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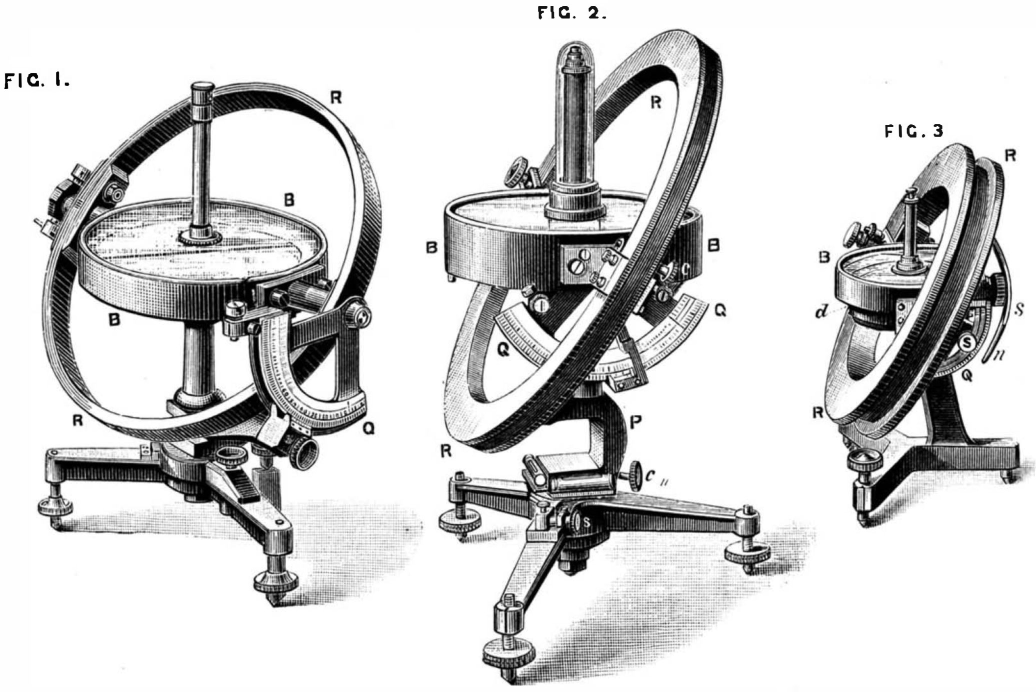
EDISON DYNAMO ELECTRIC LIGHT MACHINE.

Now that central stations for the lighting of districts are about to be erected in several parts of London, the subject of generators capable of giving powerful currents acquires a new interest, and at the same time the problem of driving them presses for solution. Hitherto a large installation has been little more than an assemblage within one building of several small ones driven from one or two counter-shafts, and thus it has come that such plants have presented an appearance of complication, and have further, from the creaking and rustling of the belts, given the idea that an immense amount of wear and tear was going on. It is quite certain that before large areas, employing many thousands of lights, can be supplied from one source, great alterations both in the sizes of the generators themselves, and in the means of transmission, will have to be made before practical success is attained.

The earliest and most enthusiastic advocate of district lighting was Mr. Edison, and although his anticipations have not been realized with the rapidity he predicted, yet his system is spreading rapidly in the States, where the company engaged in carrying it out has obtained greater experience of town lighting than any firm in this country. Consequently their operations acquire additional interest to English electricians, who, according to *Engineering*, are about to engage in enterprises of a magnitude far beyond their previous experiences; and in view of this we illustrate on this page the latest type of the Edison dynamo machine, as it appears when designed for feeding 1,200 incandescent lamps from a central station.

The generator is driven directly from the engine without the use of belts or gearing, and consequently revolves at a moderate speed, about 350 revolutions per minute, while there is no fear of a stoppage from the failure of the intermediate parts. The engine is of the Porter-Allen type, and indicates about 200 horse power; it is fitted with a Porter governor and an automatic expansion gear, and drives on to a crank pin fitted between two balance disks. The dynamo follows the ordinary horizontal Edison type, the armature being formed of copper bars upon a core built up of alternate disks of sheet iron and paper, and the field magnets, of which there are twelve, being placed in a shunt circuit. A small fan delivers a constant stream of air on the center of the armature, where it divides and flows to each end, carrying away the heat generated by the current. Five brushes, each in a separate holder, press upon each side of the commutator, and deliver the current into the two mains, shown at the right of the figure, from whence it is distributed through the network of conductors laid all over the district. The point of contact between the brushes and the commutators can be varied, as the whole system is carried on a pivot coaxial with the armature. Mr. Edison's system provides for the connection of several such machines with one set of mains, and for their regulation according to the demands made upon them.



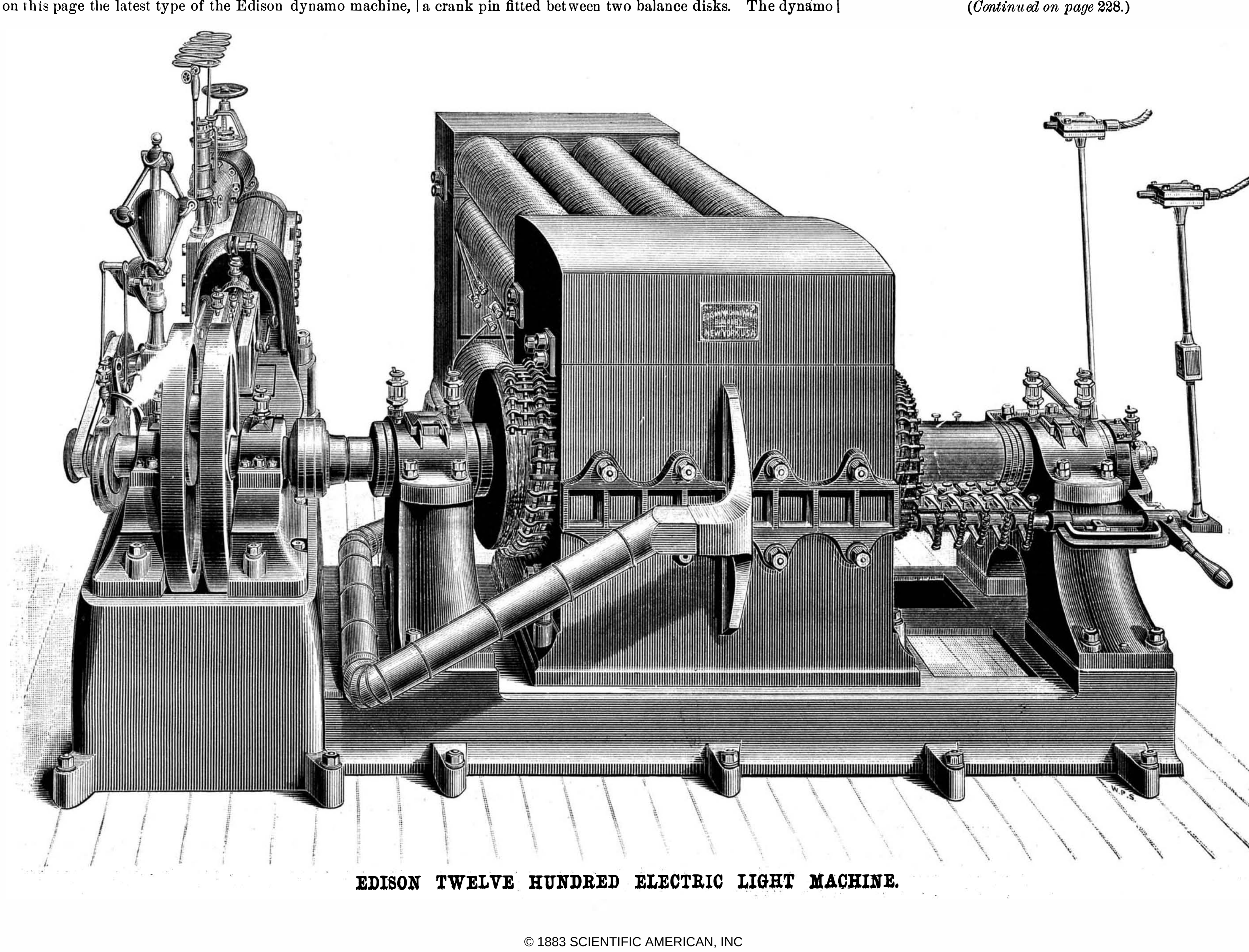
THE OBACH GALVANOMETERS.

OBACH'S GALVANOMETERS.

These instruments are made by Messrs. Siemens Brothers and Co. in three different types. Two of them are suitable for measuring both current strength and electromotive force, whereas the other is for current strength alone.

The principle upon which they are all based is as follows: If the coil of a tangent galvanometer is made movable around a horizontal axis, a given current produces different deflections according to the inclinations given to the coil. If the angles of the

(*Continued on page* 228.)



EDISON TWELVE HUNDRED ELECTRIC LIGHT MACHINE.

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NEW YORK, SATURDAY, OCTOBER 13, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 406,

For the Week ending October 13, 1883.

Price 10 cents. For sale by all newsdealers.

NATURAL HISTORY IN PUBLIC SCHOOLS.

About three years ago the authorities of the Museum of Natural History in Central Park, this city, addressed a letter to the Board of Education, suggesting that a few of their teachers be allowed to attend lectures to be delivered by Professor Albert S. Bickmore upon the objects on exhibition. The lectures proved so beneficial that the Board requested that at least one teacher from each of the 104 schools be permitted to attend, in order that they might give the most complete information to their pupils upon human and comparative anatomy and zoology, and other subjects upon which oral instruction would be given in the schools.

Professor Bickmore, in a paper read before the National Educational Association, describes his methods of imparting instruction by ocular demonstration, "believing that the sense of sight is the royal avenue to the mind." A large part of the objects which it was desired to display were either too small or too large to be taken to the lecture hall, and at the same time too important to be omitted. To overcome this difficulty the most complete stereopticon to be found was purchased; and as it was discovered that photographic transparencies of the desired subjects could not be obtained in anything like a systematic series, an assistant skilled in this branch of photography made negatives and slides from the specimens on exhibition in the public halls, supplemented by copies of the best illustrations in standard works on natural history. There have been made some 800 negatives, in addition to a large number purchased from every available source. The book and map publishers of New York and London lent their assistance by striking off uncolored impressions of their wood cuts and engravings for the use of the photographer. After the negatives have been provided, the slides can be supplied at a little more than half the usual price for such transparencies. Such slides, although giving more satisfactory results when used in connection with the lime light, will be distinctly visible by from 50 to 75 persons when a lamp burning kerosene oil is used.

As this mode of exhibition necessitated a darkened room, a second lantern was introduced by which any portion of the blackboard could be illuminated, thus keeping the classification of the specimens constantly before the audience as each appeared upon the screen.

In an adjoining place in the hall was fitted up a series of shelves, like a case in the public hall, on which were arranged the specimens to be described. Diaphragms pierced with holes of differing sizes admitted light upon any or all of the specimens, and in this way the audience was, as it were, instantly transferred to the exhibition halls, while the attention of all was kept upon the subject under consideration.

This method of teaching is applicable to any science which can be made more instructive and interesting by the aid of pictures, diagrams, or ideal sketches.

THE MAKING OF STEEL PENS.

The steel pen is a modern invention, not fifty years having elapsed since it was introduced, and like many other innovations it met with much opposition and had a number of rivals. Of these the quill pen was the most formidable, and to this day the quills of geese are used by some old stagers. Pens of silver and of gold, the latter especially, have been great favorites with those who admire much flexibility in a pen, and the handy self-feeders, as the stylographic, have plenty of users. But, after all, the steel pen is the most generally used, and unlike most inventions, the method of its manufacture has not been essentially changed or improved.

The steel from which pens are made is the finest crucible cast steel rolled into sheets $\frac{7}{1000}$ of an inch thick. From this the blanks are cut by means of a punch and die in presses worked by hand or foot, the operators being girls. The side slits in the pen, the central oval or semicircular hole, the corrugations or embossings, the curved or semicircular form to the originally flat blank, and the stamp of the pen or the maker, are all formed and produced by similar means—the screw hand press or the lever foot press—by the use of punches and dies, each pen being handled separately.

These corrugations and slits and central cuts are not merely fanciful ornaments, but are intended to adapt the pen to the user. Some want a resisting pen, very stiff and allowing considerable pressure without opening the nibs wide enough to make a heavy mark; others a yielding pen that requires but a touch to open the nibs. Then there are many degrees of these qualities required, as well as differences in sizes; so that a single establishment makes no less than forty-six styles of steel pens.

Of course, cast steel of such extreme tenuity becomes hardened by these successive pressings and punchings, and must be annealed. This is done by placing the blanks, or unfinished pens, in a cast iron box, which is then covered by a larger box leaving a space all around of half an inch, or more, which is filled with ashes or fine charcoal. The whole is then subjected to a glowing red heat for about two hours, and allowed to cool. When annealed, these blanks may be rolled up by the fingers just like so many bits of tea lead, which they much resemble in softness.

In heating for hardening the same method is used—packing in double boxes six or eight inches square—and when the pens are red hot, they are poured into a tank of animal oil. When taken out from this bath they must be handled carefully, as they are not only stiff and brittle, but crumbly; they can be squeezed to minute fragments between thumb and finger. They are then placed within a cone-shaped sheet iron receptacle open at the large end and mounted on a spindle, and are rotated over a glowing fire until they turn to a full or "low" blue. They are then chilled in oil, and when cool are rattled in saw dust until they are quite clean and bright. The next process is the grinding of the nibs on minute wheels of fine emery and of corundum, and lastly comes the essential process that completes the pen and makes it a pen—the slitting of the nibs. This is done by a pair of shears acting the same as the presses and punches. This splits the steel from point to central hole without removing a particle of material. The pens are then lacquered, straw or brown, blued or blacked, or left bright, as the style demands, and packed for the market.

The American Institute Fair.

The fifty-second annual fair of the American Institute was formally opened in this city on the 3d inst. This society has for its object the promotion of arts, sciences, and manufactures, and during its existence of more than a half a century has contributed not a little toward the advancement of the country. It has grown so as to be a national, not a sectional exhibition. Within its walls may be found each year many results of the most recent progress. Exhibitions of this nature afford a kind of instruction which is not only invaluable, but which cannot be obtained by other means.

The machinery department contains many of the newest and most interesting novelties displayed in operation, and time can be well spent in their examination; various types of the steam engine are represented. Manufactured articles of every description, both useful and ornamental, are found grouped in appropriate classes.

There is a fine display of electrical appliances, ranging from the cell of the latest pattern to the dynamo. The industries in which electricity plays a prominent part are illustrated in a very interesting manner.

Destruction of the Great Exhibition Building at Pittsburg.

At 2 o'clock on the morning of the 3d inst., the exhibition buildings at Pittsburg, Pa., caught fire and were totally destroyed, together with their contents. The exhibition was opened on September 6, and there was displayed an endless variety of articles illustrating almost every branch of art, science, and mechanical skill. The fire started in Machinery Hall, but spread so rapidly that Floral Hall and the main building were a mass of flame before any of the exhibits could be removed. The buildings were valued at $150,000 and their contents at $800,000, but since it is impossible to duplicate many of the articles, their worth cannot be estimated. The origin of the fire is unknown. Had the fire occurred during the evening of the previous day, the loss of life would have been appalling, as on that day the admissions amounted to over 25,000.

Methods of Testing Boilers.

It is alleged that the shock of forcing water into a boiler by means of a pump is equal in its effects to a succession of blows which may injure the shell. As every strain put upon the boiler decreases the final strain necessary to produce rupture, it is reasonable to presume that such a method of testing may so injure the parts that they will finally give way under a pressure much less than that at which the boiler was tested. A plan which obviates this is to fill the boiler with cold water and gradually raise the pressure to the desired point by a slow fire. Still another method is to fill the boiler with hot water and then apply the desired pressure by the aid of an injector made for the purpose, which continues to add heated water to the boiler. A relief valve is set to open at the desired pressure, and the duty of the injector is to maintain that pressure, uninfluenced by any leaks for a given time. A uniform pressure is insured throughout the boiler. An injector of this kind is made by the Rue Manufacturing Company, of Philadelphia.

A Hydraulic Theater Curtain.

Messrs. Clark, Bunnett & Co., of Rathbone Place, have fitted the new Lyceum Theater, in Edinburgh, with a hydraulic curtain. The proscenium opening is over 30 feet high by fully 28 feet wide. The curtain is constructed of two screens of wrought iron plates, an eighth of an inch thick, forming a double division, with air chambers between of 9 inches. The top of the curtain is riveted to double wrought iron girders secured to head of hydraulic rams, which are fitted, with their cylinders, on each side of the proscenium opening. The supply of water for working the rams is laid on from the town mains, and with an expenditure of only 84 gallons of water the curtain, which weighs about 6¼ tons, can be raised or lowered in fifty seconds. The means of working the curtain are in the prompter's box, and the prompter, by simply moving a lever, can drop the curtain, thus forming, with the proscenium wall, a solid fireproof division of the house, totally separating the stage from the auditorium, so that in case of fire an audience would be perfectly free from danger.

THE treatment of leprosy is becoming a hard problem in India. In the Bombay Presidency 9,483 cases are under treatment.

MARENGO CAVERN.

BY H. C. HOVEY.

During a geological excursion through Southern Indiana, undertaken about thirty years ago, my attention was called to the remarkable springs flowing out of cavernous openings in the village of Springtown, now known as Marengo. We explored the largest of these grottoes for perhaps three-quarters of a mile, following the margin of an underground stream. The entrance was wide and symmetrical, and the walls were gradually contracted so as to form a tubular passage way, by means of which powerful sonorous effects were produced, resembling those for which Echo River in Mammoth Cave is famous. There were a good many fish in the stream, but all of them seemed to be visitors from surface waters. This cave contained many interesting objects, especially several large stalagmitic columns. The temperature was uniformly 52° F.; and the atmosphere, like that of many other Indiana caves, possesses antiseptic properties, of which the villagers take advantage, using the place as a general storehouse for fruit, vegetables, and other provisions liable to decay.

The geological formation of the region is favorable to caves, heavy beds of St. Louis limestone being overlaid by Chester sandstone. Here and there the surface rocks have broken down, forming sink holes varying in size, and supposed to communicate with subterranean passages. Pankey Cave and several other small excavations have long been known in the vicinity, and along the banks of a little stream known as Whiskey Run, a tributary of Great Blue River. Wyandot Cave, frequently described, and probably next in size to Mammoth Cave, is located about eleven miles south of Marengo, and in the same geological formation. Both are in Crawford County, celebrated for its cavernous rocks.

