterward rebuilt with four drivers of smaller diameter, about 5 ft., one pair placed in front and one behind the fire box, according to the usual pattern. The long stroke cylinders were retained, however, and four or five of these engines with 38 in. stroke were in service for some time after the New Jersey lines were leased to the Pennsylvania Railroad Company. These engines had larger boilers than the one shown in the engraving, and had iron frames instead of the wooden frames which appear in the original Norris type.

"It would be interesting to know whether any drawings of this old engine survive, or whether they have



A FAST LOCOMOTIVE OF FORTY YEARS AGO.

disappeared with the records of its performance. The managers of the Camden & Amboy were rather given to experiments in locomotives, and the old shops at Bordentown would have furnished material for an interesting study had full records of the work done there been preserved."

The photograph from which our engraving was made was taken by Schreiber & Sons, of Philadelphia, from the original Talbotype. This original has been well preserved during the 43 years since it was taken, the only defect being the blur on the lower right hand corner of the plate, which has wiped out a part of the pilot.

The Balsam-bog.

A correspondent of the *Commercial Bulletin*, writing from the Falkland Islands, which are situated in the South Atlantic, near the extreme end of South America, says: Approaching the low grounds in many of the islands, you think they are scattered all over with huge gray bowlders, from five to ten feet across. To heighten the illusion, the blocks are covered with lichens, and grass is seen growing in their crevices where dust has collected, precisely as it would in rifts of rock. Each bowlder-like mass is a single umbelliferous plant—bolax-glebaria—which has been so slow in growing, and the condensation in constant branching so great, that it has become almost as hard as the rock it resembles—so hard that it is difficult to cut a shaving from its surface with a sharp knife. Examine closely a lump of balsam-bog, and you will find it covered with tiny hexagonal markings, like the calices of a weathered piece of coral. These are the circlets of leaves and leaf buds, terminating a multitude of stems, which for centuries have gone on growing with extreme slowness—ever since the now enormous plant started out—a single shoot from a tiny seed. When the sun shines warm, it gives forth a pleasant aromatic odor, and the yellowish, astringent gum that exudes from the top is prized by the shepherds as a vulnerary.

On most of the islands a shrub abounds which the people use for tea, though it bears no resemblance to the Chinese plant or to the famous mate of Paraguay and Brazil. It is a species of adianth, bearing a fragrant white berry, and the leaves, infused in boiling water, make an agreeable beverage. In the Falklands, as in all Antarctic America, celery grows in wild luxuriance.

A Swedish Railway Project One Hundred Years Ago.

Close upon forty years before Stephenson's victory, a Swedish engineer, Karl Hogstrom by name, not only constructed a locomotive on similar lines to the one of Trevithick and Vivian, but also conceived the plan of a regular railroad. His first notion was that his locomotive should be used on ordinary roads, but soon realizing the insurmountable difficulties attending this style of locomotion, he, in the year 1791, brought out his railroad scheme. The rails were to be of cast iron and perfectly smooth, and in order to prevent derailment, the wheels were to have a projecting edge. Convinced of the insufficiency of friction between the smooth wheels and rails for the propelling of heavy trains, Hogstrom proposed that a tooth wheel on his locomotive should work on a central toothed bar or rail placed between the other rails—a plan which of late has been adopted in several instances where the gradient has been exceptional. Hogstrom's plan was laid before several scientists, who were unanimous in denouncing it as utter madness, as it was absurd to imagine that a carriage could ever be propelled by steam alone. The plan was entirely shelved, and nothing more appears to be known as to the fate of Hogstrom, who afterward went abroad.

Coloring Brass a Deep Blue.

A cold method of coloring brass a deep blue is as follows: 100 grammes of carbonate of copper and 750 grammes of ammonia are introduced in a decanter, well corked, and shaken until dissolution is effected. There are then added 150 cubic centimeters of distilled water. The mixture is shaken once more, shortly after which it is ready for use. The liquid should be kept in a cool place, in firmly closed bottles or in glass vessels, with a large opening, the edges of which have been subjected to emery friction and covered by plates of greased glass. When the liquid has lost its strength, it can be recuperated by the addition of a little ammonia. The articles to be colored should be perfectly clean; especial care should be taken to clear them of all trace of grease. They are then suspended by a brass wire in the liquid, in which they are entirely immersed, and a to-and-fro movement is communicated to them. After the expiration of two or three minutes they are taken from the bath, washed in clean water, and dried in sawdust. It is necessary that the operation be conducted with as little exposure to the air as possible. Handsome shades are only obtained in the case of brass and tombac—that is to say, copper and zinc alloys. The bath cannot be utilized for coloring bronze (copper-tin), argentine, and other metallic alloys.

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NEW YORK, SATURDAY, MARCH 12, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 845.

For the Week Ending March 12, 1892.

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PATENT BILLS AND PETITIONS NOW B CONGRESS.

The number of bills for the modification of tent laws, now before Congress, is considera than usual. Heretofore, on the assembling c Congress a large number of bills have been pı The most important now under consideration i bill No. 233, which is understood to present tl of the present Commissioner of Patents, H ır. Simonds. Its main object is to make sundry necessary corrections in existing laws, as for example: to make the American patent run for seventeen years from the date of the earliest foreign patent for the same invention; at present, the American patent, if first patented abroad, expires with the date of the earliest foreign patent; hence an American citizen who takes a foreign patent before the issue of his American patent oftentimes shortens the term of his American patent. The object of this amendment is to prevent such shortening.

Another correction relates to caveats. At the present time, only citizens of the United States may file caveats; this bill corrects the statute by substituting the word "person" for "citizen of the United States," so that under the corrected statute any person will be able to file a caveat. To this no reasonable objection can be made.

The most radical change proposed by this bill relates to interfering applications. It provides that each interfering applicant shall, within a time specified by the Commissioner, file a preliminary statement under oath, giving the history of his production of the invention, in such detail as the Commissioner shall deem reasonable. After the applicant who first filed his application for a patent has filed his preliminary statement, the Commissioner may issue a patent to him for the invention. Nothing is said in this section about issuing a patent to the first inventor, but only to the party first to file his application.

Any interfering applicant who fails to file his preliminary statement, as aforesaid, shall thereby forfeit his right to a patent for the invention in controversy.

This change in the law would inflict a serious hardship upon the first original inventor who happened, by reason of sickness or poverty, to be unable to file a proper preliminary statement. There is no reason why he should be wholly deprived of his right to a patent. He might, at least, be left in the position of being able to present reasons for his omission. To cut him off altogether, and give away his invention to others and deny him hearing or right to make another application for a patent seems to be unjust and uncalled for. It may be well enough to provide that *that* particular application for a patent shall be forfeited, but to enact that the inventor shall have no right to a patent for his original invention seems to be contrary to our notions of equity.

Another section imposes a fee of $10 and appeals from the Primary Examiner to the Commissioner, which is another step making it more difficult and expensive for inventors to get justice at the Patent Office.

Senate bill No. 235 provides that the President may appoint three Commissioners to revise and amend those statutes that relate to the protection of industrial property affected by the convention of Paris and Madrid. The Commissioners are to state the reasons for any amendment they may make, also to designate such parts of the statutes as in their judgment ought to be repealed, with their reasons for such repealing, and they are to report on such other matters relating to industrial property as they shall deem proper.

House bill No. 606 is an old and familiar scheme, one of a class that formerly were very often introduced in Congress. It provides for the protection of infringers of patents, and enables any man or company to make use of any patented article, free of charge, provided that they aver that they bought the article in good faith, without any knowledge that it was patented. No damages or costs are to be awarded against the infringer who makes such averment. This bill would be a practical nullification of the patent laws, and especially would benefit the Eastern Railroad Association.

Among the petitions presented to Congress is that of Mr. William K. Tubman, of Maryland, who sets forth in brief, that he brought suit against the Wason Manufacturing Co., of Springfield, Mass., for infringement of his letters patent for a railroad car, and that the said suit is now pending; but he finds that instead of being met by the Wason Company, he is obliged to contend with a corporation called the Eastern Railroad Association, which corporation has assumed and is maintaining the defense of the suit. This association, he says, is a secret combine or conspiracy, composed of nearly all the railroads east of Pittsburg, Pa., and it has offices in Washington. He says it is organized and maintained for oppression and injustice, and for spoliation for railroad uses, of private property of inventors.

The petitioner avers that this association is nothing less than a permanent conspiracy created in the interest of trade and commerce. Its constitution requires unity of action by all its members in opposing individual patentees. It is organized and operated for the express purpose of ruining patentees by defeating their suits brought against railroad companies for infringement of patented inventions.

The petitioner says that an extension of his patent is the sole means by which he can obtain relief, inasmuch as the term of his patent has nearly expired, and after its expiration he will be unable to secure injunctions, nor will he be able to prove profits or damages, for the Eastern Railroad Association previous to infringement closed the market against him, advised and bound the infringers not to pay any royalty whatever for the use of his patent, as such payments would serve as a measure of damages should your petitioner ultimately win his suit in the court of last resort.

That in case an extension as prayed be not recommended, that the House will direct its committee to specify some adequate relief for your petitioner.

That the House will instruct its committee to report whether the President failed to execute the law by refusing to order a *quo warranto* proceeding to be instituted against the Eastern Railroad Association, as petitioned on August 12, 1890.

That a select committee be created to investigate the Eastern Railroad Association, and that means be adopted to destroy this conspiracy.

That the patent act may be so amended as to secure proper relief where the present rule regarding profits or damages is inoperative or insufficient.

That the patent act may be further amended so as to make wanton infringement a *criminal* act, as under the new patent law of Germany.

That the patent act may also be amended by providing that wanton infringers shall not be permitted to give bond and continue the infringement.

Legislation is certainly needed to put a stop to combinations formed like the Eastern Association, for the express purpose of nullifying the privileges granted to inventors by Congress.

One Hundred Miles an Hour by Electricity.

The latest electrical scheme is for an electrical railway between Chicago and St. Louis. The following is from the prospectus of the Chicago & St. Louis Electric Railroad Co., working under the patents of Dr. Wellington Adams:

The proposed road will be operated from one central station, located at the mouth of a coal mine somewhere near the center of the road. The railway company will operate this mine by means of electric mining locomotives, electric drills, electric cutters, and electric lights, which will greatly cheapen the present cost of the ordinary system of mining coal. The possibility and economy of this method of mining has already been established beyond dispute. The company will sell the good coal that it mines at a handsome profit, and use only the waste dust or slack to run the engines which develop the power for operating the mine and road, in connection with its distributing system of light and power for consumers along the line of the road. At the present time, such dust and slack is not only valueless, but has to be hauled away at the expense of the mining company. The road will be divided up into twenty-five sections of ten miles each, which will constitute a complete block system, making it impossible for any two cars to run at a high speed upon any single section at the same time, thus making collisions impossible. There will be a complete block signaling system by means of incandescent electric lights, with telephonic communication between cars upon the same section, whether running or standing still. The road will be illuminated by incandescent electric lamps for one mile ahead and one mile behind every car while running. It will be built in a practically straight line, and as far as possible will avoid grade crossings of other roads. At all grade crossings, whether wagon or railroad, a red electric light will be displayed and an electric bell rung for two minutes before it is time for the train to pass. It is intended to ultimately construct four tracks, two outside tracks for local traffic and high class freight, while the two inner tracks will be used exclusively for through passenger traffic, mail and high class express. The through cars will not stop anywhere between the two terminal cities between which they run. Spurs or branches will be run, connecting the large cities along the line of the road with the main through tracks, and from these cities individual through cars will run to and from the cities of St. Louis and Chicago without stop. Ultimately a street will be run along the sides of these tracks, along which dwelling houses and stores will be built. On both sides of these avenues the land will, ultimately, be laid out in building lots one hundred feet front by two hundred feet deep, giving an area of half an acre to each lot. These lots will be bought by people from town seeking the healthy air of the country and pleasant homes within quick and cleanly access of the city. Back of them, they will have the open farm lands, and in front of them the boulevard with the electric railway, telephone and electric light; practically uniting Washington Ave., St. Louis, with Michigan Ave., Chicago, by one grand electric highway or boulevard, along which the farmer may secure electric light and power for pumping, plowing, thrashing, chopping and mixing fodder, shelling and grinding corn, and harvesting at night in case of emergency; and the rural resident may secure electric lights for the illumination of his dwelling, and electricity for heating and cooking, and electric power for domestic purposes. Along this road there will ultimately be a constant stream of travel. The population will be scattered out into the country, and the centers of trade and business relieved of their surplus, leaving more room for business establishments near the great centers of trade, taking out of the great bustle and crowd of the city those who are not immediately engaged in trade, and leaving room for those who are. The result will be of incalculable benefit to the whole population and land holders throughout the district through which the proposed road will traverse. It will bring into use and market a large amount of real estate hitherto of but little value.

Either of the three routes which this road proposes to take between St. Louis and Chicago will be at least thirty-three miles shorter than the shortest of the existing steam routes. The standard schedule time of all through cars will be one hundred miles per hour. The trip from St. Louis to Chicago can, therefore, be made in from two and a half to three hours. It will be unnecessary to travel at night, therefore no through passenger cars will be run after 9 o'clock P. M., the tracks being reserved at night for high class freight, express, and mail. This does away with the necessity of running Pullman cars, and the expense to the company attendant thereon, as well as to the traveling public. No man will care about traveling at night when he can travel in the day time over a cleanly road which will land him so quickly at his destination. Farmers along the line can build cheap side switches with light rails which will enable cars to be run directly to the doors of their barns and granaries, to facilitate the transportation of the produce of their land, thus rendering them largely independent of the condition of the ordinary wagon roads, which, by the way, have become very poor through neglect since the inauguration of the railroad system. Thus will the large markets of St. Louis and Chicago be practically at the door of every farmer throughout this district, for the sale of his perishable produce. The moment the proposed road is completed and put in operation, all lands throughout the district traversed by the road will be increased in value from one to two hundred per cent, and ultimately, and that at a day not very far distant, the land immediately contiguous to the road will be selling by the front foot instead of, as at present, by the acre, with very little demand for even this.

It will, of course, be to the highest interest of this company to build this road and get it in operation in time for the World's Fair, so as to secure the immense traffic incident thereto. It is entirely practicable, says the prospectus, to build such a road within the time allotted. Steam roads of a much more difficult character have been built much more rapidly: for instance, the Texas and Pacific Extension was built a distance of 615 miles in twenty-two months; four hundred miles of which was through a region entirely destitute of railroads and even of population, the cattle men at that time having failed even to penetrate the greater portion with their herds. The country was of a rough and hilly character, many summits being as high as three and four thousand feet, with such modifications of climate as to make a trip across the country a series of continual surprises. For a great portion of the road a rate of two miles for every working day was maintained for several months. Ties, fuel, and bridge timber had to be transported from East Texas, a distance of from four to six hundred miles; rails from Pennsylvania, seventeen hundred miles; and water from wherever it could be gotten along the line. The present proposed road will have none of these difficulties to contend with. It will have a practically level country over which to build its road, which will be crossed at intervals by steam roads which can be utilized for the transportation of its materials. An interesting fact may be stated in this connection, that contracts can be made for the delivery of rails for the entire road within six weeks from the day of giving the order.

The electric carriage or car that will be run upon this proposed electric road is a long, low, compact, light but strong car, having two pairs of driving wheels, each of which are driven by a separate and distinct electric motor. The whole weight of the car with its passengers, and of the two electric motors, comes upon these two pairs of driving wheels, and is, therefore, all available for traction or adhesion between the rails and the wheels, through the agency of which the car is propelled. The top of the car stands only nine feet from the rail, which is three feet lower than the ordinary street car. This brings the center of gravity very low and near to the track, which decreases immensely the danger of jumping the track. It has a wedge-shaped nose or front for cutting the air, which has the effect of decreasing the air resistance and of helping to keep the car down upon the track. The motor man stands immediately back of this wedge-shaped front, and between his department and the rear wheels is the compartment for the accommodation of passengers. In the rear of this is a separate compartment for mail and high class express. The driving wheels are six feet in diameter, and are capable of making five hundred revolutions in one minute. The weight of the entire car with its motors is but ten tons. It may be interesting in this connection to state that a steam locomotive to make the same speed, if it were practicable, would have to weigh in the neighborhood of one hundred tons, and the present locomotive weighs from sixty to ninety tons. These electric carriages or cars will be illuminated and heated by electricity, and will contain all the modern appointments for the comfort of passengers. There will be no conductors and no brakemen. It will be possible to stop the car within half a mile by means of the motors themselves and auxiliary electric brakes.

Formulas for Making Different Colored Photographic Prints.

Mr. A. Lizzard, in *Anthony's Bulletin*, gives a translation from a French work on the different processes for producing prints in various colors.

"Process with nitrates of uranium and copper." By means of this process, which is as rapid as that of the salts of silver, prints of a brown tone are obtained very warm, very agreeable and of an artistic stamp.

The sensitizing bath is composed of:

A.

Nitrate of uranium	23 grammes.
Distilled water	80 cubic cm.

B.

Nitrate of copper	7 grammes.
Distilled water	80 cubic cm.

Mix these two solutions in a tray and immerse in it the gelatine sized paper, for about two minutes; then dry it in the dark. The paper thus prepared will keep for a considerable length of time, and it becomes also very leathery. The exposure to the sun requires not longer than ten minutes, a weak image showing in the printing frame. It is then developed by immersing in a solution of

Yellow prussiate of potash	16 grammes.
Distilled water	700 cubic cm.

The image will instantly appear with a rich red brown tone, with metallic reflection and bronzed. When the immersion has been sufficient, the image will appear with a nearly equal intensity on both sides, because it is in the body of the paper. By this means very fine transparent pictures are easily obtained. As soon as the print reaches the desired tone, wash it in pure water until the whites have become clear and pure, and all soluble salts eliminated; then hang it up to dry. No other fixing will be necessary.

In place of the yellow prussiate bath, if one is used composed of 2 parts chloride of platinum to 100 parts water, the prints will be a beautiful black.

In the same book is given a "process with nitrate of silver and uranium" which promises very fine results. Float a sheet of paper on a sensitizing bath composed of the following:

A.

