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PATENT CHARIOT STREET CAR.

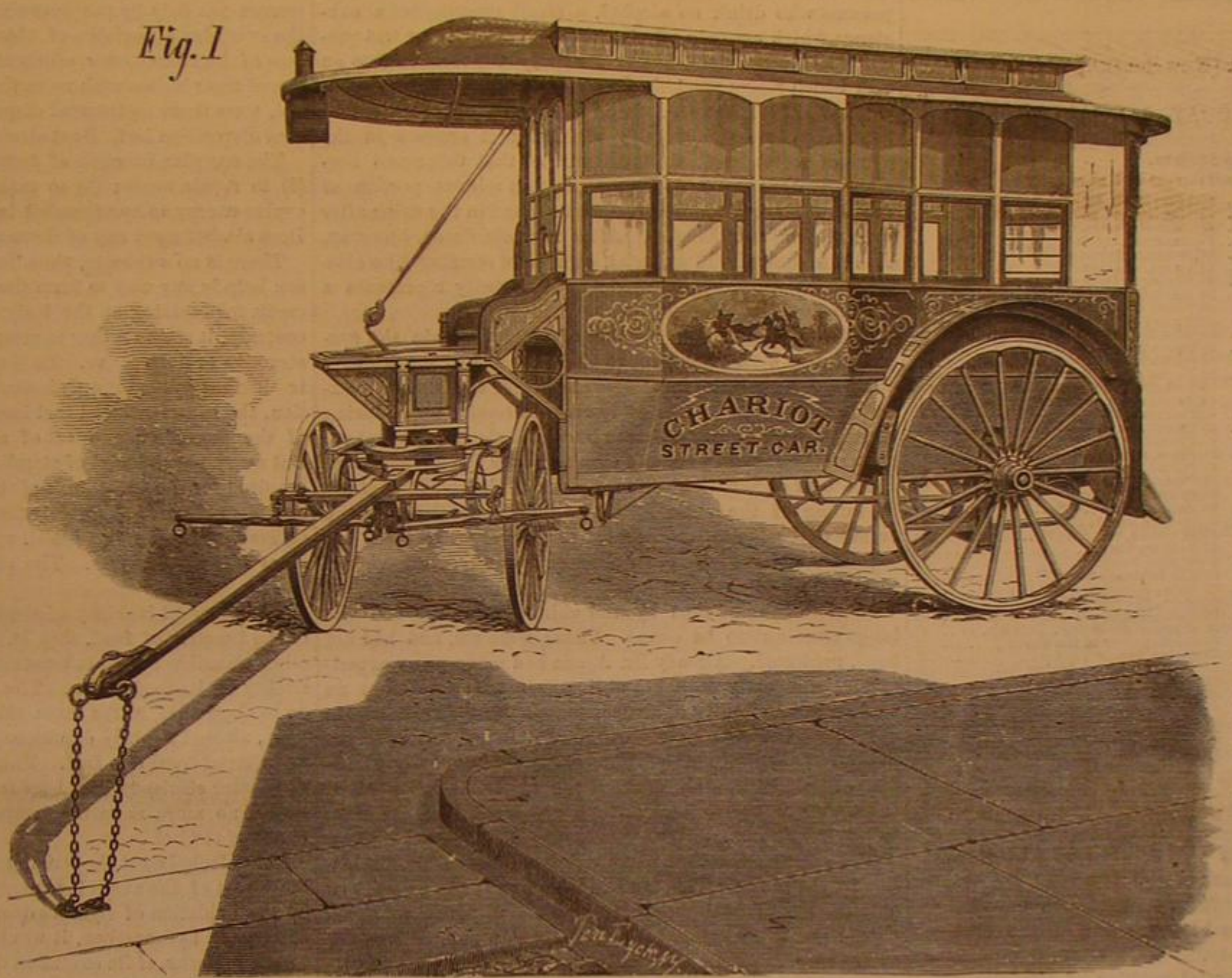
The novel vehicle represented in the engravings given herewith is designed as a substitute, in city streets, for both omnibuses and horse cars. Like the former, it requires no tracks, nor the acquisition of a right of way, and in common with the latter it has easy motion and superior facilities of accommodation. The form is handsome and symmetrical. The front part of the body in the swell forms a kind of oblong octagon, while the bottom is of equal width along the entire length, excepting a rounding at the hind end, forming a recess, so that the hind wheels do not project outward beyond the front part of the vehicle. The whole body is mounted on a combination of springs.

The front axletree is short, so that the car can be started more easily than the ordinary omnibus, also turned around in its own length, and guided more accurately, so as to avoid irregularities in the roadway. Two doors are provided, placed obliquely at the rear. Access is obtained by a low step, so that, when the vehicle is driven close to the edge of a sidewalk, a lady or infirm person may step therefrom directly into the car. The arrangement of the interior resembles that of horse cars; the hight of the roof is sufficient to allow a person to stand erect with comfort, and the usual s raps for support while in this position are provided. A patent double reflecting lamp—a device of the inventor—is supplied, by which light is afforded in advance of the chariot as well as within the same. The weight of the entire vehicle is about the same as that of an ordinary omnibus, and the cost of manufacture, we are informed, is no higher.

We learn that a car will probably be brought to this city, when those interested will be given opportunities for its examination.

For further particulars, address the patentee and proprietor, Mr. Chauncey M. Murch, No. 278 W. Sixth street, Cincinnati, Ohio.

Fig. 1



MURCH'S PATENT CHARIOT STREET CAR.

Fig. 2

Electro Music.

A correspondent, Dr. G. P. Hachenberg, calls our attention to his plan for playing one or more pianos by electricity, and suggests, among other remarks, that instruments thus arranged might prove an interesting feature in the coming Centennial Exhibition. Dr. Hachenberg says: "The electrical union of ten pianos is a very simple arrangement, but is controlled with singular effect to render volume and expression. One instrument serves to play upon, and the rest are connected with it by electro magnetic attachments, so that the pressure of a certain key on the key piano determines the striking of nine other like keys on the rest of the instruments. The pedals are governed by similar arrangements, and there is an apparatus whereby the music may be played upon as many or as few of the ten pianos as desired.

The invention is not unpractical; and in fact, a similar contrivance is in use upon the two organs of St. Thomas' church, in this city, where the tower bells are also chimed in connection with the organs, by electricity. It suggests possibilities of future musical performances quite interesting. There is no reason, for example, why pianos, minus keyboards, should not be provided in houses, and their works connected with the keyboards of three or four instruments, say in a central office. In the latter, at certain hours of the day and night, celebrated performers might be engaged to play, one, for example, executing classical, another sacred, another operatic, and a fourth dancing music, on as many separate pianos. These last could all be connected with any number of piano movements all over a city, so that the playing of one instrument in the central bureau would, of course, be repeated on every other piano, no matter how many or how widely separated, and the effect would be exactly as if the performer were individually in the parlor of every subscriber. The latter might be provided with a printed daily programme, specifying that at such and such an hour Signor So and So would play certain music; Monsieur Somebody Else some other kind, and so on. The subscriber then watches his clock, and at the specified hour turns a switch on his wall, which places his instrument in connection with either Monsieur's or the Signor's piano. Then all he has to do is to listen until he gets tired, when, without apologizing to the eminent performer, he shuts him up, by a touch of the finger on a button.

Discovery of a New Mammoth Anthracite Coal Vein.

The finding of the Mammoth vein of coal at the Reading Company's Norwegian shaft, between Pottsville and St. Clair, Pa., illustrates the correctness of the reasoning by which the conclusion was reached that an immense and almost inexhaustible basin of coal was lying deep underground at that point.

When the shaft had been sunk to the depth of nearly 1,200 feet, it was resolved, says the *Pottsville Miners' Journal*, to drill a test hole with the diamond drill, to find exactly how the veins of coal were situated. This work went quietly on for several weeks, until a few days ago, when the above-mentioned Mammoth vein was reached.

Gen. Pleasants' original calculation was that the Mammoth vein could be found at a depth of about 1,500 feet. The actual distance from the surface of the earth vertically down to the Seven Foot vein, the twin vein to the Mammoth, is 1,909 feet. The discrepancy is accounted for by the singular formation of the veins of coal as developed by the test drill. The Big Tracy vein basin is found to be 176 feet deeper than expected. And the Orchard vein is so curiously formed that it was cut three times, the distance from its first appearance to the last being 250 feet. The strata overlaps or closely folds in a very remarkable way. Taking these two entirely unexpected and unforeseen distances out of the account, the calculation would have held correct.

The Seven Foot vein, which is the upper member of the Mammoth, was found to be thirteen and one half feet thick, and of excellent coal. Underneath this vein there are seven feet of slate, three and one half feet of good coal, four feet of slate, two feet of good coal, sixteen feet of slate containing iron ore balls, and six inches of carbonaceous iron ore, or black band. Then comes the Mammoth vein, *twenty-one feet thick*, next one and one half feet of partition slate, and under this it is thought there is a nine foot vein of coal. Below this, it is believed, comes the solid rock.