On the 9th of September, 1883, five young men, while rambling over the grounds of Mr. Samuel Stewart, near Marengo, discovered a crevice at the bottom of a large sink hole, and resolved to explore. The first to enter the orifice opened were Messrs. Charles Jones and Sherman Stewart. Finding that the passage widened into a vast subterranean chamber, they returned for their comrades, and, having provided themselves with lights, renewed their explorations. The reports of their discovery were so strange as to be almost incredible. On the 12th of September Mr. Applegate, of New Albany, from which Marengo is about thirty miles distant, made a careful examination of the newly found cave, and published an account in the *Daily Ledger* of that city. Dr. E. S. Crosier, of the U. S. Surveyor's office, Louisville, Ky., writes to me that Marengo Cave is magnificent, and no "Mulhattan affair," alluding to several notorious hoaxes for which a person of that name is held responsible. The description thus far furnished shows the cave to resemble closely other great caves of the region. There are large halls embellished by stalactites, frost work, drapery, and various formations fantastic or grotesque. There are lateral branches from the main cave, leading to pits and domes. There are gypsum rosettes, alabaster columns, limpid pools, sparkling incrustations, resonant pendants, and other subterranean wonders.

No map has yet been made, but the trend of the excavation is said to be southward, showing an axis of erosion parallel with that of Wyandot Cave. The portion explored is estimated to exceed two miles in length. The more interesting localities have been named Arthur Avenue, Ledger Hall, Statue Hall, Stewart's Grotto, Diamond Dome, Organ Hall, etc. The suggestion may not be out of place that these appellations should be regarded as provisional until the entire cavern shall have been explored; then let some individual of good taste and judgment, like Dr. Crosier for instance, be authorized to revise the list and substitute an agreeable and sensible nomenclature for the meaningless medley so frequently fastened upon some of Nature's most marvelous works.

PETROLEUM FOR HEAT.

To the Editor of the Scientific American:

In your SUPPLEMENT of September 22 is an article on "Liquid Fuel as Used in Russia." The details there given seem to show that the Russians are a little in advance of us. They have made some progress, though it is not very decided, nor is it fully successful, toward the use of petroleum for heat. Let us see what we need to accomplish, and what difficulties stand in our way, and then we will look at what the Russians have already done.

All our theories of combustion, and of course of the heat derived from combustion, depend on the use of carbon in combination with hydrogen. And inasmuch as the mineral coals, soft and hard, give us a hydrocarbon in most convenient form, and at a cheap rate as well as in overwhelming abundance, we have dropped into the habit of basing all our calculations in that way, and the engine is reckoned the highest, theoretically, which can give the greatest available return of work from a pound of coal.

Now, all this is very well if we can do no better, but we may be justified, perhaps, in inquiring whether it is necessarily true that we must be thus restricted. Every coal is a hydrocarbon, but it is something more; it contains a large amount of material which is of no value, and which, after combustion, we call ashes, clinkers, etc. Every ton of coal which we buy gives us several hundredweight which we do not want. We pay for mining waste material, for hauling it many hundreds and perhaps many thousands of miles, for handling it over and over again, and then at last for *throwing it away*. Surely this does not seem like good common sense, that is, unless it is Hobson's choice with us. And as we have in great abundance another hydrocarbon which *prima facie* promises well, let us spare no efforts to learn how we may use it.

Petroleum is chemically most closely allied to the soft coals, but, unlike them, it is free from foreign matter. It is a hydrocarbon through and through; when we set it on fire, we can *burn it all;* there is nothing to throw away. It takes fire readily, burns freely, giving out a great amount of heat, and when under proper restraint is extinguished at once, economizing fuel greatly at the commencement and at the close. Its fluid form makes its transportation easy and cheap, and it can be obtained in quantities that are apparently inexhaustible.

And still, with all these advantages, it has never yet become a common fuel. We have grown so thoroughly accustomed to the use of kerosene, and so dependent on it for the light and comfort of our dwellings, that we should regard its loss as a calamity too great to be expressed in words. The term Petroleum for Light conveys our main idea of the essential value of rock oil. But why should it not read for us as well, Petroleum for Heat? Theoretically the difficulties in the way of such a result do not seem to be so great as those which have been overcome in giving us kerosene.

The difficulties lie directly in the line of its excellent qualities and spring from them. They are caused by the ease, and rapidity, and perfection with which petroleum burns. Open masses of it readily take fire, and the fierceness and extent of the conflagrations in the oil regions, and at the centers of refining, are too well known to need comment; they have been really terrific.

And with this comes another evil. Whoever has witnessed a large petroleum fire must have been much impressed with the vast and dense clouds of black smoke which poured up into the air, and often masked every object to leeward for miles in extent. The volatile nature of the fluid allows a very great amount of its carbon to be driven off before it reaches a sufficient degree of heat for combustion. This dense and offensive smoke is not only a great waste of material, but it is also such a nuisance to the senses that petroleum can never become a fuel for common use until the nuisance is abated.

Here, then, are the two lines in which invention must run; combustion must be restrained and, at the same time, it must be increased, paradoxical as this sounds. It must be restrained by feeding the petroleum to the scene of combustion at precisely the required speed; speed enough to give the bulk of flame demanded for the service, and yet not enough to prevent complete and perfect combustion. And it must be promoted by giving a supply of oxygen, that is, of air, to unite with all the carbon. This last would seem easily done, for we can force in a blast of any power asked for, but this sending in a current of air brings with it an evil which is manifestly difficult of removal; it drives off mechanically the carbon before combustion can be effected, as we will presently see.

With these, however, as the two objective points to be reached, it surely does not seem unreasonable to expect a successful result. And the degree of advance which the Russians have already secured, gives ground for encouragement. They have by no means solved the problem, but their work is full of instruction. All their efforts have been in one direction; it does not appear certain that direction is the wisest and best. At all events, it is allowable to look for a better.

Several forms of apparatus are described and figured in your paper, but they embody this one idea—they *atomize* the combustible by driving it into spray, through the agency of a jet of steam, air being combined with it. This is their *modus operandi* in each of the different forms.

Their results, as reported, condensed, are these: The heat produced is intense, so intense that from its unequal action it "destroys the tube sheet, starts the tube ends, and does not heat the firebox equally all over." At the same time there is a "great accumulation of soot" from incomplete combustion, and they are "uneconomical of fuel." This is the report of use on locomotives of three railways, but it is stated that the methods work more satisfactorily on board ship and on stationary engines.

All these forms of apparatus are planned for burning the "naphtha refuse" remaining from the Baku petroleum after the kerosene is distilled. Baku affords a petroleum decidedly different from our Pennsylvania oil, and what we propose is to burn the crude petroleum as it flows from the wells. Still the two fluids are so far similar that probably the difficulties in regard to the combustion of the one will not vary greatly from those affecting the other. It is therefore reasonable to infer that the Russian failures of success may show us what we need to avoid. And it is perhaps fair to think, though with some degree of uncertainty, that the powerful draught is to be avoided, and possibly the atomizing.

A correctly graduated supply of oil, and a free influx of air which shall utilize the oil fully without waste—these seem to be the two points. And we will interpolate here a statement of what we have seen done, and perhaps some one who has the divine afflatus in the way of invention may take from it a hint. The material burned was common crude petroleum, and the quantity burned was sufficient to heat thoroughly a kitchen range of good size, and to cook with it as fully and as well as could be done with a good coal fire.

The apparatus, very simple, is this: Across the whole length of the range grate runs an iron tube of suitable size, pierced with multitudes of very fine holes. This tube revolves steadily by the agency of a coiled spring or any other device. One end of this tube is closed and turns in an ordinary box or bearing; the other end, which is open, penetrates a small cistern or box, the side of which makes its bearing with a suitable stuffing box. From this cistern a pipe leads to a reservoir of petroleum placed at a proper elevation. A stop cock regulates the supply of oil, and it is forced out through the minute holes by gravitation only. This is the only atomizing, and it is certainly effective, for we have seen it in operation. On turning the stop cock and applying a match the tube is instantly a mass of flame, and by properly regulating the pressure the oil is consumed without any dropping. A very few minutes, however, would clog it badly, were it not for the revolution, for at one side a scraper or knife is fixed so as to clean the entire length of the tube as it revolves against it. Nothing remains on the tube, and that which is continuously scraped away is at once burned.

To accomplish this combustion air is admitted freely at as many points as possible, but no forced draught; only the draught which a good chimney produces. This has been found so far effectual that the accumulation of soot has been very small, as well as the escape of smoke.

We do not by any means assert that this plan can be made effectual in using petroleum on a large scale, but the idea is well worth studying. It certainly seems to promise fully as well as atomizing and powerful draught.

Now let us turn to the question of cost, for on this everything depends. In your paper of September 29, you publish an article on "Petroleum as Fuel," in which the writer proves to his own entire satisfaction, that its cost is so much greater than that of coal that it can never come into active service. He says that crude petroleum "is not fit to be used as a fuel without distillation," and then quite remarkably states a few lines further along, "there is no difficulty in burning mineral oils, notwithstanding what may be said to the contrary by anxious inventors." Perhaps he will show us how it is to be done, for the plain fact remains that up to the present time no one has practically succeeded in the attempt. Of course the oil will burn; but if it does it wastefully, as, for instance, in the experiments of the French Academy, where they give as their result an evaporation of eleven pounds of water only to the pound of fuel, it is certain that economy will be against its use.

This writer, after going through his figures, carefully arrives at the conclusion that the relative efficiency of coal to petroleum as an agent for the production of heat is as 1 to 2, and from this estimates their relative expense in service. He counts his coal at 15 shillings (sterling) per ton, and his petroleum at sixpence per gallon, and thus "makes the actual cost of evaporating a given quantity of water with petroleum to be 4·63 times as much as it is with coal."

His figures are doubtless accurate, but it must be remembered that they pertain to England and not to this country, to London and not to New York. We will turn to the slate and figure for ourselves. Our coal will cost us at least a dollar a ton more, and our oil very much less than his estimates give. Expressed in fraction of a dollar, a pound of coal on his basis costs 0·001875, while a pound of petroleum costs 0·015, whereas in New York, at average prices, a pound of coal costs 0·0025, and a pound of petroleum costs 0 00375. Taking now his estimate, which from all trustworthy data appears to be a fair one, that one pound of petroleum is equal in efficiency to two pounds of coal, $3.75 expended for petroleum will have evaporated as much water as $5.00 expended for coal at New York prices.

In making this calculation we have counted coal at $4.75 per ton, and petroleum at $1.25 per barrel. It is plain, therefore, that we can allow a decided increase from any price that petroleum has borne for some time past, and yet find that it ought to be, in New York, a more economical fuel to use than coal.

But one thing more is to be said: there is so much coal consumed in starting a fire, and in its continuance after the need for its service is ended, that petroleum would have an actual advantage in cost, even if its rate per hour were the greater of the two; and when to this we add the economy in point of labor, the expense of firemen, etc., we are certainly entitled to ask whether there is not good reason for studying "Petroleum for Heat."

W. O. A.

Memory.

A man's memory is like his stomach. To do its best work it must have good treatment. It must neither be neglected nor overloaded. It can easily be so abused by neglect, or by irregular and unsystematic employment, as to become chiefly a cause of annoyance and discomfort; or, again, it can be so overworked and heavily taxed that it becomes practically the chief organ or agent of the entire system; every other portion dwindling in its comparison. The latter course is the great danger of those who value the help of a tenacious memory.

Both memory and stomach are valuable, not in proportion to the burdens they can carry, but in proportion to their training for their part in the work of the system as a whole; and either of them is made effective as much by what is kept from it, as by what is packed into it.—*S. S. Times.*

How to Cleanse the Waste Pipes.

One of the most frequent and trying annoyances of housekeeping, as many can testify, and which a writer in the Philadelphia *Ledger* freely asserts, is the obstruction to the free, quick outlet of the waste water of the washstand, the bathtub, and the kitchen sink.

This is caused by a gradual accumulation of small bits of refuse material, paper, rags, meat, bones, or other offal, which check and finally entirely stop the outflow of the waste water, and then the plumber is called to remove the stoppage with his force pump.

Sometimes this is effective, at others the offending waste pipe is cut out, and a new one put in its place at considerable cost.

But the plumber is not always near at hand or free to come at one's call, and the matter demands immediate attention. A simple, inexpensive method of clearing the pipe is as follows: Just before retiring at night pour into the pipe enough *liquid* potash lye of 36° strength to fill the "trap," as it is called, or bent portion of the pipe just below the outlet. About a pint will suffice for a washstand, or a quart for a bathtub or kitchen sink. *Be sure that no water runs into it till next morning.*

During the night the lye will convert all of the offal in the pipe into *soft soap*, and the first current of water in the morning will remove it entirely, and leave the pipe as clean as new. The writer has never had occasion, in over thirty years' experience, to make more than two applications of it in any one case.

A remarkable example of the value of this process was that of a large drain pipe which carried off the waste of an extensive country house, near Philadelphia, and ran under a beautiful lawn in its front. A gallon of the lye removed all obstruction in a single night, and saved the necessity of digging up the pipe and disfiguring the greensward of the lawn, as the plumber intended, until advised of this process.

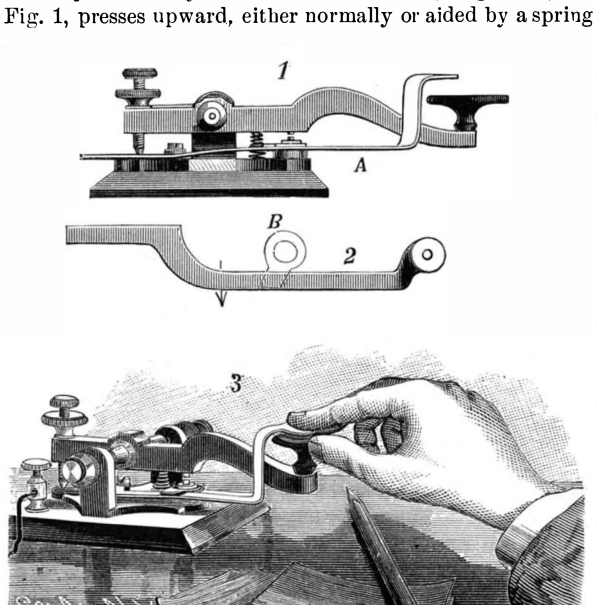
The so-called potash lye sold in small tin cans in the shops is not recommended for this purpose; it is quite commonly misnamed, and is called caustic *soda*, which makes a *hard* soap. The lye should be kept in heavy glass bottles or demijohns, covered with wicker work, and plainly labeled; always under lock when not in actual use. It does not act upon metals, and so does not corrode the pipes as do strong acids.

Typhoid Fever in New York.

The death rate in this city so far this year has been unusually low, and the prospects are that the record for the year will correspond. The greatest danger is from the increasing prevalence of typhoid fever. The impression that the fever infection results only from contamination by ingestion is gradually giving place to the belief that a lodgment may also be effected in the air passages. In conjunction with the Board of Health, physicians can do much toward stopping the advance of the disease by enforcing the immediate disinfection of typhoid fever excreta. The Board has issued circulars giving directions for the best means of accomplishing this object.

AUTOMATIC CIRCUIT CLOSER.

This simple device is designed to automatically close the circuit of telegraph keys, and may be applied to either old or new keys or to keys of various sizes. A spring lever, A, Fig. 1, presses upward, either normally or aided by a spring

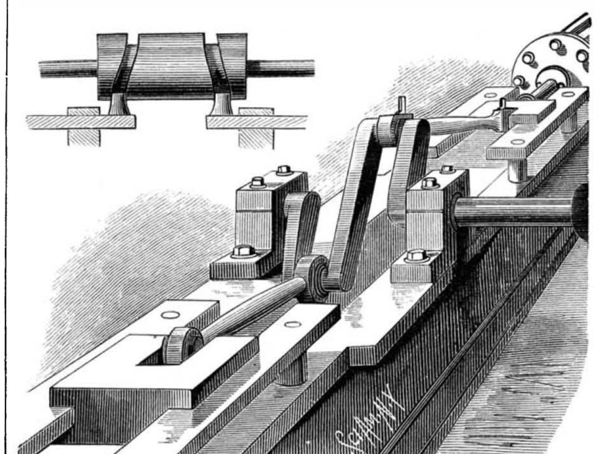


AUTOMATIC CIRCUIT CLOSER.

placed beneath it, against a projection, B, from the side of the key. Fig. 2 is a plan view of the lever and projection. One end of this lever is so bent that its extremity rests about three-eighths of an inch above the finger button of the key. The rear end of the lever is secured to the frame by a screw. When operating, the forefinger is placed on the end of the lever, A, which is pressed down until it rests on the button of the key, which is grasped by the thumb and middle finger. When the lever is released, it presses against the projection and automatically closes the circuit. The device is very convenient, as the operator need not take the trouble to close the circuit every time he stops telegraphing, as it can never be left open. This invention has been patented by Mr. Samuel J. Spurgeon, of Liberty, Missouri.

COUNTERBALANCE.

The counterbalance herewith illustrated can be applied to all kinds of machines having a reciprocating motion, such as saw mills, gig saws, steam engines, grain separators, mowing machines, etc. It consists in the use of a weight connected with the crank or other moving part so that the weight of the parts is counterbalanced and an even and steady motion produced, permitting the machinery to run at a high rate of speed. The counterbalance can be placed upon the same side of the shaft as the cross head or upon the other side, as shown in the engraving, when it runs upon its own slides. When applied to a cam, the cam is made double, or with two grooves inclined in opposite directions and engaged by reciprocating bars that counterbalance



ELWELL'S COUNTERBALANCE.

each other upon the cam, as shown by the small engraving. The principle is applicable to motions obtained by other devices than the crank or cam.

This invention has been patented by Mr. Orlando Elwell, of Van Ettenville, New York.

Biography of a Mosquito.

If the mosquito were a very rare insect, found only in some far off country, we should look upon it as one of the most curious of living creatures, and read its history with wonder—that an animal could live two such very different lives, one in the water and the other in the air. We speak of the mosquito as if there were but one, while really there are over thirty different kinds, all, however, having similar habits, so that a description of one answers for all. The female mosquito lays her eggs on the water. She forms a little boat, gluing the eggs together side by side, until she has from 250 to 350 thus fastened together. The boat or raft is oval in shape, highest at the ends, and floats away merrily for a few days. The eggs then hatch and the young mosquito enters the water where the early part of its life is to be passed. You can find the young insects in this, their larval stage, in pools of fresh water, or even in a tub of rain water which has been standing uncovered for a few days. They are called wrigglers, on account of the droll way in which they jerk about the water. They feed upon very minute creatures, and also upon decaying vegetable matter. Near the tail the wriggler has a tube through which it breathes. If you approach the pool or tub very quietly, you can see them in great numbers, heads downward, with their breathing tube above the surface. If you make the least disturbance, they will scamper down into deep water. After wriggling about for two weeks, and changing their skins sevreal times, the larva becomes a pupa.