Nitrate of uranium	60 grammes.
Distilled water	50 cubic cm.

B.

Nitrate of silver	8 grammes.
Distilled water	50 cubic cm.

Mix the two solutions, float the paper for two or three minutes and hang it up to dry in a dark room. Expose it under the negative and immerse in a bath composed of

Proto-sulphate of iron	16 grammes.
Tartaric acid	8 "
Sulphuric acid	a few drops.
Distilled water	200 cubic cm.

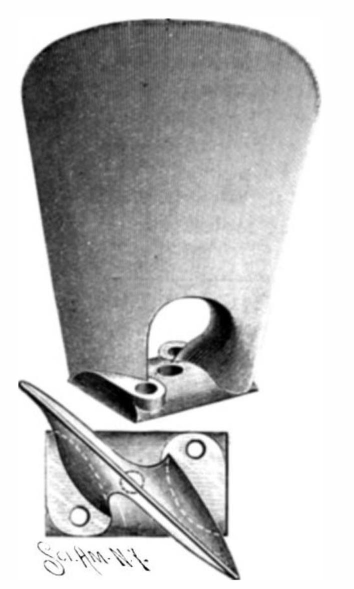
The development is very rapid and the print is fixed by washing in pure or rain water. The sensitiveness of this paper is so great that in diffused light a print is visible and black in eighteen seconds, and in half an hour before a kerosene light of moderate size at 5 inches distant from the flame. The process is very simple, and the chemicals of the ordinary kind to be found in every well conducted dark room.

Fireproofing Receipts.

Prizes were awarded for the following finishing processes for fireproofing, respectively diminishing the combustibility of tissues, curtain materials, and theatrical scenery. For light tissues: 16 pounds ammonium sulphate, 5 pounds ammonium carbonate, 4 pounds borax, 6 pounds boric acid, 4 pounds starch, or 1 pound dextrine, or 1 pound gelatine, and 25 gallons water mixed together, heated to 86° F., and the material impregnated with the mixture, and then calendered as usual. One quart of the mixture, costing about threepence or fourpence, is enough to impregnate 15 yards of material. For curtain materials, theatrical decorations, wood, furniture. 30 pounds ammonium chloride are mixed with so much floated chalk as to give the mass consistency; it is then heated from 125 to 140° F., and the material given one or two coats of it by means of a brush. A pound of it is sufficient to cover five square yards.

AN IMPROVED PROPELLER BLADE.

This improvement is based upon the assumption that from the end of the blade toward the hub only one-half or three-fourths of the outer portion is the real working part, water being forced inward and becoming dead near the hub requiring more or less power to churn it. By this improvement the dead water is allowed to pass away as soon as it becomes so. The invention forms the subject of a patent issued to Mr. Daniel H. Welch, of Astoria, Oregon. The propeller blade is mounted obliquely upon a flat rectangular base piece, having bolt holes by which it is secured to the hub of the propeller, and there is an oblique water passage through the base end of the acting portion of the blade, the walls of the passage forming acting or propelling extensions of the main or outer acting surfaces of the blade, when it is set angling on its hub or shaft. The smaller figure shows a plan or edge view of the blade, any number of blades being arranged in an angling manner, as in other screw propellers, around the shaft or hub of the propeller. By this construction it is claimed that the dead water will pass away more freely than is possible with a wheel of any other design, the wheel also requiring less power to operate it, and, if properly made, it is designed to be stronger, not to shake the boat as much, and be easier on the rest of the machinery. It can be made solid or as a sectional wheel.



WELCH'S PROPELLER BLADE.

Iron Aluminum Alloys.

The advantages of an addition of aluminum to fluid iron are important. With moderate care absolutely pure and solid castings can be obtained capable of receiving a high polish. An addition of aluminum is especially to be recommended for the manufacture of steam cylinders, engine castings, press cylinders, and generally for castings which are to be subjected to a high pressure. A few hints will serve to show how aluminum is best alloyed with iron. As aluminum only lends itself with difficulty to combination with iron, it is not immediately to be introduced in the ladle which is to be poured into the mould; a smaller ladle is selected, in which is placed the heated aluminum; somewhat fluid iron is brought from the furnace, poured in the ladle, and stirred until the aluminum iron compound begins to stiffen. The iron intended to be cast is now let out of the furnace into the ladle intended for it, the aluminum iron mixture is poured in, the lot being intimately mixed. The molten metal should not be poured into the mould too quickly, as it does not solidify so rapidly as ordinary iron. Aluminum iron in the fluid condition is very active; small globules are formed, which gradually extend to the edge of the ladle, where they disappear. At first the iron is of a milk-white color; then it becomes orange-yellow, and forms a thin film on the top. When this moment has arrived, the film is removed and casting is proceeded with, care being taken that the mould is always kept full. For 100 kilogrammes the proportion of aluminum recommended is 200 grammes. Cost can be no drawback in view of the present cheapness of aluminum, particularly when it is considered with how much greater certainty clean castings can be obtained. Aluminum improves cast iron as phosphorus improves tombac and brass, the thin fluid is increased, and the oxide separated. —*Metallarbeiter*.

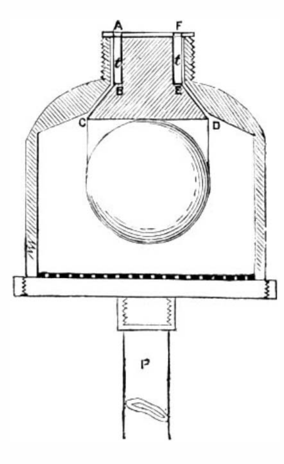
THILANINE.—"This is a new modification of lanolin, obtained by Liebels by the action of sulphur on lanolin, and which is stated to be a definite compound. Dr. Sadlfeld, of Berlin, has experimented with it in his dermatological practice, and reports very favorably on its action in various affections. It gives rise to no irritation and allays all itching, and is said to be destined to supersede Hebra's ointment in dermatological work."—*Br. Col. Drug.*

AN AUTOMATIC BOILER FEED.

A patent has recently been granted to John R. Hanlon, of Pennington, N. J., for an automatic feed water apparatus, by the use of which a regular supply of water to low pressure steam boilers is at all times automatically secured. The operation of this apparatus is based upon the principle of water seeking its level.

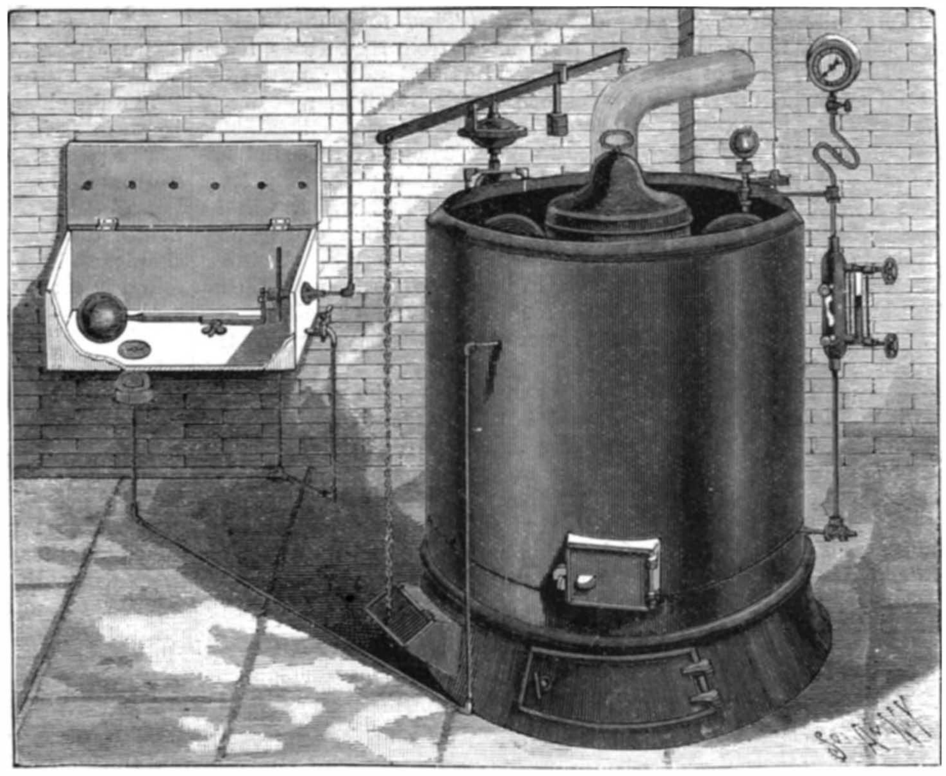
The arrangement consists of a tank furnished with two valves; one, an automatic float valve connected with the water main and regulating the supply of water to the tank, while another small float valve is fastened to the bottom of the tank and connected therefrom directly with the boiler. This last mentioned valve is governed by the flow of water into the the boiler and by steam pressure from the boiler. When the steam pressure is off or very low and the height of the water in the boiler is below the pre-established level, the water in the tank, seeking its proper level in the boiler, forces the valve from its seat and the flow into the boiler begins. The supply valve maintaining the same level of water in the tank, the flow from this valve in the bottom of the tank will continue until there is a corresponding level of the water in the boiler. When this point is reached, the downward pressure upon the valve ceases and the valve in virtue of its floating quality is lifted against its seat and closed, thus preventing the possibility of backward pressure from the boiler forcing the water back into the tank; in fact, the stronger the pressure, the tighter this valve binds to its seat. One form of this valve is shown in the detail sketch.

A fine wire gauze screen connected to the inlet valve prevents foreign matter from entering the tank from the main, while another similar screen attached below the float valve in the bottom of the tank prevents anything in the way of scale from the boiler reaching this valve. Thus the possibility of this valve becoming clogged is the least possible; in fact, practically removed. The pipe connecting the apparatus with the boiler enters the boiler 10 or 12 in. say, below the established level. Thus, even assuming the remote contingency of the drop valve becoming accidentally stopped and prevented from closing tightly, yet the water could not be forced from the boiler below this point of connection. That is, it is impossible for the boiler to be emptied through any accident to the apparatus.



The arm of the float of the inlet valve is sectional, the two parts being regulated by a thumb screw. The tank is fastened to the wall of the boiler room approximately at the height desired for the water level in the boiler, and the height can be accurately fixed by simply loosening this thumb screw and turning the arm of the float up or down; up to lift the level and down to lower it, and then retightening this screw. In other words, you can adjust the level of the water in the boiler by a very simple method.

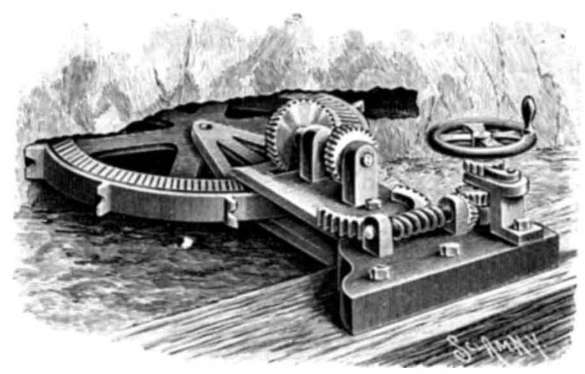
A check valve attached below the escape valve of the boiler admits the atmosphere over the surface of water in the boiler when the steam pressure is removed. Thus is destroyed any tendency to form a vacuum over the surface of water in the boiler. Consequently, the pressure upon the water in the tank and boiler being equalized, the water is enabled to attain a corresponding level in each.



HANLON'S AUTOMATIC WATER FEEDER FOR LOW PRESSURE STEAM BOILERS.

AN IMPROVED COAL MINING MACHINE.

The machine shown in the illustration, for cutting coal in coal mining, is designed to be operated by an electric or other motor placed on the machine, the latter being advanced by hand or power as the cutting goes on, until the body of the coal to be detached is undermined. The improvement has been patented by Mr. James Taylor, of Edwards, Ill. A stationary frame is secured to any suitable fixed support, and two forwardly-extending arms are pivoted to the frame, the cutting wheel being journaled between the free ends of the arms. The cutters in the rim of the wheel are removable, their shanks extending through the rim and receiving nuts. On the upper face of the cutting wheel is a toothed rim, engaged by a bevel pinion on a shaft journaled in bearings on the upper pivoted arm, this shaft also having a spur wheel for receiving power from an electric or other motor. On the rear of the arm is also a segmental worm wheel, concentric with the pivotal bolt, a worm journaled on the frame engaging the worm wheel. The worm shaft has a bevel gear, engaged by a corresponding gear on a short, vertical shaft, provided with a hand wheel, the shaft also having a ratchet wheel, engaged by a pawl. By means of the worm and the pawl and ratchet mechanism, the cutting wheel is constantly held up to its work. Owing to the construction of the arms carrying the cutting wheel, the wheel is adapted to cut a groove in the body of the coal equal in depth to nearly its own diameter.



TAYLOR'S COAL MINING MACHINE.

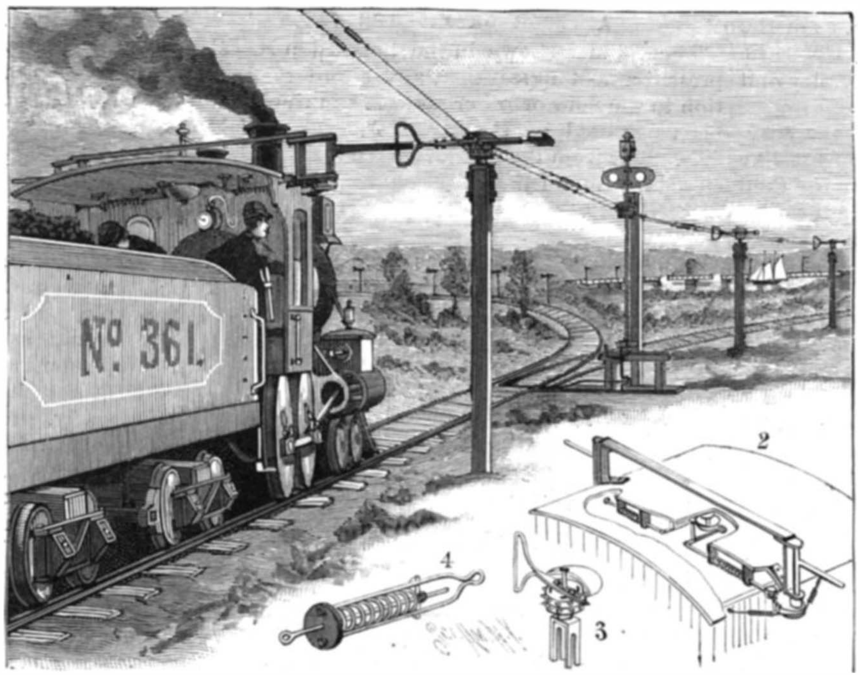
Seed Growth Promoted by Electricity.

Dr. James Leicester, of the Merchant Venturers' Technical School, Bristol, has been studying the growth of seeds in what may be described as electrified earth. The *Chemical News* says: A box about 3 ft. long and 2½ ft. wide was filled with soil, and near each end two metal plates, one of zinc, the other of copper, each about one square foot in size, were immersed, and were united outside by a copper wire. It is evident that by slow chemical action on the zinc a current will pass through the earth toward the copper, and returning by the outside copper wire will form about the simplest of simple cells. Various seeds were sown in the earth between the plates, and in every case it was found that the seeds grew much quicker than they did when the plates were absent. Similar and even more definite experiments were made with glass tanks, some with and some without the metal plates. All of them were filled with the same earth, and were treated with the same quantities of water. In one typical instance the result is thus stated: "In the case of hemp seed, it was fully an inch above the surface before there was any sign of it in the ordinary vessels." The experiments were varied in several ways, but always with substantially identical results. It was found that if the soil was watered with a little very dilute acetic acid, the growth of the seeds was much quicker when the metal plates were present, whereas without them no difference was noticed.

IF you take a good conductor like copper, and run the temperature down, its resistance almost disappears at very low temperatures; hundreds of degrees below zero copper is almost a perfect conductor. If you heat it up, it becomes more and more resisting. Let us take glass—a good insulator—or any insulating material, and run its temperature up, it loses its insulating power, and if we run it up until it gets to red heat, it approaches a conductor; so that all substances are conductors when they are hot enough.—*Prof. Thompson.*

AN IMPROVED RAILROAD SIGNAL.

A signal designed to give a positive alarm to the engineer on the locomotive when his train approaches an open switch or drawbridge, or a semaphore set at "danger," has been patented by Mr. James S. Parmenter, of Woodstock, Ontario, Canada, and is shown in the accompanying illustration. From the top of a post erected along the track, at convenient distances apart on each side of the ordinary danger signal, wings or arms are made to project toward the line when there is danger ahead, and operate a swinging bracket on the locomotive, by which a bell is rung inside the cab, the wings being held parallel with the line when the road is clear. Each wing forms part of a slotted extension bar adjustably secured to the top of a double sprocket wheel journaled in a forked bracket adjustably attached to the top of the post, as shown in Fig. 3, a sheet iron cover protecting their parts from snow, ice, etc. On the main shaft of the switch, near the top, a similar sprocket wheel is mounted upon it and connected with the others in the series by a wire rope or cable. At the lower end of the switch shaft is a gear wheel meshing with a gear pinion on the countershaft connected with the switch bar, which is operated by a handle. That the wire connecting rope may be held taut at all times, without being affected by changes in the temperature, an automatic take-up turn buckle is provided, as shown in Fig. 4, by which compensation is made for expansion and contraction. Swing brackets journaled at the top of the cab on each side have extension pieces normally extending outward at right angles, and held in such position by spiral springs connected with a corrugated eccentric plate, as shown in Fig. 2. Sliding rods held in brackets on the interior top of the cab have their outer ends held against the corrugated edges of the eccentric plate by springs, and hinged to each rod is a hammer lever adapted to strike an alarm upon a bell. The extension wings being positively held toward the track, at about right angles, whenever a switch or drawbridge is open, or a semaphore at "danger," the extension piece of the swinging bracket on the approaching locomotive in such case strikes the wings and causes the alarm to be sounded in the cab, the bracket swinging backward sufficiently to allow it to pass the wing. In using this device upon a curve, it is designed to have a shaft on each post extending downward to within three feet from the ground, made triangular in cross section at its lower end, wrenches to fit this shape being then carried upon the train, so that when a train might be delayed at or near a curve, the signal might be set by a train hand from the nearest post, without the necessity of going back a half mile or so to signal, in the ordinary way, a train that may be following.