Besides the red ash veins, which will be worked, there are the following white and gray ash coals: Primrose, fourteen feet deep; Seven Foot vein, seven and one half feet deep, and the Mammoth, twenty-one feet deep, making a total depth of forty-eight and one half feet of coal.

The importance to Pottsville of the success of this great and plucky undertaking by the Reading Company cannot be overestimated. It makes Pottsville the great mining city of the future. For years and years to come, in all reasonable probability, hundreds, perhaps thousands, of men will be at work here, taking the black diamonds from this inexhaustible supply. It takes no great stretch of the imagination, says our contemporary, to see in operation here the largest and finest colliery in the world.

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NEW YORK, SATURDAY, JANUARY 16, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

ANSTIE AND DUPRE ON THE ACTION OF ALCOHOL.

About the last literary work of the lamented Dr. Anstie was to describe, in *The Practitioner*, what with unconscious prophecy he called his "Final Experiments on the Elimination of Alcohol from the Body."

Though fatal to a fundamental position of the ultra-temperance party, that alcohol is treated by the body precisely like a poison and eliminated without chemical change, the investigations thus closed will be more fruitful for good to the genuine temperance cause, we believe, than anything else that has been done during the period of Dr. Anstie's labors. Moral and social reform can have no permanent basis other than in truth. And seeing no possible cure for the curse of intemperance except through remedies suggested by real knowledge of the physiological as well as the moral and social problems involved, we cannot but regard Dr. Anstie—notwithstanding the opposition of the nominal temperance party—as one of the truest and most efficient temperance apostles of the time. This in justification, not apology.

The controversy began, some fifteen years ago, on the appearance of M. Lallemand's work, in which, on the evidence of certain qualitative experiments detecting alcohol in the urine, it was asserted that alcohol passes through the system unchanged. This being true, the alcohol contained in wines and other spirituous beverages—as the temperance party were not slow to discover and teach—could be regarded only as a disturbing element, a poison, not only unserviceable to the system but positively harmful.

A result so strikingly in opposition to universal experience could not go long unchallenged. Among others, Dr. Anstie immediately instituted several series of experiments which proved that the idea of the non-destruction of alcohol in the body under normal conditions,and its copious elimination by the kidneys, must have arisen from nothing less than an experimental blunder. Except in conditions of profound alcoholic intoxication, there appeared in the urine only the most minute fraction of any substance which the comprehensive chromic acid test would lead one to believe might be alcohol: a position confirmed by the subsequent researches of Schulinus and Drs. Dupré and Thudichum.

In 1867 Drs. Anstie and Dupré together made another series of investigations, covering a period of six months, and carrying the question of elimination as regards the urine to a higher certainty of conclusion. It was found that when, during any twenty-four hours, not more than an ounce and a half of absolute alcohol by volume was taken—whether under the form of beer, wine, or spirit of any kind—it was never possible to obtain evidence of the presence, in the whole day's urine, of more than a small fraction of a grain of unchanged alcohol, reckoning as such everything that affected the bichromate test. When, however, the daily quantum of one and a half ounces of absolute alcohol was greatly exceeded, a larger portion of alcoholic substance was found in the urine,though never more than one or two grains, notwithstanding as much as three or four ounces of absolute alcohol had been consumed.

These experiments were followed, and in a general way confirmed, in 1870, by those of Drs. Parkes and Wollowicz, who, while admitting that it was quite improbable that any large amount of unchanged alcohol escaped through the kidneys, yet maintained that the amount might be larger than Drs. Dupré and Anstie had estimated, the period of elimination assigned by them being, it was said, too short.

The objection seemed well taken, and Dr. Dupré made, in 1872, a new series of investigations to test the matter more thoroughly. Two unexpected and very important observations resulted. Some time previously Dr. Dupré had established the fact that—contrary to the assumption of Lallemand—it was possible to recover from urine, by distillation, any alcohol it might contain, within an exceedingly minute fraction. He now discovered that there is, in the urine of persons who drink no alcohol, a small quantity of a substance,which not only affects the chromic acid color test precisely as alcohol does, but is similarly convertible into an acid which reacts precisely like the acetic acid derived from alcohol. If it is alcohol,it is certainly not alcohol which has been taken into the body as such, since it appears in the urine of teetotalers. He found further that this small normal constituent of urine represents that minute portion of supposed alcohol which can alone be found in the urine after moderate doses of alcohol. After narcotic doses, however, the larger quantity of material, capable of reacting like alcohol, which appears in the urine, undoubtedly represents a real alcoholic elimination.

As for the temporary retention of alcohol within the system, as had been suggested, to be eliminated by the kidneys at a later period, the facts were altogether adverse. For example, during the course of twelve successive days, during which something over nineteen ounces of alcohol were taken, not one thousandth part was eliminated by the kidneys; and the rate of elimination was no greater at the end than at the beginning of the period. There remained fully nineteen ounces of alcohol to be accounted for: it certainly could not remain unchanged in the system without creating violent disturbance.

Possible eliminations by the skin, the bowels, and the lungs remained to be tested. These were not, and had not been, neglected. Already Dr. Anstie had made many experiments, admittedly rude but still sufficient to prove that no considerable quantity of alcohol escaped by the skin except during dead drunkenness. In 1866 Dr. Dupré estimated the alcohol in the fæces of a typhus patient whose daily allowance of brandy was six ounces: the alcohol eliminated by the bowels proved to be less than one tenth of a grain in twenty-four hours.

The question was thus narrowed down to possible elimination by the lungs. This too had been repeatedly tested, and only the most trivial quantities were found to be so eliminated; and as Professor Binz subsequently pointed out, the amount would naturally be overestimated, since the volatile ethers, which we smell in the breath of persons who have been drinking wine, brandy, whisky, and the like, affect the chromic acid test precisely like alcohol. During the twelve days above mentioned, Dr. Dupré found, by methods proved by careful check experiments to be capable of indicating at least two thirds of the alcohol which might pass out with the breath, that about half as much alcohol was eliminated in the breath as in the urine.

Experiments like these would seem to be sufficient to dispose of the elimination theory; but more exacting ones followed, in consequence of Victor Subbotin's study of the action of alcohol on rabbits enclosed in a Pettenkofer chamber, a plan which made it possible for the whole of the excretions—breath, urine,dung, and sweat—to be collected,and the amount of alcohol in them estimated. The experiments made by Subbotin were unsatisfactory in that the doses of alcohol administered were enormous, and the rabbit is an animal specially incapable of withstanding severe alcoholic narcotism.

It was unfortunate at this stage of the investigation that London did not contain a Pettenkofer chamber large enough for research on human beings, and Dr. Anstie and his associate were unable to provide the four thousand dollars which one would cost. So they were forced to content themselves with a smaller apparatus and smaller animals. Dogs were selected, being known to bear alcohol with some approach to human tolerance for that substance. Two healthy terriers were chosen, one (A) weighing 10 pounds, the other (B) weighing 9 pounds 12 ounces.

We have no space for a description of the apparatus prepared, or the processes and precautions taken to guard against deceptive results. Suffice it to say that the experiments on the dog, A, showed that two drams of brandy, containing 47·73 grains of absolute alcohol, can be disposed of by a little terrier within eight hours, with the elimination of only one fifth of a grain of unchanged alcohol by all channels together. It was further ascertained (before brandy had been given) that there was in the dog, as in man, a small normal elimination of substances capable of reacting like alcohol.

With dog, B, the experiments were even more conclusive. For a period of ten days he was given daily one ounce of brandy, containing 190·92 grains of absolute alcohol, administered in two portions. On the eleventh day he was killed, quickly cut into minute fragments—bones, skin, and all—and the amount of alcohol in him carefully determined: or rather, the whole of the substances in the body and blood capable of yielding acetic acid. The experiments on this dog showed that a terrier of less than ten pounds' weight could take with comparative impunity nearly 2,000 grains of absolute alcohol in ten days; that on the last day of the regimen he eliminated by all channels only 1·13 grains of alcohol; and that on being killed two hours after swallowing half an ounce of brandy, there were recovered from his whole body and all its contents (elaborately treated, so as to provide against material loss during the examination) only 23·66 grains of what might be taken for alcohol, a considerable portion of it due, undoubtedly, to the normal constituents of the unalcoholized body, previously noticed.

These results tally so closely with those obtained from the human organism, by other methods, that it is altogether unlikely that the case against the theory of alcoholic elimination could have been made much more conclusive had Dr Anstie lived to submit a human subject to the chamber test.

Alcohol in less than narcotic doses is thus evidently disposed of almost entirely within the body. What becomes of it? That it cannot be stored up permanently in the body is proved not only by the experiments above narrated, but by the everyday experience of thousands of drinkers. The excess of ingestion over elimination would long since have stored their bodies with more than their own weight of alcohol, were there no internal disposition made of it. What can that disposition be? Does alcohol play the part of a food?

The complex function of food is (1) to build up the body; (2) to repair waste; (3) to maintain the bodily heat; (4) to evolve energy to be expended in internal and external work. Does alcohol meet any of these requirements?