You know that most insects in the pupa state do not move, but take a sleep of greater or less length. Not so the lively little mosquito. In its pupa state it becomes a big headed creature which does not eat. It moves about quite rapidly, but not with the same wriggling motion; it now has a pair of paddles at its tail end, and takes in air through tubes near the head. In five or ten days the mosquito ends its life in the water, and becomes a winged insect. The pupa comes to the surface, and the skin cracks open on the back, allowing first its head and chest to come forth, finally the legs, wings, and rest. This is a most trying moment in the life of the insect; if a slight puff of wind should upset it before the wings are dry, it will surely drown; only a small proportion of the whole number succeed in safely leaving the pupa case; the greater share become food for the fishes. If the wings once get fairly dry, then the insect can sail away, humming its tiny song of gladness. How does it sing? Perhaps when you heard its note at night you did not stop to consider. It is a point which has puzzled many naturalists, and it is not certainly known how the note is produced, but probably the rapid motion of the wings and the vibration of the muscles of the chest are both concerned in it. The most interesting part about the insect—the "business part," as some one has called it—is its sting, or sucker. This is not a simple, sharp pointed tube, but consists of six parts, which lie together in a sheath, and are used as one. How sharp these must be to go through our skin so easily! After the puncture is made, it then acts as a sucker to draw up the blood. The insect which visits us is the female. We rarely see the male mosquito. Blood is not necessary to the existence of the mosquito, and probably but a small share of them ever taste it. The countries in which mosquitoes live in greatest numbers—actual clouds—are not inhabited, and there are but few animals.—*Donahoe's Magazine.*

Glycerine as a Preventive of Crystallization in Strained Honey.

Having for several years had considerable trouble and loss in keeping pure strained honey, on account of its tendency, in a short time (particularly in warm weather), to crystallize, I have been ready for any remedy that was feasible. One lot that I purchased in the comb and strained myself soon became almost worthless from this cause. Some two months ago I had a small lot that I found crystallized when wanted for use, although I had taken the precaution to cork tightly and put in a cool place in the cellar. It occurred to me to see what would be the result from melting and adding a small amount of glycerine. Placing the bottle in a water bath, I soon had it melted and added one ounce of glycerine to about one and one-half pounds of the honey, setting aside to cool. It has shown no sign of recrystallization as yet, and I am just using the last of it. I can see no objection to this on the score of adulteration or any harm from its use. In making simple sirup I have occasionally found it crystallized in the bottom of the bottle, causing some trouble to remove, and several times have found some chemical change, which has caused an unpleasant odor, which I have not at all times been able to obviate, although using distilled water and the purest sugar obtainable. Have not as yet had an opportunity of trying the effect of glycerine, but think it might prove beneficial and in no way objectionable. Have been accustomed to add a small amount to my beef, iron, and wine for a long time, and find it prevents souring and, in a large measure, precipitation.—*J. W. Colcord, Amer. Pharm. Assoc.*

Novel Rheostat.

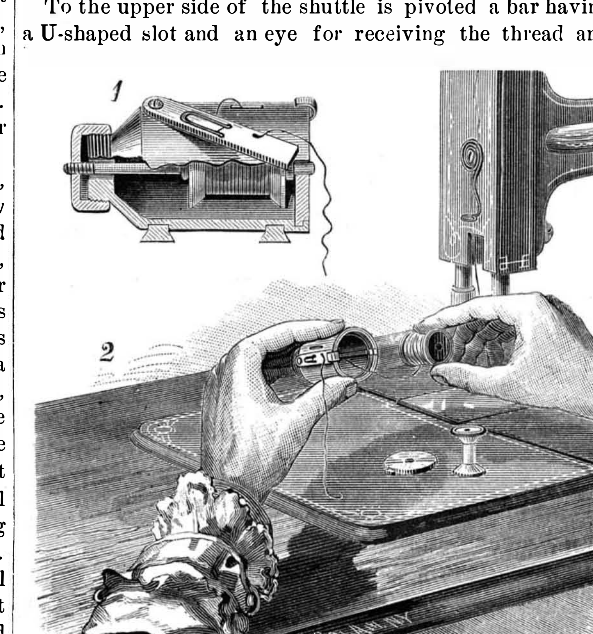
A very useful rheostat has been devised by M. Trouvé, the well known Parisian inventor. It consists of a German silver spring inclosed in a nickel plated tube, the spirals not being allowed to touch each other, and insulated from the tube by a pasteboard sheathing. Inside the spring is a rubbing contact formed of a metal rod split into four parts, like the split plugs of a resistance box. This rod is graduated in divisions. The current enters at one end of the spring, traverses it, the rubbing contact, and the graduated rod. When the rod is deeply inserted into the spiral coil, the current only traverses a few turns, and the resistance in circuit is very small; but when the rod is pulled out, the number of turns inserted is considerable.

The divisions on the scale tell the number of turns in circuit. The device is employed by Trouvé in connection with his polyscopes to regulate the strength of current supplied by a small Plante accumulator.

NOVEL SEWING MACHINE SHUTTLE.

The improved shuttle shown in the engraving is made so that it can hold any ordinary spool of thread or silk, and thus avoid the trouble of rewinding, and save the expense of a number of bobbins. The shuttle is a hollow cylinder tapered at one end and fitted with a screw cap which receives the spindle upon which the spool is loosely mounted. This spindle extends through the opposite end of the shuttle and is provided with washers to hold the spool in place. The plate forming the larger end of the shuttle is retained in place by a spring.

To the upper side of the shuttle is pivoted a bar having a U-shaped slot and an eye for receiving the thread and



IMPROVED SEWING MACHINE SHUTTLE.

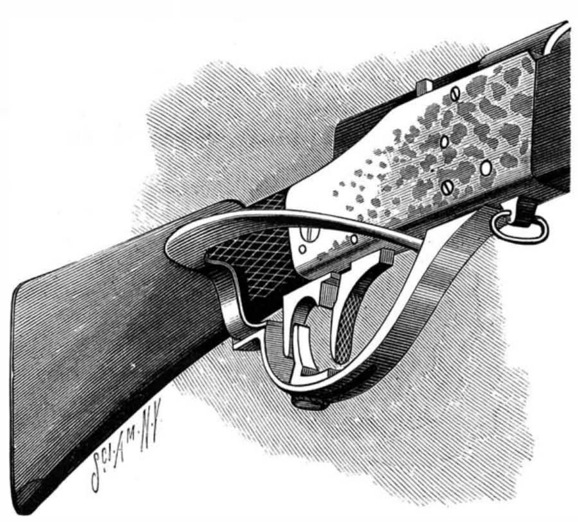
giving it a certain amount of tension, and the shuttle is slotted for the passage of the thread, which passes thence to the U-shaped slot and the eye in the bar. The bar is held in working position by a spring catch. The spool is removed from and replaced upon the spindle after taking out the larger end of the shuttle. When it is necessary to remove the spindle, it can be done by unscrewing the cap on the conical end of the shuttle.

Fig. 1 shows the shuttle with a part broken away to exhibit the internal arrangement. Fig. 2 shows the method of removing and replacing the spool.

This invention has been patented by Mrs. E. Chavers, of Seddon, Mich., who may be addressed for further information.

FIRE ARM.

Mr. Salvatore J. Buzzini has invented an improved breech-loading fire arm, in which the breech is opened and closed by the operation of a lever which may also serve as a trigger guard. The lever not only ejects the exploded shell, but cocks the arm, and the same motion automatically moves a safety catch which locks the trigger, thereby preventing accidental discharge. The arm cannot be discharged except by intentionally releasing the catch and pulling the trigger. There is an adjustable device attached to the breech lever for automatically controlling the safety catch that locks the trigger, so that when it is desirable to fire rapidly, the closing of the breech lever automatically releases the catch from the trigger. When rapid firing



BUZZINI'S FIRE ARM.

is not required, the adjustable device may be set so that it will not release the safety catch. The engraving shows the breech lever, at the side of the butt, the upper and laterally projecting part forming a convenient rest for the hand when its rapid manipulation is desired. The safety catch is directly under the butt, behind the trigger, and it is automatically released by the device attached to the inner under side of the breech lever. This device can be shifted along the lever and locked in its new position when quick firing is not required. Mr. Buzzini's address is 500 West 125 Street, New York city.

Standard Railway Time.

The subject of standard time is now before the railroad managers of this country, demanding not simply approval, but action. It will be remembered that at the spring time conventions the proposition of Mr. W. F. Allen, Secretary of both these conventions, to adopt for North America five standard times, exactly an hour apart, namely, the time of 60, 75, 90, 105, and 120 degrees west of Greenwich, was unanimously approved, and Mr. Allen was instructed to send information concerning the new standards proposed to the managers of all the railroads, and endeavor to have them adopt them. This information has been given by Mr. Allen in the completest way by means of two maps of the United States, on one of which all the railroads having the same time standards at present are colored alike, and on the other they are colored in accordance with the proposed uniform standards. The map showing the present standards makes a striking picture of the existing complexity. There are different times close alongside. A line run by Philadelphia time projects through a network of lines run by New York time; in some places there are several kinds of railroad time; and in the United States there are no less than *forty-nine* time standards, which by the proposed change will be reduced to four; for the time of the 60th meridian will apply only to the British maritime provinces. Roughly speaking, the time of the 75th meridian, which it is proposed to call "Eastern time," will apply to all the railroads of New England, New York, Pennsylvania, Maryland, and the two Virginias and the two Carolinas, the exception being the extension of the 90th meridian time ("Central time") to Buffalo, Pittsburg, and the other western termini of the trunk lines; while in Canada, "Eastern time" will extend to Detroit and Lake Huron. The chief points of junction between "Eastern" and "Central" time are Sarnia, Detroit, Buffalo, Pittsburg, Wheeling, Parkersburg, Huntington, W. Va., Bristol, Tenn., Gastonia, N. C., Augusta, Ga., and Charleston, S. C. This time is four minutes slower than New York time, one minute faster than Philadelphia, and eight minutes faster than Washington time.

But by far the larger part of the railroad system of the country will come under "Central time," or that of the 90th meridian, which is but one minute faster than St. Louis time, three minutes slower than Vicksburg time, just New Orleans time, and nine minutes slower than Chicago time. It takes in all the railroads from Buffalo, Pittsburg, and Savannah to the Missouri River in Dakota, nearly to the Colorado line in Nebraska and Kansas, and the whole of Texas except a little corner from New Mexico south to the Rio Grande. Nine-tenths of the railroads of the country come under these two times. The 105th meridian (Denver) and the 120th (the line between California and Nevada) naturally cover a small mileage.

Whether a time which in some places will be half an hour from solar time will be adopted for general use is questionable; but for the railroads the proposed standards are certainly a great improvement on the present confusion, and perhaps as likely as any that could be proposed to come into general use.

Mr. Allen has studied out the subject thoroughly, and has prepared "translation tables" by which the proposed standard can be substituted for any one of the fifty existing standards without any computing. A large number of important railroads have agreed to adopt these standards if the majority of the roads in their district do so, and at the coming time convention it is hoped that something may be effected.—*Railroad Gazette.*

Inside Guard Rails.

In a paper by Mr. William Howard White, M. Am. Soc. C. E., upon the subject of "Railroad Bridge Floors," the author advocates inside guard rails for the purpose of preventing, as far as possible, serious results from the derailment of wheels.

His reasons for advocating the inside guard rails are that he considers them more efficient for the same height above tie than the outside guard; that they can be placed so as to hold the wheel nearer the rail, particularly when the use of the snow plow is considered; that they can be more strongly secured at the ends for the purpose of drawing derailed wheels toward the rail, or to secure the ditching of a car which has gone too far to be safely drawn back; that they are more economical. He considers that the ties should have five inches of clear distance between them.

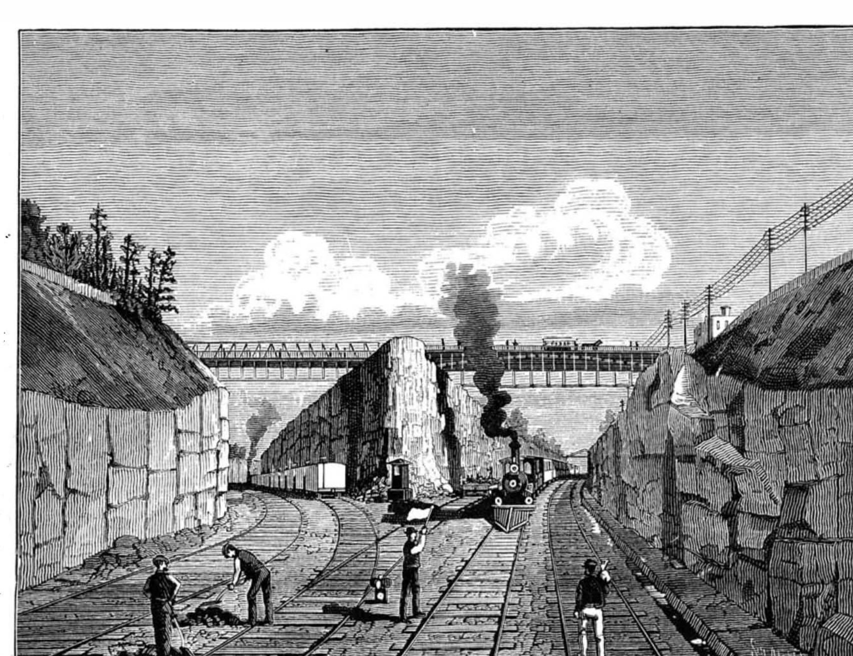
Storage of Wind Power in Sand.

The Oil City, Pa., *Blizzard* states that one Townsend has six arastras running to their full capacity, and four more will be started up in a few days. The arastras are placed in a little sandy flat, where only sufficient water for drinking purposes and to moisten the ore operated upon is to be obtained. The arastras are actually operated by sand, which drives a large overshot wheel. A windmill runs a belt containing a large number of buckets, and these carry the sand up to a big tank, just as grain elevators carry wheat in a flouring mill. A stream of sand being let out upon the overshot wheel, it revolves just as it would under the weight of a stream of water, and the arastras move steadily on at their work. When there is much wind, sand is stored up for use when calm prevails, so the arastras are never idle.

DEEP ROCK CUTS NEAR NEW YORK.

The line of the Pennsylvania Railroad from the depot in Jersey City, on the Hudson River, opposite New York to a point several miles back encounters the hills of rock which begin at New York Bay, and gradually rise until they form the famed Palisades of the Hudson. These hills have caused more or less trouble to all the roads whose termini are on the west bank of the river. The old line of the Pennsylvania road passed through these rocks by means of cuts and was quite circuitous, the curves in some places being very sharp. Some time ago a line was surveyed which obviated these difficulties and reached the depot in a direct line. The new route was made of a width sufficient to accommodate four tracks, two for the passenger and two for the freight traffic.

The work of opening the new cuts was, in some cases, extremely difficult, owing to their great length, depth, and width and the hardness of the rock. Our illustration represents a section of the road as viewed from a point about two and a half miles from the ferry, the rock passed through in this case being trap. To the right is shown the new cut, the old road curving from it as indicated upon the other side. There are several new cuts through the rocky obstruction that present the same general appearance as the part above illustrated.



DEEP ROCK CUTS ON PENNSYLVANIA RAILROAD NEAR NEW YORK.

WAGON TONGUE SUPPORT.

The object of this device is to relieve the horse's neck from the strain incidental to supporting the weight of the wagon tongue, at the same time allowing the connection between the tongue and wagon to have such a flexibility that the wagon may easily adjust itself to uneven ground. The tongue is hinged to the forward hounds in the ordinary manner. Placed under the tongue is a spring whose forward end is connected with and slides upon a keeper attached to

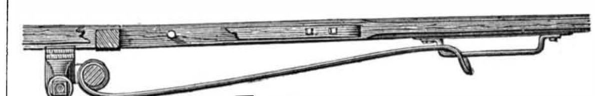


Fig 1

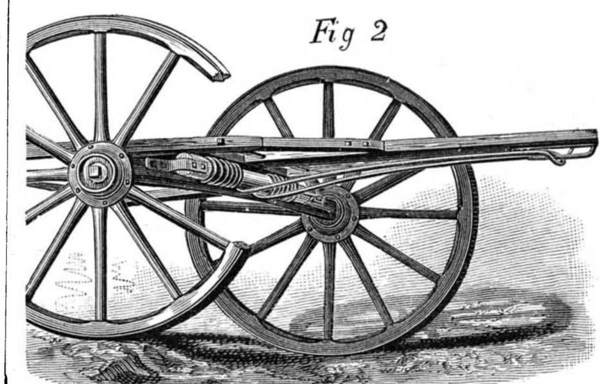


Fig 2

BALLARD'S WAGON TONGUE SUPPORT.

the middle part of the tongue. The rear part of the spring is coiled around a bar whose ends are secured to the forward axle. By this means the tongue is held in a horizontal position, and yet is free to adjust itself to the wagon's movements. This invention has been patented by Mr. D. C. Ballard, of Townsend, Montana.

American Manners in Traveling.

An English snob, named Robinson, writing about his visit over here, describes certain bad habits as characterizing the traveling Americans generally, leading to the idea that at least nine out of ten Americans when traveling grab their food, and gorge and snort in ways too hideously unpleasant for repetition. This is teetotally denied by Mr. Richard A. Proctor, the English traveler and lecturer, than whom few persons have had such extensive opportunities of learning the manners of different peoples, especially in traveling. He answers Mr. Robinson as follows:

I believe the truth to be that the American system leads to a diminution of otherwise prevalent bad habits—for ninety-nine hundredths of the so-called lower class in America will *not suffer* any inferiority to be shown in their habits in the presence of those whom they regard as no otherwise better than in having more money to spend. But be this as it may, a fair, unbiased comparison of the manners of the traveling community, class for class, or comparing the whole number of travelers, would show that—in some way or another—a marvelous superiority has arisen on the other side of the Atlantic. Such offenses as the stolid, stupid staring so common in England, even among well-to-do people, rudeness to women or children, carelessness as to the comfort of the old and weak, etc., are scarcely ever seen on the other side of the Atlantic. If I were an American, with what "pride in my port, defiance in my eye" should I be tempted to boast that a young, inexperienced, and pretty girl, poor or rich, in her teens, can travel across the length and breadth of the United States alone and unprotected, not only in perfect safety and comfort, but with the certainty that nine-tenths of the men—of all classes—with whom her journey brings her into contact esteem it equally a duty and pleasure to assist her in every possible way. How contemptuously I might be tempted to remind the Briton that—for reasons too well known—the most courteous and well meant proffer of assistance to such a traveler in England is apt to be looked on with suspicion. On the Continent, and especially in France, it is even worse.

THE substance known as anthracene has been found by Dr. Tommasi to possess a new property, namely, a sensitiveness to light, which will doubtless prove of value. Anthracene on exposure to light acquires different physical and chemical properties without any change in its composition. If a cold, clear, saturated solution of anthracene in benzol is exposed to the direct rays of the sun, it becomes turbid and deposits crystals, which have received the name of paranthracene.

OBACH'S GALVANOMETERS.

(Continued from first page.)

coil with the vertical are measured, their "secants" are the multipliers of the tangents of the deflections. The current strength or electromotive force to be measured is therefore:

Current strength or electromotive force } = tan. deflect. × sec. inclin. × constant.

The constant of the formula being the number of amperes or volts which give the unit deflection of 45° (tan=1·0) when the coil stands in its vertical position.