PARMENTER'S RAILROAD SIGNAL.

TERRACING IN THE FOOTHILLS.

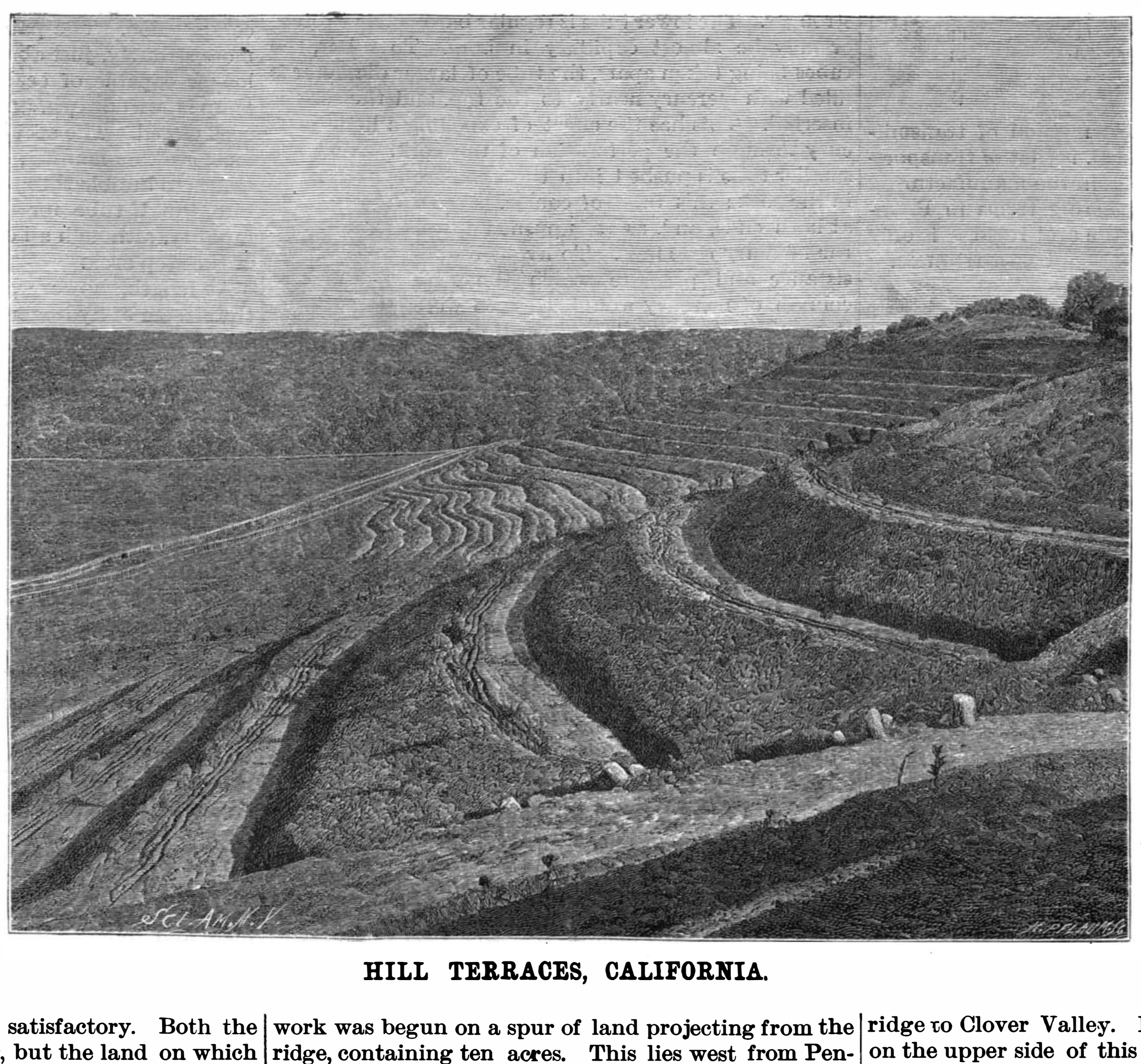
There is a strip of country on the east and north of the San Joaquin and Sacramento valleys that extends their entire length, known as the "thermal belt." It lies in the first foothill lands that rise out of the valleys, and is only a few miles in width. There is less frost here than in the valleys; and above, the cold steadily increases until the summit of the Sierras is reached. In this region a great variety of fruit can be grown of superior quality.

Many of the hillsides, however, are too steep to be planted to orchards in the ordinary manner, but during the last few years some of them have been terraced and planted to oranges and early peaches with results that are highly satisfactory. Both the fruits require abundant water, but the land on which the trees are grown must have perfect drainage. They will then produce fruit large in size, and in great quantity, and it will ripen earlier than where less water can be used, as I have noticed for some years the finest fruit and the first to ripen was always from trees that stood near water ditches on hillsides. The ground thrown over in terracing gives depth of loosened soil that makes a rapid and healthy growth of tree and fruit, that it is thought fully compensates for the cost of the work. The terracing gives picturesque beauty to the country, of the highest order known to practical horticulture, thereby creating a value beyond intrinsic comparison. Newcastle, with an altitude of 1,356 ft., is in a direct line six miles northeast from Rocklin—altitude 249 ft., Loomis and Penryn being between the two places, and all on the line of the Central Pacific Railroad, the land rising at the rate of over 100 ft. to the mile. Sacramento can be seen from each of these towns, and is distant from Rocklin twenty-two miles.

A ridge of land beginning at Newcastle runs west some two or three miles, when it curves toward the south for several miles, abruptly terminating west of Rocklin, and very near the town. A large portion of the land lying north and west of Rocklin, Loomis, and Penryn, between the top of the ridge and the railroad, belongs to the individual members of the Placer County Citrus Colony. The sides of this ridge are being terraced by their owners and planted to oranges, from plans made by me, and the work in part has been done under my supervision. In the spring of 1888 the work was begun on a spur of land projecting from the ridge, containing ten acres. This lies west from Penryn two and a half miles, northwest from Loomis equally distant, and in plain view from either place. Near the base of this hill, and at the point of central approach, is a cottage house, neatly built of split granite, that is now being used as a club house, for the Colony Club. Beginning just below this house, I built a zigzag avenue up the center of the spur to the top, on a regular grade of twenty inches to the rod. This makes an easy carriage road, the steepness of the hill being overcome by the continuous curving. After the terraces were made, I paved the gutters on the upper sides of the avenue, changing to the opposite side at each curve. Pipes were laid across the road as the gutter changed sides, four inch pipe being used on the upper turn, increasing to eight inch pipe at the lower crossing, as in a rainfall the water is greater in quantity at the base than at the top of the terraces. From the highest part of this spur that was to be planted I began the terraces on each side of the avenue, the first being only a few rods in length, increasing with each terrace until the base was reached. The terraces terminate at the side of the avenue, and have a grade of two and a half inches to the rod for the running of water in irrigating. The terrace step was made level, with a bank slope of 45 degrees, varying according to the steepness of the hillside. The width of the terraces as measured on the slope was about 25 ft. on an average, but only from 12 ft. to 20 ft. was the width of the level part. Sidehill plows were used in making the terraces, and they were run back and forth until the work was nearly done, when it was finished with shovels, some dirt having to be taken from high points to low places in wheelbarrows. Recent experience, however, has made me familiar with an implement called a "V," which, following the plow, does the leveling much more cheaply. This implement should be made especially for this work, which I cannot describe in this article. The trees were planted eighteen feet apart in the row, and near the edge of the terrace, that they might stand centrally over the greatest depth of loosened soil.

Orange trees in this section should be planted in March, that they may become well rooted before summer, when the heat is liable to check their growth if planted late. Since planting this orchard I have been nearly all the time in Southern California, and have frequently visited the orchards of Riverside, Pomona, and Redlands, and I find the trees on these terraces are as large, as vigorous, as healthy, and as uniform in size, as any in the favored sections of the South, that are of the same age and were of the same size when planted.

Among the visitors to this orchard when first planted were some English gentlemen. They were so impressed with the picturesque beauty of the place and the surrounding country, that they purchased land adjoining, and in the spring of 1890 began to terrace and plant the hillside south of the terrace planted in 1888. Continuing last spring, they now have nearly one mile in length of the hill slope terraced and planted, and many more acres are to be planted in the neighborhood during the coming season. These terraces are irrigated by several lines of pipes laid from the top running down the face of the hill to the bottom. The distance between these lines of pipe is 330 ft. The pipes are laid under the ground, with faucets attached and coming to the surface, just at the base of each bank. Each terrace can thus be supplied with water by the opening of a faucet, and the trees can be irrigated for a distance of 330 ft., when another line of pipe is reached, this continuing along the entire length of the orchard. Near the center of this planted tract is an avenue that runs diagonally over the face of the ridge to Clover Valley. I have made a paved gutter on the upper side of this avenue, into which runs all surplus water when irrigating, and all that may accumulate on the terraces from heavy rains. A deep furrow is plowed at the base of each terrace to conduct this water to the gutter.



HILL TERRACES, CALIFORNIA.

Many Englishmen have already located here, some of whom are gentlemen of abundant means, who have brought their families, have built substantial houses, and have come to stay. Others have purchased land which they are having improved, and will come themselves as soon as they can arrange to leave their present callings. With their national thrift, they prefer to have their country homes where a good income can be derived from their investment, rather than have their country residences in some suburban town of San Francisco, where no income is ever expected, as in the Oakland or Santa Cruz highlands that overlook the towns, as the foothills here overlook the valley and the capital city of Sacramento.

These terraces, as they lie on the face of the curving ridge that encircles the sloping valley, are like "pictures hung on the wall" to travelers on the Central Pacific Railroad as they pass through the towns of Penryn, Loomis, and Rocklin, and to the people who live in the vicinity they are a constant source of pleasure. When the face of this ridge from the Newcastle line to Rocklin becomes converted into terraced orange orchards, as the owners purpose doing in a few years, and when the trees attain good size, and come into bearing, they will present scenes of unique beauty unequaled by anything similar in the country.—*P. W. Butler, in Rural Press.*

Transmission of Power by Compressed Air.

Compressed air is, perhaps, the chief rival of electrical transmission. It is at present used chiefly in mines, where it is still a very successful rival of electricity, but from present appearances it is likely that it will gradually be replaced by the latter method. In Paris there is a large central station for the distribution of compressed air, and it seems to be in successful operation. It does not appear, however, that the advantages over electrical transmission are so great that it will not soon be replaced by electricity. Its introduction is not making the rapid strides that the introduction of electricity is now making. Its efficiency as compared with electricity will be shown very well at the Niagara Falls power plant, where I understand a compressed air system is to be introduced in competition with electricity. From a paper by Professor Unwin it appears that the transmission of power by compressed air is practical to a distance of at least 20 miles. It seems that 10,000 horse power can be transmitted to a distance of 20 miles in a 30-inch main at 132·3 pounds per square inch with a loss of pressure of only 12 per cent. The efficiency of such a plant is said to be 40 to 50 per cent if the air is used cold, and 59 to 73 per cent if the air is reheated. The relative efficiencies in per cent for different distances of several systems is as follows:

Distance in Miles.	Efficiency in per cent. Hydraulic.	Pneumatic.	Wire Rope.
½	50	55	91
1	49	54	85
3	41	51	61
5	37	50	43
10	26	43	21
13	18	39	11

The most usual and extended method of transmitting power, if so it may be called, is that of transporting the coal itself from the mines in the manufacturing cities. The efficiency in engineering terms in Philadelphia, which is not far from the coal regions, is only 50 per cent. CARL HERING.

Good Will—Trade Name.

The following rulings regarding the important subjects of good will and trade name were made by the Supreme Court of Louisiana, in the case of Vonderbank *vs.* Schmidt, viz.:

1. Good will is the favor which the management of a business wins from the public and the probability that old customers will continue their patronage and to resort to the old place.

2. It may be said to consist of those intangible advantages or incidents which are impersonal, so far as the vendor is concerned, and attach to the thing conveyed. When it consists in the advantage of location it follows an assignment of the lease of the location, and if not assigned it passes to the lessee of the property at the termination of the lease.

3. A trade mark has no separate existence, but owes its existence to the fact that it is actually affixed to a vendible commodity, whereas a trade name, or a fictitious name, may be considered as a quasi-trade mark, a mere property which is somewhat allied to good will.

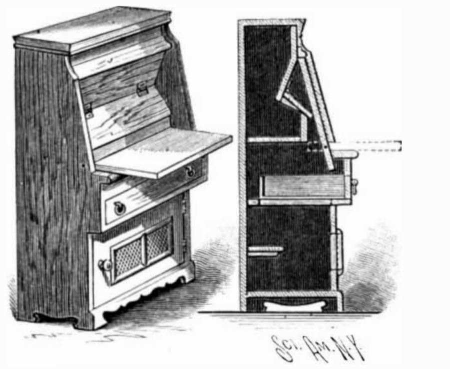
4. The only restraint the grant of good will imposes upon the grantor is to prevent his subsequent employment of his name so as to deceive and mislead the public.

5. A surname may become impersonal when attached to an article of manufacture, and become the name by which such article is known in the market; and, in case of sale of the right to manufacture the name passes also, though it does not pass as good will, but as a trade mark.

6. By giving a particular name to a building, as a sign to the hotel business, a tenant does not thereby make the name a fixture to the building and the property of the landlord upon the expiration of the lease. One may consent to the employment of his name as that of a place of refreshment, but if such consent be purely gratuitous he may withdraw it at pleasure, particularly if such name be his surname, it being personal to the proprietor and not an element of good will of the business.

A FLOUR OR KITCHEN CABINET.

The cabinet shown in the illustration is designed to present a neat appearance, and afford ample ventilation to the flour or other materials in the bins. It has been patented by Mr. Albert A. Tinker, of Madison, Wis. The front opening of the flour compartment is closed by an inclined hinge cover, and pivoted to the



TINKER'S FLOUR CABINET.

framing is a moulding board, adapted to be swung up in front of the cover, as shown in the sectional view. When the moulding board or leaf is tilted, any flour on it may be readily scraped off into a drawer below. The rearward movement of this drawer is limited, an air passage being left behind it so that air may freely circulate, the door of the lower compartment being provided with wire gauze.

A LECTURE BAROMETER.

T. O'CONOR SLOANE, PH.D.

A simple form of barometer is illustrated for exhibiting the principle of the instrument in lectures or before audiences. The object is to have a large air chamber, so that it can be readily seen at a distance, yet to avoid the necessity of using very large amounts of mercury. It also is comparatively portable, as the tubes composing it are much shorter than the barometric column.

Two tubes and a perforated rubber cork comprise the recipient of the barometric column. The upper tube may be half or three-quarters of an inch in internal diameter, resembling a test tube in general appearance, but should be considerably heavier and stronger. The lower tube is regular barometric tubing, or may be almost capillary in bore. To fill it, the tubes being taken apart, the tube of larger diameter is filled with mercury nearly to the top, and the cork is inserted. This has the effect of expelling a little mercury through the perforation of the cork. Next the smaller tube is pushed into the aperture in the cork; this tube, of course, is open at both ends, and, as it is pushed down, the mercury rises in it. To avoid the resistance and pressure which the long column of mercury would produce were it vertical, it is well, in thrusting this tube into its final position, to hold the two, as shown in the cut, nearly horizontal with the lower end of the small tube over a recipient, which would naturally be the mercury cistern. When com-

A LECTURE BAROMETER.

pletely filled, the finger is placed over the end of the lower tube and the whole system is inverted in mercury, as in the manipulation of the ordinary barometer tube; the finger is removed and the mercury settles down to the proper height.

As regards their lengths, the upper tube may be 8 in. or 10 in. long and the lower one about 24 in. Owing to the large volume of mercury employed, it settles down slowly to its position, the long almost capillary lower tube acting as a damper upon its motion exactly as in the ordinary sea barometer.

The advantages of this method of filling are that air can be so readily excluded. When a barometer is filled from the top, air is always carried in with the mercury, and to get rid of it some trouble is requir The bubbles may be fished out with a wire. By verting the tube in mercury they may be made coalesce into a large bubble; or the mercury may boiled. In the present case, if any bubbles collec the large tube, they may easily be drawn out v glass rod or iron wire before inserting the cor the subsequent filling, as there is no agitation e mercury, a perfect integral column is obtained.

As its disadvantage, the liability to leakage of the joint between the tubes should be mentioned. This is to be guarded against by using a very soft and perfectly fitting cork.

Palladium.

An experiment, illustrating the remarkable power possessed by palladium of occluding hydrogen is described by Prof. Wilm, of St. Petersburg, so says *Nature*, in the current number of the *Berichte* of the German Chemical Society. The experiment is so simple, and requires so short a time to exhibit, that it would appear to be eminently suitable for lecture demonstration. The metallic palladium is employed in the finely divided state obtained by heating the easily prepared yellow crystals of the compound $PdCl_2 . 2NH_3$, first in the open air, and subsequently for a short time in an atmosphere of hydrogen. A small quantity, about four grammes in weight, of the palladium so obtained is placed in a bulb blown at the bend of a U-shaped tube. The extremity of one limb of the U-tube is bent round at right angles, and connected with a wash-bottle containing sulphuric acid, which in its turn is connected with a Kipp's apparatus generating hydrogen from zinc and dilute sulphuric acid. The wash-bottle serves not only to dry the hydrogen, but also to indicate the speed of the current of gas.