There is no evidence, thus far, to show that its products can help in any way to form tissues; hence we cannot give it credit for building up the body or repairing waste. On the contrary, it seems rather to retard tissue change, either constructive or destructive. To those who hold the ancient doctrine that pysical energy is developed only by tissue destruction, the last-mentioned fact bars the way to any recognition of the possible usefulness of alcohol as a force producer. But every physiologist of standing now admits that the force required for the great bulk of the work done in and by the organism is evolved directly from the food carried to the several organs by the blood, without its previous employment in tissue forming. The objection is therefore groundless

The apparent inability of alcohol to perform the third part of the function of food, that is, to produce heat, affords another plausible but unsubstantial argument against the possibility of its food action. The observations of Dr. Parkes go to show that, so far from raising the temperature of the body, alcohol slightly depresses it. But too much must not be inferred from this fact. There is no heat-producing food of greater efficiency than beef fat; yet an ounce of beef fat would no more raise the temperature of the body than an ounce of alcohol.

Does alcohol meet the fourth requirement of food? A very large part of the available energy of the body is developed by the oxidation of hydrocarbon, like fat. Being a highly oxydizable hydrocarbon, it would be strange indeed, as Dr. Anstie remarks, if its oxidation did not prove to be the mode by which alcohol disappears within the system. There is much to sustain this view, and not a fact to disprove its correctness. The theoretical force value of the alcohol daily disposed of by multitudes of sober people is very great. It is incredible that so much alcohol can be transformed in the body without the evolution of energy, for good or evil. It does not, in the temperate people in question, produce any visible disturbance of their bodily functions. It must therefore be vitally useful, and belong, where Pavy and universal experience put it, among the force-producing foods, its usefulness depending very largely, it would seem, in the rapidity of its transformation, and the promptness with which it supplies available energy.

This, it is proper to add, with important limitations. Beyond a certain small dosage, perhaps six or eight hundred grains in twenty-four hours for an average adult in health, alcohol is demonstrably a dangerous narcotic poison, not the least of its disadvantages being that it cannot be eliminated to any considerable extent. If employed at all, in health, it is obvious that it should be used for special purposes and with great care, unless it be in the diluted condition in which it appears in cider, beer, or light wine.

In many diseases, the system seems to be able to make use of almost unlimited quantities of alcohol, with strikingly beneficial effects; but that is a field upon which it would be out of place here to enter.

OUR NAVAL EFFICIENCY.

Large standing military establishments have always been justly viewed as unnecessary and inexpedient in this country; and it is the standing argument, of those who would defend the paucity in numbers of our war vessels, that we can afford to remain quiet, watching the development and trial of new systems by foreign nations, gaining experience without sharing in its cost, and simply maintaining a nucleus which, in time of need, the resources of the country could speedily augment to formidable dimensions. In the abstract, certainly,no exception can be taken to this reasoning, but unfortunately practice and theory are at wide variance. Instead of devoting moderate sums to the thorough construction and maintenance in the highest possible efficiency of a small number of vessels which, though even not embodying the very latest refinements, are nevertheless types of their kind, the enormous sum of fifty millions of dollars of the people's money has literally been frittered away during the past five years in tinkering old ships of war, not one of which is thoroughly fit for severe service. Three million two hundred thousand dollars has been appropriated for eight new sloops, it is true, but this is not included in the above amount; nor is any portion of the same, except one million dollars, chargeable to any other necessary expenditure save repairs. The money that has been wasted is sufficient to have provided a powerful fleet, armed with every accessory of modern warfare, instead of a navy the crack ships of which could not, as the Key West drill proved, steam at a higher rate in company than four and a half knots per hour, and which are armed with guns contemptible before the modern European ordnance.

A very brief examination of the present condition of the array of vessels now borne on the navy register, as recently given by the *Army and Navy Journal*, will show to the reader that the status of affairs is the reverse of encouraging. Beginning with the wooden vessels, there are five large steam frigates; one is utterly rotten and worthless, and the newest of the rest, the Franklin, built shortly after the war, is armed with old-fashioned smooth bore 9-inch guns, and can, as the writer knows by personal experience, just hold her own against a stiff gale, under full steam power. The next class or second rate includes thirty-three vessels; three are old paddlewheel ships twenty years and over old, one being changed to a screw steamer. Eight are "Isherwood's failures," rotten, not worth repairing, and will shortly be broken up. Five are old-fashioned but in moderate condition; the boilers are so placed as to be unprotected. Four have Isherwood engines and Martin boilers, and are small vessels built of white oak, moderately rotten. Five built before the war are the best vessels in the service. Six are not launched, one never will be, the rest have engines—Isherwood again—every one of which has gone into the scrap heap. One is being tinkered at, and has cost two and a half millions alone thus far for repairs, and one has never been to sea except for a deceptive trial. Her total weight is 4,339 tuns, and of this her machinery and coal alone weigh 2,010 tuns.

The third class numbers twenty-four vessels; one, the Swatara, has been rebuilt and fitted with compound engines. She consumes 15 tuns of coal under six boilers per 24 hours, and makes an average speed of 6½ knots. Five are in fair condition, though merely old-fashioned gun boats. One has had her machinery condemned and is being repaired. Two are old sailing vessels on which attempts at conversion into steamers are being made. Two are unsafe in a seaway; two are condemned and are to be broken up. Another is old and useless. Two are in Asia and cannot get back; two are unseaworthy. Two more are worthless, and are to be repaired, if possible. Five are three-gun gunboats, (boilers above the water line and bad machinery), and the last is an old paddle wheel steamer, 25 years old, stationed on Lake Erie. The fourth class includes a couple of old blockade runners and some dispatch boats.

The ironclads number fifty-one. There are twenty "light drafts," which are condemned and perfectly worthless. The department is selling them at any price. Next, there are seven of about 1,200 tuns displacement. These have laminated armor, which guns equal in power to the 7, 8, and 9 inch Woolwich rifles can pierce like so much cardboard. Six monitors have about 1,500 tuns displacement, open to the same fatal objection. Four are double turreted, and displace 3,000 tuns. These have green white oak hulls, thoroughly rotten, and armor also no shield to modern heavy projectiles. Four more are on the stocks, have never been launched, and are so much decayed that it is recommended that they be broken up. Three are a remnant of the old Mississippi flotilla, of course now of no value. The Dictator has weak armor; but if this could be replaced with solid plating and modern guns be mounted in her turrets, she would be one of the most formidable ironclads afloat. The same may be said of the unfinished Puritan. The Roanoke is an old frigate razeed and covered with worthless armor.

Add to this category a few tugs, two torpedo boats, and a few ancient sailing vessels (used for practice, store, and receiving ships), and the entire United States Navy is summed up.

PRINTING THE PATENTS.

Recently, in the House of Representatives, the committee on appropriations reported a clause authorizing the expenditure from the patent fund of $40,000, for producing copies of current and back issues of the patents, whereupon several gentlemen took occasion to express their sentiments.

It is gratifying to observe that all of the speakers were in favor of having the back patents printed as early as practicable: and although they did not sanction a sufficient appropriation for the work this time, they did something towards it, and expressed the opinion that next year it should be wholly accomplished. Mr. Meyers thought that the proposed printing would greatly benefit inventors. "We should," he said, "consult their best interests, and in doing so will always best develope the inventive genius of our people."

Mr. Conger said: "I think it very necessary and essential to the interest of inventors, who pay all these expenses in the end, that as large an amount as it is possible shall be appropriated."

Mr. Garfield was in favor of a larger appropriation, but thought it impracticable at present to use it, owing to the crowded state of the Patent Office, and the consequent necessity of hiring space, at a heavy cost, if additional draftsmen were to be employed.

NINE THOUSAND dollars has thus far been contributed toward the Agassiz monument.

THE CULTIVATION OF OYSTERS.

In our last issue, we traced the oyster from the spawning bed through its four or five years of development. It is now on what may be called the fattening ground, the firm gravelly bottom of a channel between rocky islands, swept by a tide which runs like a river in flood. Here the oysters spend their last season, with as much enjoyment, we fancy, as oysters are capable of. The conditions of oyster life are here evidently at their best, for the oysters improve astonishingly, doubling in bulk of meat, it may be in six months. Here the crooked are made straight by their own efforts, the slender grow broad and round, the lank become stout, and the flesh of all grows plump and hard to the very gills. Notice the difference between the opened "natural" and a "transplant" of corresponding age, especially in front of the circular muscle commonly called the heart!

But the oyster is not yet in condition to tickle the palate of the epicure. It is full of bitter, salt sea water; the gills are discolored, and the whole system needs renovating. It must have a drink of fresh water. The common run of oysters are taken direct from the "salt" to the market. Not so the fancy product of cultivation. These are taken to the mouth of a sweet-watered river and placed for a few hours in a shallow float, which swims near the surface of the water. Here the oysters "drink," as it is technically called, spirting vigorously, and freeing themselves of all deteriorating matter. Open one now. It lies plump and white in the shell, rounded to the gills, which are scarcely visible, in every part clean and tempting to the most fastidious. Taste it, and know how sweetly delicate an oyster may be!

Not many people know it, but there is as great a difference between a thoroughbred oyster, properly handled, and an ordinary oyster such as one sees in the markets, as there is between a rough seedling pear and a Bartlett which melts in the mouth. Those who have learned the difference experimentally will eat no other where the cultivated are to be found.