The galvanometers for measuring currents and electromotive forces are so arranged that the two constants are identical, *i. e.*, that the same number of amperes and of volts correspond to the unit deflection. This offers the great convenience that the calibration of the instrument in volts at any particular place, by means of some cells of known electromotive force, gives without further trouble the calibration in amperes also. These galvanometers can be provided with a "compensating magnet" made to turn on a horizontal axis, and by means of such a magnet the constant can be kept at the same value for different localities. In order to effect this, a few cells of known electromotive force are required, and the magnet is simply turned until the proper deflection is produced, corresponding, for instance, to a constant of 5 or 10 volts. One-half of the deflection scale is divided into tangents, but the other half bears degrees as usual. The inclination scale has, in addition to the degrees, ten secant marks representing the multipliers 1 to 10. A vernier allows the degrees to be read very accurately. The simple form of current and potential galvanometer has the secant marks, but no other divisions on the inclination scale. Any dipping of the needle is completely prevented by fixing it to a vertical axle loaded at the lower end. The swing of the needle can be made quite dead beat by means of an adjustable air damper.

The particulars and engravings herein given we derive from *Engineering.* Fig. 1 shows the instrument constructed for current strength only. For absolute measurements it can be calibrated by means of a silver or copper voltameter at the particular locality where the currents are measured. It has no compensating magnet, but can be provided with a "constant shunt" for very strong currents. Instruments without a shunt measure from 1 to about 90 amperes, and those with a shunt two or three times as much, according to the adjustment, and with our horizontal component of the earth's magnetism. The solid ring, R, consists of gun metal of high conductivity, and has a rectangular cross-section. The inclination scale is engraved on a quadrant, Q, fixed outside the ring. Three screws and a circular spirit level inside the needle box, B, serve for leveling the instrument.

Fig. 2 shows a highly finished form adapted for currents and potentials. The gun metal ring, R, is V-shaped, and the groove filled with a great many turns of German silver wire. The inclination scale, Q, is between the needle box, B, and the coil, R. The coil as well as the pillar, P, carrying the needle box can be firmly fixed with great nicety by means of clamping arrangements, C_I and C_{II}. At the base of the pillar are two straight spirit levels placed at right angles. The screw, *s*, is for adjustment into the meridian.

Fig. 3 is a simplified and smaller model of an instrument of the same construction as Fig. 2, and likewise for currents and potentials. The damping partition, *d*, can be taken out, so that the needle can swing right round. The inclination scale on the quadrant, Q, fixed to the needle box, B, bears only the secants and multipliers, as already stated. The coil is held fast on the quadrant by means of the screw, S, and the instrument is leveled until the needle swings freely; *n s* is the curved compensating magnet used for adjusting the constant to a given value. With this magnet the needle is much less exposed to disturbances from outside. The currents are led to the solid ring by means of flexible leads stranded together in such a manner that they are absolutely inactive upon the needle; they are termed "adynamic leads."

The instrument, Fig. 2, is intended for very accurate measurements, and may, for instance, be used as a standard wherewith other galvanometers can be compared. The mean error of a single observation with the instrument is below one-half per cent, and the probable error below one-quarter per cent.

Fig. 3 is constructed for ordinary purposes, but it should not be placed too close to dynamo machines or single leads conveying strong currents.

Current strengths or electromotive forces can be measured with these galvanometers by either of the following four methods, which may be chosen according to circumstances.

1. *General Method.*—Turn the coil until a deflection a somewhere near 45 degrees is obtained, then read off the inclination φ of the coil.

The formula then is:

$$x = \tan. a \times \sec. \varphi \times \text{constant}.$$

2. *Method of Equality.*—Turn the coil until the deflection a and the inclination φ are at one and the same angle ψ.

The formula is now:

$$x = \tan. \psi \times \sec. \psi \times \text{constant}.$$

These products of tan. × sec. can be calculated beforehand and tabulated.

3. *Method of Constant Deflection.*—Turn the coil until the needle each time points to the same degree, say for convenience 26½ degrees, 45 degrees, or 63½ degrees. The tangent of this deflection enters the constant and the formula is reduced to:

$$x = \sec. \varphi \times \text{constant}.$$

The instrument here acts as a secant galvanometer, and the method has the peculiarity, that for a number of measurements the needle occupies the same position, which, in some cases, may be found of advantage.

4. *Method of Constant Inclination.*—Set the coil at a proper angle, of which the secant now enters the constant.

The instrument here simply acts as a tangent galvanometer with the formula:

$$x = \tan. a \times \text{constant}.$$

As will be seen from the foregoing description, the movable coil galvanometer offers several advantages over other constructions which have been proposed for the same purpose.

The Methods and Aim of Electrotechnical Instruction.

Prof. Braun, in his inaugural address at the Polytechnic School, in Carlsruhe, discussed the subject of educating practical electricians in a careful and exhaustive manner. Some of his remarks will doubtless prove of interest to those who intend taking up this study here.

The first question, said he, that arises is whether a technical school for electricity should be arranged and conducted like the special schools for engineers, machine builders, and the like. The lecturer was of the opinion that electricity, in its present state, is not adapted to such treatment, since everything is still in the evolutionary stage, where theory is imperfect, and the physical basis can by no means be referred to a few axioms from which everything else can be deduced. In electricity, even more than in the application of mechanical principles, Grashof's statement holds good, that "polytechnic schools should not follow in the tow of practical requirements, but, on the contrary, should be the forerunners that precede them. The scientific culture that they afford should not merely satisfy the demands of the present state of the arts, but as far as possible fit them to fill all the demands that may arise up to the time when they shall pass from the stage of action a generation later."

Men educated in such an institution must be able to study and test the literature of their profession with an independent judgment of their own. They must be able to solve the new and difficult problems that present themselves, with ease and a clear understanding when there is no rule at hand that applies directly to the case. How is this to be obtained? Lectures that go more into detail than those on experimental physics generally do, but which are based essentially upon an equality of previous preparation, are insufficient, however desirable they may be for a general oversight of the subject.

To be brief and to the point, something like the following requirements should be made: A year and a half of mathematics, a good insight into analytical mechanics, practice in solving the simpler problems of higher mathematics, exercise in the use of the so-called principles of mechanics, in chemistry, a firmly grounded knowledge of inorganic chemistry, such as can only be obtained by laboratory practice; in physics, a clear and full understanding of the whole of experimental physics; a clear knowledge of electricity based upon mathematical principles, and especially in galvanic electricity; and experience in the application of theory to special cases.

To this must be added practical work in the laboratory, so as to become familiar with the principal methods of physical and electrical measurements in general use. It would also be desirable for him to carry out successfully some scientific physical research, especially in galvanism. Of course a knowledge of machine building must be added to these.

The lecturer then goes on to show, indirectly, that these rather high requirements are really necessary. Suppose that any one has listened understandingly to experimental physics, that he possesses some knowledge of higher mathematics, can use the rules for calculating the division of the current in any desired system of wires, and is practically acquainted with the methods of measuring resistances, electromotive force, intensity of currents, mechanical work, and the intensity of light; knows how much current a lamp needs; is acquainted with the machines now in use; in short, is in possession of a whole lot of positive information which is of practical value. This man can certainly be employed with advantage in many establishments, but he is not able to conduct and manage one alone. These acquirements are not difficult to attain; some theory and a year's earnest work in a physical laboratory.

But more than this is required of the technical electrician. At present he is required, more than in any other technical pursuit, to produce something new, to bring up new questions, or answer difficult ones. He must, therefore, stand in the same intimate connection with science as those who would produce anything in a purely scientific field.

Hence he must know: First, theory. This does not stand, as many believe, opposed to practice, but is rather the shortest recapitulation or summary of all the facts obtained by observation and experiment, sometimes of a very tedious nature. This knowledge saves time and prevents mistakes.

Secondly. In order to understand the theory a previous knowledge of mathematics is necessary. Even if this mathematical knowledge is never actually employed in solving a problem mathematically, it is, nevertheless, an indispensable aid in climbing up to the theoretical view and the simple principle.

Thirdly. Even this is not enough, for a theoretical knowledge of the methods will not suffice. Not all the details can be obtained in this way, even when they can be calculated upon theoretical bases. A full insight into the thing, such as can only be obtained by practical work, is necessary in order to become so familiar with a thing as to be able to estimate approximately from experience what can be calculated more accurately with numbers. A view obtained by theory alone bears the same relation to one that is supplemented by your own observations, as the picture that you form of a certain region from descriptions compares with that formed by visiting the place yourself.

Fourthly. Just as a person does not begin to appreciate all the perplexing details on the map until he begins to travel, and feels thankful for them when he has to use them, so it is here. When he stands before a new problem and is seeking a new road, then he begins to really thank the theory that led him, and is able to appreciate the guide posts and conscientiously hunt them up. The apparently unnecessary fullness of the theory, which is liable to be despised, begins to be appreciated, and the contempt for it vanishes.

Many difficulties are to be encountered in physics. The time of study is too short to overcome all of them; they follow the investigator through life. But it is necessary to have got over those, at least, which lie nearest, to have grappled with the difficulty yourself, and to have come out victorious, to have made the beginning to a clear and transparent mastery over matter, and this can only be accomplished by some scientific work of your own. Neither the scientific nor the practical results of this early work are to be taken as the measure of their value, nor does it depend upon the importance of the question, but it depends upon the value that the work has for the author, its effect upon him. Then only will he be able to actually combine theory and practice, even if in after life he allows himself to be led more by one than the other, according to his natural inclination and taste.—*Poly. Notizblatt.*

Death of a Noted Electrician.

Richard Sigismund Karl Werdermann was born in 1828, in Silesia, Prussia, served for some time as officer in a Prussian artillery regiment, went then to Paris, and established himself there as a civil engineer. In Paris he made the acquaintance of M. Gramme, at that time a workingman, and seeing the Gramme machine, he began to be interested in the electric light and transmission of power. Like many other Germans, he found it advisable to leave Paris in 1870, but before leaving he bought M. Gramme's English and American patents. He came to England in September, 1870, and exhibited here the first Gramme machine. Ever since then he has been actively engaged in the introduction of the electric light, and the development of the Gramme machine on a large scale. Only a few months before his death, a large modified Gramme had been finished at Stockport, which was built to his designs.

He was the first to show—in the Institution of Civil Engineers—the transmission of power by the Gramme machine, and he had also a little Gramme working for some months in the Postal Telegraph Office, taking the place of batteries. In 1875 he exhibited the electric arc light from the top of Charing Cross Hotel, and in 1878 he invented—and exhibited in a factory in the Euston Road—his well known Werdermann semi-incandescent lamp. He invented, simultaneously with Jablochkoff, the electric candle, and sold his patent to the original Jablochkoff Company. At the Paris Exhibition of 1881, the Salle du President, one of the most attractive rooms of the Exhibition, was lit by Werdermann lamps. Like many inventors, says the *Engineer*, from whose columns we copy, Mr. Werdermann, although very fertile in brilliant and ingenious ideas, was not a sufficiently shrewd business man to reap material benefits by his inventions. There was a certain child-like simplicity in his character which made him look only to the successful carrying out of an invention, and not to what it might bring commercially. He left the commercial part to others, and with the usual results, viz., very little benefit to himself; law suits and interminable vexations, which at last undermined his health. It is a fact which redounds very much to Mr. Werdermann's credit, and is characteristic of his scientific dignity and honesty, that last year, when, during the electric light craze, inventors could ask and obtain their own price for inventions, good, bad, or indifferent, he would have nothing to do with limited companies. Mr. Werdermann leaves a widow, three daughters, and one son.

The Geology of the Great West.

In his report to the Secretary of the Interior, Mr. J. W. Powell, director of the United States Geological Survey, gives some interesting facts. In Colorado, valuable beds of anthracite and of bituminous coal have been found, surpassing in quality any heretofore discovered in that region, and indications of large deposits of iron are visible. Evidences of the former existence of a large fresh water lake in western Nevada have been discovered. Traces of a vast continental glacier have been found, of so well defined a character as possibly to change the present geological conclusions of previous explorations. In the work done is included a survey of the Cascade range in Oregon and Northern California. Mr. Powell says that this region is perhaps the holder of the grandest and most extensive display of natural phenomena in the world, and its exploration and thorough investigation will add greatly to the facts of geologic science.

Correspondence.

Remedy for Warts.

To the Editor of the Scientific American:

At the bottom of third column, page 178, issue of September 22, you quote chromic acid as a remedy for warts; that is a very powerful caustic, and its use is liable to be attended with bad results in inexperienced hands. I would state that I have never seen a wart that could not be removed safely by glacial acetic acid applied in the same manner. All who try it will attest the same.

C. H. RUSSELL.

Boston, Sept. 26, 1883.

New Stereo Instrument Wanted.

To the Editor of the Scientific American:

The movements of persons and animals having been successfully reproduced by a series of instantaneous photos kept in rotation under proper adjustment, you may, perhaps, suggest to inventive readers of your valuable paper the construction of a suitable stereoscopic apparatus for reproducing the movements of anything in action by means of series of instantaneous double photos taken with a photographic apparatus for stereoscopic views, specially arranged for that purpose.

JULIO PFLUCKER Y RICO.

Naples, Italy, Sept. 8, 1883.

Flax Yarns Eighty-five Miles Long Weighing One Pound.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of the 15th inst. there is an article on "The Factory Numbering of Yarns," taken from the *Textile Gazette*," in which there is evidently an error. It is there stated, "A No. 1 cotton yarn contains 840 yards to the pound, and a No. 10 contains 8,400 yards. No. 40 cotton yarn contains 40 times 840, or 33,600 yards to the pound, *and its diameter consequently only one-fortieth as great as that of No.* 1."

The relative diameters of Nos. 1 and 40 would be 6·3+ and 1, or inversely as the square root of the number of the yarn; by the rule that circles are to each other as the squares of their diameters.

A yarn whose diameter was one-fortieth that of No. 1 would be No. 1,600, provided the density of the fibers composing each were alike.

Permit me to add a little about flax yarns. A lea or cut is the unit of measure, and contains 300 yards. 30 lea yarn would contain 9,000 yards; but if made into 2 cord thread, would contain *about* 4,000 yards, viz., one-half of 9,000 less allowance for contraction in twisting.

As a rule, the twist necessary for the different numbers is in proportion to their diameters. Thus, if 16 lea requires 8 turns per inch, 36 lea will require 12; thus $\sqrt{16} = 4$; $\sqrt{36} = 6$.

It may astonish many of your readers to know that flax yarns have been spun as fine as 500 lea, or 85 miles to the pound, and even finer. I inclose you a small specimen of 250 lea.

GEO. ANDERSON.

Cleveland, O., Sept. 25, 1883.

Chemistry for Digestion.

To the Editor of the Scientific American:

In the editorial "The Chemistry for Digestion" in your issue of September 8, you speak of the injurious effects of hot bread—the great curse of the American people. Many —perhaps millions—accustomed to hot bread from infancy, prejudiced by habit and influenced by desire, refuse to believe hot bread injurious, or at least will not give it up. Now there are three things that can be done for these people.

1. They can be informed that bread that has become cold may be rewarmed and be more digestible, because warm food is more digestible than cold and because it is more palatable.

2. They can be informed that if they *will* eat fresh hot bread, that made with baking powder is less injurious than that made with yeast.

3. Their attention can be called to the great variety of healthful breadstuffs that can be resorted to as a change. Besides oat meal porridge, hominy, hominy grits, corn meal mush, and cracked wheat, which are getting to be quite generally known and used, there are two which are hardly known in American homes, which two I think should head the list. I refer to first quality pilot bread (ship biscuit) and homemade oat meal crackers (what the Scotch call oat meal cakes).

In both of these there need be no danger from impure baking powders or bad yeast, for both of them are light and digestible without the use of either yeast or baking powder.

S. P. CHEESEMAN.

Storing Wind Power.

In the matter of "Storing Wind Power," Mr. C. C. R. suggests the use of wind wheels to drive dynamo electric machines to decompose water, the constituent gases to be stored in suitable holders, and used when desired for lighting purposes, such as the oxy-hydrogen or oxy-calcium lights for heating purposes; or for any use to which such gases might be of utility.

Luminous Paints and Colors.

The luminous calcic sulphide (also called sulphide of calcium), now obtainable in the market, has a yellowish white tint, which considerably limits its direct application as a paint. On the other hand, the calcic sulphide, or the luminous paint obtained therefrom, loses its luminous property, if it is directly mixed with the ordinary commercial paints. An invention recently patented by Gustav Schatte, of Dresden, Saxony, has for its object to produce durable white or colored paints, containing a luminous substance, which causes them to shine in the dark, without changing or neutralizing in daylight the tint of the coloring substance or substances contained in such paints.

For this purpose Zanzibar or Cowrie copal is melted over a charcoal fire, 15 parts of this melted mass are dissolved in 60 parts of French turpentine, and the resulting mixture is filtered, whereupon 25 parts of pure linseed oil are added, which linseed oil has been previously boiled and allowed to cool a little. The lake varnish thus obtained is carefully treated in a paint mill with granite rollers, and worked into a luminous paint by one of the processes hereinafter described. Iron rollers capable of giving off under great pressure small particles of iron, which might affect the luminous power, should not be used.

Lake varnish as obtained in commerce contains nearly always lead or manganese, which would destroy the luminous power of the calcic sulphide. A pure white luminous paint is produced by mixing 40 parts of lake varnish obtained as described with 6 parts of prepared baric suphate, 6 parts of prepared calcic carbonate, 12 parts of prepared zinc sulphide white, and 36 parts of calcic sulphide in a luminous condition, in an oil vessel, and therein worked into a coarse emulsion which is then ground fine between the rollers. To produce a red luminous paint 50 parts of the said lake varnish are mixed with 8 parts of prepared baric sulphate, 2 parts of prepared madder lake, 6 parts of prepared realgar (diarsenious disulphide) and 34 parts of calcic sulphide in a luminous condition, and the mixture worked in the same way as described for the white color.

To produce a luminous orange color, 46 parts of prepared lake varnish are mixed with 17·5 parts of prepared baric sulphate, 1 part of prepared Indian yellow (jaune indien), 1·5 parts of prepared madder lake, and 35 parts of calcic sulphide in a luminous condition. To produce a luminous yellow color or paint 48 parts of prepared lake varnish are mixed with 10 parts of prepared baric sulphate, 8 parts of prepared baric chromate, and 34 parts of calcic sulphide in a luminous condition.

To produce a luminous green color or paint, 48 parts of prepared lake varnish are mixed with 10 parts of prepared baric sulphate, 8 parts of chrome oxide green, and 34 parts of calcic sulphide in a luminous condition. A luminous blue color is produced with 42 parts of prepared lake varnish, 10·2 parts of prepared baric sulphate, 6·4 parts of ultramarine blue, 5·4 parts cobalt blue, and 36 parts of calcic sulphide in a luminous condition. A luminous violet is produced with 42 parts of prepared lake varnish, 10·2 parts of prepared baric sulphate, 2·8 parts of ultramarine violet, 9 parts of cobaltous arseniate, and 36 parts of calcic sulphide in a luminous condition.

A luminous gray color or paint is produced with 45 parts of prepared lake varnish, 6 parts of prepared baric sulphate, 6 parts of prepared calcic carbonate, 0·5 part of ultramarine blue, 6·5 parts of zinc sulphide gray, and 36 parts of calcic sulphide in a luminous condition. A yellowish brown paint is obtained with 48 parts of prepared lake varnish, 10 parts of prepared baric sulphate, 8 parts of orpiment, and 34 parts of calcic sulphide in a luminous condition. Luminous colors for artists may be manufactured, if in the mixtures previously described the respective parts of lake varnish are replaced by the same quantities of pure East Indian poppy oil and the product is then finely ground and prepared.