The extremity of the other limb of the U-tube is narrowed to a capillary, and terminates with a tightly-fitting stop cock and jet. In commencing the experiment, the hydrogen current is started, and then, first the metal, and afterward the whole U-tube, is carefully heated with a Bunsen flame in order to remove the moisture formed by the action of the hydrogen, under the influence of the palladium, upon the oxygen of the air contained in the apparatus. When all the air and moisture are thus driven out of the apparatus, an attempt may be made to ignite the issuing hydrogen at the jet above the open stop cock. It will be found, however, that even while the metal is hot and the stream of hydrogen very rapid, a constantly burning flame cannot be maintained at the jet with the stop-cock fully open; instead, a series of somewhat explosive ignitions and sudden extinctions occur. It is only when the stop cock is turned so as to reduce the exit of the gas to a minimum that a constantly burning jet can be obtained, the hydrogen in contact with the palladium being then subjected to a certain amount of compression. The palladium is now heated a little more strongly, just above bright redness, when it is no longer capable of occluding hydrogen, and then the lamp is withdrawn, and after a few seconds the stop cock closed. The occlusion is then demonstrated in a most striking manner, for the stream of hydrogen continues to bubble through the sulphuric acid bottle and into the U-tube for several minutes with its original rapidity, although all exit is prevented by the closing of the stop cock.

At length, however, the occlusion diminishes, and the stream of hydrogen gradually becomes slower and slower, until it entirely ceases, the palladium having regained the temperature of the room, and becomes saturated with hydrogen at this temperature. If now the stop cock is opened, and the metal again heated, upon applying a flame to the jet, the issuing hydrogen evolved from the palladium takes fire, and burns with a tall flame which remains constant for some minutes, then, as the hydrogen stored in the palladium becomes exhausted, diminishes in size, and finally disappears. The moment the flame is removed occlusion instantly commences again, and the experiment may be repeated any number of times with undiminished effect.

Torpedo Depot Ship.

The French government is about to construct one after designs which have been prepared by M. J. C. Duplaa-Lahitte, of the Corps du Genie's Maritime. The vessel, which is to be named the Foudre, will be 370 feet 6 inches long and 51 feet 3 inches broad, and at a mean draught of 20 feet will displace 5,970 tons of water. Engines of 11,400 aggregate H. P. will drive twin-screws and give an extreme speed of 19 knots. The armament will consist of eight 3·9 inch, four 2·5 inch, and four 1·8 inch, quick firing Canet guns, and five torpedo ejectors; and she will carry ten torpedo boats, corresponding with ours of the second class, which will be hoisted and lowered by means of hydraulic gear. A certain amount of protection will be given to the vessel by a steel deck 1½ inches thick. The Foudre, which will be ready for sea in 1895, will be supplied with material and apparatus for the repair of torpedoes and torpedo boats and for the construction of small craft.

Correspondence.

The Philosophy of Vision.

To the Editor of the Scientific American:

In your issue of January 16, in answer to the query, "What makes the sun and moon appear so much larger when in the horizon than when high up in the sky?" you remark that the atmosphere then acts as a lens. As I have always taken great interest in anything relating to the most wonderful of all the senses—that of sight—I will, with your permission, give some reasons in your valuable journal for thinking that is not the reason for their enlarged appearance. If they are magnified by the air at the horizon, then they will subtend when seen at that point a larger angle when measured by a theodolite or any instrument adapted to measuring angles. In the absence of costly instruments, a simple one can be made to show that the enlargement is wholly deceptive and not a real magnification. Take a flat stick like a ruler, some two feet long or more, and at one end fasten a piece of tin or card with a small orifice, say one-eighth inch, placed so as to look along the length of the rule; then, about two feet from this peek-hole, place two pins in the wood, just far enough apart to take in the moon at the horizon when the eye is at the peek-hole. They will be a little less than one-half inch apart if two feet from the peek-hole, for the apparent diameter of both sun and moon is about one-half degree.

Now, with the same apparatus, look at the moon when high in the heavens, and it will be found just as large as at the horizon. Why, then, the great apparent difference? To answer this we must consider some of the laws and principles of this wonderful sense of vision. First, we judge *primarily* of the size of objects by the angle of vision they subtend; but with a given object, experience soon shows us that this angle varies inversely as the distance, and we learn to make allowance for distance when judging of size. Thus the tip of my little finger, when held arm's length from my eye, covers up entirely a large dwelling house about one mile distant; but as I look at the house it appears full size, and I should never think of calling it as small as my finger tip. Why? Because I learned to unconsciously allow for its distance. The same principle is illustrated in the answers given to the question, 'How large does the moon look to you?" The answers vary from a tea saucer to a cart wheel; but the tip of the little finger when held farthest from the eye will more than hide the moon, even at the horizon. Yet no one thinks of comparing fair Luna to so small an object as the tip of their smallest digit.

It follows from all these facts that our judgment of the size of objects depends very much upon the allowance we unconsciously make for distance. The hunter anxiously looking for game may vainly fire away at a supposed coon in a tree, but, failing to bring him down, may find that a minute brown insect hanging by its web in front of his eye, but supposed to be at a distance, was mistaken for a much larger animal and led to a vain expenditure of ammunition. This same principle is well illustrated when exhibiting the planets to unaccustomed observers through the telescope. I have often, when exhibiting Jupiter with a power that would magnify it to twice the moon's diameter, therefore to four times its size, inquired of the observer, "How large does it appear to you? As large as the moon?" "Oh no, not half! Why about the size of a dollar." Then I would say, "Open your other eye to take in more of the heavens, and remember you are not looking into the telescope, but through it at the sky;" and they would instantly be convinced that it appeared much larger than the full moon. I was once walking along a street with which I was well acquainted, and saw upon one of the neighboring heights a building with a cupola of large cylindrical form that I had never noticed before, although I had often seen, as I supposed, every structure in that neighborhood. Looking more carefully and changing my position a little, the supposed cupola instantly shrunk into an electric street lamp with its metal protecting cylinder, which the supposition of distance had magnified into a large cupola. But to return to our muttons: the moon when in the horizon is seen to be beyond the houses, the trees, the hills, and even the huge mountains, and, we unconsciously allowing for her great distance, she swells out to an immensely greater size than when seen high in the heavens, where we have no such convincing proof of her distance. If these views are correct, the phenomenon is a subjective and not an objective one, or, to put it in more elegant Greek, it is all in your eye. R. S. BOSWORTH.

Brownville, Feb. 19, 1892.

A Problem in Physics.

To the Editor of the Scientific American

Consider a cylinder one square foot in area and two feet high, with a piston having no weight, but moving air tight in the cylinder. Suppose that no heat can escape from the cylinder, and that the two cubic feet of air are at atmospheric pressure and a temperature of 60° If we place weights upon the piston, one pound at a time, until the total amounts to 2,160 pounds, the piston will continue to descend till it has fallen not quite one foot. The air in the cylinder will be compressed to not quite two atmospheres, and will have a temperature, according to the formula in *Science*, February 19, of about 169°. The work performed will be equivalent to the fall of 1,080 pounds one foot, and a little calculation will show that this amount of work would raise the temperature almost exactly to that given by the formula. It is easy to see that all the heat due to the work of compression in this case will be concentrated upon the air, if we consider that neither the piston nor the cylinder absorbs any of the heat. If now we should remove the weights one by one, it is easy to see that the air in expanding would gradually lift the weight on the piston, and as the last pound was removed the air would return to atmospheric pressure and to a temperature of 60°.

Suppose, now, that when the piston had descended one foot we had cooled off the compressed air until it had reached 60°, then upon expanding, as in the last instance, the air would be cooled to about 29° below zero, as shown by the formula. This discussion seems to be perfectly plain thus far, but now we come to a point that is not quite so easy to elucidate.

Joule, in experimenting upon a practical determination of the mechanical equivalent of heat, was obliged to immerse his cylinder, into which the air was to be compressed, together with the compressing pump, in a vessel of water, in order that all the heat developed by the work of compression should enter the water bath. We then can state at once the proposition: *If air when compressed is to be raised to the temperature indicated by theory, it is very essential that all the heat developed in the work of compression, ignoring that due to friction, should enter the air.* This seems a self-evident proposition, but, plain as it is, it is a fact that nearly all the errors which have arisen in the various discussions bearing on this question have come from a neglect of this very obvious statement. In this experiment of Joule's, let us suppose that the compression pump had been in one water bath and the cylinder in another. Under these conditions the first bath would have received the more heat, supposing that the air when compressed lost none of its heat in passing from the pump to the cylinder. If now the air, in passing from the pump to the cylinder, were cooled to the air temperature, nearly all the heat due to the work of compression would have been either retained in the bath around the pump, or would have been lost on the passage to the cylinder, and, in consequence, the air in the cylinder would have been heated only a very little in being crowded to two atmospheres.

Instead of connecting the pump directly with the cylinder, let us take two cylinders of equal size having a connecting tube closed at first. Let us compress the air in one cylinder to three atmospheres, the air in the other being at atmospheric pressure. The air will be heated by the compression to about 245°. Now, on connecting the two cylinders, an equilibrium will very quickly be established, the air in the first cylinder will be very slightly cooled in imparting a velocity to its particles, but will still remain at not far from 230 or 240°. The air in the other cylinder will be very slightly heated by the impact of the air rushing in, and will be heated much more by the hot air from the first cylinder, the resulting temperature being not far from 160°. But now, if the air had been cooled in the first cylinder to the air temperature before the connection was made, it is very plain that the cooling in one and the heating in the other would have been exceedingly slight.

In some experiments by the present writer the air was cooled after leaving the compressing pump and before it entered the cylinder, and the resulting temperature, after compressing to 1⅓ its former pressure, was about 4° higher than before. If in this case all the heat due to the work of compression had entered the cylinder, the temperature of the air would have been raised 43°. It was noticed always that the compressing pump became very highly heated during the operation. We may say, then, that the mere crowding together of the particles of air does not develop any heat. Joule found that when he had one cubic foot of air at two atmospheres heated to a certain temperature, they were still at that temperature when expanded into two cubic feet.

There is one other phase of this problem. Suppose that, instead of opening the cylinder in which the air was compressed to three atmospheres into another cylinder in which the air was at atmospheric pressure, we had opened it to the free air. In this case the resistance to the flow of the air would have been much less than before, the velocity imparted to the particles of air would have been somewhat greater than before, and the resulting cooling, due to the work of giving this velocity, slightly greater; but it would have been exceedingly slight as compared with the cooling which would have resulted had the gas expanded against a resistance. The present writer, under the latter conditions, found that, when the compression had been carried to 1⅓ times atmospheric pressure, the cooling on releasing the pressure was about 4° and not 38°, as would have been the case if the gas had expanded against a resistance.

The most important point dwelt on here is the fact that a mere crowding together of air particles does not develop heat. It is with some diffidence, and only after the most careful and long continued study of the problem, that I have brought my mind to accept this proposition. I most sincerely trust that physicists will consider this question and present their views upon it. It seems to me of the profoundest importance in many theories lying at the base of the science of meteorology, and an elucidation of this fact may lead to important discoveries in that science. I am well aware of the fact that the mind of the physicist recoils from the thought that there can be any expenditure of energy in compressing a gas without the latter becoming enormously heated; but there seems no way of avoiding the conclusion that sometimes the heat developed in the work of compression may be dissipated while the particles of gas themselves are crowded together.

H. A. HAZEN.

Feb. 22, 1892.

Montana Sapphires.

What with emeralds, hiddenite, and rutile from North Carolina; topaz, phenacite, and aquamarine from Colorado; garnets and peridots from Arizona; opals from Oregon and Idaho; thompsonites, chlorastrolites, and amethysts from the Lake Superior region; tourmalines from Maine; golden beryl from Connecticut; pearls from Wisconsin, Tennessee, and the Pacific coast; sphenes and diopsides from New York; turquoise from New Mexico; agate and onyx from the Rocky Mountain belt; rock crystal and smoky quartz from the Alleghanies and Arkansas; and sapphires from Montana, it seems as if the United States had become one of the principal gem-producing countries of the world. Unfortunately, for some reasons, the sapphires of Montana have slipped through the fingers of the people who should own them, and are now mined by an English syndicate, that has paid in $2,000,000, the best stones being sent to London, where high prices are demanded for them.

The diggings are known as the Spratt sapphire ground, and are about twelve miles north of Helena, on the Missouri River. A fact that is not generally known is that the soil is rich in gold as well as gems, and that two assays from the tailings have shown $58 and $71 to the ton respectively. There are three important bars—El Dorado, Ruby, and French—where the stones are found, and such is their abundance that 1,016 of them were "jigged out" of two wheelbarrow loads of gravel from El Dorado bar in a few minutes. The material of the bars appears to be glacial drift, varying in depth from 30 inches to 30 feet, but also includes rock that seems to have been broken down from a dyke a thousand feet high and nine miles up the river. Gold, silver, and galena are found in the neighborhood, and it is whispered that another deposit of sapphires was recently found, and that the land is being quietly bought up by American miners, but the country immediately about is a grazing land, encircled by mountains. Nodules of limonite—round, oval, lenticular, and reniform in shape, with mamillary markings—are of common occurrence in the bars.

The Kleinsmith collection of gold specimens found along the Missouri at this point, and on view at the national bank at Helena, numbers 500 gold crystals, for which $4,500 has been refused. The stones grade from almost water-white to sky-blue—none have been found of the deep blue color shown by Oriental sapphires—and incidentally exhibit green, lavender, pink, and gray. A few show dichroism, green and blue being discovered in alternation, and in a few cases blue and red. Stellation and chatoyancy are not uncommon, but perfect stars have not been discovered. One interesting stone cut with facets shows a series of concentric "phantoms" that are revealed in milky lines when the gem is held with the table before the eye. These stellations and phantoms occasionally make the interior of the stone appear turbid, but there are several gems of good size, three or four carats in weight, that are magnificent in brilliancy.—*Minerals.*

Pineapple Juice.

Some time ago the late Dr. V. Marcano, of Venezuela, noted that pineapple juice contained a proteid-digesting substance. No careful study of this fact was, however, made by him. Recently, Professor R. H. Chittenden, assisted by Messrs. E. P. Joslin and F. S. Meara, have investigated the matter fully, and announce facts which are likely to give to the succulent pineapple a prominent place in dietetics.

Pineapple juice is an acid fluid of specific gravity of 1·043. An ordinary pineapple yields 600 to 800 cubic centimeters of it. The proteid-digesting power is quite remarkable in its intensity. Three ounces of the juice will dissolve ten or fifteen grains of dried albumen in four hours. The action takes place in acid, neutral, or even alkaline media, thus resembling trypsin more than pepsin. It acts best in neutral solutions. The pineapple juice contains also a milk-curdling ferment. A well-known meat powder is said to be prepared with the help of pineapple juice.—*Med. Record.*

DISTANCE PHOTOGRAPHY.

In the annexed illustrations we represent a few photographs taken from "Prometheus," to show the wonderful results obtained by Dr. Adolf Miethe's new camera with a teleobjective.

The objective of this apparatus consists principally of a convex lens of considerable length of focus and a concave lens having short focus. The two lenses are placed a distance apart corresponding to the difference of the two focii. According to optical laws, this arrangement projects an inverted image of an object located a considerable distance from the convex lens. The size of the image varies according to the distance the lenses are held apart, and becomes larger on moving the lenses toward each other; the size of the image also depends on the relative proportions of the focii of the lenses; that is, the greater the difference between the focii, so much larger is the projected picture, the conditions being otherwise the same. For instance, if the relation of the focii is 25 to 1, the projected pictures are about twenty-five times as large as those projected by an ordinary lens, the distance of the object from the camera being the same in both cases.

In order to produce photographic pictures of a high quality by such a system of lenses, the lenses must necessarily have a special form and rendered achromatic by using crown and flint glass in the usual manner. The entire apparatus looks very much like a Galilean telescope.

By substituting an ordinary opera glass for the objective on the camera, and drawing the bellows out as far as possible, a fairly good picture of a distant object will be produced on the ground glass of the camera.

The pictures shown in the annexed engravings were taken by the same camera placed in Figs. 1 and 2, about two miles from the object, the city of Potsdam, near Berlin. For Fig. 1 an ordinary aplanatic objective of 5¾ inch focus was used, and for Fig. 2, Dr. Miethe's tele-objective above described and with the camera drawn out to 10 inches. The part inclosed by the rectangularly arranged black lines in Fig. 1 corresponds with the detail picture of Fig. 2.

For taking the picture shown in Figs. 3 and 4, the camera was placed about 400 yards from the object, a river with a bridge and brewery in the background. The picture shown in Fig. 3 was produced with an ordinary objective, and the part inclosed in the black lines forms the subject of the detail picture illustrated in Fig. 4, and was taken with the tele-objective.

By a careful comparison of the pictures of the two sets, it can be readily seen that the contours of the pictures remain the same, and hence the camera could not have been moved nearer to the objects for taking the pictures shown in Figs. 2 and 4. T. G. H.

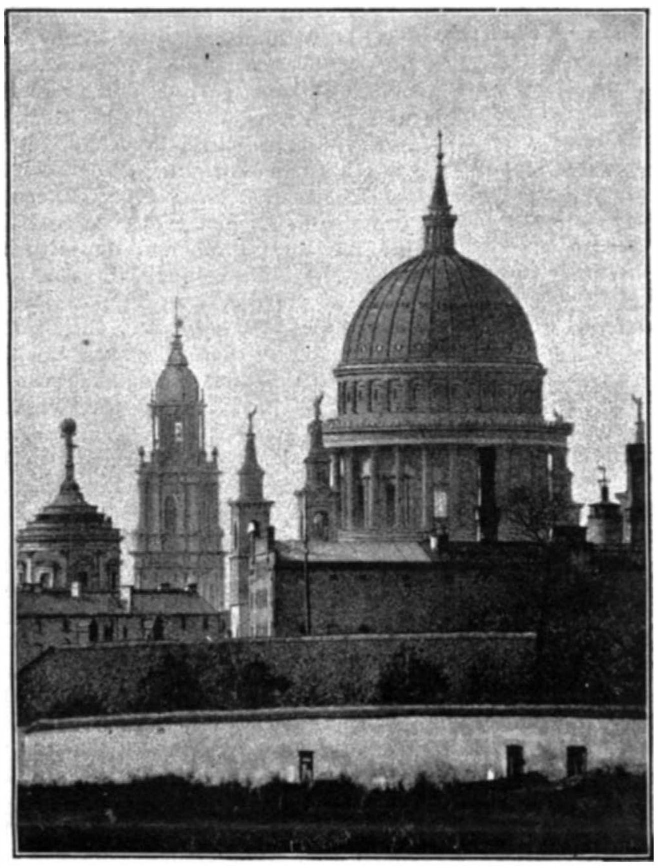


Fig. 2.—DETAIL VIEW OF THE PART INCLOSED IN BLACK LINES, Fig. 1.