The variety we have been studying are genuine "saddle rocks," raised on their native soil. Other varieties differ in color and flavor, and have their local admirers; but none surpass the true saddle rock in all the qualities that form the perfect oyster.

We set out to describe the cultivation of oysters, and have done so as one might describe the cultivation of wheat in Nebraska, omitting to mention grasshoppers. It will not do, however, to leave out the shadows of the picture. The oyster eater may care but little for the long battle that has been waged with various enemies to secure the development of the savory morsel that lies before him on the half shell; but to the man who raised the oyster it is a matter for serious consideration. If a crop of wheat required five or six years to come to maturity, and during all that time was subject to invasion by destructive insect pests, not to mention human marauders and elemental dangers, it would bear some resemblance to a crop of oysters. The likeness would be still closer if the attacks were made invariably in the dark. It is hard watching against enemies which work under cover of from ten to a hundred feet of water.

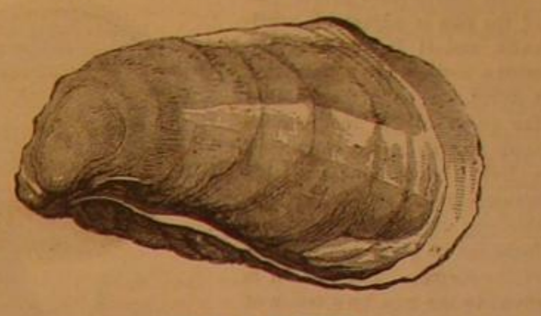
The chief animate enemies of the oyster and the oyster cultivator are (barring oyster thieves) the starfish, the drill, and—shall we say it?—the periwinkle. The starfish is perennial. It is to the oyster grower what the grasshopper or the army worm is to the farmer on *terra firma*. Its worst assaults, too, are made in like manner, that is, in overwhelming masses. The sea is full of them, and at times they will come up from deep water in solid column, broad enough to run over large areas, and so numerous that not a living

STARFISH AT WORK.

thing remains in their path. Miles of oyster beds have been laid waste by them, and the perpetual possibility of such invasions makes the oyster grower's investment extremely precarious. It is only by constant dredging that it is possible to do anything on the north shore of the Sound, the cost of carrying on the war, with the losses entailed, making the heaviest of the oyster breeder's taxes. On the Long Island shore they have been, we are told, less troublesome of late. By persistent labor many grounds formerly given over to their ravages have been recovered; and when steam comes to be more generally used in dredging, it is possible that the pest may be quite overcome and exterminated.

A short time ago one of our scientific cotemporaries published a digest of a French report, in which the starfish was described as helping to complete the work of destruction begun by the drill. It would be fortunate, indeed, for our oyster breeders if the stars were thus dependent. It is true enough that the drill paralyzes the oyster (chiefly those under three years old) by boring a hole into the oyster's heart, as its large muscle is called; but the star waits for no such intervention. On the contrary it destroys both the drill and the oyster, and every other mollusc it comes across.

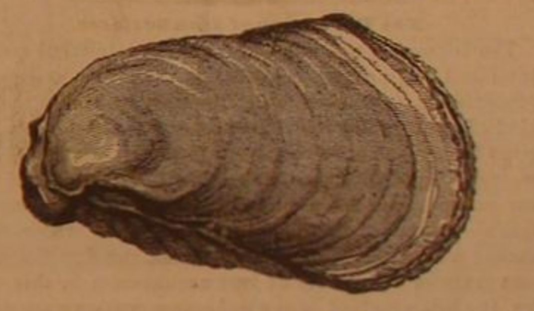
In the current issue of the *Popular Science Monthly*, Mr. Lockwood gives a more correct account of this baleful star's proceedings. He errs, however, in saying that the star merely clasps the oyster, then patiently awaits its opening, whereupon it drugs its victim as a burglar might blow chloroform through the crack of a partly opened door. The rapidity with which stars destroy oysters, and the invariable corrosion of the outer edge of one of the valves of the oyster's shell, making it shorter than the other and the junction of the



WORK OF STARFISH.

two imperfect, is evidence enough that the burglar waits for no opening of the door. By what process the shell is eaten away, whether by an acid secretion or otherwise, we do not know. That it is eaten away, the shell of every oyster killed by stars bears unmistakeable testimony.

The case of the periwinkle is less clear. The assertion of certain naturalists that the 'winkle is a harmless and innocent vegetarian is met with such derision, by oystermen, as shepherds would be likely to greet the assertion with that wolves eat nothing but grass. They regard 'winkle as the chief destroyer of mature oysters, and will show you just how the oyster's nose is broken off between the tough foot of the 'winkle, and its outer shell. They have caught the rascal in



WORK OF PERIWINKLE.

the act time and again, with more or less of the oyster devoured. It is a pretty case of conflicting testimony as it stands, possibly one of mistaken identity.

The drum fish, which makes such havoc among the oysters of other localities, is but an occasional visitor in the Sound, and never in sufficient force to do much harm.

It must not be supposed that this exhausts the list of the difficulties and dangers which the oyster grower has to contend against. Inanimate as well as animate Nature bears hard upon him in more ways than we have space for mentioning. Nevertheless endurance, pluck, and energy prevail in this as in other forms of industry, especially new ones, in which everything has to be learned by experience. Though greatly extended during late years, the business of oyster culture is yet in its infancy. It cannot fail to become more and more important as rapid transit broadens the area over which live oysters may be distributed, and more of the inhabitants of the interior learn to know the oyster's capabilities.

In closing, we must express our special indebtedness for information, for opportunity to study the workings of oyster culture on the spot, and for the specimens selected for these illustrations, to the Messrs. Hoyt Brothers, oyster farmers and dealers in fancy oysters, at Norwalk, Conn.

Prizes for Chemical Discoveries.

The following prizes for chemical discoveries are offered by the *Société d'Encouragement*, Paris: Disinfection and prompt clarification of sewage, $200, 1875. Ink not attacking metallic pens, $200, 1875. Economical production and application of ozone, $600, 1875. Fixation of atmospheric nitrogen, either as nitric acid, ammonia, or cyanogen, $400, 1876. Artificial production of graphite, suitable for lead pencils, $600, 1877. Artificial preparation of a compact black diamond, $600, 1877. Industrial application of oxygenated water, $400, 1878.

The Railway World.

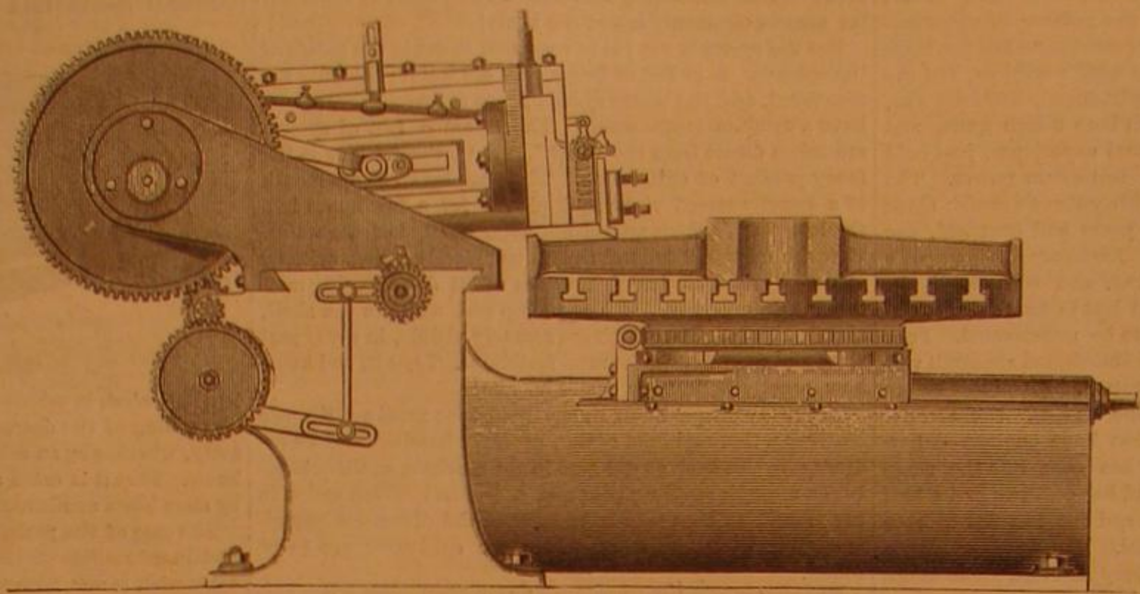
This is the title of a new and handsome weekly paper, 16 quarto pages, $4 a year, lately established at Philadelphia. It is the successor of the United States *Railroad and Mining Register*. If we may judge from the contents of the first number, the new periodical is in the possession of the real requisites for success, namely, ability and enterprise. We cordially wish for it the highest prosperity.

IT is reported that the owners of the Great Eastern are contemplating the project of turning the ship into an immense hotel, and sending her to the Centennial Exposition.