Luminous colors for oil printing may be produced by using, instead of the above mentioned parts of lake varnish, the same quantities of pure linseed oil won by presses only, and thickened by boiling. All the paints described may be made into luminous colors suitable for making colored paper and other purposes if the lake varnish is omitted, and the dry luminous colors thus got are ground or mixed with water, and some binding substance free of acids.

They may also be made into luminous wax colors for casting on hollow glassware and similar objects, if, instead of the lake varnish composed as described, ten per cent more of cera japonica and the fourth part of the latter quantity of oleum olivarium alb. is used, or into colors for painting on porcelain. The color is painted on porcelain and then incinerated with the exclusion of air. The paints may also be treated with soluble glass (potash and soda water glass).

Improved Rapid Method of Copying Drawings, Manuscripts, Etc.

The common method of copying drawings by contact with the blue process or sensitive silver paper, which requires an exposure to the sun of from fifteen minutes to half an hour, seems likely to be superseded to some extent by the introduction of improved gelatine bromide of silver paper.

Gelatine sensitive paper has been difficult to prepare, but by means of recent improvements the manufacturers are now able to furnish it in large sheets uniformly coated, so that its use in various branches of the arts promises to be extensive.

Architects, draughtsmen, engineers, and others who wish to make duplicate copies of their drawings are, by the usual processes, obliged to first make a tracing upon transparent linen cloth, so that the light may easily affect the sensitive paper. Much extra time is lost and expense incurred. By means of the gelatine sensitive paper any ordinary thick card board drawing can be copied in a few seconds, either by diffused day light or gas or lamp light. The copy will be an exact reproduction of the original, showing the letters or figures non reversed.

If it is desired to make a copy in the day time, any dark closet will answer, where all white light is excluded. The tools required are an ordinary photograph printing frame and a red lantern or lamp.

The sensitive gelatine paper is cut to the size required, and laid with the sensitive side upward upon the face of the drawing, and pressed thereon in the usual manner, by springs at the back of the frame, which is then carried to the window and exposed with the glass side outward from two to five seconds to the light; the exposure varying according to the thickness of the drawing. If gas or lamp light is used at night, from twenty to thirty minutes exposure is sufficient.

The frame is returned to the dark closet, the exposed sheet is removed to a dark box, and other duplicates of the drawing can be made in the same way. It is thus possible to make from ten to twenty copies of one thick drawing in the same time that it usually takes to obtain one copy of a transparent tracing by the ordinary blue process.

The treatment of the exposed sheets is quite simple; all that is necessary is to provide from three to four large pans or a large sink divided into partitions. The development of the exposed sheets can be carried on at night or at any convenient time, but a red light only must be used. The paper is first passed through a dish or pan of water and then immersed in a solution, face upward, composed of eight parts of a saturated solution of oxalate of potash to one part of a saturated solution of sulphate of iron, enough to cover the face of the paper. Both chemicals are easily obtained at a druggist's. The latent image soon appears and a beautiful copy of the drawing is obtained, black where the original was white, with clear white lines to represent the white lines of the drawing. With one solution from six to eight copies can be developed right after the other. After development the print is dipped in a dish of clear water for a minute, and finally immersed for three minutes in the final or fixing solution, composed of one part of hyposulphite of soda dissolved in six parts of water. It is then removed to a last dish of water face downward, soaked for a few minutes, then hung up to dry; when dry it is ready for use. Instead of a drawing, manuscript can be placed in the printing frame and exposed as described. All the water marks or peculiarities of the grain of the paper will be faithfully reproduced. The advantages of this process are self-evident.

Intricate mechanical drawings can be so rapidly copied, that working copies can be quickly delivered. By this process original manuscripts, certificates, and documents of every kind can be rapidly copied, every detail being brought out, the original paper serving as the negative, the copy being of the exact size as the original.

A Large Family.

The Madrid *Estafette* states that a Spanish gentleman, Señor Lucas Nequeiras Saez, who emigrated from his native land to America seventy years ago, recently returned to Spain in a steamer of his own, and brought with him the whole of his family, which consists of no fewer than 197 souls, sons-in-law and daughters-in-law not included. Señor Saez has been three times married. His first wife had 11 children at 7 births, his second had 19 children at 13 births, and his third had 7 children at 6 births. The youngest of this family of 37 is aged nineteen; the eldest, who is seventy, has 17 children, of whom the first born is forty-seven. Of Señor Saez's 23 sons, all of whom are living, 13 are married, 6 are unmarried, and 4 are widowers; and of his surviving daughters, 9 are married. The granddaughters number 34, and of these 22 are married, 9 are unmarried, and 3 are widows; and of the 45 grandsons, 23 are married, 17 are unmarried, and 4 are widowers. There are also 45 great-granddaughters, and 39 great-grandsons, of whom 3 are married. Señor Saez has never tasted wine or any alcoholic liquor, and lives chiefly upon a vegetable diet, with but little salt. In spite of his ninety-three years, he is still hale and hearty, and makes a point of walking briskly for at least three hours every day.

The Cotton Goods Trade of the United States.

The prosperous condition of the cotton industry in this country is shown by the statistics of exports. In 1825 there were no exports of cotton goods; in 1835 the value was $2,858,681; in 1845 it was $4,327,928; 1855, $5,857,181; 1865, $2,273,509; 1875, $3,071,882; 1882, $13,225,000; and for the first eight months of the present year, $8,414,433. Of this industry the *Economist* says: "Americans have driven the English not only from the American markets, but largely from the European markets, and even in the English markets, we have commenced a not unsuccessful competition. We do not hope nor do we expect to at once step to the front in Eastern markets, under present conditions, but with time, study, and patience our excellent manufactures will gain an unshaken foothold and compete on anything like even terms with those of other countries."

THE CABLE CARS OF THE BROOKLYN BRIDGE.

On September 24 the passenger cars began their regular trips. In previous issues we described the endless wire cable to which the cars are attached, and also the machinery for driving it, located beneath the roadway of the Brooklyn approach. At the Brooklyn station the cars are shifted from the incoming to the outgoing track by small locomotives, but at the New York end the shifting is done by a small auxiliary rope. As the cable enters the New York station it passes over a grooved sheave, 10 feet in diameter, and then under a similar sheave, both sheaves being in the same plane and so near that their rims all but touch. By this means the sheaves are made to revolve in contrary directions. The journals in which the shafts of these wheels revolve are bolted to an iron frame supported in a inclined position, as shown in Fig. 4. After leaving the lower sheave the cable passes around a sheave whose plane is horizontal, and then goes across the station to a similar sheave, which is supported on a car running upon inclined rails, by which means the slack at this end of the route is taken up. On each shaft of the upright sheaves is a loose, grooved drum, and around these two drums are wound coils of a small wire rope which runs over pulleys guiding it to the second floor of the station on which the cars are. The slack is taken up by weights hung on the wire, as shown in the engraving. The plan of the two sheaves, the auxiliary rope, and the tracks is shown in Fig. 3, the dotted lines representing the rope.

The rope leads through the center of the main track to the switch, and thence through the center of the crossing to the other main track, up which it goes to the end of the building. To this rope is permanently attached a bar projecting from the bottom of a small car. By aid of a lever controlled by a switch, which is on a platform in the center of the station, so that an unobstructed view may be obtained by the operator, either of the driving drums can, by means of friction clutches, be made to revolve with the shaft it is on, while the other drum, being free, takes its motion from the rope. The drum which is in gear therefore controls the direction in which the small car moves. The passenger cars are brought to the station by the main cable, and after having discharged their passengers are coupled to the little switching car. The lever is shifted, the little rope moves, and the car is taken to the upper end of the station, but on the other track. The direction of the rope is now reversed, and the car is pushed down the other main track. The little car only starts the larger one, as the grade is sufficient to carry it to the platform. A second small rope, operated by similar drums on the other side of the sheaves, extends to the rear of the station along the incoming track, so that the cars may be taken to the upper end of that track and switched to the other by a second crossing.

On the platform above mentioned are five levers, by which the drums are thrown in and out of gear, and from which all the operations of switching the cars are controlled. Beside the switch tender is a telephone connected with the other station. Fig. 2 is a view of this platform and of the switching car, which is shown attached to one of the passenger cars.

The grip that takes hold of the cable is beneath the center of the car. It consists of four wheels, about 18 inches in diameter placed in the same plane, which makes a very sharp angle with the horizontal. These wheels are rimmed with wood, in which a shallow groove is cut. Oak was tried, but did not prove as satisfactory as maple. The grain of the wood runs toward the center of the wheel. The wheels face each other, two being on each side of the cable. They are attached to levers so that they can be moved near to or away from each other. The iron rim of the wheel projects so as to form a cylinder, against the inner surface of which presses the wooden shoe of a brake. These brakes are on the sides of the wheels nearest to each other. The cable is lifted and placed between the grooves, which hold it in position. The wheels now revolve at a rate corresponding to the speed of the cable. The brakes are brought into action and the cable is gradually pressed tighter and tighter between the grooves. The car starts very slowly, no jerk being felt, and the grooved wheels move slower and slower until they finally stop, the car having attained a speed equal to that of the cable. The wheels are expected to press the cable so tightly that the inertia of the car will be gradually overcome by the friction of the brakes upon the inside of the rim. The grasp thus obtained on the cable is continued until the car has neared the opposite station, when the grip is tripped by an arm coming in contact with a standard on the side of the track. All the operations of the grip are made from the brake on the platform of the car.

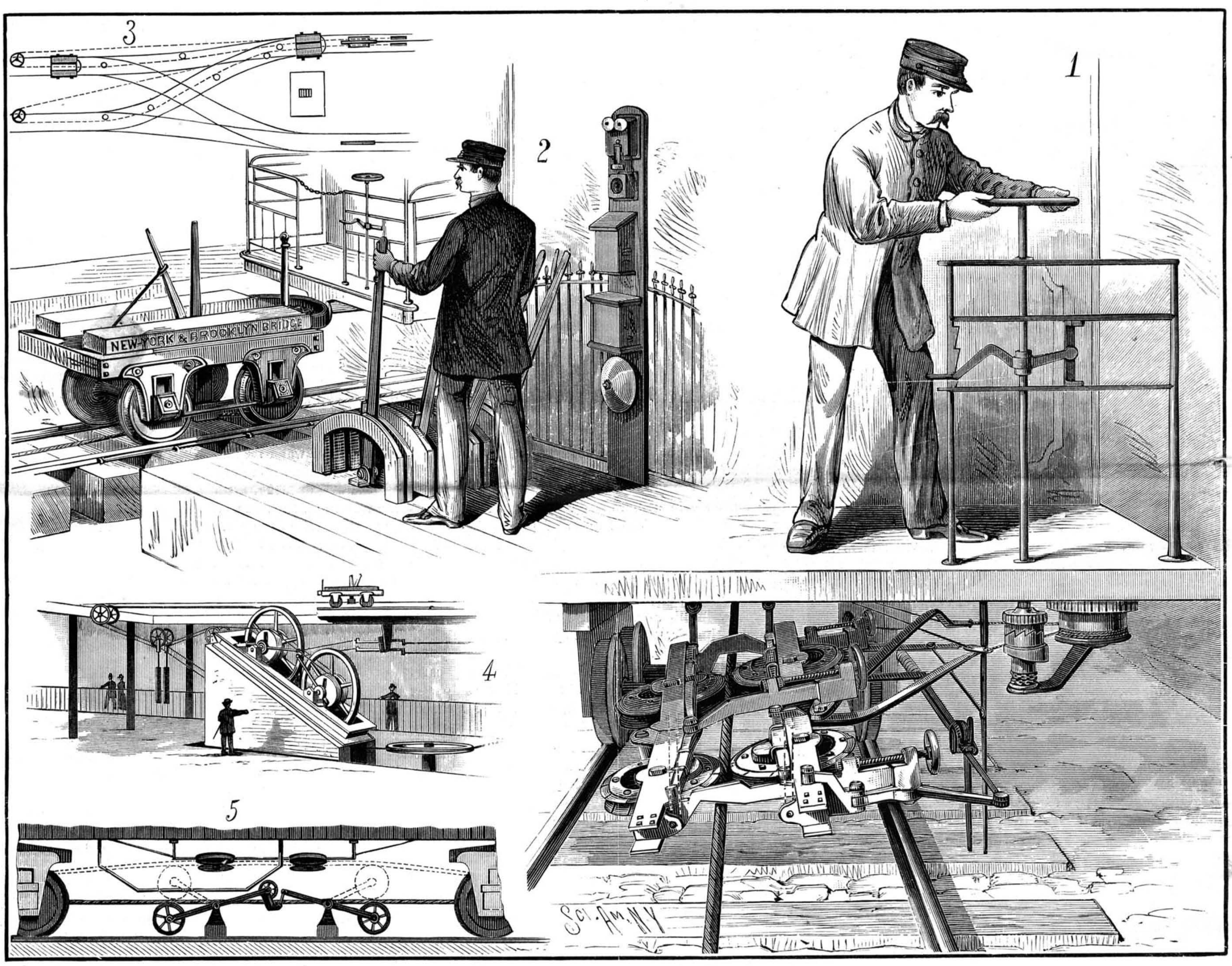
Fig. 1 is a view of the grip looking in a direction parallel with the track. When the hand brake is raised, a pinion on its lower end engages with a gear operating a drum about which is wound the wires attached to the ends of the levers that work the brakes upon the inner rims of the wheels of the grip. When the brake is lowered, as shown in the engraving, the brakes can be applied to the wheels of the car.

The cable is lifted to the grip by two pulleys in the center of the track. Each pulley is on the end of a rod, working on a fulcrum at its center, the adjoining ends of the rods being connected. It will be readily seen that if the joined ends of the rods are depressed, the pulleys will be raised until the cable is on a level with and is running between the grooved pulleys of the grip, the car having been stopped so that the grip is between the two pulleys.

Upon the adjoining ends of the two rods is a grooved pulley which is depressed by a bar projecting from the bottom of the car. The lower portion of this rod is horizontal, the ends which first come in contact with the pulley being inclined upward. The working of the lift will be readily understood from the drawing, Fig. 5.

When the engine was started, much trouble was occasioned by the journals heating. The shaft is of steel and the journals of brass. As the brass expanded more rapidly than the box, and as the excess of material so formed had no outlet, it bound the shaft. This was obviated by chipping away the inner edges of the brass. Then it was found that the oil would not pass to the under side of the shaft. A longitudinal channel was cut in the inner face of the under half of the journal and was branched at the ends. This accomplished the object.

The entire system of running the cars was designed by the assistant engineer of the bridge, Colonel Wm. H. Paine.



MECHANISM FOR OPERATING THE CARS OF THE BROOKLYN BRIDGE.

Comet Photographs.

Six photographs of the late comet, which were taken at the observatory of the Cape of Good Hope by D. Gill, were sent to the Paris Observatory and presented to the Academy by Admiral Monchez, who pronounced them the finest he had seen. The stars in the center of the image are reduced to a point of remarkable sharpness, in spite of the very long duration of the exposure, which amounted to 140 minutes for the sixth negative. More than fifty stars are seen through the tail of the comet. The slight increase of diameter which is observed in the stars remote from the center is due to the employment of an apparatus with too short a focus. The fine result is explained by the well known skill of the photographer and the purity of the South African sky. The success of the experiment encourages the hope that it will soon be possible to make excellent celestial charts by photography.—*Comptes Rendus.*

THE CROWNED PIGEON.

The crowned pigeon (*Goura coronata*), shown in our illustration, is the largest and most conspicuous of its tribe. This family (*Gouridæ*) embraces three known species, found in New Guinea and the neighboring islands of the Indian Sea. Two of the species are often seen in our zoological gardens.

The crowned pigeon is about seventy-five centimeters long, its wings thirty-eight centimeters, and its tail twenty-six centimeters long. The general color of its plumage is a light slate blue, somewhat darker upon the tail and wings. The quill feathers of the wings are black at the root, with a patch of white and maroon in the center; the tail feathers have a broad band of slate gray at the end; the eye is scarlet, the bill horn color, the foot red.

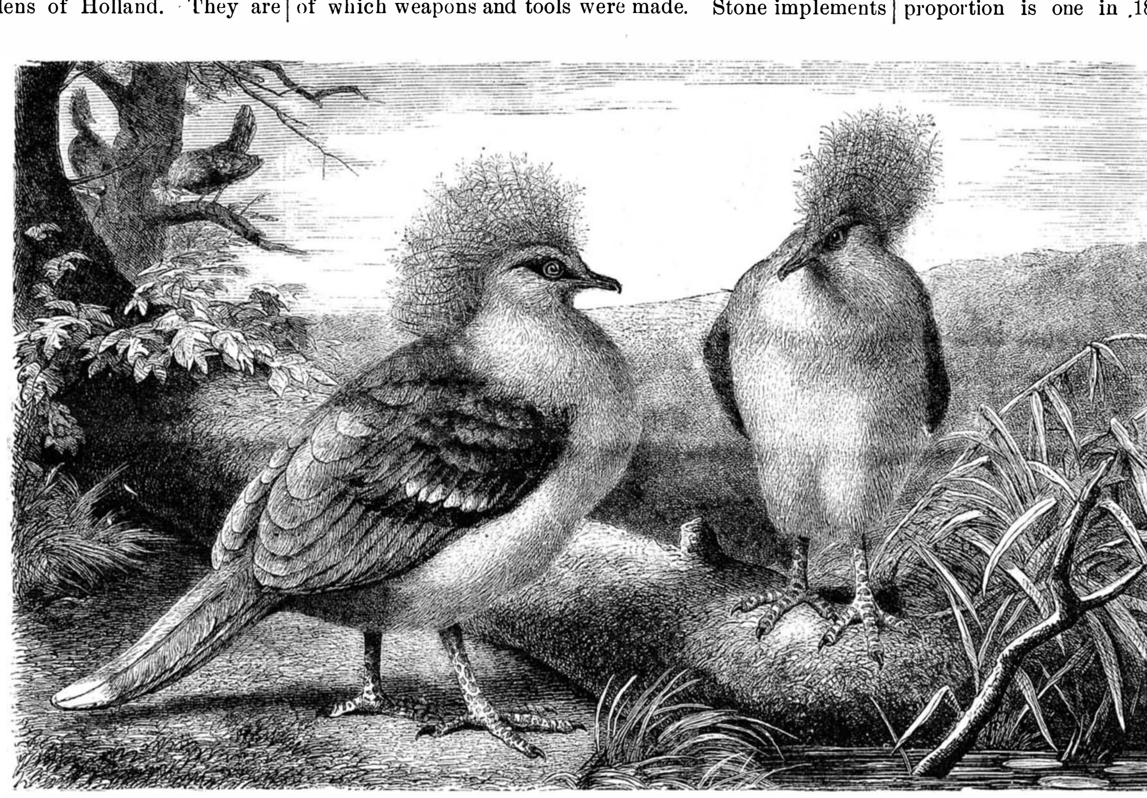
In the year 1699 the elder Dampier saw the crowned pigeon in its native country; later several were carried to the East Indies and the island of Sunda, where they were kept in yards like hens. They were also taken to Holland, and were found in the collections of rich amateurs. Until recently very little was known of their wild life.