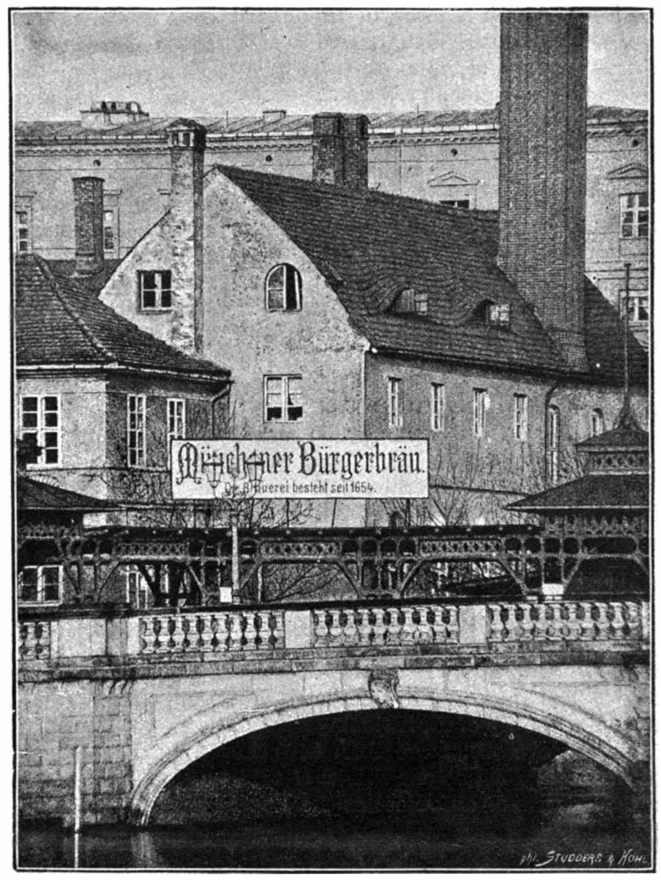


Fig. 4.—DETAIL VIEW OF THE PART INCLOSED IN BLACK LINES, Fig. 3.

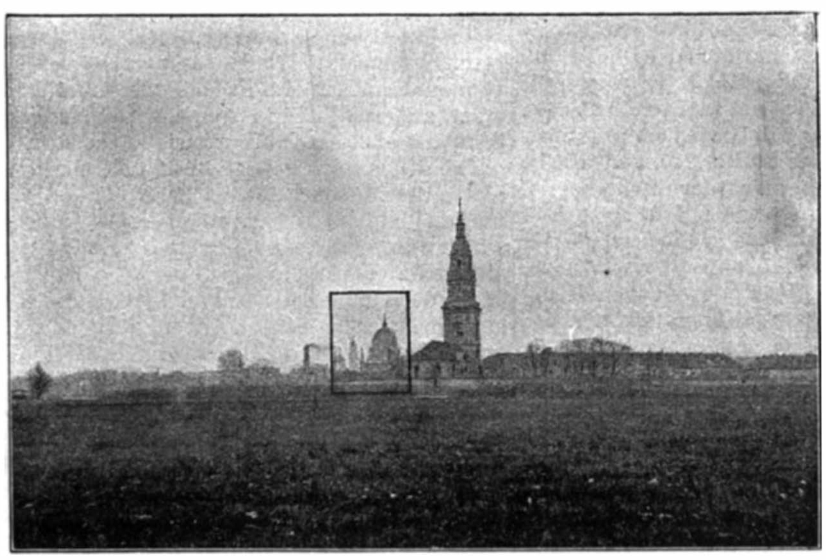


Fig. 1.—VIEW OF POTSDAM, NEAR BERLIN.

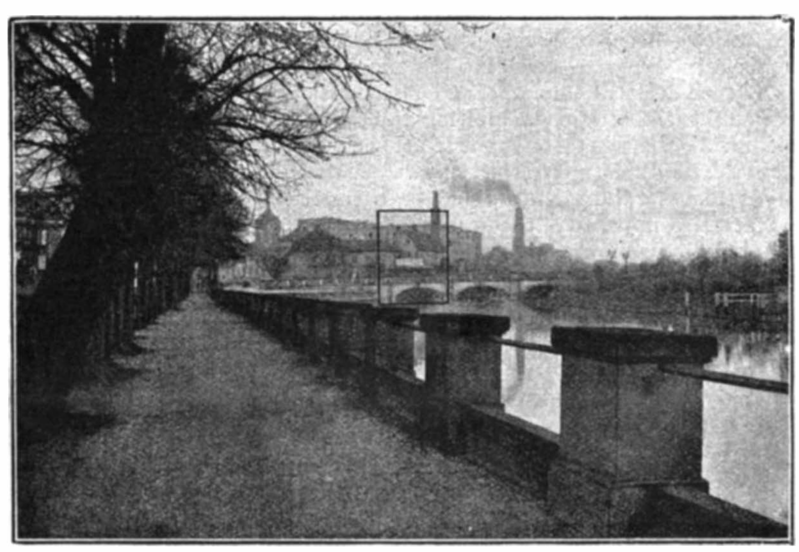


Fig. 3.—VIEW OF A RIVER WITH BRIDGE AND BREWERY IN THE BACKGROUND.

The Risks of Leather Workers.

There is a process of softening the leather used for saddlery which is very injurious to the health of the workmen engaged in the craft. M. Etienne Ferrand, of Lyons, has recently brought forward proposals for remedying this evil. After the leather has been tanned, but prior to its being rendered supple and before it is scraped and polished, grease has to be rubbed into the pores. The entire skin before it is cut is heated and thoroughly dried in a stove. The skin is then spread upon a table, and tallow at a temperature of about 250° C. is poured upon the leather. The workmen rub this melted tallow into the pores of the skin. But the tallow when heated to this extent gives off acrid vapors, which irritate the respiratory organs and occasion much suffering to the workmen. This is due to the presence of acroleine in the vapors, produced by the decomposition of the glycerine. The acroleine, when coming in contact with the air, forms acrylic, acetic, and formic acids, and is readily volatile at ordinary temperatures. A few drops of acroleine volatilized in a room will render the atmosphere almost insupportable. For this reason, workshops and factories where leather for saddlery is made are put by the French legislature in the second category of unwholesome industries. M. Ferrand proposes that, instead of rubbing superheated tallow into the skins by hand labor, the skins should be placed in stoves with tallow maintained just in a state of liquefaction—namely, from 100° to 120° C. No irritating vapors would then be produced. If it was found that the liquid tallow did not sufficiently permeate the skins, the rubbing by hand could be replaced by rollers or other methods of bringing to bear mechanical friction. M. Ferrand touches, however, upon the real difficulty when he suggests that tallow costs 80 c. the kilogramme and leather 3 fr. 50 c. the kilogramme. By the hand process the workmen are able to introduce so much tallow that the grease in the leather represents from 35 to 45 per cent of the total weight. For doing this the workmen receive a supplementary wage of 3 fr. per day, which, added to their ordinary wage of 5 fr. a day, makes a very considerable difference. Doubtless if some such method as that suggested by M. Ferrand were applied, good leather could be made without any inconvenience or risk to health. But the leather, though equally strong, would not be so heavy, and the workmen would lose their claim to a supplementary wage. Therefore both employers and workmen are opposed to the more wholesome process. M. Ferrand is more likely to be supported by the trade when he urges that in any case there should be, by the side of the workshop where the tallow is rubbed into the leather, a spare room, well warmed and ventilated, where the workmen could seek rest and fresh air between each operation. To this the workmen at least would not object, but the employers would probably complain of the extra expense involved. It seems deplorable that the health of the workmen should be gravely compromised for the sake of increasing the weight of leather by forcing into the pores more grease than is necessary.—*The Lancet.*

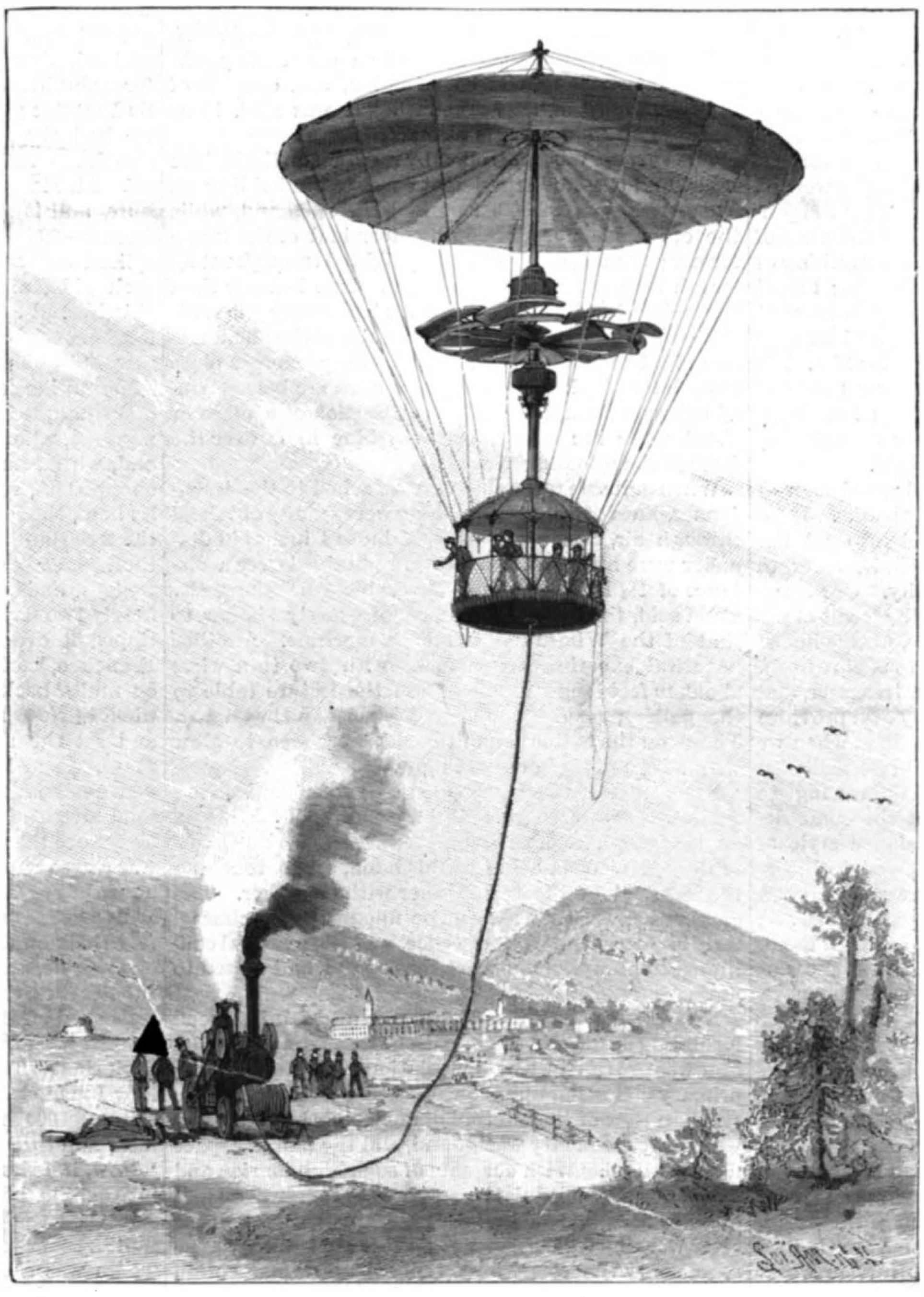
BLOOD travels from the heart through the arteries ordinarily at the rate of about twelve inches per second; its speed through the capillaries is at the rate of three one-hundredths of an inch per second.

APPARATUS FOR AERIAL ASCENSIONS.

BY J. HENRY SMITH.

The original drawing of this cut was made as long ago as 1849, when the writer was a pupil of and mechanical assistant and draughtsman to Professor Henry, at Princeton. Many experiments were made with aeroplanes and on the lifting power of screws of various forms revolving in a horizontal plane. After the great electrical discoveries of Faraday and Henry, came the dynamo electrical machines of Pixi and of Gramme, on which many dynamos and dynamotors have since been built up and patented and placed upon the market.

The steam engine and dynamo and a winding drum and boiler are mounted on a carriage, and a wire, wound on the drum, leads up to and holds captive dynamotors and screws free to revolve on the vertical shaft, or tube, which supports the car. The car and staff do not revolve and no torsion is put upon the wire. At the upper end of the staff is a parachute, of large diameter, which is provided for safety in case of the stoppage of the upward flow of the current from the dynamo on the carriage. The current passing from the motor by the upwardly extending wire is sufficient to turn the screws at a high speed. For military use the elevation at which the field glass could be used, with the aid of this apparatus, would permit the disposition of the camps and forces of an enemy to be seen at a great distance, while on the water an approaching ship could be sighted at a like distance. Meteorological observations could be taken in all the various strata of the air, from the earth to the highest altitudes.



APPARATUS FOR AERIAL ASCENSIONS, DESIGNED IN 1849.

Military Ballooning.

Lieutenant H. R. Jones, R.E., read a paper recently at the United Service Institution, dealing with the practical working of balloons in military operations. First noticing the question of gas, the lecturer pointed out that, in spite of its cost, hydrogen, from its great lifting power (*i. e.*, from 60 lb. to 68 lb. per 1,000 cubic feet), effects economy in transport, and is specially suited to the plan, first adopted by England, of carrying gas ready made in tubes of about 70 lb. weight, each containing 120 cubic feet of hydrogen. The advantages of the system are:

(1) Rapidity of filling, a balloon being prepared in from fifteen to twenty minutes, instead of four hours; (2) purity and greater power; (3) independence of a large water supply, otherwise necessary; (4) the power to immediately replenish a partly wasted balloon, according to requirement. The English military balloon contains 10,000 cubic feet, lifting 650 lb., including two very light men, 1,500 ft. of rope and the balloon, with the necessary fittings. After discussing the fittings in detail, the lecturer spoke of the mobility and use of balloons. In a light breeze, he said that a balloon can be towed so as to travel as fast as infantry, often even much faster. In England the laws of trespass, as well as telegraph wires and trees, present exceptional obstacles to balloons, yet during the last three summers good work has been done at Aldershot. Communication is kept up between the balloon and the ground by telephone on the Siemens-Halske system; plans and papers are sent down the line in a small bag. Observation from a balloon naturally suggests itself as a matter of course. It requires special practice, however. The country looks like a map, but hills are all flattened, and it is often wrongly assumed that movements seen from the balloon must be visible below and need not be reporced. Practice is required also to estimate the magnitude of bodies of troops. At Aldershot, after the first summer's work, the working of the balloon was reported as satisfactory, but the reports furnished by the balloon as unsatisfactory. Subsequently examples were given of the value of balloons; for instance, a cavalry force was enabled to avoid all outposts and get right into camp on one occasion, by balloon direction. Again in 1890, a balloon, from a mile and a half distance, made a sketch of an enemy's camp, showing all the dispositions of the troops and outposts, and even identifying regiments. During the last French maneuvers General Gallifet actually commanded from a balloon, sending orders by telephone. In the direction of artillery fire a balloon offers great advantages. The question of the liability of the balloon to destruction by artillery fire naturally arises. At Lydd a balloon was fired at by a 13-pounder gun, at 4,000 yards range. The balloon was raised and lowered by paying out or hauling in line. It was struck the seventeenth shot, and as it slowly descended struck again by a shrapnel. Nevertheless, it reached the ground so gently that no appreciable shock would have been felt. The damage consisted of two holes torn by shell fragments, and some bullet holes, two of which were through the car. The balloon could have been made fit for use again in about two hours. As to foreign powers, the French adopted the English tubes for carriage of hydrogen, fill in about the same time, and have used balloons in their maneuvers as well as in Tonkin on active service. Germany at present prepares gas, but the English method is under trial. Russia and Italy have both adopted balloon equipments.

Motive Power only a Small Item.

The popular notion that with cheap motive power—water power, for example—we might have cheap electrical lights and motors, was dispelled the other day, at Buffalo, by Mr. Charles L. Huntley, in his presidential address before the National Electric Light Association. In view of the approaching completion of the works at Niagara Falls for the utilization of that gigantic water power, some very great expectations have been indulged, in Niagara and Buffalo, respecting the electrical advantages which those cities would probably enjoy. With the great cataract close at hand to turn the dynamos, it was supposed the electric currents, for lights and motors, might be supplied to every shop and dwelling at a cost of but little above nothing. But Mr. Huntley, who is celebrated for having a very level head, sweeps away this pleasing illusion without the least compunction. He says:

"Whether we are engaged in the distribution of electric light by arc or incandescent lamps, or in generating current for stationary or railway motors, or for heating, we are essentially engaged in generating, distributing, and converting power into its various forms; hence, any method by which the initial power can be obtained in a manner or from a source of greater economy, deserves our most serious consideration.

"The question may, therefore, naturally be asked, What would be the effect of the utilization of Niagara or other large water powers, so far as concerning outlying cities? How far will it be possible to transmit this power, not theoretically, or in an experimental way, but commercially, so as to insure a fair dividend to the investor? At what point does it become cheaper to carry current than to carry coal? Now, these are large questions. They are, in fact, the largest problems in modern engineering. When you come to deal with such an immense and incalculable source of power as Niagara, our previous plans and methods and successes sink into nothing, as indicative of final results and realizations. Our attitude toward such a taming of nature is very much the same as that of the first electrical experimenters when they interrogated her with the help of pith balls and little chips of amber. Even the late demonstration at Frankfort teaches us little, for there we had the utilization of only such a water power as a well-to-do American citizen puts in his back yard for ornamental purposes; and the experiment was tried in summer time, when winds are light and skies are clear. Moreover, that plant was run as an exhibition, with the Emperor of Germany and other dignitaries lending a patriotic hand and subscribing patriotic dollars. Now, gentlemen, when you and I who operate stations come to use such water powers, or distant coal beds, we shall not be able to fall back on kindly emperors for timely donations. Some of our fellow citizens will be quite ready to help us, but with the instinct that is born in every American, they will want the dollar they pay out to bring another back with it.