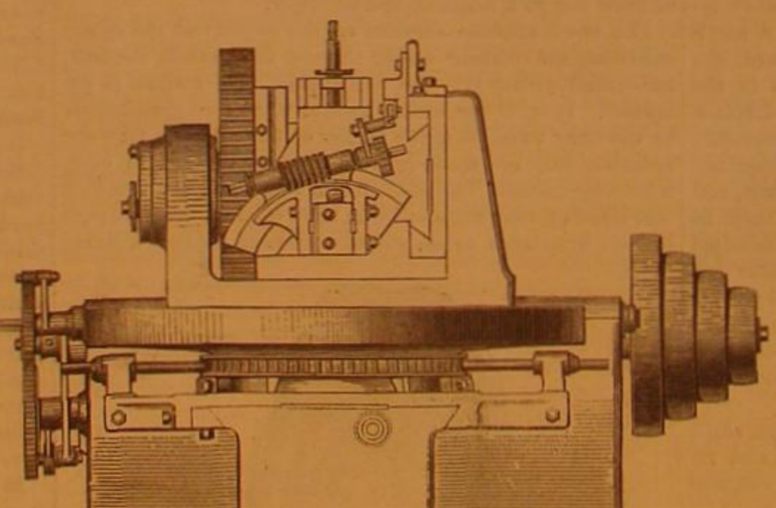
FINISHING LOCOMOTIVE WHEELS.

On page 6 of our current volume, we illustrated an ingeniously designed machine for slotting curvilinearly the insides of locomotive wheels made of wrought iron; and in further illustration of the subject of finishing such wheels, we publish two views of a tool of German origin, exhibited by the Chemnitz firm at the Vienna Exposition. It is designed for planing the spokes of locomotive wheels, the tool traveling at an angle to the horizontal to provide for increased thickness of metal at the hub. The tool holder is located at the outer end of a reciprocating ram, said ram working in guides formed on a plate which can be adjusted at different angles, so that the tool is made to take its cut in a direction corresponding to the desired taper of the wheel spoke.

The tool holder at the end of the ram is adjustable vertically, and it is also provided with a toothed arc actuated by a worm, and so arranged that the point of the tool can be made to traverse on the arc of a circle, convex upwards, this traverse being self-acting. In this way the desired rounded form can be given to the edges of the spokes. The motion is given to the ram by a crank of adjustable throw in the ordinary way, and it will be noticed that the carriage on which the ram is mounted is capable of being traversed along its bed by self-acting gear, the machine being thus made available for a variety of work besides that of spoke edge planing. This machine is, in fact, a very useful one for a locomotive shop where it is desired to turn out highly finished wheels, and is of very good design generally.



WHEEL SPOKE PLANING MACHINE.



WHEEL SPOKE PLANING MACHINE.—END VIEW.

The Protection of Iron Surfaces.

The increasing utilization of iron as a material of architectural and engineering construction, and the necessity for protecting it from surface deterioration by means of some kind of paint which is at once economical and durable, have given the subject to be considered in this article a very great practical importance to painters. Until within a short time, our painters have not seemed to realize that iron required special treatment, very different from that which would answer with wood or brick; and during the first ten or fifteen years of the history of iron architecture in this country, the best effects of design and ornamentation were spoiled by heavy coats of white paint, which were sure to become streaked with reddish stains very soon after they were put on. There has been a very decided progress—towards a style of painting at once tasteful, durable, and adapted to iron as a material of construction—since white iron fronts were general, and many of the iron buildings in New York are models of beauty as well as strength; but we may consider the painting of iron an art yet to be learned by a majority of painters, if we may judge by the many conspicuous examples of ugliness and bad taste which disfigure our finest business streets.

In mixing paints for iron surfaces, it is of the first importance that the best materials only be used. Linseed oil is the best medium, when free from admixture with turpentine. A volatile oil, like turpentine, cannot be used with advantage on a non-absorbent surface like that of iron, for the reason that it leaves the paint a dry scale on the outside, which, having no cohesion, can be readily crumbled or washed away. Linseed oil, on the other hand, is peculiarly well adapted for this purpose. It does not evaporate in any perceptible degree, but the large percentage of linolein which it contains combines with the oxygen of the air, and forms a solid, translucent substance, of resinous appearance, which possesses much toughness and elasticity, and will not crack or blister by reason of the expansion and contraction of the iron with variations of temperature. It is, moreover, remarkably adhesive, is impervious to water, and is very difficult of solution in essential oils, spirits, or naphtha, and even in bisulphide of carbon. Another important advantage of linolein is that it expands in drying, which peculiarly adapts it to iron surfaces; since cracks, however minute, resulting from shrinkage, expose enough of the metal to afford a chance for corrosion, which will spread in all directions, undermining the paint and causing it to scale off, besides discoloring it.

With all its advantages, however, the best linseed oil paint is but poorly adapted to long service as a protection to iron surfaces exposed to extreme variation of temperature and to all kinds of weather. Even the continuous film of linolein, notwithstanding its compactness and the additional substance afforded by the body of the paints, gradually losses its toughness, curls up, and peels off. If chipped off by accident before it had lost its hold on the iron, we find, if we carefully examine the exposed spot, that a thin film of oxide has formed under it. This fact accounts for its diminished adhesion. Iron, in uniting with oxygen to form a rust, increases its bulk in proportion to the amount of oxygen it has taken up, and necessarily occupies increased space. In a word, it swells, and in so doing pushes off the paint film, which, sooner or later, drops away from it. This undermining action of the rust is the chief difficulty to be contended with in effectually preserving iron surfaces by means of paints or varnishes. It is not improbable that the linolein itself an oxide, may impart oxygen to the iron, and thus promote its rusting. This idea has been suggested by Professor Williams in a recent treatise on the subject; and while it is purely speculative, it may account for the oxidation of iron surfaces, when to all appearance effectually protected by a film of paint thick enough and continuous enough to exclude both air and dampness.

In selecting a paint for ron, mechanical adhesion is a consideration of the first importance. In this respect, paints differ widely, but it must be remembered that, in painting or varnishing a metallic surface, mechanical adhesion is all we have to depend upon. With absorbent surfaces it is different. Professor Williams gives it as his opinion, based on observation and experiment, that pitchy or bituminous films are especially effective as regards their adhesion to iron: for example, solutions of asphalt or pitch in petroleum or turpentine. These are also very effective as regards continuity, owing to the fact that, in drying, they form plastic films, which yield with the expansion and contraction of the iron, and manifest no tendency to crack. If the surface is rusty, they penetrate the oxide scale, and envelope the particles very effectually, making them a portion of the paint. The solubility of such a film in water may be counteracted by mixing it with linseed oil. The experiment may easily be tried by mixing about two parts of Brunswick black with one of white, red, or stone colored paint, the body of which is composed of red or white lead or litharge. Red lead is the best for many reasons, if finely ground and thoroughly mixed with linseed oil. Any one of several kinds of bitumen may be used, either natural mineral asphalt, pine pitch, or artificial asphalt, such as gas tar or the residuum of petroleum distillation in cases where the crude oil has been distilled before being treated with acid. This gives a very hard, bright pitch, which is soluble in "once run" paraffin spirit, and which makes the base of an excellent, cheap, and durable paint for ironwork in exposed positions.

During the past few years the writer has heard many accounts of the preservative influence of paraffin when applied to iron surfaces, and can recommend it for all classes of ironwork which can be treated hot. The most effective method of applying it is to heat the iron in vacuo, in order to expand it and open its pores, when paraffin, raised to the proper temperature, is run upon it. By this means the iron is penetrated to a sufficient depth to afford a very effectual protection against oxidation, especially when a suitable paint is subsequently applied. Any non-oxidizable substance would probably answer, but paraffin is as cheap as any, and quite as good if not better, the only exception as to quality being made in favor of some kind of vitreous enamel, which, while costing more, would certainly be more permanent in its benefits. Brushed upon the outside merely, it is doubtful if paraffin would have much effect in preserving the iron, while it would certainly tend to lessen, if not destroy, the mechanical adhesion of a surface paint. There is no reason, however, why bridge work, iron fronts, etc., should not be treated with paraffin before they leave the shops where they are made, which would greatly simplify the problem of their easy and economical preservation from oxidation. In the absence of such treatment, a careful coating with the paint above described will probably prove the most effectual means of protecting iron surfaces.—*Painters' Magazine.*

An Unhappy Attachment.

The Dover (Ohio) *Reporter* states that a painful scene occurred in a church in Bucks township, Ohio, a few Sundays ago. The church had lately undergone repair. Among other improvements a new coat of paint was placed on the pews, followed by a coat of varnish; the result was most pleasing to the eye, but unfortunately the varnish had been applied so late in the week that it had not had time to become hard before Sunday, when the congregation flocked to their seats. No apparent inconvenience was suffered until the clergyman was about to deliver the benediction, when the congregation were horrified to find that they were unable to stand up; they were, in fact, glued, or rather varnished, to their seats. Their spasmodic efforts to rise were most distressing to witness; in vain did the clergyman exhort them from the pulpit to resignation. They were seized with a kind of panic, all the more frightful because they were for the moment powerless; at last, by what seemed to be a simultaneous and herculean jerk, they managed to tear themselves from their sittings; but at what a sacrifice! The pews were literally covered with fragments of Sunday apparel. Shreds of silk, lawns, calico, broadcloth, and cassimeres were left as souvenirs of the tenacity of the varnish used in beautifying that church and the hapless congregation, rushing from the doors, hurried homewards with an expression on their faces as though their hearts were even more severely rent than their garments.