Rosenberg says: "These birds live in great numbers upon the coasts of New Guinea, also upon the islands of Salawati and Misul. In their manner of life they resemble the pheasants, roving in small flocks around the forests."

Wallace has often seen them in New Guinea running along the forest paths. They spend the greater part of the day upon the ground, eating the fallen fruits, and only fly, when frightened, to the lower branches of the nearest tree. They choose also the low branches for a roosting place. Rosenberg writes that he obtained a female bird while sitting upon her nest. The nest consisted of twigs loosely put together, and contained a young bird just escaping from the shell.

At the present time these pigeons are found most frequently in the zoological gardens of Holland. They are kept quite easily on a frugal diet, and bear the winter very well, if put into sheltered rooms. A large number of these pigeons died in the London Zoological Gardens, and Mitchell says that the only remaining pair were placed in a room in the old bird house. In the beginning of August they commenced to build a nest. In the open part of the bird house there was a stout branch of a tree, about two meters from the ground, which served as a perch. Upon the outermost point of this branch they carried small twigs, which were given them for this purpose, and tried in vain to build a nest upon this slippery and unsatisfactory foundation. The attentive keeper perceived their perplexity and nailed a broad piece of basket work to the branch; then they began to build in earnest, the male carrying the twigs and the female doing the work. The nest was completed on the 15th of August. An egg was laid on this same day, it is thought, although the keeper could not see it, as it was constantly covered by one or the other of the birds. The nest was not far from the outer wall of the bird house, and during the brooding time thousands of visitors passed by it. The keeper was only able to see the egg once, at a time when one bird relieved the other. The young bird left the shell on the 13th of September, after twenty-eight days of brooding. It continued to be sheltered and fed by the parents, who hovered over it. On the morning of the 17th it was found dead in the nest, whether from an excess of care or by accident is not known. The mother hovered over the dead bird and warmed it with her breast as if she could not believe it dead.

"The cry of this bird is loud and sonorous, and every time it utters this note it bows its head so low that the crest sweeps the ground. Its flesh is spoken highly of by those who have eaten it."—*From Brehm's Animal Life.*



THE .CROWNED PIGEON.—(GOURA CORONATA.)

Meat.

The value of meat as a food is due in a degree to its heat-producing properties, though in this respect it is surpassed by fatty and amyloid substances. It is as a tissue building material, and as an excitant of assimilative changes in the tissues, both with regard to itself and to non-nitrogenous foods, that it is most useful. It is stimulant as well as nutritive, and it therefore holds a deservedly high place in the daily dietary. Experiment has shown that three-quarters of a pound of lean meat fairly represents the quantity per diem which, taken with other less nitrogenous matter, suffices to maintain a person of average size and weight in a normal state of health. Some there are who largely exceed this standard, eating freely of meat at every meal, and living all the time quiet, sedentary lives. Such carnivorous feeders sooner or later pay a penalty by suffering attacks of gout or other disorders of indulgence. But it is equally important to note that many others, especially women, healthy in all points but for their innutrition, are apt to err as far on the other side. Thus one meets with people who consume about a pound of butcher's meat in a week, or not even that. This fact has been fully brought out by Dr. Graily Hewitt, in his address to the Obstetrical Section at the recent meeting of the British Medical Association. He has likewise with much probability assigned this defect of diet as the chief cause of that general "weakness" which is so common among the antecedents of uterine displacement. The experience of many practitioners will confirm his observation. Different causes are at work to produce this kind of underfeeding—too rigid domestic economy, theoretical prejudices, the fastidious disinclination for food which comes of a languid indoor life without sufficient bodily exercise, tight lacing perhaps, and many more. These difficulties are all more or less removable, unless, indeed, where absolute poverty forms the impediment. No effort should be spared to remove them. The advantages derived from a diet containing a fair amount of solid animal food could not be obtained from a purely vegetable or milk regimen without either unnecessarily burdening the digestive system with much surplus material, or, on the other hand, requiring such revolutionary changes as to quantity and quality of food and times of eating as would probably altogether prevent its general adoption, even were that desirable, into household management. In our opinion, such changes are not desirable, as being inadequate to secure their purpose.—*Lancet.*

Stone Implements.

Herr Reyes, in a recent essay upon the use of stone implements by ancient races, has adduced some interesting considerations to prove the persistence of their use during the succeeding periods when metal began to form the material of which weapons and tools were made. Stone implements were employed by nations at a time when they were well acquainted with the preparation of the hard metals. Thus the Egyptians used flint chisels and granite sledges in the quarries of Mt. Sinai. In the excavations at Syene stone tools have been found. The Romans used stone chisels in the gold mines of upper Egypt. The Assyrians at the zenith of their power used stone axes along with metallic weapons. The Chinese were armed with stone weapons when they (2200 B. C.) descended upon the plains and subjugated a race using metals. The Mexicans have wrought delicate sculptures on stone with stone implements. In the mines of Spain and Sardinia stone hammers were in use during historic times. Many reasons explain these survivals. Conservative habits prolong the use of old and valued tools. Religious ceremonies connected with their use, as the acts of embalming among the Egyptians, circumcision with the Jews, sacrificial knives with the Phœnicians and Etruscans, maintained the employment of stone in such rites from traditional and reverent motives. Again, the poorer classes could not afford the purchase of the new and dearer implements, and used the older and cheaper material for the construction of their toools. The new metallic objects were probably not always able to replace in efficiency their stone counterparts. Workmen were more expert in the use of the stone than the metallic implements.

Again, linguistic evidence supports these conclusions. The Basque names for weapons and tools imply the use of stone; ax is a "*big stone*," hoe a "*scraping stone*," knife a "*little stone*," or stone chip. The holy spear of India is named Akman, *i. e.*, *sling stone, thunderbolt.* The god Thor is armed with a stone sledge. Our word *hammer* meant originally *stone, cliff*, and later acquired the associated idea of "*a stone to strike with.*" The German word *Messer* originally meant *ess stein, i. e.*, eating stone. *Hellebarte*, English halberd, meant "beard-shaped stone," stone ax. In the Indian and German myths stone weapons take an important place. From which the author concludes that these peoples had reached the advanced stage of mental development implied in these legends and stories, before their chiefs and heroes had replaced their stone with metal weapons. On the other hand, the races of southern Europe describe the heroes of their myths as fighting with metal armor only, which implies the origin of these tales at a time when the preparation of metal and the manufacture of metal weapons were understood. The same inference is drawn with regard to the Semito-Hamitic races.

From these examples it is clear that the stone age with different races did not correspond to any identical and prevalent condition of culture, but varied, as might have been presupposed, according to the varied and opposite conditions by which they were surrounded. And it also plainly is seen that the stone age itself but slowly yielded before the encroachments of its modern successor.

Longevity in the Different States.

A student of the reports of the tenth census has compiled a table for the Boston *Commonwealth* for the purpose of showing in what State or States one has the best chance for a long life. New Hampshire seems to him to be the favorite refuge of green old age, for he finds that one seventy fourth of the inhabitants are at least eighty years old. The proportion among native white males is 1 to 80, but the environment in New Hampshire seems to have been even more favorable to the preservation of life in the other sex, for the proportion among native white females is 1 in 58. Other New England States do not contain quite so many old persons, the average proportion for the six being 1 in 134. Coming to New York, he finds that for one person who has reached the age of eighty there are 161 who have not been so fortunate, and in the three Middle States the average proportion is one in 182. As he goes southward he discovers a greater preponderance of young blood, for in six South Atlantic States the average proportion is 1 in 203. The Gulf States afford a less attractive shelter for the aged, for the average is 1 in 300. In Texas, where so many worthy persons die with their boots on in the prime of life, only one octogenarian can be found in a group of 497 citizens. The average rises again in the interior States east of the Mississippi, but in the Great Lake States it falls to 1 in 263, a good old age being attained with the greatest difficulty in the wealthy and prosperous State of Illinois. In seven States west of the Mississippi River the aged rarely appear, for the average proportion is 1 in 453. In Iowa a crop of 334 persons yields only one who has reached the age of four score; in Minnesota, Nebraska, and Kansas only one of these aged citizens can be found in a group that would yield two in Iowa, and in Colorado 1,150 inhabitants must pass in review before an octogenarian comes in sight. The old are even more rare in Nevada, but in California and Oregon the proportion is nearly 1 in 500. If the inhabitants of the whole country could be assembled in two hundred and twenty-seven groups, it would be possible to place at the head of each group one patriarch of eighty or more years. So our student, assuming that long life is the inalienable right of those who reside in New Hampshire, Vermont, and Maine, cries: "Flee to the mountains of New England for health and longevity!"

The Postal Notes.

In an article advocating the substitution of fractional silver for small bank notes, the New York *Herald* says: "If Congress should withdraw from circulation all the small notes—ones, twos, and fives—for which postal notes answer all necessary purposes, it could safely order the coinage of at least two hundred and twenty-five millions, and perhaps two hundred and fifty millions, of small silver, and this would pass naturally and immediately into circulation as the small notes were called in."

It is difficult to see how the postal notes answer the purposes of circulation for small amounts. Their value depreciates after they are three months old. Then they must be returned to some office of issue and the holder must receipt for them, even though he cannot write, and they are made payable to bearer. There is no prospect—as there was probably no intention—that postal notes will become a circulating medium to the extent to trench upon the territory now occupied by the lower denominations of bank notes. *Underwood's Reporter* says that the postal note may easily be "raised," and if this is so, the fact alone will confine it to its legitimate use, a convenience of transmitting small sums by mail, taking the former place of scrip and the later place of postage stamps.

The Vienna Electrical Exhibition.

The Rev. Charles A. Stoddard, D.D., one of the editors of the New York *Observer*, is writing from abroad to his paper some very interesting letters descriptive of the places he visits, his experiences and observations as a traveler on the Continent. His last letter was from Vienna, and his account of the International Electrical Exhibition now open there is the best we have read. Mr. Stoddard pronounces the exhibition complete and beautiful, and says: "Aside from the telephones, telegraphs, and countless varieties of electrical appliances for generating and applying power, the two striking points of the exhibition are the Siemens electric railway and the numerous practical methods of lighting which are exhibited. The railway seems to be a success, its car runs back and forth constantly, carrying crowds of people to their own satisfaction and to that of the onlookers. It differs from the electric railway which was constructed in the environs of Berlin, in that the electricity is stored for the trip, beneath the car. In the Berlin railway it was communicated by means of a cable on posts along the line. The car runs rapidly and noiselessly and is easily controlled by the conductor.

"The lighting of the buildings by electricity is on a vast scale. There are numerous steam engines which drive the machines furnishing the electricity, and the immense hall when lighted was as bright as day. There are English and American and German systems exhibited, and a series of rooms fitted up with extreme elegance illustrate the practical application of the electric current to the purposes of house lighting. No more beautiful and brilliant suites of apartments could be seen even in the palaces of kings. The Edison, Brush, Maxim, and Swan systems are each magnificently represented. The Swan light is white and more agreeable than the Brush or Maxim, but the yellow light of the Edison system, while it is accompanied by some heat, is upon the whole the most agreeable; all are brilliant, and all are painful to the eye after a few hours, but they are vastly superior to gaslight, and in due time the gas companies will pass away and their meters will be exhibited in the same museums with the instruments of extortion used by the Inquisition. The accuracy and perfection of some of the electrical machines made upon the Continent was worthy of notice. They were so steady and constant in the light which they furnished as to excite the admiration of all beholders. These lamps are called by different names, known to experts as the Pilsen, Ganz, Schuckert, and Schwerd machines. The Ganz lamp is the simplest in its construction and gives a steady light. It is a lamp with a single solenoid; the electric current enters through a lower, fixed carbon, passes into the solenoid's iron core, and by an ingenious but simple contrivance forms the arc upon a positive carbon.

"The possibility of turning on and off any number of incandescent lamps in one circuit, without regulating the main current, is shown in a very successful way. This will reduce the expense of electric lighting by removing the necessity for special apparatus designed to introduce a greater or less resistance into the circuit; and thus the main obstacle to the introduction of electric lighting, its great expense, bids fair to be modified by the inventions presented at the Vienna exhibition. Some of the designs shown are most beautiful. Besides ordinary chandeliers and brackets, there are bouquets of glass flowers, from which the light proceeds; fountains in the center of a room that seem to be throwing out crystal streams of light; rays of light flowing into the room without any jet or fixture being visible, a beautiful boudoir whose ceiling is pierced in manifold places in the form of little stars, and behind each opening an incandescent lamp is placed, so that the apartment seems starlit. To recount the wonders which have already flowed from the practical application of electricity, and which are on view at Vienna, would require," says Mr. Stoddard, "the knowledge of an electrician, the terminology of a machinist, and several issues of the New York *Observer*."

A Deep Artesian Well.

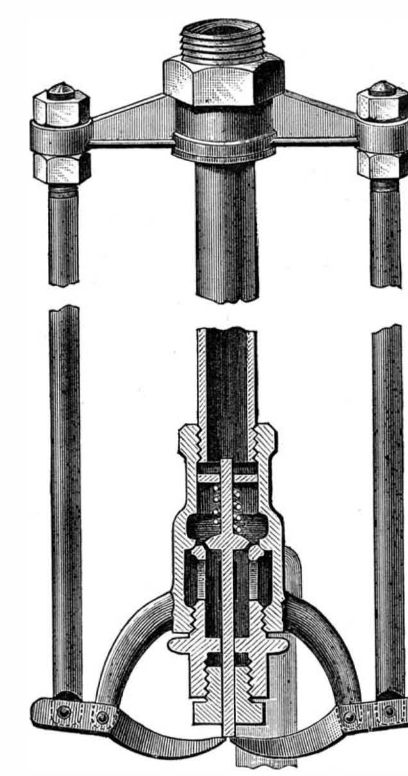
The artesian well now being drilled in the cellar of Cyrus W. Field's new building, at No. 1 Broadway, will be one of the deepest and largest in this country, and the tools used are among the heaviest ever made for this purpose. The bore is 8 inches in diameter, the usual size being from 4 to 6 inches. The hole in this well is between 300 and 400 feet deep, and progress is being made at the rate of 100 feet a week. An abundance of water has been reached, but not in sufficient quantity to justify a discontinuance of the drilling. The auger and bit weigh 4,800 pounds, and are lowered into the hole by a cable. One end of the cable is attached to an immense walking beam, by which it is raised and let fall with every stroke. A man stands constantly at the mouth of the well, turning the cable as the bit is raised, so that the boring is as perfectly done as if the rock were of pine and the auger of steel.

The hole is round and smooth, and almost polished by the constant friction. Every few hours the auger is drawn out and a large brass syringe inserted to suck out the rock sand which is made by the drilling. The bits are constantly being dulled by rocks, and a blacksmith's forge is necessary to sharpen and temper them to their work. One bit lasts usually about four hours, when it is removed and another one put in its place. Mr. C. J. Bushnell, the contractor for the work, estimates that the well will cost nearly $15,000, and will yield about 50 gallons of water per minute.—*Engineering News.*

THE CHAMPION STEAM TRAP.

This steam trap is simple in construction, effective in operation, and strictly automatic. It consists of a central tube of heavy brass passing through a crossbar, to each end of which is attached an iron rod by means of two nuts. The lower end of the brass tube screws into the top of the valve case. The rod of the valve is held in place at its upper extremity by a horizontal piece extending across the chamber, and its lower extremity passes through a stuffing box, and upon the outer end rest the two points of the curved levers. A spiral German silver spring tends at all times to close the valve.

From the lower part of two opposite sides of the case project two downwardly curving arms, whose ends are pivoted to two horizontally placed arms attached to the ends of



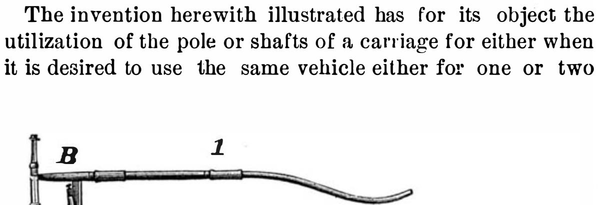
THE CHAMPION STEAM TRAP.

the iron rods. As the brass tube is expanded by the water passing through it the levers are depressed, the relative lengths of the long and short arms allowing the valve to move a great distance compared with the expansion of the tube. This enables the trap to act through a wide range of temperature and to discharge water almost cold or at the boiling point, as may be required. The valve is adjusted by means of the two nuts on each end of the iron rods. The ends, levers, and valves are made of hard brass. The expansion and contraction of the tube will not result in leakage or breakage, and the annoyances consequent upon such occurrences are done away with.

Further information may be obtained by addressing the manufacturers of the Champion Steam Trap, 821 Cherry Street, Philadelphia, or the New York agents, Messrs. H. T. Patterson & Co., 138 Centre Street.

POLE AND SHAFT FOR VEHICLES.

The invention herewith illustrated has for its object the utilization of the pole or shafts of a carriage for either when it is desired to use the same vehicle either for one or two



MARRETT'S POLE AND SHAFT FOR VEHICLES

horses, thus doing away with a separate pole and separate shaft. For this purpose a sectional construction is used, with socketed screw couplings, for uniting or disconnecting the sections of the pole and shafts, special devices being designed for other connections. This plan insures greater compactness when not in use, increased strength, facility of repair in case of breakage, and adaptability for stowing the parts away in the carriage when not in use. Figs. 1 and 3 represent the shafts and pole respectively. To change the shafts to the pole the whiffletree of the former is removed and two nearest couplings unscrewed, and the pole and its whiffletrees attached, the manner of making these connections being shown in the sectional drawings, Figs. 6 and 7. The two first sections of the shafts are then placed end to end and constitute the central portion of the pole, a side view of which is shown in Fig. 2. The screw coupling for the straight sections is shown in Fig. 4, and Fig. 5 shows the first joint of the shafts. All the details of construction will be readily understood from the engravings, in which like letters represent like parts.

This invention has been patented by Mr. Walter H. Marrett, of Brunswick, Maine.

Asphalt Pavement in St. Louis.

Pine Street, St. Louis, is being newly paved with asphaltum. The contract under which the work is being done, after providing for a foundation of cement, mortar, and concrete, provides that the pavement shall be completed as follows:

Upon the concrete foundation thus prepared shall be laid the wearing surface or pavement, the basis of which or paving cement must be pure Trinidad asphaltum unmixed with any of the products of coal tar. The wearing surface shall be composed of: 1. Refined Trinidad asphaltum. 2. Heavy petroleum oil. 3. Fine sand, containing not more than 1 per cent of hydrosilicate of alumina. 4. Fine powder of carbonate of lime.

The Trinidad asphaltum (so called), whether crude or refined, as found in this market, contains from 20 to 35 per cent of impurities, and is especially refined and brought to a uniform standard of purity and gravity.