"Our field of work, in short, with its newness and rawness, is one in which experience must always moderate enthusiasm. To me, perhaps, more than to many of my fellow members, this question of long distance power transmission is fraught with large possibilities and grave responsibilities. It is imperative that I should know the truth and the facts; and if ever the time comes when I can be humbly instrumental in giving Buffalo a sparkling midnight firmament created by yonder falls, I shall ask no grander task. I have ventured to make this momentous subject one of the leading topics here, and my call for information has been responded to by some of the most authoritative workers and thinkers in this direction. To them I shall leave the exposition of its details, with the conviction that you will forgive me if, under a sense of duty, I have indicated the practical limitations that must govern every man of affairs.

"In this connection I cannot help pointing out again that, after all, the cost of coal to operate an electric plant is only one among many items, and frequently a small percentage of the total cost at that. For instance, in electric railway work the cost of coal comes to about 10 per cent of the total operating expenses, while in electric lighting it probably does not exceed from 15 to 20 per cent. In these days, when municipal plants are the subject of frequent discussion, these facts are generally lost sight of, and the cost of electric lights is calculated by reference to the amount of coal burned under the boiler, thus ignoring the fact that firemen, engineers, linemen, trimmers, etc., are required; that carbons require daily renewal and globes break; that, like all other machinery, engines, boilers, dynamos, and lamps are subject to depreciation, require repairs, that the building must be insured, and that a sinking fund must be established for renewals.

"Cheap power in itself would, therefore, influence the cost of electric lighting very little, even if the electric current is distributed in the immediate vicinity where it is generated; while its distribution to any considerable distance in large power units on a commercial basis seems to be awaiting its demonstration here rather than in Europe. Hence I would recommend a study of the facts pointed out, which ought to make any community falter before investing in a municipal plant simply because it may happen to have what is supposed to be a cheap source of power around the corner."

WHEN a belt gets saturated with waste oil, an application of ground chalk will soon absorb the oil and make the belt workable.

Tesla at the Royal Institution.

So great was the interest and enthusiasm with which Mr. Tesla's first lecture and experiments were received at the Royal Institution that he complied with the urgent request to repeat the same, and at the close of the second meeting Lord Rayleigh arose and spoke as follows: Sir Frederick Bramwell, ladies and gentlemen—Although it is not our custom here to follow the lecture with remarks from anyone else, I think you will agree with me that this is no ordinary occasion. At the request of the managers of the institution, and for the delectation of its members, Mr. Tesla consented to repeat the labors of last night, labors which, though small to him, would have completely exhausted any one else.

I wish our great electrician, whose name appeared before us in letters of fire, in one of Mr. Tesla's experiments, were here to propose this motion. There is only one respect in which I have any qualification to speak, and that is that I have made attempts myself to experiment with currents of a high degree of frequency. I was tolerably satisfied when I had a discharge rate of 2,000 per second, but we have had to-night ten or twenty thousand per second. My apparatus was on a very small scale indeed. Mr. Tesla has taken us into some of the dark—metaphorically dark—places in nature. These fields have been but little trodden. Mr. Crookes and Mr. Tesla alone have had the *entree*. In what has been put before us to-night, there has been matter which will afford food for intellectual contemplation for a long time to come. I think, at the same time, it will be obvious to you that Mr. Tesla has not worked blindly or at random, but has been guided by the proper use of a scientific imagination. Without the use of such a guide, we can scarcely hope to do anything of real service. I do not think there is anything I need add; it does not require any great capacity to see that Mr. Tesla has the genius of a discoverer, and we may look forward to a long career of discovery for him. His labors will be followed with admiration by all men of science of England, and especially by those in this institution to whom he has done the favor of lecturing to-night. I thank Mr. Tesla for his lecture.

Sir Frederick Bramwell: Ladies and gentlemen—I believe it is usual to second the vote of thanks. I, for one, should be very glad for Lord Rayleigh to put the motion to you. It is the duty of myself, however, to second this vote, which I do most heartily. Our treasurer is not here to-night; he foresees, as the result of the lecture, that the whole of our apparatus, in this line of study, is antiquated, and we shall have to begin afresh. This has evidently been too much for our treasurer, and he has consequently stayed away. In my own province of mechanical engineering, there was a time when we were content to have boilers which would be ridiculed now; and turning from mechanical engineering to electrical science, we have seen to-night the same development from the slow-going, old-fashioned style of phenomena, as that which I have referred to in the case of the steam boiler. I can only regret that Mr. Tesla has kept within the limits of time, and has had to refrain from giving us that which we so much liked. I wish he could give us another evening, and show us more of the experiments. I put the vote to the meeting.

Mr. Tesla: It would be difficult for me to find words to express the thoughts I feel; I have been so kindly received and generously treated. Whatever I have shown you here is not my own; it is the outcome of the work of English scientific men, whose names we delight to hear, and whom every one loves and admires. To-night my aspirations are fulfilled in having my labors appreciated by some of the foremost men in the world, and I cannot tell you how highly I esteem your thanks, and how much it will encourage me to further work. There is one thing I desire to tell you—I am not a speaker, nor did I prepare to speak at all, and these two considerations should disqualify me at once—but this I want to say:

We have worked before with the problems that are at hand until they have been perfected. The water wheel, the gas engine, the steam engine, thanks to the great spirits which your country has produced, are brought to a high state of efficiency. In these departures we have come, so to speak, to the limit. We have now a possibility opened to us of accomplishing things we never dreamed of before, and in this lies the whole aspiration of scientific investigators. These contrivances are but in an imperfect state; they have consumed many years of my incessant thought; some other experimenter will start where I have stopped, and so the world goes on; but the same advantage which another will have from my work, I have already had myself from those who have gone before. The foremost scientific men of this country agree that there is a way of producing the electric light by fluorescence as the result of oscillations of a certain frequency. I will not dare to speak of what they have achieved in this direction, for if I do my discourse would be the praise of their work; it is, therefore, out of place. You will believe that these words are sincere, even if they are not put forth in the expressions of a good orator. We have a start. We can set up in a room the oscillations, and the only difficulty with which we are confronted is the perfecting of the apparatus. Thus we can have a light which will not need any leading wires, which will be a good luminant, and will never be destroyed—it will last for any length of time. This will be a great advancement over present methods. These difficulties are nothing compared to the problems English scientific men have opened up before. For instance, in the production of power. We are able to produce power at any point in the universe, and when this great work is finished, what an effect it will have upon the whole human race! I wish to say that the results I have shown you to-night are the outcome of the work of others, and I do not want to impress you as though I was displaying any discovery of my own. If any one can reap the benefit of it, my desire is fulfilled. I am only paying a duty which any lover of science must pay to those who have been before in the field. Others have arrived at results. We are younger, and we go on from them, climbing the stairs; or, rather, we younger ones are taking the "lift"—we are using the "elevator." The older ones were content with the stairs. I thank you most heartily, and express the hope that I may be able to bring before you some better work than I have shown you to-night.

For the purpose of the experiments, says the *Practical Engineer*, Mr. Tesla employed an alternating current dynamo of special construction, and capable of producing alternations amounting, it was said, to as many as 20,000 in a single second.

The current was controlled by a switch on the lecture table, and the first experiment consisted in holding an exhausted glass tube, 3 feet long, in one hand, while the other was placed upon the terminal of the transformer; the tube then appeared lighted throughout its length with a brilliant blue light. The lecturer then showed a glass bulb lighted in a similar way when attached to one wire only, and also showed the phenomenon of a Crookes' shadow. On attaching a copper plate to each terminal of the transformer, an arc being formed between them, and upon the insertion of a plate of ebonite, the arc gave place to a blue light over the faces of the opposing plate.

When suitable terminals were attached to the transformer, lines of light 7 inches long were readily obtained through air, and when balls of brass 4 inches in diameter were attached, sparks were obtained over a distance of 1¼ inches. Under favorable conditions, Mr. Tesla said, this discharge appeared exactly similar to that of the Wimshurst influence machine. Another beautiful experiment was made with two thin wires about 10 feet long stretched from the lecture table to the gallery, at a distance of about 9 inches apart. These, on the extinction of the gas, were seen to glow with a blue phosphorescent light.

Some Geissler tubes, provided by Professor Crookes, were then exhibited; one of these contained yttria and another sulphate of calcium. Attaching a wire to one of these, Mr. Tesla held it in his hand, while touching the terminal of the transformer with the other. The glass vessel was then seen to be filled with the characteristic colored phosphorescence, and the material continued to phosphoresce after the current had ceased to flow.

Referring to the difficulties found in obtaining good insulating media, Mr. Tesla said the transformer used by him was provided with oil insulation, the exterior of the primary coil being about one-quarter inch less in diameter than that of the internal diameter of the tube upon which the secondary was wound, and the annular space filled with oil. With currents of such high tension and frequency, solid insulation, according to Mr. Tesla, is quite useless, and is absolutely certain to break down after working for a short time, a fact he adduced as the reason why the costly induction coils now made often become useless after a short period. His transformer had, he said, sometimes broken down twelve times a day, yet, owing to the fluid insulation, it was never permanently injured. For the production of the effects shown with yttria and sulphate of calcium tubes, alternations amounting to the almost inconceivable number of 100,000 per second are, according to Mr. Tesla, essential. One of the most remarkable effects observed in connection with these currents of high frequency is, that no matter how great their intensity, they have no effect on the animal system, and thus appear to be perfectly safe. As an illustration of this, he took an iron bar in one hand and a vacuum tube in the other. On making his body a portion of the circuit by placing the point of the bar upon a terminal, emitting sparks several inches long, the vacuum tube glowed brilliantly, while the lecturer remained wholly unaffected.

The most striking experiment, however, was one designed to show the possibility of illuminating a room by making the space itself electric. Above the head of the lecturer was hung a plate of zinc about 8 feet long by 1 foot wide, a similar plate being hung upon the wall at a distance of about 10 feet, and parallel to the first. Between these two plates an intense electrical field was then produced, and exhausted glass tubes placed anywhere in the field at once glowed with phosphorescent light. The lecturer took in his hand a glass wand, 3 feet long, and, with no special connection of any sort to his body or to the glass, when waved in the magnet field it shone like a flaming sword. If such an electric field were produced in a room, it is manifest that it could be illuminated by merely hanging suitable glass globes without connection of any kind.

We have not been able to more than faintly describe a portion of Mr. Tesla's experiments, but it will be evident that the phenomena disclosed were of no ordinary kind. On the possibilities of their immediate application it would be almost rash to speculate, and we shall look forward with excited curiosity to the further experiments and lectures which we understand Mr. Tesla has promised to give on the subject.

Felling a Washington Gigantea.

FOR THE SCIENTIFIC AMERICAN.

About 1856 I had some business with William W. Hanford, who owned a saw mill a few miles from the famous Mammoth Grove. in California. I rode from his mill, some ten or twelve miles, to see the monsters.

Mr. Hanford was the gentleman who had the big tree, as it is called, cut down, and related to me his experience as follows. Said he: "I thought there would be a speculation in stripping the bark from the ground up about twenty feet, taking it off in sections, and shipping it to New York, and then setting it up for exhibition, the bark being about two feet thick. So I set five good men at the work, and in a few days we had the bark off, ready to ship. Then an idea struck me to fell the monster before taking the bark off. I had measured with a long tape line around the butt, and it was a few inches over 96 feet in circumference—33 feet across. I then had some pump augers spliced out, and set four men to boring through from each side; and I put long handles into mortising chisels, and set the fifth man to cutting off the wood left between the auger holes, so, after some weeks, we saw light clear through the center of it, which was sound to the core. I left a portion on each side, north and south, to be cut off with chopping axes. I selected my men, who chopped right and left hand foremost, and, with four light chopping axes, we soon had it chopped off, so that it settled down about an inch on its base, the top being light, and little or no wind, and the tree standing so erect that it did not fall over. I then made hard wood beetles and got some iron wedges and very large wooden wedges, and, after nearly two days of hard work of five good men, we tipped it over. I then sent my 20 feet of bark to San Francisco, loaded them on a steamer, and packed them on mules' backs across the Isthmus, and finally got them to New York, hired a large hall on Broadway, and set them up. Men would come in and pay their 25 cents, and look at it and say: 'Mister, where did you get that?' I would tell them the truth. Then some of them would say: 'Oh, my! you can't make us believe that that ever come off a tree; there never was a tree on earth the size of that.' I was determined not to be beat. So I sent back, had my men dovetail four or five long crosscut saws together, and saw about one foot thick off the butt of the tree, showing the borings on one side, and hewed off so as to leave a piece with the heart of the tree in the center and 12 inches wide, smoothed off the sawed side with a carpenter's plane, packed it and took it to New York, and fitted it into my bark shell. Then I said: 'Now, look at that, and see how I made it.' By that time I was out of pocket between $3,000 and $4,000, so I sold out to some Englishmen, and they took it to London. Said Mr. Hanford: "Now, if I should find a mermaid with 3 tails, I would not exhibit her in New York." They hewed off and smoothed the upper portion of this fallen tree, and built a roof over it, and used it for a bowling alley. There was a staircase of 23 steps up the side of this tree, near the large end, which reached a little above the center; then notches were cut in for the feet to walk up to the top. To look off the butt down was like looking off the stern of the Great Eastern. There were about 70 of these monsters in the grove of about 70 acres, variously named the Twin Sisters, Father and Son, Mother of the Forest, Father of the Forest, etc., etc. The Prostrate was the largest in circumference, and hollow for 72 feet.

In Trenton, N. J., some twenty years ago, I was in a lumber office, and some lumbermen sat there on a work bench, telling of some of the big trees they had seen up the river. I heard a number tell their yarns, and said: "Boys, you don't call them big trees, do you? Why, I saw an old hollow tree in California that a man could ride 70 feet through on horseback, and ride out through a knot hole."

One of them got down and took off his old slouched hat, and said: "Say, mister, that ain't the best of a hat, but it is all I've got, and you are welcome to it." The gentleman in the office said that, after I went out, one of the men said: "That was an almighty good liar."

I had actually told the truth, but could not blame the man for calling me a liar. J. E. EMERSON.

THE mean annual temperature of the globe is 50° Fahrenheit.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — James L. Carr, Henryville, Ind. This device has a coupling pin or bar pivoted on a cross bolt or shaft, the pin being formed with two arms, a link-securing arm and a gravity arm. The bearings of the pin or bar give the coupling great strength. An entering link lifts and passes under the pin, which falls by gravity to secure the link, the latter then being held by the gravity arm in horizontal position to properly enter a meeting drawhead. The uncoupling is readily effected by means of a shaft extending to the side of the car.

SPARK DEFLECTOR FOR FREIGHT CARS.—Louis C. Terry, Columbus, Miss. Cars loaded with cotton, hay, and similar articles, especially liable to take fire, are ordinarily protected by having wooden strips or battens nailed behind their doors, such precaution being insisted upon by the insurance companies. This invention provides a device for the purpose which may be readily opened or closed, and which will be automatically held in either of the two positions in which it may be placed. It consists of a narrow oblong door carried on a rock shaft, and adapted to cover the opening between the sliding door and the side of the car. The door may be folded back in a recess entirely out of the way.

RAILWAY TICKET. — Richard McCoy, Creston, Iowa. This invention provides a novel ruled and numbered ticket, for use instead of what are known as mileage books, from which portions are cut or torn off by the conductor corresponding with the draughts made upon the ticket during successive trips, till the whole ticket has been used up. By this improvement the counting or work of the conductor is greatly facilitated in determining the tearing of the ticket at the proper place. The ticket may be of any desired length to take in any maximum number of miles.

Electrical.

ELECTROPLATING VESSELS' HULLS. — Alexander D. Buchanan, Long Island City, N. Y. This invention covers a process and apparatus for making a metallic deposition upon the entire hull of a vessel, as a protection thereto. The process consists in docking the vessel, incasing its hull in a flexible envelope which is filled with a metallic solution, after which electric connections are made between the solution and the hull of the vessel. The envelope is preferably made of canvas with a wire warp, and outer and inner insulating coating, and is made of a size to inclose large vessels, or be raised up around smaller ones, so as to leave only a small space between the envelope and the hull.

Mechanical Appliances.

WHEEL WRENCH AND BOLT CLIPPER. —Marshall Martin, Walla Walla, Washington. This machine is adapted to carry a vehicle wheel for rapidly securing the bolts to the wheel tires and fellies and also to clip the bolts. It consists of a bench or frame on which is held to slide a wheel-carrying saddle, there being a swinging wheel wrench pivoted in the front end of the bench, and a bolt clipper arranged between the wheel wrench and the saddle. The wheel wrench is substantially like that forming the subject of a former patent granted to the same inventor. The bolts are all turned home first, and are all cut off afterward, the bench bolts for holding the wheel permitting its easy revolution in order to bring the necessary parts into the correct position for work.

WRENCH.—William H. Haire, Morristown, Tenn. This is a simple, durable and inexpensive tool, consisting essentially of two pieces. A sleeve is held to slide on the shank, its upper end having a horizontal lip constituting the inner or movable jaw of the wrench, while in the bore of the sleeve is a tooth adapted to engage the toothed surface of the shank which constitutes the handle. In a recess in the back of the sleeve is a recess in which is a spring connected with a bolt or block, at all times held in engagement with the shank. The adjustment of the jaws is quickly made by pressing the extension of the sleeve to an engagement with the shank, and the operator may, with the same hand with which the wrench is grasped, run the sleeve upward or downward on the shank to adjust the inner jaw to an engagement with nuts, bolts, etc.

PLUMBERS' TACK.—William H. Evory, Brooklyn, N. Y. This device consists of a two part clamp, the parts shaped to fit a pipe and having a spring connection with each other, the parts having base wings adapted to be secured to a support. The improvement affords a simple and efficient tack, quickly and easily secured to a pipe, which may thereby be conveniently secured to an adjacent wall, and will hold the pipe securely in place.