Chemical Action of Sea Water on Boilers.

In all boilers in which salt water is used, the plates are attacked and the portion of the iron dissolved is ultimately found in the scale, or the mud, to which it imparts a brick red tinge. Out of the three principal salts always present in salt water, namely chloride of sodium, chloride of calcium, and chloride of magnesium, to the former two the deleterious action mentioned is ordinarily attributed. This, however, is an error, since both salts are neither decomposed nor altered at the highest temperatures, and hence they cannot be caused to affect the iron through the heat in the generator.

The chloride of magnesium, however, a writer in the *Annales de l' Industrie* points out, decomposes into hydrochloric acid and magnesia. The former in contact with the iron attacks it, forming chloride of iron, which is soluble in water. When the chloride of magnesium is deposited by the salt water on the portions of the boiler, this result takes place; and the chloride of iron, dissolving in combination with the carbonate of lime already in solution, forms chloride of calcium and red oxide of iron, which is found in the scale. It remains, therefore, to find a means of combatting this action of chloride of magnesium, in order to preserve marine and other boilers in which sea water is used.

DISAPPEARANCE OF A VALUABLE BOOK.—The London *Builder* states that the Book of Kells, written by Saint Columbkill in the year 475, the most perfect specimen of Irish art, with illuminations, and valued at $60,000, has disappeared from Trinity College library. It is alleged to have been sent to the British Museum for the purpose of being bound. The volume is regarded as the palladium of Ireland. A receipt for it, signed by a Mr. Bond, purporting to be from the British Museum, has been placed in the hands of the Provost of Trinity College, Dublin. The greatest excitement prevails in the College respecting the mysterious disappearance of the volume.

APPLES HALF SWEET, HALF SOUR.—We are indebted to Mr. J. H. Parsons, of Franklin, N. Y., for specimens of fruit as above. They are of the greening species, sound and ripe. The two flavors are quite distinct; the sour portions have a greener and more full appearance than the sweet parts, which are softer and of a yellow hue.

HILLSIDE MINING IN COLORADO.

The mineral wealth of California, Colorado, and Nevada is such as to render it probable that there will consequently be an increase in the values of all commodities, owing to the vastly increased amount of the precious metals which will, during the next few years, be brought into the market. Moreover, the labor interests of this country will be largely affected by recent discoveries, as the want of employment in the Eastern States creates a steady flow of travel to the El Dorado of the Great West.

The San Francisco *Chronicle* reports as follows:

"The recent wonderful developments on the Comstock are far ahead of anything before made on that famous lode. The great *bonanza*, or ore body, running through the Consolidated Virginia, California, and Ophir mines, seems to be improving in all directions. The general character of the ore is the same as in all mines—being a mixture of red chloride and sulphuret ores. The California mine has come suddenly forward as the richest mine on the Comstock, and Belcher and Crown Point, producing over a million a month, are thrown into the shade by the developments in the mine above mentioned. Mining experts who have visited the lower levels place most astounding estimates on the amount of ore in sight. Some of these estimate that in the Consolidated Virginia there is, standing in the mine above the 1,550 feet level, over $43,000,000 worth of ore, or about $27,000,000 in dividends. The estimates of the value of the ore in the California vary from $50,000,000 to $150,000,000.

"Plenty of ore is found in the Consolidated Virginia, assaying on an average $600 per tun. At one place the ore body is found to be 140 feet wide.

"In the California mine the discoveries are attracting universal attention. Quite recently the north drift on the 1,500 foot level was connected with the south drift on the same level in the Ophir, thoroughly ventilating the mine and creating a fine circulation of air. The cross cut from the bottom of the south winze on the south line of the Ophir, 60 feet below the 1,465 foot level, is developing a more valuable body of ore than anything yet found in that section, no longer leaving a doubt that the California has one of the richest and most extensive ore bodies ever discovered on the line of the Comstock.

"The ore in the Ophir is the same as that in the Consolidated Virginia, showing that both companies are at work on the same body. On the 1,466 foot level the *bonanza* is constantly expanding, and the value of the ore is almost daily increasing. It is estimated by those who have taken the pains to make the necessary measurements that there are now in sight, on the 1,465 and 1,300 foot levels of the Ophir, not less than 150,000 tuns of ore. Specimens are here found that are so pure as to be malleable on some of their surfaces. A specimen taken out here lately assayed over $8,200. It is thought that the ore in this drift will average $1,200 per tun. At last accounts the face of the drift was in the same material."

Our engraving, taken from *Harpers' Weekly*, shows the manner in which mining is carried on in the mountainous districts where the lodes lie above the surface of the valleys, embedded in the hills. Many of the slopes are literally honeycombed by these horizontal workings, and the labor expended in prospecting for paying ores, frequently without adequate result, has been very great. But in the aggregate, the yield of the gold and silver has been enormously profitable to the Colorado miners, and the occasional failure of a lode, or an unsuccessful prospecting scheme, is not likely to discourage so hardy a race.

HILLSIDE MINING IN COLORADO.

The Cause of Earthquakes and Volcanoes.

The interesting paper of Professor Robert Mallet on the above subject, an abstract of which was first published in this country (we believe) in the *Science Record*, January, 1873, is attracting much attention. We will briefly recapitulate the points of the new theory.

The various relations and points of connection between volcanic phenomena, earthquakes, and lines of mountain elevation imply that they are the results of the play of one set of cosmical forces which have been brought into operation by the gradual cooling of the earth from an incandescent sun-like state to its present condition. His argument is as follows: As the cooling of the earth proceeded, the crust gradually thickened and contracted less and less as the temperature became lowered. The hotter nucleus, on the other hand, contracted more, being at a higher temperature than the crust and having a higher co-efficient of contraction for equal loss of heat. By this process, which is still going on, the crust of the earth would shrink at one rate, and the vastly hotter central portion at another and greater rate; and cavities would be formed between the crust and the nucleus, cavities which would be inevitably filled by the crushing down of the solid crust on the more swiftly contracting nucleus, by the force of gravitation, which is sufficient to crush the hardest rocks; and as the solid crust follows the shrinking nucleus, "the force expended in mutual crushing and dislocation of its parts is transformed into heat," by which, at the points of crushing, the rocks are heated even to fusion. The access of water to such points determines volcanic eruption. These points of crushing may occur at various depths in the solid crust. He then proceeds to measure the amount of actual contraction by the annual amount of heat lost by radiation into space, which is sufficient to liquefy 777 cubic miles of ice into water at 32°, and comes to the conclusion that less than one fourth of total annual loss of heat would suffice to produce the contraction necessary for his hypothesis. The actual amount of annual contraction is estimated at a reduction of three fifths of an inch, an amount too small to be measured by any astronomical method, and yet more than enough to produce all the volcanic phenomena now to be observed on the surface of the earth.

Aggregate Steam Power of the World.

Dr. Engel, director of the Prussian Statistical Bureau, has been making estimates, on such statistical data as is available, of the total horse power of steam engines in the world, as every country has tolerably correct railroad statistics. Dr. Engel thinks that the following returns with reference to locomotives is not far from right:

	YEAR.	NUMBER.
United States	1873	14,223
Great Britain	1872	10,933
Zollverein	1871	5,927
Russia	1873	2,684
Austria	1873	2,369
Hungary	1869	506
France	1869	4,933
East Indies	1872	1,323
Italy	1872	1,172
Holland	1872	331
Belgium	1870	371
Switzerland	1868	225
Egypt	1870	212
Sweden	1872	185
Denmark	1865	39
Norway	1871	34
Total		45,467

It may be assumed that there are still four or five thousand additional locomotives in countries from which no statistics have been received, so that something like fifty thousand engines of that description, of an aggregate of 10,000,000 horse power, are now in use. Dr. Engel estimates all the engines in use—locomotive, marine, and stationary—at about 14,400,000 horse power.

Assuming that the above statistics are approximately correct, it would appear that one third of all the steam engines and steam power in the world are employed in the United States. This will, in some degree, account for the extraordinary industrial progress of this country and the high rank it maintains in all departments of practical engineering. The population of the United States is 40,000, while the aggregate population of the other countries above named exceeds 350,000,000.

Extraordinary Inundation of the Nile.

The Nile inundation for 1874 reached a higher level than has ever been the case within the memory of man. On the 10th of October, whole villages along the banks, it seemed, must be swept away; and had it not been for an immense levy upon the population for workmen, the losses and destruction would have been enormous. No less than 700,000 people were set at work opening ditches and channels for the flood. It was only by the protracted and severe effort of this multitude that the danger was averted.

Greenhouse and Window Plants.

Ventilation is one of the most important things to look after at this season, as by a little injudicious opening of ventilators many choice plants may be ruined. Always open on the side opposite to that from which the wind blows. When the weather is very cold and freezing, air enough will enter through the little cracks to afford the necessary ventilation.