The heavy petroleum oil, which may be the residuum by distillation of the petroleum oils as found in the market, generally contains water, light oils, coke, and a gummy substance soluble in water. The petroleum oil is freed from all impurities and brought to a specific gravity of from 18° to 22° Baume, and a fire test of 250° F.

By melting and mixing these two hydrocarbons, petroleum oil and asphaltum, the matrix of the pavement, called asphaltic cement, is manufactured, which cement has a fire test of 250° F., and a temperature of 60° F. has a specific gravity of 1·19.

They are mixed in the following proportions by weight: Pure asphalt, 100 parts; heavy petroleum oil, 15 to 20 parts.

The asphaltic cement being made in the manner above described, the pavement mixture is formed of the following materials, and in proportions stated: Asphaltic cement, from 12 to 15; sand, from 83 to 80; pulverized carbonate of lime, from 5 to 15.

In order to make the pavement homogeneous, the proportion of asphaltic cement must be varied according to the quality and character of the sand. The sand and asphaltic cement are heated separately to about 300° F. The pulverized carbonate of lime, while cold, is mixed with the hot sand in the required proportions, and is then mixed with the asphaltic cement at the required temperature and in the proper proportion, in a suitable apparatus, which will effect a perfect mixture.

The pavement mixture, prepared in the manner thus indicated, shall be laid on the foundation in two coats. The first coat, called cushion coat, shall contain from 2 to 4 per cent more asphaltic cement than given above; it shall be laid to such depth as will give a thickness of half an inch after being consolidated by a roller. The second coat, called surface coat, prepared as above specified, shall be laid on the cushion coat; it shall be brought to the ground in carts, at a temperature of about 250° F., and if the temperature of the air is less than 50°, iron carts with heating apparatus shall be used in order to maintain the proper temperature of the mixture. It shall then be carefully spread, by means of hot iron rakes, in such a manner as to give a uniform and regular grade, and to such depth that, after having having received its ultimate compression, it shall have a thickness of two inches. The surface shall then be compressed by hand rollers; after which a small amount of hydraulic cement shall be swept over it, and it shall then be thoroughly compressed by a steam roller, weighing not less than 250 pounds to the inch run, the rolling being continued for not less than five hours for every 1,000 yards of surface.

The powdered carbonate of lime shall be of such degree of fineness that 5 to 15 per cent by weight of the entire mixture for the pavement shall be an impalpable powder of limestone, and the whole of it shall pass a No. 26 screen. The sand shall be of such size that none of it shall pass a No. 80 screen, and the whole of it shall pass a No. 10 screen. In order to make the gutters, which are consolidated but little by traffic, entirely impervious to water, a width of twelve inches next the curb shall be coated with hot pure asphalt and smoothed with hot smoothing irons, in order to saturate the pavement to a certain depth with an excess of asphalt.

The St. Gothard.

The approaches to the St. Gothard Tunnel are really more wonderful than the great tunnel itself. To get up to the level of the tunnel the railway track makes many spirals, winding, in some instances, three times around a single mountain, on three terraces one above the other, through twisting tunnels. The curves are, however, so gradual as to be hardly noticeable unless one carries a compass. Then is seen the curious fact that the needle makes complete circuits, and is constantly shifting its position.

The Electric Railway at Brighton.

On the 4th of August there was opened at Brighton an electric railway about a quarter of a mile in length, running along the beach, from the entrance to the Aquarium to the Chain Pier. It was constructed very hurriedly, and only ordinary apparatus and materials used. The whole of the line, car, etc., excepting the engine, dynamo, and motor, were erected in about eighteen days; this included moving and fixing the engine and dynamo and adapting the dynamo used as a motor.

The generator consists of a Siemens D_5 dynamo, electromotive force, 55 volts; current, 18 ampères; revolutions per minute, 1,700; the gas engine is Crossley's two horse power, having two flywheels running at 160 revolutions per minute; the dynamo used as a motor was made by Mr. Volk, the corporation electrical engineer; it weighs about 2¾ cwt., and runs about 700 revolutions per minute, and is connected by means of a belt to a countershaft and thence to a pulley fixed to one axle; the pulley on the motor is 5 inches in diameter, connected to a 10 inch pulley on the countershaft, thence from a 6 inch on the countershaft to a 12 inch pulley on the axle. The speed of the car up an incline of 1 in 100 is about 5 miles per hour, the return down the incline ten miles per hour. The car carried twelve passengers, exclusive of the driver, but has carried sixteen adults, and is illuminated at night by 20-candle Swan lamp.

The motor stands on one of the footboards covered by a box. The reversing is effected by a commutator switch which inserts several resistances before breaking the circuit, so that but little sparking takes place; the same handle that actuates the switch also alters the lead of the brushes, one pair only being used; the wear of these has been so slight that they were only shifted after three weeks' nearly continuous running. The track is about a quarter of a mile long, resting on the shingle; ordinary flange rails and longitudinal sleepers are used; the rails are connected by No. 8 copper wire loops bolted on with three-eighths inch bolts. The gauge is 24 inches.

The rails only are used as conductors, and the wet weather has not interfered with the working in the least; the loss even during rain does not exceed 10 per cent; and in dry weather it is less than 5 per cent. It may be interesting to compare this installation with the Chicago exhibit:

Engine 2 H. P. nominal, about 3½ indicated.	
Current	18 amperes.
Electromotive force	55 volts.
Weight, motor	2¾ cwt.
" car	7 cwt.
Load, twelve persons	1 ton.
Gradient	1 in 100.
Speed, mean	7 miles per hour.
Daily journey	25 to 30 miles.
" average passengers	350.

Application is now being made to extend the system the whole front of Brighton under the Esplanade wall, a distance of two miles, and to run cars in both directions every ten minutes, and also to have an electric hoist to convey passengers up the face of the eastern wall, a height of 62 feet.

The expenditure to convey twelve passengers sixty journeys, of half a mile each, *i. e.*, twelve passengers 30 miles, or one passenger 360 miles, is as follows:

	s.	*d.*
Gas, ten hours at 3d	2	6
Oil and waste, total	0	8
Conductor	3	4
Laborer to clean and attend to engine, repair shingle track, etc	4	2
Depreciation, 15 per cent on 500*l*., say	5	0
	15	8

or a trifle over ½ *d.* per mile; as the car is only running five minutes and standing five minutes, the carrying capacity can be multiplied by two, the only increased expense being 50 per cent extra gas, the cost in wages remaining the same, so that the cost is only a trifle over ¼ *d.* per passenger, supposing the car to run full every journey.—*Engineering.*

M. Pasteur's Instructions to the Members of the French Commission Sent to Study Cholera in Egypt.

"These instructions," M. Pasteur writes to the London *Times*, "all relate to cases in which the disease is supposed to be at a maximum of intensity. Besides, they are based on the supposition, which I consider very probable, if not certain, that cholera does not enter the human system through the organs of respiration, but through the digestive organs alone, except under very exceptional conditions."

1. Not to use any of the drinking water of the locality in which the members may be pursuing their researches without having previously boiled it, and when cold fill a bottle to one-half its capacity, cork well, and shake for some minutes.

The water of the locality may be used, provided it is taken from the spring and is put into what he calls *vases flambés*, that is, exposed for some minutes in air heated to 150° C. (302° Fahr.).

2. Natural mineral waters may be safely used.

3. Wine heated in bottles from 25° to 60° C. (77° to 140° Fahr.), and used from glasses *flambés*, may be taken.

4. Use only food that has been well cooked and fruit which has been washed in boiled water preserved in the vessels in which it has been boiled.

5. Use bread which has been cut into thin slices and then exposed for twenty minutes to a temperature of 150° C.

6. All the vessels (*vases*) employed for alimentary purposes (*aux usages alimentaires*) should be heated to 150° C., or more.

7. Bedclothes and linen used on the person (*linges de toilette*) should be soaked in water above the boiling point (*très bouillante*), and then dried.

8. Water used for the toilet should be previously boiled, and then, when cold, there should be added to it one five-hundredth part of thymic acid, or one-fiftieth part of carbolic acid (*acide phenique*).

9. Wash the hands and face several times a day with water to which thymic acid dissolved in alcohol, or carbolic acid in water, has been added.

10. Only in cases in which it becomes necessary to handle the corpse, the soiled clothing, or the excreta, will it be necessary to cover the mouth and the nostrils with a mask formed of two layers of fine wire cloth. Between these is placed a moderately thick layer of cotton. This mask before use is to be exposed to a temperature of 150° C., and is to be disinfected and purified by exposure to the same temperature every time it becomes necessary to use it.

The *Journal d'Hygiene* remarks upon them in substance as follows:

It seems like a dream to read such details. Why not advise the commissioners to shut themselves up in a heated oven for twenty-four hours? If, indeed, so much time is required for the commissioners to protect themselves, what time can they find for scientific investigations? Truly, an admirable illustration of the difference between the mere experimentalist in dealing with epidemic diseases, and the courageous physician who comprehends their nature in general terms, and proceeds to get clear of them by the use of destructive agents.

Bronze and Speculum Metal.

Copper alloyed with from 1 to about 5 per cent of tin is much harder than before, the color yellow with a cast of red, and the fracture granular. It is still considerably malleable. This seems to be the usual composition of many of the very ancient copper tools and weapons before the common use of iron; whence it appears that the ancients did not (as has often been supposed), possess any peculiar art of hardening pure copper, otherwise than by mixture. It is certain that the quenching of red hot copper in water will not at all make it harder, or have any such effect as it has upon iron. An alloy in which the tin is from one-tenth to one-eighth of the whole is hard, brittle, but still a little malleable, close grained, and yellowish white. When the tin is as much as one-sixteenth of the mass, it is now entirely brittle, and continues so in every higher proportion. The yellowness is not entirely lost until the tin is about seven twenty-thirds of the whole.

Copper, or sometimes copper with a little zinc, alloyed with as much tin as will make from about one-tenth to about one-fifth of the whole, forms an alloy which is the principal, and often the only, composition for bells, brass cannon (so called), bronze statues, and several smaller purposes, and hence it is called bronze, or bell metal (always observing that there is no perfect uniformity in the different alloys under these names, either in the preparation or the actual number of ingredients), and it is excellently suited for these purposes, by its hardness, density, sonorousness, and fusibility, whereby the minute parts of hollow moulds may be readily filled before it fixes in cooling. Bronze cannon are much less liable to rust than those of iron, but in large pieces of ordnance, by very rapid firing, the touch-hole is apt to melt down and spoil the piece; also on account of the sonorousness of bronze, these cannot give a much sharper report than those of iron or steel, which for a time impairs the hearing of those working them.

A common alloy for bell metal is about 80 parts of copper to 20 of tin; or where copper, brass, and tin are used, the copper is from 70 to 80 per cent, including the portion contained in the brass, and the remainder is tin and zinc. The zinc certainly makes it more sonorous. Antimony is also often found in small quantity in bell metal. Some of the finer kinds used for small articles contain also a little silver, which much improves the sound.

When the tin is nearly one-third of the alloy it is then most beautifully white, with a luster almost like that of mercury, extremely hard, very close grained, and perfectly brittle. In this state it takes a most beautiful polish, and is admirably adapted for the reflection of light for all optical purposes. It is then called speculum metal, which, however, for the extreme perfection required in modern astronomical instruments, is better mixed with a very small portion of other metals, particularly arsenic, brass, and silver. But the basis of these compounds is copper alloyed with nearly half its weight of tin. The use of this alloy for the same purpose is of great antiquity, and certainly was in frequent use in the days of Pliny. Klaproth analyzed a portion of an ancient speculum, which he found consisted of 62 parts of copper, 32 of tin, and 8 of lead, which last was probably an adulteration of the tin, and not added designedly.

When more tin is added than amounts to half the weight of the copper, the alloy begins to lose that splendid whiteness for which it is so valuable as a mirror, and becomes more of a blue gray. As the tin increases, the texture becomes rough-grained, and, as it were, rotten, and totally unfit for manufacture. The speculum metal is therefore in the highest proportion of alloy of tin that copper will admit for any useful purpose.

A perfect speculum metal should be quite white without showing any cast of yellow when polished, not very liable to tarnish, quite free from pores even when examined by a lens, of a certain coherence or toughness to bear the grinder, and, for the convenience of working, as soft as may be consistent with the other requisites.

Mr. Mudge, whose specula were celebrated for their goodness, observes, that the extreme of whiteness is given by 32 parts of copper and 16 of tin, but this is excessively hard and brittle; that 32 of copper and 14½ of tin is still quite white and as hard as can be wrought. He also observed by many trials, that the metal to turn out free from pores should be twice fused, that is, the first time for the purpose of mixture (in which the copper is to be first melted separately), and then remelted with as little heat as possible for casting. As there is always some loss by the calcination, chiefly of the tin, a little allowance in the proportion of this latter may be made on account of the double fusion.

An alloy containing 6 of copper, 2 of tin, and 1 of arsenic was nearly the proportion of Sir Isaac Newton's specula, which was very good, but polished somewhat yellow.—*Glassware Reporter.*

The Colored Curtain in the Eye.

BY WILLIAM ACKROYD.

This ring-like curtain in the eye, of gray, green, bluish-green, brown, and other colors, is one among the very many remarkable contrivances of the organic world. The eye cannot bear too much light entering into it, and the colored curtain so regulates its own movements that too much light cannot enter the eye. The dark circular aperture in the center, known as the pupil, is consequently for ever altering in size; on a bright, sunshiny day, out in the open, it may be only the size of a pin's head, but at night, when there is no light stronger than starlight, it is even bigger than a pea.

This colored ring curtain is fixed at its outer edge, and its inner edge expands or contracts so readily and, apparently, so easily, preserving its circular outline all the while, that it is quite provoking to the inventor, who has been trying to invent movable "stops" or "diaphragms" for years, and after all his labor cannot even approach it in perfection, and his despair is complete when he learns that the movements of this eye curtain are automatic and quite independent of the will.

It is unlike the ordinary window blind, which is generally of a rectangular shape, and is drawn up or let down according to the amount of light entering the room. The eye curtain or iris is of ring shape, and possesses a wonderful power of expanding itself so as to diminish the area of the pupil, and of shrinking in, so as to enlarge the area of the pupil. Its movements may be watched in a variety of ways, some of which we shall describe.

The common way of watching the movements of the iris is to regard it closely in a looking glass while the amount of light entering the eyes is varied. Place yourself before a looking-glass and with your face to the window. Probably the iris will be expanded, and there will only be a very small opening or pupil in the center. Now shut one eye suddenly, while narrowly watching the other in the glass all the time. At the moment the light is cut off from one eye, the iris of the other contracts or is drawn up so as to enlarge the pupil. This shows that there is a remarkable interdependence between the curtains of the two eyes, as well as that they are affected by variations in the quantity of light falling on them.

Perhaps one of the most interesting ways of watching the movements of these sympathetic eye curtains is one which may be followed while you are out walking on the street these dark winter nights. A gaslamp seen at a distance is, comparatively speaking, a point of light, with bars of light emanating from it in many directions. These bars, which give the peculiar spoked appearance to a star, are probably formed by optical defects of the lens within the eye, or by the tear fluid on the exterior surface of the eye, or by a combination of all these causes. Be that as it may, the lengths of the spokes of light are limited by the inner margin of the eye curtain; if the curtain be drawn up, then the spokes are long; if the curtain be let down, or, in other words, if the pupil be very small and contracted, then one cannot see any spokes at all. Hence, as I look at a distant gaslight, with its radiating golden spokes, I am looking at something which will give me a sure indication of any movements of the eye curtains. I strike a match and allow its light to fall into the eyes; the spokes of the distant gas-lamp have retreated into the point of flame as if my magic; as I take the burning match away from before my eyes the spokes of the gas-lamp venture forth again.

The experiment may be utilized to see how much light is required to move the window curtains of the eyes. Suppose you are walking toward a couple of gas-lamps, A and B; B about fifty yards behind A. Then, if you steadfastly look at B and at the golden spokes apparently issuing from it, you may make these spokes a test of how soon the light of A will move your ires. As you gradually approach A you come at last to a position where its light is strong enough to make the spokes of B begin to shorten; a little nearer still and they vanish altogether. I have found that about a third of the light which is competent to contract the pupil very markedly will serve to commence its movement.—*Knowledge.*

CATERPILLARS are seriously damaging Louisiana's cotton crop.

ENGINEERING INVENTIONS.

Mr. Walter L. Phelps, of Wortendyke, N. J., has patented an improved railroad torpedo. The invention relates to the construction and shape of the plate to which the torpedo is attached, and to the provision which is made for attaching two or more torpedoes on one plate, so as to insure an explosion.

Mr. Arthur G. Leonard, of New York city, has obtained a patent for an improved railroad signal which consists in a novel mechanism by which when a danger signal is set the same mechanism by which the semaphore is raised will deposit a torpedo upon the track. In this way a double safeguard is provided, for in case the engineer from any cause fails to observe the semaphore his attention will be drawn to the signal by the exploding of the torpedo.

A very simple and inexpensive steam whistle has been patented by Mr. Frank McCabe, of Providence, R. I. The steam is admitted into the steam chamber by depressing an ordinary check valve, and the said chamber is provided with a longitudinal slot for the escape of the steam. By increasing or diminishing the size of this slot different tones may be produced in the whistle, and in order to enable the size of this aperture to be varied the inventor has provided the whistle with a movable lip plate which may be adjusted in the desired position.

Mr. John Houpt, of Springtown, Pa., has patented an improved compound feed pump for steam boilers. In this invention the force pump which supplies the water to the boiler has combined with it an auxiliary pump, with check valve between them, the auxiliary pump being arranged between the first named pump and the heater, and both pumps working simultaneously in like directions to produce an artificial pulsation and overcome any undue back pressure in the cylinder and supply pipe. This invention is an improvement upon a patent granted to same inventor in August, 1882, and the especial feature of the improvement consists in using elongated plungers in the pump instead of pistons with valves in them.

MECHANICAL INVENTIONS.

Mr. William Lane Hutson, of St. Lawrence, N. C., has patented a lever wagon brake, the simple mechanism of which keeps the brake applied to the wheel without effort on the part of the driver, and by which the brake is instantly released by a movement of the lever precisely like that which engaged the brake, thus greatly simplifying the operation of the brake.

Mr. Joseph W. Davis, of Port Jefferson, N. Y., has obtained a patent for a very efficient road scraper. This scraper is mounted upon wheels and is so arranged that the scraper may be raised or lowered by means of a windlass, so as to avoid any obstructions that may be in the way, and so that the machine will not do any work while passing from place to place.

Mr. Matthew Newlove, of Grand Island, Neb., has patented an improved chain saw, which is especially adapted for cutting mortises. This invention consists in an endless chain composed of links or sections having teeth or cutters at their outer edge, and united together by pivotal connections, and driven by a sprocket or notched wheel, with which the chain saw engages.

A new lever cotton and hay press is patented by Mr. Thomas G. Holloway, of Boston, Ga., in which two combined levers act, the long ends of the levers being connected and moving through the same arc, the radius of which is greater than that of the shorter, unconnected ends. An immense advantage is thus gained over any toggle lever whose unconnected ends are extended from each other.