NUT LOCK. — Charles O. Vinyard, Navajo Springs, Arizona Ter. This nut lock is designed to lock a series of adjacent bolts in place, preventing the nuts from loosening after being screwed up. It consists of a locking plate provided with openings engaging the nuts to be locked, a nut screwing on one of the bolts having an integral spring arm adapted to engage one of a series of rigid teeth or projections formed on the locking plate. The several parts can be readily unfastened when desired by the bending of the spring. arm. The invention is an improvement on a former patented invention of the same inventor.

Agricultural.

CULTIVATOR. — Leonard J. M. Nehf and George W. Mitchell, Sutton, Neb. This invention relates more particularly to an improved adjusting device whereby the shovels can be adjusted to suit the growth and condition of the plants to be cultivated. The main beam is slotted at its rear end, and a semicircular frame having a series of perforations is arranged in the slot; the forward cross beam has a series of horizontal perforations, the rear slotted cross beams having vertical perforations, and the central beam having a reduced forward end, and in connection therewith are provided locking and pivotal bolts, the construction being very simple and inexpensive, and very convenient in operation.

COTTON HARVESTER.—William Hodge, Memphis, Tenn. This is a machine to be drawn over the field, when the plants are guided into a receiving box where picker disks are revolved to pick the cotton from the pod, leaving the plant standing as the machine moves forward. The cotton is carried inward and taken by brush disks from the picker disks, being deposited upon conveyer belts, and taken by elevator belts, twigs, stems, etc., being removed by a stripping brush. A brush roll removes the cotton from the elevator belt into a chute, which conducts it to a sack held on the platform.

ELEVATOR FOR SELF BINDERS. — John J. Jones, Pittsfield, Ill. This invention provides an improved form of elevator belt, at intervals along the length of which transverse tubular longitudinally slotted slats hold folded portions of the belt, rods holding such portions of the belt within the slats, while the tubular slats near each end of the belt have slotted edges with oppositely projecting ears, there being adjusting straps along the under surface of the belt, and rivets passed through the ears, the belt, and the straps. The slats are thus attached to the endless apron in such a way as to prevent the grain from catching between the apron and the slats.

WEED TURNER. — John J. Miller, Bartow, Fla. This is a device adapted for attachment to plow beams, and capable of being conveniently and expeditiously adjusted to or from the mould board of the plow to regulate the amount of sod to be turned under, the construction being such that the device will yield and automatically return to its normal position when engaging with and passing a stump or other fixed obstruction. A narrow edge of the blade only is presented to the front of the beam and to obstructions, thus insuring a minimum of pressure thereon.

PLOW. — William H. Myers, Oregon, Wis. This improvement relates especially to the construction of plow shares, providing a means whereby the mould board is fitted with a removable and adjustable plate constituting the lower cutting edge, and whereby also the point may be removed and sharpened or adjusted as it becomes worn, there being a removable share upon the forward edge of the mould board. The invention likewise provides for the simple, durable, and inexpensive construction of the mould board, its attachments, and the point and landside.

Miscellaneous.

MECHANICAL CALCULATOR.—Theodore Mader, Corpus Christi, Texas. This is an improvement in calculators having a fixed right angular arm inscribed with a scale, a movable arm pivoted to one end of the fixed arm, and a third scale-bearing arm or bar arranged at a right angle to and sliding on one limb of the fixed arm, the calculations being made by adjusting the pivoted and the sliding arm. According to this invention the sliding bar is held at an angle of about sixty degrees instead of ninety degrees, there being also various other differences of construction and arrangement, and a difference in the scales, whereby the instrument is adapted for the use of surveyors and civil engineers, being designed to solve geometric problems as well as all proportions relating to ordinary business, etc.

COPY HOLDER.—Hans A. Isberg, Long Island City, N. Y. The frame of this copy holder has a guideway in one edge, and a rope is mounted on three pulleys to travel in the guideway, while the line or indicating bar is attached to a slide which is in turn secured to the rope. The improved device is designed for the use of typewriters, typewriter operators, typesetters, etc., the construction being simple and durable, and the indicating or line bar may be moved any desired distance or equidistant spaces as desired.

CASH CARRIER APPARATUS.—Joseph Starr, New London, Conn. This invention relates to an improvement in the propelling mechanism whereby cash or parcel carriers are taken to any desired point along their track, means being also provided whereby any slack that may occur in the track may be conveniently and expeditiously taken up. An exceedingly simple carrier and latch is adapted to operate upon the car, while an adjustable trip mechanism uniformly and positively releases the car at the proper time, the factors in the propelling mechanism being so arranged that the moment the trip mechanism acts to release the car the latter will have adequate movement imparted to it.

LEDGER, SALES, AND BILLING BOOK. —James E. Depue, Oakland, Cal. This improvement is designed to do away with a multiplicity of books, and lessen the labor of the bookkeeper, one book being made to combine within itself three books. The leaves each have a column or series of ruled ledger blanks or spaces on its inner end, and corresponding perforated separable and ruled account blanks on its outer end, while a series of copying leaves or sheets are bound up in successive order with the leaves. Each of the separated accounts or bills bears its own special number, copied upon the copying sheet when the copy is made, and the bill is ready to detach and present at any moment as may be desired.

STRINGED MUSICAL INSTRUMENT. — Henry Dahlman, Cambridge, Minn. This invention provides improvements in stringed instruments, such as guitars, mandolins, banjos, etc., to enable the performer to enrich the accompaniment by playing on additional bass strings. An additional set of strings is made extend over the sounding board, from an auxiliary head on and facing at an angle to the main or ordinary head, to extension rests or pins on the sounding board. A rod connects the auxiliary head with the body of the instrument, and the auxiliary strings extend in an arc along the rod.

KEY BOARD ATTACHMENT. — Maximilian Brownold, New York City. A locking device for each key is provided by this invention, a mechanism for simultaneously locking the corresponding keys of the several octaves, and a pedal action for simultaneously unlocking all the locking devices for the keys. The improvement relates to pianos, organs, etc., the attachment permitting of playing on the keys called for by the key in which the music is written while the remaining keys are locked and rendered mute. The instrument may also be used in the usual manner without restriction as to the use of any of the keys.

MUSIC LEAF TURNER. — Martin A. McMartin, Raton, New Mexico. This device consists of a vertically adjustable case adapted to be secured to a support by a clamping device, a revoluble shaft pivoted in the case being provided with operating means, while swinging arms have their inner ends geared to the shaft, and spring leaf holders are adjustably secured in the outer ends of the arms. The device may be quickly and easily fastened to a piano, organ, music rack, or any convenient support, and is adapted to quickly and accurately turn the leaves of sheet music in either direction.

STAMP SAFE. — Harry A. Stevenson, Sag Harbor, N. Y. This device consists of a small case, to be conveniently carried in the pocket, for carrying stamps in roll form upon a roller, a stamp-protecting ribbon or band being reeled in connection with the stamps upon the roller, while there is a spring take up roller for the ribbon arranged in front of the feed roller, and a spring pressure roller over the take up roller, a pawl or stop mechanism controlling the movement of the rollers, and the whole forming an automatic feeder of the stamps.

GUMMING MACHINE. — Hugh Mooney, Jersey City, N. J. The gum fount of this machine is suspended beneath a slotted feed table, and revoluble gum wheels are adapted to deliver gum from the fount through slots in the table, a feeding mechanism carrying the material over the gum wheels, while movable carrying tapes are arranged in the rear of the gum wheels. The machine is of simple construction, and especially adapted for gumming labels or other articles in which the gum is applied in regular lines, and it is so designed that it may be easily adjusted and will work rapidly.

CONVERTIBLE BATH AND WASHTUB. —Nellie F. Hurdel, New York City. The main tub has grooved strips secured to its ends, sliding upon vertical posts, the tub having also a central transverse groove, fitted by a removable adjustable partition, with gear mechanism for quickly adjusting the tub for use as a bath tub, and as quickly changing it to form two washtubs. Means are also provided for adjusting it vertically to suit the height of a person washing.

INHALER AND RESPIRATOR.—John A. Perou, Perris, Cal. This is an improvement in devices worn to prevent direct breathing through the mouth, the appliance having exterior guards to prevent its accidentally entering the mouth or throat of the wearer. It consists of an elongated thin plate having its edges shaped to conform with the channel between the lips and gums and teeth of the wearer, and provided with two pairs of guard limbs that project outwardly and are then bent oppositely in pairs to lie upon the exterior of the lips when in service.

TREE PROTECTOR. — Thomas W. Evans, Lecompton, Kansas. This improved protector for trees and shrubbery consists of a sheet metal body having overlapping edges with registering holes entered by a spring latch, there being lugs on the body near one edge adapted to overlap the adjacent edge, and a series of teeth on the top edge of the body. The cylindrical body thus formed has perforations which admit air freely.

POLICE NIPPERS.—Samuel A. French, New York City. This device has two separable handle sections provided on their inner adjacent faces with an undercut or dovetail interlocking rib and groove extending longitudinally of the shank portions of the handle and tapering toward their inner ends. A chain connects the two sections, and the device is designed to be quickly placed upon the wrist and securely locked.

AUTOMATIC BRAKE. — Giles Bowler, Layton, Utah Ter. According to this improvement springs normally maintain the brake shoes of the beam in engagement with the wheels of the vehicle, cross levers pivoted to the brake beam being connected by a chain to a sliding draught tree, and thence with the draught bar. When the vehicle is drawn forward the brakes are disengaged and remain so until the vehicle is stopped. An operating means is also provided to act somewhat as an equalizer, and when desired the brake may be held permanently out of engagement with the wheels.

PROTECTOR FOR HORSES' HOOFS. — Theodore P. Skellenger, Morristown, N. J. This is an improved packing slipper comprising a foot plate adapted to carry a pad, a skeleton wing to one side of the plate conforming in contour to one outer side contour of a hoof, while a second similar wing has a hinged connection with the opposite side of the plate, there being an adjustable connection between the two wings. The device is designed to prevent snow from balling under the foot, and affords facility for applying a salve or ointment when it is desired to treat the bottom of the foot.

HEARSE ATTACHMENT. — Thomas J. Weir, Cincinnati, Ohio. This invention provides means for the automatic coiling of the truck strap for a hearse, so that the strap will be held under tension wherever the truck may be located in the hearse. The improvement is especially designed for application to hearses having a longitudinally movable truck on which the foot portion of the casket is placed when deposited in the vehicle, a strap connected to the truck and extending to the rear end of the hearse furnishing means to control the truck.

STONING KNIFE.—Frank H. Disbrow, Glendora, Cal. This is a flat reversible knife having its opposite ends sharpened and provided with rounding notches, the knife being held in a holder secured in a box to be attached to any suitable support. The knife is not held in the hand, leaving both hands of the operator free, and the knife is of a form especially designed to facilitate the stoning of fruit, etc.

GAME APPARATUS. — Myra E. Favor, Brooklyn, N. Y. In this apparatus a canvas body is supported upon posts in an inclined position, the canvas having openings and pockets toward which balls are thrown, the different pockets representing different numbers and values in a game. The game is very simple, and may be played indoors or upon a lawn.

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

NEW BOOKS AND PUBLICATIONS.

ACADEMIC ALGEBRA FOR THE USE OF COMMON AND HIGH SCHOOLS AND ACADEMIES, WITH NUMEROUS EXAMPLES. By Edward A. Bowser, LL.D. 12mo. Pp. 252. Half leather. Boston: D. C. Heath & Co. Price $1.25.

Dr. Bowser is well known as a writer of a valuable series of mathematical text books which are largely used in the best institutions of learning. The chief merit of the present work lies in the remarkably clear manner in which the principles are explained and illustrated. The examples and problems are numerous and well selected and provided with answers. The whole work is inviting to the student, and the aim of it seems to be to render the study of algebra attractive without any loss of scientific method. Complicated examples are excluded because they consume both time and energy which may be spent more profitably on other branches of mathematics.

A HISTORY OF THE PEOPLE OF THE UNITED STATES, FROM THE REVOLUTION TO THE CIVIL WAR. By John Bach McMaster. New York: D. Appleton & Co. 1892. Pp. xvii, 584. Volume III. Price $2.50.

The completion of the third volume of Professor McMaster's important history of the American people is a subject of congratulation. The period its five hundred pages cover extends from the Louisiana purchase at the beginning of the present century down to the first days of the war of 1812 and the surrender of Hull at Detroit. The story of Burr's treason, of the early history of the steamboat, including the achievements of Fulton, Livingston, and Stevens, the first railroad, and many other of the triumphs and trials of early industries are here chronicled. It is out of place for us to indulge in encomiums on a work which has already won for itself a place as an American classic. The period covered by the third volume is full of events of the deepest interest, and is at once interesting and curious reading, in view of the political changes that have ensued since 1812. The author has very positive views of his own and does not hesitate to show them, which gives an aspect of life and interest to the book. His account of the long embargo that preceded the war of 1812 is specially interesting.

Business and Personal.

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4086) B. C. J. asks: 1. Would you kindly answer in your paper the following question: Do you know of any practical dry storage battery, for closed circuit work? A. We know of no practical dry storage battery. 2. Can a storage battery be charged by an alternating current? A. No.

(4087) R. H. T. writes: 1. I have built a motor similar to that described in SUPPLEMENT, No. 641. Forged iron magnet with 5 lb. No. 18 wire on it, armature 14 coils No. 20 wire, 4 layers, 8 convolutions. Would I burn out No. 12 plug if I were to attach it to our circuit of 110 volts, Edison system, or would I in any way destroy motor? A. The motor referred to is not suited to the Edison circuit. If placed in the circuit without using rheostat, the fuse would melt. The resistance of the machine should be increased many times to adapt it to the Edison circuit. 2. Can I charge storage battery from our system above mentioned, 110 volts? How many cells, and what size would I have to use, in order to obtain a proper supply for motor? A. You can charge a storage battery with the Edison current, but resistance will be required to prevent an excess of current from passing through the cells. About two cells will be required for the motor. 3. What is the voltage of motor? A. 6 to 10. 4. Suppose one foot of No. 18 copper wire will carry 44 amperes, will 10 feet carry 440? A. No. 5. I am a subscriber to both SCIENTIFIC AMERICAN and SUPPLEMENT. What is my best way to get them bound? Would I have to pay a duty on the price of the bound book if I sent them to you? A. We think you could make arrangements with the customs officers so that you would be obliged to pay duty only on the binding. Possibly you can find a book bindery in your vicinity.

(4088) D. B. T. says: Pressure, volume and temperature are the three elements entering into all heat motors. I should be pleased to have a few questions answered concerning these elements and their variations and the natural laws governing them. Suppose we have a quantity of air in a cylinder whose piston moves air tight, and without friction. Say one cubic foot at a temperature of 490° F., and a pressure of 120 lb. per square inch above the atmosphere. If we allow this air to expand (performing work) four volumes, that is to 4 cubic feet, what will be its pressure and temperature? Next, suppose we now force the piston back to its original position, what will be the temperature, and pressure? Supposing in each case there be no loss of heat by absorption or radiation. Can any one of the elements, volume, pressure, and temperature, be varied while the other two remain constant? A. In the movement of the piston as described, the temperature, volume, and pressure are all changed in terms of the absolute temperature and absolute pressure. No one can be changed without a corresponding change in both the other elements, although not always in the same direction; decreasing the volume increases the pressure and temperature and the reverse. With a volume fixed by the piston, change of temperature changes the pressure only, while with a free piston the volume is also changed. The details of these changes are complex, and require more study than comes within the scope of Notes and Queries. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 279, for a valuable table of the conditions of pressure, temperature and volume of compressed air for each pound of pressure up to 100 pounds. Also No. 799 for a valuable illustrated lecture on compressed air and its properties; 10 cents each mailed.

(4089) E. A. K. writes: 1. I have ten 6 by 8 glass jars and ten 3 by 8 porous cups. Now, can you tell me how I can make ten batteries or cells, using the above and sheet zinc and electric light carbons for elements? I want to construct them so as to get the most possible current. A. Paraffine the ends (only) of the carbon rods by heating them and rubbing on paraffine, allowing it to soak in. Arrange two or three rows of the rods in a mould, and cast lead around the paraffined ends. Connect the wire with the lead by means of a screw or solder. Probably you will find it both cheaper and better to use carbon plates. The sheet zinc should be from ⅛ to ¼ inch thick, and well amalgamated. 2. How many hours would such a battery run? A. With constant use it would probably run four days with fair usage. 3. How much current does the sewing machine motor require which is described in "Experimental Science"? A. 10 or 12 amperes. 4. Would the above batteries run it? A. Yes; connected 2 series of 5 each in parallel.

(4090) W. F. W. writes: 1. I notice that Remsen's late Chemistry and other recent works of that kind give the following reaction when hydrogen is evolved: $Zn + H_2SO_4 = ZnSO_4 + 2H$. And in all other equations showing two atoms of free hydrogen, they appear as 2H instead of H_2 as the earlier chemistries give. Prof. Remsen does not believe the hydrogen atom and molecule to be identical, for he gives the hydrogen molecule as H_2 in another place. Unless the first is an allotropic modification, I cannot see why it should be given 2H. Please explain. A. In writing formulas as a rule no attempt is made to indicate molecules of elements. Thus in the formulas you quote 2H is no more incorrect than Zn. The hydrogen molecule must be at least H_2, possibly much more, and the zinc molecule must be Zn_2 and possibly much more. 2. Is the space above the mercury in a thermometer a vacuum? If not, does it contain air or mercury vapor? A. It contains a trace of vapor of mercury.

(4091) T. S. asks for a simple way of giving small articles of lead a coating with copper; the covering required to be only of the thickness of tissue paper. A. You will require a battery of one or two cells with a sulphate of copper bath.

(4092) W. M. B. says: Please inform me as to the cause of black specks appearing on silver prints. The bath which I use is very clear and the paper of good quality. Please state cause and how it may be overcome. A. The specks are caused by the bath being too acid. Neutralize the acid with a small amount of ammonia. Consult a professional photographer in your vicinity.

(4093) J. M. McI. asks: What progress is being made in the Nova Scotia ship railway? Also are they still at work on the tunnel they were cutting under the Hudson? Also give a constant clastic force of 8,000 lb. pressing on a radius of 7 in. What horse power will it produce? These are the figures approximately. I especially want to get the most convenient formula where just these data are known? A. Work on the Chignecto ship railway has been suspended, wanting funds. Ditto work on the Hudson River tunnel. Both expected to resume soon. A constant pressure, as stated, has no significance in horse power without motion. If the circumference of your radius moves under the constant stated pressure at 200 feet per minute, you will have $\frac{8,000 \text{ lb.} \times 200}{33,000} = 48{\cdot}4$ actual horse power.