Water should be applied only when the soil is dry; and then give an abundance, otherwise the plants will soon perish. Shower the foliage once or twice a week, except during the coldest weather.

House plants usually suffer from the dry, dusty atmosphere of the rooms in which they are placed. If showered occasionally, and the thick-leaved kinds wiped off with a damp sponge, they well grow much better.

Wardian cases or ferneries are now in general use among plant lovers, as they enable one to grow a few ferns and other plants very readily and with but little attention, except to shade from the direct rays of the sun. But little water is needed after that given the plants when first set out; if any mold appears, the case should be opened for an hour or two every day.

Bulbs that have made good roots may now be brought up from the cellar, and in six weeks' time will give an abundance of flowers.

Succulents, such as echeverias and tender sempervivums, will winter in a cool part of the greenhouse, if kept dry. Water should only be given sparingly.

Cactuses coming into flower will require plenty of water, and those at rest scarcely any.

Insects should be looked after closely; give the house a thorough smoking once or twice a week, to kill the green fly and other pests.—*Agriculturist.*

Sheet Metal Pipes.

M. Vanche Denis, of Gaulier (Ardennes), France, says the *Ironmonger*, has invented a system of manufacture of lap-jointed metallic pipes, by forming a bend in and turning up the longitudinal edges of a long, narrow sheet of metal. By curving this band by the aid of a special shoulder piece, and then passing the band, thus prepared, between a series of grooved pulleys, which draw toward each other, and clasp and press together the edges of the metal band, curved so as to produce a cylinder, he makes a pipe with perfectly tight joint, and of the required diameter.

CLOSING CRACKS IN CAST IRON STOVES.—Good wood ashes are to be sifted through a fine sieve, to which is to be added the same quantity of clay finely pulverized, together with a little salt. The mixture is to be moistened with water enough to make a paste, and the crack of the stove filled with it. The cement does not peel off or break away, and assumes an extreme degree of hardness after being heated. The stove must be cool when the application is made. The same substance may be used in setting the plates of a stove, or in fitting stove pipes, serving to render all the joints perfectly tight.

W. R. S. says: "In making a rubber joint, take a piece of chalk and rub it on the side of the rubber and flange where the joint is to open; and when required, they will come apart easily, and not break the rubber, although the latter may be burnt and hard. Repeat the chalking before screwing up, and you will have as good a joint as ever, and the rubber can be used a great number of times. I have seen a blacksmith measure a piece of iron and put chalk marks where he wanted to cut it; he then put it in the fire and heated it to a bright red, and the chalk was still there, unaffected by the heat."

A CURE FOR BRIGHT'S DISEASE.—Dr. Hegewald says: Half pint, thrice daily, of a fresh infusion of the leaves of *asplenium scolopendrium*, L., is a most successful treatment in Bright's disease. This is the hartstongue or spleenwort, and is said to be popular, in Devonshire, England, and elsewhere, for its medicinal virtues.

Correspondence.

Zinc in Boilers.

To the Editor of the Scientific American:

In your paper of December 12, a correspondent states that zinc is a preventive of boiler incrustation. Seven or eight years ago, I tried the experiment, under the idea that an electrical condition might probably have something to do with boiler incrustation. The boiler I had was an upright one. I placed a piece of zinc, weighing about two pounds, on the dome inside, between the tubes; it remained there about two months, and during that time the boiler was opened at the bottom, on three sides, for a weekly cleaning. I noticed that the mud (Mississippi mud) was quite different from that previously deposited. Before it was mostly made up of scales; but after the zinc was put in, the deposit was soft, and scarcely a sign of scale was visible, the surface of the iron within looking fresh and new.

Notwithstanding this favorable action of zinc, it is not to be recommended for this purpose. I found the cylinder, piston rod, and piston head badly incrusted by something which I could not understand; the pump worked badly and frequently failed, becoming incrusted within. I sent it to be repaired to the maker, who, on opening it, expressed his surprise at its condition, and said: "How came this stuff on the pump? It looks like calamine." Zinc as a preventive of boiler incrustation will not do; if, however, the zinc produces a galvanic current, and renders the iron negative, then the experiment is suggestive of a principle that can be used by an external application of the galvanic force.

Carondelet, Mo. L. T. Wells.

To the Editor of the Scientific American:

I saw in your issue of December 12 that an engineer on the steamship St. Laurent, running between New York and France, had left an ingot of zinc in one of his boilers; and on looking for it at the end of the next trip, he found it all wasted away to a mere mud. This is not new here. Mr. J. J. Illingworth, Chief Engineer of the Utica Steam Cotton Mill, first introduced zinc in their boilers nearly 20 years ago; and by his recommendation it is now used in the New York Mills' boilers and in many other places. Mr. I. claims that the zinc has a great affinity for oxygen, and therefore absorbs the oxide in the water, and thus prevents its affecting the iron of the boiler. I herewith send you a couple of pieces which I obtained from him; and you will see that they are not all gone to mud, as they would have been if they had been left in the boiler a week or two longer. These pieces have been in the boiler about four weeks. In the New York Mills where soft water is used, the zinc will lay there without being affected; but as soon as the hard water of the Sauquoit Creek is used, it begins at once to affect the zinc. Nor is this all the effect of the zinc in the boilers; it prevents the steam pipes (running round the mill for heating purposes) from rusting.

To show this more conclusively, I will say that the piping in the above mill, where zinc has been so freely used, has been in 25 years, and has needed no more than the ordinary repairs that such pipes require. But on the other hand, the company built a new mill (which was started in October, 1869), and, for some reason not explained, there was no zinc put into the new boilers for about 3 years. The result of this neglect or oversight was that the heating pipes all through the mill began to leak at the elbows, couplings and Ts; and on taking the pipe apart for repairs, it was found that, wherever the steam either struck the T or elbow or dripped into it, there was a hole eaten into it; and when a piece of pipe was to be taken down, there was no telling where the workman could stop, because the pipes, Ts, elbows, and couplings were generally eaten away. I also send you a T, which is a fair sample of all the pipe and other joints connected with it.

When this was brought to the knowledge of Mr. I., he began at once to put zinc into the boilers of that mill, and the result of it is that the rusting of the pipes has entirely stopped, and the bill of repairs lessened accordingly. I am told that the above engineer has used zinc in his boilers for over 25 years, with the same results in all cases.

Utica, N. Y. Ajax.

Phosphor Bronze.

To the Editor of the Scientific American:

The manufacture of this alloy was commenced in our city in 1872, and has since gradually gained its way into many of our industrial works. At the time of its introduction, I had charge of the machinery of one of our large rolling mills, and was induced to try it for journal bearings for our rolls and other heavy machinery. The disadvantage that bearings in rolling mills labor under is that they are scarcely ever bored or fitted in any way, the pattern being made as exact as possible, so as to save the work of fitting. Thus the bearings are subjected not only to the heat induced by friction, but also to that imparted to the rolls by the hot iron passing between them. Add to this the muddy, gritty water run upon the necks to keep them cool, the immense amount of cinder thrown into them from the hot iron, and often bad grease and a careless roller, and you have a combination of difficulties that are hard to overcome. The brass bearings in an eight inch train of rolls last for from one hour to six months, the latter being the exception. As I have seen both brasses and necks cut so badly as to be worthless within an hour, by cinders getting into them, by worthless grease, by hard spots in the brass starting a neck, by the chippings from the neck tearing the brass to pieces, and by the carelessness of the roller, I know what the bearings have to stand.

I will describe the three most important trials made with the bronze bearings. I placed a set of trial bearings under the necks of a pair of finishing rolls, in a ten inch mill, on November 25, 1872. On November 23, 1873, they were taken out and examined, when it was found that they had not worn one thirty-second of an inch on the bearing proper; and they were only discarded because the collars were worn out on account of the excessive end wear, caused by forcing the bearings against the ends of the rolls by set screws, to keep the grooves over each other. The second test was a much severer one. A set of bronze bearings were placed under and over the middle roughing roll of an eight inch train on December 2, 1872, and were used just one year before they were worn out, though the necks of the rolls had been previously badly scored by cinders. In the roughing rolls of any mill a large amount of cinder is thrown into the bearings, thus making such tests as the above very severe. In the first test, a careful roller was in charge of the mill; in the second test, a careless one. The third test was the most severe of all. One of the E bronze plates was put under the upright shaft of a thirty-five ton rotary squeezer, and a set of A bronze plates under the horizontal shaft. Every rolling mill man knows that it is an impossibility to keep all the cinder from the bearings of the horizontal shaft, cover it as you will. The one mentioned had four covers, owing to the fact that, as water is used on the squeezer to keep it cool, it will wash fine particles of cinder into the journals. After using it from August 1, 1873, to August 1, 1874, having made about seven millions of revolutions and turned out over ten thousand tuns of iron, the upright bearing had worn but one sixteenth of an inch, and the horizontal about one tenth of an inch, a result far ahead of any other I have ever been able to hear of.

Six or seven grades of this alloy are now made, being marked by letters, the Sligo, or A, being used principally for journal bearings. The E brand is almost as hard as steel. I send you a sample of the A, and also a chart of its tensile strength compared with other alloys. I have never had anything to approximate it for rolling mill use, except a composition of nine parts tin to one of copper; but this is not often available, on account of its low melting point.