An improved grinding attachment for valves has been patented by Mr. A. Wells Case, of South Manchester, Conn. The invention consists in a valve head constructed with a square recess in its face to receive the square end of a rod which slides longitudinally through a stuffing box in a screw plug opposite the face of the valve head, thus enabling the engineer to grind the valve heads to their seats without removing them from the valves.

An improved flour and meal bolt has recently been patented by Mr. William Mosher, of Poughkeepsie, N. Y. In this machine the coarse particles are separated first instead of last, as in the ordinary revolving bolt, and in consequence the large flakes which commonly cover the meshes, and prevent the escape of the finer particles will be disposed of at first, whereby the separating will be greatly expedited and facilitated.

An improved evaporator is the subject of letters patent recently issued to Mr. T. L. West, of Palatine, Ill. The improvements consist in the construction and arrangement of the evaporating pan, the means of supplying the sirup to the pan, the means of regulating the application of the heat, and for the management and action of the sirup, and the separating of it from the semisirup, as well as discharging it from the pan. The inventor claims it is more economical in the use of fuel and is better in its application of heat than the evaporators now in general use.

Mr. John Spengler, of Clarion, Iowa, is the patentee of a car mover adapted to move railroad cars by means of a lever power applied to the railway track at one end, and to a frame beam of the car at the other end. The lower end of the implement grasps the head of the rail by means of jaws and a chisel edged lever, and the upper end is attached to the floor beam of a car. A horizontal lever with connecting bars is used to work the device, and it may be used attached to the middle of a car instead of at the end, as the operator stands outside of the track.

An improved annealing furnace has been patented by Mr. Daniel G. Barnard, of Winslow, N. J. In this furnace the machinery is very simple and is designed to reduce to a minimum the breakage of the glass while it is being carried through the tunnel. The glass rests upon a series of parallel bars while a secondary set are so arranged that they may be raised between the stationary set, and thus will carry the glass forward a certain distance when they deposit the glass once more upon the stationary set, and then are moved back again to the position they were in at first, and then the glass will again be raised and carried forward as before. The invention consists in the improved arrangement of the mechanism.

AGRICULTURAL INVENTIONS.

Mr. G. W. Hunt, of Muscatine, Iowa, has patented an improved wheel plow by which the driver can instantly adjust the depth of the plowshare without leaving his seat, and without interfering with the management of the team. The plow beam holding the share may be raised and lowered, and will be held rigidly in any position by a very simple device that is self-locking, and that may be disengaged by the movement of a simple lever.

Messrs. Louis C. Rummel and Emil J. Fiedler, of Ledbetter, Texas, have invented a new and useful improvement in self-packing cotton presses, the object of which is to facilitate the baling of cotton as it comes from the gin. The invention consists in a cotton press constructed with a pivoted double baling box, a pair of rolls and their driving mechanism for packing the cotton into the baling box automatically, and a screw driven follow block for compressing the cotton into bales.

A combined harrow and clod crusher has been patented by Mr. Samuel Miller, of Moweaqua, Ill., which is an improvement on one for which letters patent No. 188,379 were issued to him and Mr. W. H. Kuhn. The machine consists of a series of independent frames carrying the harrow teeth and suspended side by side from a common rod or bar on which they swing vertically. Each frame acts independently of the others, thus adapting the harrow to unevenness of surface, and clods are broken up by the combined weight of the entire harrow and of the driver seated upon it.

MISCELLANEOUS INVENTIONS.

A simple and efficient device for cleaning sinks has recently been patented by Mr. C. R. Turner, of Brooklyn, N. Y. It consists of a suitable brush or scraper for collecting the refuse in the sink, combined with a shovel for scooping it up.

Mr. Elijah Tolman, of Taunton, Mass., has invented an improved form of spoons and forks intended to retard the wear at the convex portions of the articles. Instead of more heavily plating these portions or of forming projections at their points, he flattens the portions slightly, so as to give greater area of wearing surface, without disfiguring the spoons or forks.

When wash tubs are packed for transportation there is often some difficulty in getting them in compact shape, owing to the awkward shape of their handles. Mr. W. H. Parrish, of Richmond, Va., has avoided this objection by an improved metallic handle made of such a shape that the sections of the tub may be packed with the greatest facility.

Mr. J. W. Page, of Rollin, Mich., has patented a wire lock which relates to locks for worm rail fences, in which wire is drawn around the rails to prevent the fence from being blown down or from being pushed down by animals; also provision is made for tightening the lock from time to time, as shrinkage or wears may render necessary.

A patent has recently been issued to Mr. F. S. Gulick, of Bolivar, N. Y., for an improved stove pipe holder, which consists of an extensible hanger and an extensible hoop, contrived in a simple arrangement for suspending stove pipes from the ceiling in a better way than by the wire suspenders commonly employed.

An improvement in table casters for holding condiment bottles is the subject of a patent by Mr. Orin F. Bacon, of Taunton, Mass., which provides an anti-friction bushing, or collar, for the holder, or for the standard, by which the wear of the holder on the pintle and the consequent rattling of the caster when turned are obviated, and the durability of the caster is greatly extended.

A fire escape has been patented by Mr. Richard E. Andrew, of Shepherdstown, West Va., which is intended to lower, by weights, one or more ladders from the eaves of a building to the ground. The entire mechanism, and the ladders themselves (which are flexible, being made of jointed rods or plates), are located in the attic of the house, and the ladders pass out through openings under the eaves, the openings being closed automatically when the ladders are wound up.

A gate has recently been patented which is provided with a long arm, so arranged that by raising this arm the gate itself will be raised in the post rails upon which it is hung. This enables the gate to be swung out readily in snowy weather, and the invention recommends itself on account of its simplicity and the readiness with which the contrivance may be applied to an ordinary gate. The inventor of this device is Mr. Bernard Selting, of Dyersville, Ia.

Mr. P. T. Forsyth, of Memphis, Tenn., has patented a portable fire escape which consists of a belt held to the end of a rope passing over a pulley, and through a sleeve of pliable material provided with a flap. The flap is passed around the strands of the rope when a person is using the fire escape, which sleeve and flap are pressed more or less firmly against the strands of the rope, to increase or decrease the friction, so as to regulate the rapidity of the descent.

Mrs. Augusta Netzner, of New York city, has patented a very strong suspender end. This suspender end is provided with a cord between the two strands of each strap, which cord has its lower end secured at the lower end of the strap, and its upper end secured to the upper part of the strap. This cord is thus made to bear the greater part of the strain and the ends thus rendered exceedingly durable.

Mr. William Gosshorn, of Waterloo, Pa., has obtained a patent for a very convenient gate for use where pedestrians and horses and carriages are likely to pass. This gate is hinged at one end and at the end opposite the point where it is hinged is provided with a sliding section, so that foot passengers will not be compelled to open the whole gate in order to pass through. The gate is further arranged so that it may be raised at its hinges in order that it may be swung out readily even if the ground be covered with snow.

Mr. Emil C. Eyl, of Jefferson City, Montana Territory, has patented a combined folding fire escape and ladder, the platform or fire escape being a net work frame of iron or steel, hinged against the house in such a position that when lowered it forms a platform just below the window sill, a chain ladder at the same time unfolding from it to the ground. When not in use the ladder is folded into the frame and the frame is turned up against the wall of the house and secured to the window sill.

An improved gate has been patented by Mr. J. L. James, of Forsyth, Ill. This gate is constructed in two sections, only one of which is swung open under ordinary circumstances, but the whole being so arranged that in case the opening is too narrow the two gates may be swung open as one. Further, a long crossbeam is provided carrying pulleys at the ends over which pass ropes arranged conveniently, so that a person riding or driving in a wagon can open the gate without being compelled to alight.

Mr. Lorenzo D. Cather, of White Pigeon, Mich., has patented an improved "stake and rider" fence for farms, the supports of which are two braces crossing each other, with a vertical binding stake which with longitudinal riders are held securely by wires, forming a fence so rigid that it may be moved bodily without falling apart. It has no stakes or posts inserted in the ground, but the leaning stakes may rest upon blocks or stones. It may be put up by unskilled labor and may be made close enough to keep out sheep, dogs, and other small animals.

Mr. Edward A. Hemphill, of Elizabeth, N. J., has invented a new and improved memorandum book, having its covers stitched to each other a short distance from the back, forming a pencil pocket along the back of the book. Preferably both covers are made in one piece, and the pocket is formed by stitches a short distance from the back, and the book is then pasted to the covers. The pencil in the pocket stiffens the book and prevents it from being doubled over or bent, and does not interfere with using the book and turning the leaves, and is entirely out of the way when not in use.

Mr. Walter S. Bishop, of New Haven, Conn., has obtained a patent for some improvements relating to polishing wheels. The object of this invention is to construct polishing wheels in such a manner that they will not become changed in shape from dampness, and will be strong and durable, and Mr. Bishop accomplishes this by providing the emery wheel with a metallic rim and with a web of peculiar form, and in covering the rim of the wheel with a leather band and covering this band with a second band cemented thereto, and sewed together at the ends. A wheel thus constructed will not be changed by swelling or warping.

NEW BOOKS AND PUBLICATIONS.

A SUMMARY OF THE LAW OF PATENTS FOR USEFUL INVENTIONS, WITH FORMS. By William Edgar Simonds, Hartford, Conn. New York: L. K. Strouse & Company, 95 Nassau Street.

This is an enlargement of a volume issued by the author as a manual in 1874, which combined the laws relating to the issuing of letters patent, and the compilation of rulings under the law as it then existed. The present volume may be considered a compendium of patent law and patent law practice, being intended, not only as a guide to patentees, but as a help to patentees' attorneys. The volume, which is neatly bound in sheepskin, is provided with a copious index which enables it to be used as a ready reference book.

FINLAND: ITS FORESTS AND FOREST MANAGEMENT. By John Croumbie Brown, LL.D. Oliver & Boyd, Edinburgh; Simpkin, Marshall & Company, and William Rider & Son, London; Dawson Brothers, Montreal.

The first fifty pages of the book are taken up by descriptions of the lakes and rivers of the country, but a serious mistake was made by omitting an examination into the relations they bear to the climate. This branch of the subject was treated very cursorily. The old practice of clearing the land by burning the forests, the custom being known in Finland as *Svedjande*, is described at length, together with the methods pursued in other countries, and a discussion of the evils following the practice in India and an account of the merits and demerits of the practice as now pursued in France. Several chapters are taken up with forest economy, administration, protection, exploitation, and the kinds of trees. A valuable account is given of the school of forestry, its management, method of instruction, and work it accomplishes; and also of ship and house building, and industries in which wood is made use of. The last part of the volume treats of the physical geography of Finland and its flora, fauna, and climate. The author has contributed a valuable book to the literature of forestry, and his work clearly shows much study and an intimate acquaintance with the labor of those who have preceded him in similar paths.

THE MACHINIST'S AND STEAM ENGINEER'S PRACTICAL CALCULATOR. By D. B. Dixon. D. Van Nostrand, New York City. Price, $2.00.

The author, recognizing the need of a rudimentary manual for the use of machinists and steam engineers, has succeeded in producing a book admirably filling the want. The ground is very thoroughly covered, and yet no useless subject is admitted. Algebraic formulas and technical phrases are entirely avoided, and all the rules laid down are illustrated by examples worked out in plain arithmetic. The language is well chosen, simple, and direct.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

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

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

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) H. W. writes: I have some gutta percha chips; how can I soften them and then make them hard again, like gutta percha buttons? A. Soak the fragments in hot water. It will quickly soften them, and they will become hard on cooling.

(2) J. R. H.—The ordinary solid bluing consists of indigo and starch, or of artificial ultramarine. To make liquid bluing the following is a good receipt: Powder one ounce Prussian blue very fine, add it to one quart of very pure water, to which add one-fourth of an ounce of oxalic acid. This is very powerful. The oxalic acid is poison.

(3) O. T. asks: Can you give me a formula or two for brilliant, quick drying furniture polish? A. The following will dry in a moderate time: 4 ounces shellac is dissolved in 2 pints strong alcohol; to this is added pints linseed oil and 1 pint spirits of turpentine. When mixed, add 4 ounces common ether and 8 ounces ammonia water. Apply with a sponge. For French polishing, shellac varnishes are often used. The follow- is good: Shellac 2 pounds, mastic and sandarach, of each 1 ounce, copal varnish 12 ounces. Alcohol 1 gallon. Make in the cold in a stoppered can or demijohn, and do not filter. This is for use in French polishing, which involves rubbing in with a rubber.

(4) W. L. T. asks for a receipt for gilding and silvering on wood. A. The wood must be coated with size. To make this boil half a pound parchment shavings with three quarts of water, constantly stirring. This gives a clear solution of gelatine, which must be passed through a sieve. Paint over the wood with this, and while it is still moist apply gold or silver leaf or Dutch metal. Much manual skill is necessary, and you should see the exact details practiced by a gilder. You may also gild wood by mixing bronze powder with copal varnish and painting it with the mixture. Finally, gold paint may be bought all ready for use and this will probably give you the most satisfaction.

(5) E. G. H.—To prevent the rotting of seines, we would suggest the use of raw linseed oil, applied to the seine while it was perfectly dry.

(6) A. R. J. writes: How can I remove the gold gilt and name from the cover of a book that is pressed in one-sixteenth of an inch? Can the indentation be entirely taken out? Also, is there any preparation to renew the muslin or leather covers of old books? Also can the stains of dampness, mould, or other discolorations be removed from the cover and leaves? A. The impressions on the outside of the book cannot be removed. It would also be very difficult or impossible to remove the discolorations you speak of.

(7) D. J. P. asks: 1. Is there any solvent of coal tar other than heat or "dead oil"? A. Turpentine, naphtha, kerosene, benzine, and many other similar liquids will dissolve coal tar. 2. How may the odor of coal tar be destroyed or disguised? A. It is extremely hard to remove or disguise its odor, as we have found by experience.

(8) T. F. asks (1) what two colorless or nearly colorless liquids when mixed will become black. A. Mix a dilute solution of copperas with an infusion of nut galls. 2. What colorless or nearly colorless vegetable or mineral solution will become dark by contact with a metallic solid, and what metal will effect the change? A. Mix a dilute solution of nickel sulphate with a very little hydrochloric acid and add sulphide of ammonium. A piece of metallic zinc will neutralize the acid and cause a black precipitate of sulphide of nickel which will color the solution before settling out of it.

(9) E. C. S. writes: 1. I have a lot of surgeon's isinglass adhesive plaster which is not very proof against water or moisture. What should I apply to the silk side to render it entirely waterproof, so it won't wash off when slightly wet? A. After applying it give it a coat of shellac dissolved in alcohol, or coat it and the skin surrounding it with collodion. 2. What is the liquid used on muslin drilling, or cotton duck to make it waterproof, and fit for coats, horse and wagon covers, etc.? It gives the material a slightly yellowish tint. A. Linseed oil.

(10) H. C. W. writes: 1. Please give us in "Notes and Queries" the formula for a good liquid shoe dressing; one that will not injure the leather and which will give a luster without rubbing, and which will also answer for harness? A. Many receipts are given. We give the following, as it contains no oil of vitriol, and can be tried cheaply. Ivory black, 1 pound; molasses, $\frac{3}{4}$ pound; sweet oil, 2 ounces. Mix well and rub together, then add beer, 1 pint, vinegar, 1 pint. Also see SCIENTIFIC AMERICAN, Vol. 48, No. 10. 2. Can you also give the formula for Day's liquid blacking, an English preparation? A. The formula for Day & Martin's English blacking is thus given: Fine bone black is mixed with sperm oil until a thorough mixture is effected. Sugar and molasses is mixed with a little vinegar, and added to the mass. Oil of vitriol is next added, and when effervescence has ceased vinegar is poured in until a proper consistence is attained. The quantities are not given; they probably run about as follows: Bone black, 1 pound; sperm oil, $\frac{1}{4}$ pound, or enough to mix; molasses, 1 pound; oil of vitriol, $\frac{1}{8}$ pound; vinegar enough to secure proper consistency.

(11) C. F. S. asks: Is there any way we can keep glue from getting thick after reducing down very thin? What can we put in it to destroy the offensive odor while cooking? A. Add acetic acid to the glue. This will keep it liquid and tend to overcome the odor. Try also muriatic acid or acetate of lead; both are good.

(12) E. Bros. ask if this is intended to make a first class mucilage for gumming large sheets of paper which may be kept for use without curling, and stick well on glass or other substances when wet, viz., paste or glue for paper labels:

Starch	2 drachms.
White sugar	1 ounce.
Gum arabic	2 drachms.
Water	q. s.

Dissolve the gum, add the sugar, and boil until the starch is cooked. A. This seems to be a good paste. Try the following, said to be that used on postage stamps: Gum dextrine, 2 parts; acetic acid, 1 part; Water, 5 parts. Dissolve in a water bath and add alcohol, 1 part.

(13) J. W. R. asks how to make green japan for tin, such as is used on toy cups, bird cages, etc. Say what ingredients to use, and how to mix? A. Color the japan green by adding a mixture of King's yellow (or other good yellow) and Prussian blue: also try aniline greens.

(14) F. W. writes: 1. Will you please answer the following questions, and oblige: At what degree of heat will platinum melt? A. 4,591° Fahr. 2. Has it a clear ring like silver? A. It is not nearly so sonorous as silver. 3. What is it worth per pound? A. About $155.00.

(15) L. R. G. writes: I forward you with this a sample of white quartz sand from a deposit in this State. Would you inform me whether the sample is of a kind suitable for fine glass manufacture, and also if it is likely that the sand would find a market as a commercial article if suitably prepared? Would you also acquaint me through the SCIENTIFIC AMERICAN what are the requirements of manufacturers in their choice of sand for different classes of articles, and where the most suitable are found in this country? A. The value of sand for manufacturers in general consists especially in its freedom from iron. The sample you send seems very pure and well adapted for glass making. Correspond with some of the large glass factories, and send them samples if they ask for them.

(16) G. W. H. writes: Will you please inform me in your answers to correspondents how steel plate engravings can be transferred to vases and other articles for ornament. Some method by which the ink can be softened and transferred to any kind of hard surface? A. Varnish the surface to which the engraving is to be transferred with copal or dammar varnish. After it has dried for six hours and is still sticky, wet or soak (if necessary) the engraving, using soft water for the purpose. Then press the engraving well upon the varnished surface, carefully avoiding the formation of bubbles. Let the whole dry perfectly (which will take a day more). Then with a wet sponge and the fingers and soft rubber wash off the paper in pieces, and the lines of the engraving will be left upon the glass or porcelain surface. This must then be revarnished.

(17) A. A. R. asks: Can you give a process whereby empty ink bottles can be sufficiently cleaned, so that they may be used without injury to health in bottling and preserving catsup, table sauce, etc.? A Muriatic acid followed by water will answer we think, It depends on what kind of ink the bottles held.

(18) A. G. asks: Are the colors used in making pastel pictures durable, or will they fade after a time? A. Most of the colors are very permanent.

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September 25, 1883,

AND EACH BEARING THAT DATE.

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Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.