(4094) T. M. says: In blowing out a boiler, does the water pass through the blow-off pipe with more or less force than there is in the boilers? With a 2 in. blow-off pipe 18 in. down from bottom of boiler, then connect with 2 in. feed pipe 10 ft. from check valve, 5 ft. from blow-off valve, 6 in. from blow-off turn, with elbow 2 ft. to sewer, what is the force or pressure at elbow, and at the sewer, 40 to 50 lb. pressure on boilers? A. The only additional pressure at the end of the blow-off pipe is due to the hydrostatic head of water or 0·43 of a pound for every foot height between the water level in the boiler and the end of the blow-off pipe. This is more than counteracted by the friction of the water in the pipe while blowing off, the open end and freedom of exit making the pressure in the pipe much less than the boiler pressure.

(4095) C. L. asks: Is there any solution placed upon the inside of a mould in which plaster of Paris may be cast to prevent it from adhering to the mould when cast? A. Use olive oil or soapsuds.

(4096) D. B. T. writes: You have, no doubt, noticed watches oscillating while hanging on the file at jewelers'. Why do these watches oscillate? They seem to be an anomaly. Motion is usually communicated from a stationary base, but these watches seem to have their base of motion within themselves. Please explain their *modus operandi*. A. The slight change in the center of gravity, due to the motion of the escapement, tends to set the watch in vibration. One movement of the escapement does not produce any visible effect. The action is cumulative, like that of destroying a bridge by the march of soldiers. The first impulse produces little effect. The effect of the second is added to the first, that of the third to the second, and so on until the maximum is reached. It is essential that the watch be very delicately suspended.

(4097) T. H. asks: 1. Where Zwicker's "Engineer's Companion" is published. It treats of setting of valves of engines, etc. A. We can supply Zwicker's "Instructor for Machinists, Firemen, and Steam Engineers." Price $1, by mail. 2. Which is the proper way to set a globe valve, and reason for so doing? My method is having the pressure against the seat, but have been told different. A. Always set a globe or angle valve to shut against the source of the steam. This always allows of packing the spindle when steam is on. 3. Is there any good book published on setting the valves of the Corliss engine? If so, where, and what price? A. We can supply "The Corliss Engine," by Henthorn and Thurber. Price, $1 by mail. Also Halsey's "Slide Valve Gears," price $1.50. 4. What is the cause of having a T. H. alternator spark? It seems as though fire was coming out of the armature (inside), and has a strong smell of burned rubber. Would the dampness of the room after being mopped cause it? A. You have a short circuit, we presume, somewhere. Investigation only could show where. The dampness of the room has nothing to do with it. You should have it attended to at once, as you are spoiling the insulation evidently.

(4098) W. E. T. asks: 1. What effect would dipping or saturating oak posts in lime water or a strong brine have on them in the way of preserving them from rotting after being put in the ground? A. The cheapest process for preserving posts, and probably the best, is to soak the ends in a nearly saturated solution of sulphate of iron (1¼ lb. of the crystal sulphate to 1 gallon of water) for 24 hours. 2. Which would be the best, lime water or brine? A. The most convenient arrangement for this work is to use a tight hogshead with one head out, set it on end and pour the solution in about 6 inches deep; then fill the hogshead with the posts. Repeat the operation each day, until the required number of posts are treated. The setting can commence at once. Oak timber treated in this manner is known to have lasted 30 years in damp mines, where 2 years is its life without treatment. 3. What strength of each solution, and how long should the posts stand in the solution to insure the best results? A. If the posts are pointed, the solution should be made deeper than 6 inches, so that when the hogshead is filled with posts the solution will rise to 2 feet in depth. 4. Do you know of a cheap way to preserve oak posts from rotting? I have charred them and dipped in coal tar, but it is too expensive.

(4099) E. F. H. asks: Is a vacuum power? What is its chief advantage when used in connection with the steam engine? A. A vacuum is power when applied against atmospheric pressure. It adds about 13 lb. per square inch to the work of the piston, and in proportion to the mean engine pressure on the steam side is the measure of economy.

(4100) E. W. asks: 1. How long will a Bunsen cell, 1 pint, last, run steady on a motor for 13 hours at a time for 6 days out of every week? A. If the motor has a high resistance, the cell might operate for a week with the renewal of the electropoin fluid at the end of the third day. If the resistance is small, the cell might fail in ten hours, or it might run forty hours, all depending on the amount of current used. 2. Will a 1-16 h. p. motor run a canoe? A. It might at a very slow speed. You cannot expect much from a motor of less than ⅛ to ¼ h. p. 3. What is the voltage of a 1 pint Bunsen? A. Two volts. 4. I have an Edison lamp, 4 candle power. How many ½ pint Bunsen cells will be required to run it? A. Three to four.

(4101) T. B. P., Jr., asks: 1. I have just made a spark coil. My method was as follows: The inside of a bamboo rod, 7-16 inch in diameter, I filled with No. 16 soft iron wire. The rod is 8½ inches long. On this I wound five layers of double covered No. 16 copper wire. The terminals of the wire I connected with binding screws on the end pieces. On putting the coil in circuit with a ratchet burner and four cells of Leclanche, it was found that there was scarcely spark enough to light the gas; so the spark coil was removed, and in its place an iron bolt, 5½ inches long, wound with 16 layers of same wire, was substituted. This arrangement produced a spark fully twice the size of the other. What is the matter with the first spark coil? I had always understood that a core of iron wires was preferable to a simple bolt. A. In the first instance your wire was too far from the iron core. 2. Would it be possible to converse by means of two telephone receivers if the binding posts were connected each to each, or would it be necessary to introduce a cell or more of battery? Please let me know if communication between two rooms in the same house could be had in that way. Also if the steam pipes would answer as one conductor? A. The receivers can be used in the manner proposed. The sound will be weaker than when a transmitter is used. 3. How many cells of open circuit battery are required to successfully operate an automatic gas lighting burner? A. Four or six.

(4102) J. G. K. asks: 1. The height of a column of water to equal one pound pressure per square inch at sea level. A. 2·3093 feet. 2. The height of a column of mercury to equal one pound pressure per square inch at sea level? A. 2·0408 inches. 3. The mean pressure of the atmosphere at sea level, and the height of column of water it will support. I find different authorities do not agree on this subject, and would like to get, in your opinion, the nearest correct. A. The pressure of the atmosphere when the barometer is at 30 in. is 14·7 lb. per square inch. The height of a column of water at 14·7 lb. pressure and 30 in. of the barometer is 33·947 ft. 4. What would be the cubical volume of a tetrahedron or four-sided body with all sides equilateral triangles, whose edges are 2 in. long, and the formula for working it arithmetically? A. For the volume of a tetrahedron multiply the linear edge of one side by 0·11785 for the volume or contents. The formula is a mathematical one. You will find a table of all the conditions for computing the elements of polygons in Haswell's "Pocket Book," $4 mailed.

(4103) D. L. asks: What materials give best results for insulating heat and cold in refrigerators. Which is preferable—charcoal or mineral wool? I am about to make a refrigerator, and I have very little experience along this line. I will also be very much obliged for any suggestion in regard to construction to attain the best result? A. In large refrigerators and cold storage rooms, the best practice is to line the space with paraffined building paper and fill in with dry sawdust. For house refrigerators pulverized and mineral wool are both used. The mineral wool if properly packed is the best non-conductor, but charcoal makes the sweetest refrigerator, as it absorbs any odors from dampness that may accidentally get into the insulating space. In large refrigerating rooms the insulating space should be 6 in. thick. In household refrigerators 2½ to 3¼ in. space, according to size. The method of construction you will readily understand by examining the refrigerators in use.

(4104) J. P. asks: 1. I have a C. & C. one-eighth horse power electric motor to be run in connection with a plunge battery. The carbons and zinc were allowed to remain in the solution for some length of time, and have become covered with a thick coating, so that they are in one solid mass. How can I get the carbons and zinc clean again? A. Soak them in hot water for a few hours. 2. If I run the motor by a pulley from a water motor, how many lamps of 16 candle power would the motor light? A. The voltage of motor would probably be too low for anything but small lamps. 3. Could I connect the electric motor with the wires of Edison's system of incandescent lighting for houses, so as to run a lathe or sewing machine, and if so would I have to reduce the power in any way, and how? A. No. The motor must be differently wound for the Edison circuit.

(4105) J. H. G. asks for the cheapest and best method to extract the metal from the scum and skimmings from spelter, used to galvanize steel wire; it looks like dark yellowish ashes and is very heavy. A. It will not pay. The substance is principally oxide of zinc. Distillation with charcoal in a retort is the method of reduction.

(4106) N. B. R. writes: 1. I am building the dynamo described in SUPPLEMENT, No. 161. I have No. 16 B and S gauge single-wound cotton-covered copper wire for the field magnets. Is the insulation complete enough, or would it be better to paint each layer of wire with shellac before winding the next layer? A. The insulation will be sufficient if thin paper is placed between the layers. 2. Would No. 16 wire be as good as No. 14 for connecting the commutator springs with the binding posts? A. Yes.

(4107) R. L. W. asks for a good ink eraser. A. Try a saturated solution of oxalic acid in water. The red inks are made of various bases; for the color, as Brazil wood, cochineal, and aniline red. The aniline red may be removed by alcohol acidulated with nitric acid. Javelle water is good for many colored inks. —From the "Scientific American Cyclopedia of Receipts."

(4108) C. E. A. asks: Can you give me any plan for the cheap production of cyanide of ammonium? Have tried the passing of the ammonia gas over heated charcoal, which does not seem to give the desired result. A. Heat sal ammoniac (ammonium chloride) and dry potassium ferrocyanide together in a loosely closed flask or retort. The ammonium cyanide volatilizes and condenses in crystals. The work is very dangerous on account of the poisonous nature of the compounds.

(4109) A. W. B. asks: Is it practicable to have a dynamo (one to furnish eight 16 candle power incandescent lights) run by a windmill? If so, how large would the windmill have to be, and what size dynamo would be necessary? As the wind might not furnish power enough at all times, how many storage cells would be necessary to store enough electricity to run the lights four hours, etc.? A. It requires a full horse power to run the dynamo. You would need from 8 to 12 storage cells.

(4110) C. A. G. writes: 1. Take an electric current: A man could readily see that the deflections of a galvanometer were not in proportion to the current. So who made it, and how was the discovery made that the currents were proportional to the tangents? A. In the tangent galvanometer the needle is so far removed from the coil that the lines of force passing through it are virtually parallel. The earth's directive action on the needle varies with the sine of the angle it makes with the magnetic meridian, the action of the lines of force due to the current is proportional to the cosine of the angle. The intensity of the current producing a given deflection under both forces varies with the sine divided by the cosine or with the tangent of the angle. 2. Taking the law that the current is equal in all parts of the circuit (which I suppose means that it is equal in voltage and amperage), how can there be any difference of potential in any part of the circuit? A. Voltage is not an attribute but a cause of current; therefore your supposition is wrong. As it is the cause of current, any two points on a circuit in action include between them a fall of potential, as the cause of or force producing the current in such part. 3. Given a current: Now, on one galvanometer say it registers 5°, on another 8°, must there not be a standard method of conveying the current around the needle so as to make the deflections equal for equal currents, on different galvanometers? A. There is nothing absolute about a galvanometer, except those of special construction. Generally they have to be calibrated before their readings can be interpreted directly. Galvanometers can be and frequently are (as in ammeters and voltmeters) constructed for uniform readings for given currents. 4. About how many heat units are there in a cubic centimeter of zinc? A. In conversion into oxide it will liberate 12·1 kilogramme calories. 5. I have made the motor described in SUPPLEMENT, No. 783, and it works to perfection, going so fast it hums. Now, as I understand it, the centers of greatest attraction on the field magnets are right next to the coils; therefore, the armature revolves, being attracted on one side and repelled on the other. Am I right? A. Yes. 6. On the motor referred to, one side of the armature is positively and the other side negatively magnetized, is it not? A. Yes.

(4111) W. H. W. asks: 1. Will you please inform me through your paper what is the difference between nitrate of silver and oxide of silver, and how each are formed and what are their characteristics? A. Silver nitrate is a compound of the nitric acid radical and silver, and is made by treating silver with nitric acid. It is a white solid, fusible and known often as lunar caustic. Silver monoxide is a brown powder formed by precipitating the above in solution with caustic alkali. 2. What is the substance called salicylic acid and how formed, and in what way is salacine connected with it? A. It is ortho-oxybenzoic acid, $C_6H_4(OH)CO_2H$. It is made by heating sodium phenate in a stream of carbon dioxide. It occurs free in the flowers of *Spiræa ulmaria*, and as a methyl ether in oil of wintergreen. Salicin is a glucoside, $C_{13}H_{18}O_7$, not directly related to salicylic acid. It is contained in the leaves and young bark of the willow, poplar, and other trees. Your other questions we cannot undertake to answer.

(4112) A. C. writes: 1. Last year bought Hopkins' "Experimental Science." Constructed motor as therein described, page 497, etc., using cast iron magnet; did not double number of coils and convolutions; used field magnet just as it came to me from foundry. Should four volts make such motor move sufficiently to test accuracy of winding and connections? A. The voltage should be sufficient to overcome the resistance of the machine. The amperage must be great enough to produce the power. With an E. M. F. of 4 volts and 4 or 5 amperes the motor should work very well. 2. With what degree of accuracy should halves of magnet be fitted together, and if inaccurately fitted, can failure to respond to four volts be attributed to that cause? A. The joints of the magnet should be as perfect as possible. Your trouble was probably due to insufficient current. 3. What is the difference if, in winding armature, the terminal end of each of the twelve coils comes from the inside (or under) of core in place of from outside, as in illustration, page 500? A. No difference.

(4113) T. D. W., Jr., asks: 1. What kind of battery is required to run the electric tray illuminator as described in the SCIENTIFIC AMERICAN, vol. lxv., No. 21, page 329? I wish to construct one of one or two candle power incandescent lamps. What kind of battery and how much would it cost to run the same for a year? I would not use it every day, but only once every now and then. Sometimes it is a month before I will take a picture. A. Use 4 or 6 cells of Leclanche battery or 3 or 4 cells of Fuller. The cost is very small when the battery is used only occasionally. It would not cost more than 50 cents per year after the batteries are provided. 2. Is the flash made by the flash light (described on the same page as above) instantaneous or does it require a time exposure? Is the lens left uncapped and the flash made, or is the flash made and the exposure made a time one? Also what number of Seed's or Cramer's plates should be used? A. The flash is instantaneous. Use the quickest plates. The lens may be left uncovered. 3. Will beeswax do as well for lining a tray for silvering paper as paraffin? A. Yes.

(4114) J. B. M. asks: 1. I have some statuary made of composition (sample inclosed) having a similar appearance to Rogers groups in finish. The outer coating or finish is wearing off, giving them a soiled, spotted appearance. What can I use to restore this brownish, or drab finish? It is a dead color, not a gloss. A. Give it a coat of paint made of white lead, raw umber, a very little oil and turpentine. Tube colors such as are used by artists can be used after thinning with turpentine. 2. What will restore the gloss to frame work of a type writer that has become dull? A. A thin coat of hard drying japan varnish. A fine quality of furniture varnish with refined lamp black added is sometimes used.

(4115) J. A. P. writes: 1. I have a boat 12 feet long. What size motor would it require to run it 5 or 6 miles per hour? Would two simple motors like those described in Hopkins' "Experimental Science" answer? A. You will hardly get more than three miles an hour with the simple motor. 2. How many cells storage battery would it require? A. 12 cells. 3. How many square feet of positive plate would it require to each cell? A. 2 or 3 square feet. 4. How can I anneal cast iron? A. Imbed in blacksmith's cinder and oxide of iron and heat in closed iron boxes to redness for several days. 5. How much current does a storage battery receive in circuit with a 16 candle power 110 volt lamp? A. Half an ampere.

J. N. L. says: Kindly give me a receipt for an ink eraser in liquid form.—C. R. D. says: Will you please give me a good receipt for making soldering fluid to be used in jewelry?—F. C. A. says: Tell me of a cheap substance that can be melted and run into moulds and become hard like rubber when cold.—A. F. J. says: Will you please let me know how to dissolve amber in some quick drying solvent, so as to dry about as quick as shellac in alcohol?—G. B. B. asks for a copying paper.—J. H. says: I noticed the article on cement for metals made of zinc oxide and zinc chloride. Won't you kindly let me know how it is prepared?—W. W. G. says: Please inform me what is generally used in making plaster of Paris moulds, and how to mix it.—C. A. B. asks: Can you inform an old reader of what that compound is, and the manner of making it, that rubber hand stamp manufacturers use to take their impressions of the type in?—W. B. R. asks: Can you tell us in your paper the kind of rubber cement that is used on the back of felt letters by which they are stuck to cloth, simply by running a hot iron over them? What is the cement made of and how is it applied to the felt?—W. M. says: I should like to know of some washing preparation.—C. J. M. says: Please answer through your Notes and Query column how to make colored crayon for the purpose of rough sketching on paper.—A. D. says: If it is not outside your province, will you kindly give me the recipe for making koumiss out of cow's milk?—P. C. asks for a reliable washing compound.—G. W. S. asks for a formula for a benzine-resisting preparation to apply to corks.—F. C. & Co. ask for a burnishing ink for the use of shoemakers.—A. B. C. says: 1. Please inform me how carbon paper such as used with the typewriter in making transcripts is made. 2. How can typewriter ribbons be renewed or re-inked?

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 1, 1892.

AND EACH BEARING THAT DATE.

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

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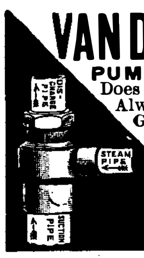

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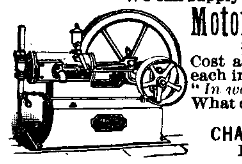

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