I am induced to send you these lines, as I have not noticed any actual trials reported by any of your correspondents, and for the reason that I have received so many good things from the table you spread that I cannot refrain from adding my mite. John A. Brashear.

Pittsburgh, Pa

Steam Boiler Explosions.

To the Editor of the Scientific American:

The frightful results of the bursting of steam boilers, entailing (it may safely be assumed, in three cases out of four) the loss of life or maiming of one or more persons, have led to many inquiries as to the probable cause of these catastrophes. The almost invariable verdict is rendered, however, by the coroner's jury that "Mr. ——, the engineer, came to his death by the explosion of a steam boiler in the factory of Messrs. Smith & Jones, to whom no blame is to be attached, the cause of said explosion being unknown, reliable witnesses having sworn that five minutes prior to the explosion the water stood at 3 inches over the flues and the steam gage indicated only 90 pounds pressure to the square inch." In some cases, a stoker testifies that he observed a trifling leak in the lower part of the boiler a day or two previously, but did not mention it, as it appeared so insignificant. Let us, however, examine into the subsequent effects of this insignificant leak.

The nature of the effects of one of these apparently spontaneous explosions, the demolition of the entire building in which the boiler was, the shattering of all the windows for some distance around, and the deafening report, all preclude the possibility of our assuming a steadily increasing force as their cause. A sudden and violent force, such as caused by the explosion of gunpowder, has evidently here been at work. Witness the bursting of the Westfield's boiler, of which two pieces, smashing through bulkheads and machinery, traversed the entire length of the ferry boat and lodged respectively in her stem and stern. I need not recall, to the recollection of your New York readers who visited the scene of the disaster, the appearance of the buildings near the excavation on the New York and New Haven railroad one year ago, occasioned by the explosion of the boiler of (if my memory serves me) but a six horse power engine. Since such effects as these could only be the result of some sudden and violent force, where must we look for it?

It is obvious that no steadily increasing power could produce the too well known effects of bursting boilers, as is shown by the manner in which they do occasionally burst while being subjected to the water test. Then, as a rule, a line of rivets gives way, or a seam tears open; but in no case is a fragment torn completely away, as is almost invariably the case when they burst while in use.

The reason is simply this: Let us assume that a boiler containing 1,000 pounds of water generates steam to a pressure of 90 pounds to the square inch. According to Régnault, the temperature of the water in the boiler would be 318° Fah., or about 106° above the boiling point under the ordinary atmospheric pressure. Now suppose the boiler to burst from weakness of a plate or corrosion of a line of rivets. The pressure is instantly relieved, *but the water in the boiler is 106° above its natural boiling point.* Now the heat required to raise 1,000 pounds of water through 106° would raise about 586 pounds of water through 180°, or, according to Lavoisier, would convert about $\frac{2}{11}$ as much water into steam at the ordinary atmospheric pressure. What is the consequence? *About 207 pounds of water are instantly converted into steam,* occupying about 2,890 cubic feet: in other words, producing an explosive effect just about twice as great as an equal bulk of gunpowder. Imagine exploding 3 cubic feet of gunpowder in a steam boiler!

The figures here given are rather an under than an over estimate, as no account has been taken of the evaporating power of the enormous amount of heat made sensible by the condensation of the superheated steam in the boiler at the moment of explosion. R. D. Williams.

Maryland Agricultural College, Md.

Bridging the Niagara River.

To the Editor of the Scientific American;

Is it impossible to erect a bridge across the Niagara river at Lewiston, to consist of one or more arches of some enduring material, such as stone, bronze, or iron? Will some engineer answer this question, or give an opinion?

Such a work, if practicable, and built about 100 feet wide, would be better for the interests of the people of this continent than the results of the late war. It might be built as a monument to Washington, and be dedicated to his memory. If such an enterprise can be inaugurated and completed in twenty years, I will give $500 toward it, and $500 to create a trust fund of $100,000 for the engineer and the family of the engineer whose skill shall be used to this end.

We have a monument of the war system in our colossal debt; now let us have one for a better purpose—one that shall interlock the friendship of two great and growing nations, Canada and the United States, and put them on good behavior and progress in the arts of peace. I make this proposition in the highest hope for results to industrial progress. C. A. H.

[The suggestion of our correspondent is a good one. We think it probable that such a bridge could be built, and that Captain James B. Eads, of St. Louis, Mo., is the man to execute the work.—Eds.]

A New Light.

Considerable attention is now being given in Paris to a new lamp, the invention of Messrs. B. Delachanal and A. Mermet, and intended for photographic and other purposes where a brilliant light is required.

The media employed are carbon sulphide and binoxide of nitrogen. Ignition of binoxide of nitrogen containing vapor of carbon sulphide produces a brilliant flame of a violet blue tint, peculiarly rich in chemical rays. The carbon sulphide lamp by which this flame is produced continuously is constructed simply of a flask with two tubulures, the vessel having about 30·5 cubic inches capacity. The flask is filled with spongy fragments of coke, or, better, of dried pumice, which imbibes the carbon sulphide. Through the central tubulure passes a tube to within a short distance of the bottom; in the other mouth or tubulure is fixed a tube of larger diameter, about 7·85 inches in length. The latter tube is of glass or metal, and contains an arrangement acting as a safety valve as well as impeding return of the gas and preventing explosion. Binoxide of nitrogen is passed by this tube into the flask, and the gaseous mixture is conducted by a caoutchouc tube to a kind of Bunsen burner, from which has been removed the air port and the cone regulating the supply of gas. The binoxide of nitrogen is produced by a St. Claire Deville apparatus; but instead of decomposing nitric acid by copper, which would be too expensive, a mixture of nitric and sulphuric acid is caused to act upon iron.

The flame, which is about 10 inches in hight, possesses high photogenic properties, and is much superior to the light obtained from the magnesium ribbon. The apparatus is nearly as portable, the mixed acid being contained in one vessel which communicates by a tube with a vessel containing fragments of iron. Supply is regulated by a cock. The flame is constant, unlike that of the electric light, and is not subject to spontaneous extinctions like the magnesium lamp. Photographs of human subjects are obtained in a less exposure than fourteen seconds. Photometric tests show (flame for flame, per measure) about twice the power of the oxyhydrogen light.

The inventors are studying the question of development of the green coloring matter of plants by means of this light. The experiments are being made in M. Dumas' laboratory at the Central School of Paris, and the result will shortly be made public.

Jaw-Wrenching Chemical Nomenclature.

Is it not about time that something was done to simplify the chemical names of organic compounds? It seems to us that some of the new cognomens trench closely upon the bounds of absurdity; and while they may be clear enough to the older chemists, accustomed to words which would stagger the best of orthographists, we submit that they tend to heap up a mountain of technicality as unnecessary as it is discouraging to the coming student, and thoroughly unintelligible to the general reader.

A recent number of the *Deutsche Chemische Gesellschaft* informs us that a certain chemist has studied *orthoamidocresylparasulphurous* acid, and that by the aid of hydrochloric acid and chlorate of potash he has transformed it into *trichlororthotolaquinone.* Further on the author discourses on *nitrorthocresylolparasulphurous* acid, and finally some other chemist hurls at us the fearful jaw-breaker of nitrate of *ethenyldenitrophenyldiamine.* There are plenty more examples of this kind before us, but we spare the reader. These names are of German origin, and hence the German chemists are responsible for them. Goethe, in his "Aphorisms on the Natural Sciences," says: "The Germans have the gift of rendering the sciences inaccessible," a sharp criticism which finds an apt illustration in the present instance.

PRACTICAL MECHANISM.

NUMBER XV.

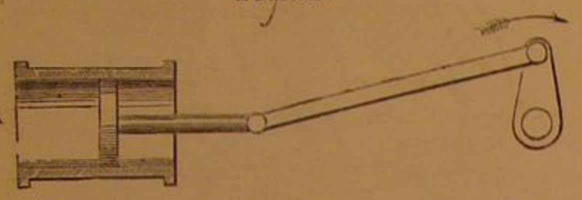
BY JOSHUA ROSE.

MOVEMENTS OF PISTON AND CRANK.

The variation in the supply of steam, when considered in proportion to the amount of piston movement, to which reference has already been made, arises from the irregularity of speed in feet per minute at which the piston travels at different parts of the stroke: which irregularity is due to the varying angles of the connecting and slide valve rods during the stroke, but mainly to those of the connecting rod. The amount of this irregularity will vary with the length of the connecting rod; the longer the connecting rod is, the less will be its variation.

The fly wheel, acting as an equalizer of the power of the engine throughout the stroke, travels at a comparatively uniform speed: and nearly the whole of the variation of speed (caused by the unequal admission of steam during one stroke, as compared to the other stroke, necessary to complete a revolution of the engine) falls upon the piston. In an engine of 12 inches stroke, the connecting rod being, say, 23 inches from center to center of its journals, the piston will have moved 6¾ inches of its stroke when the crank has performed the first quarter of its revolution, and stands at or near its point of full power, as shown in Fig. 52, which

Fig. 52.



represents a cylinder, piston, piston rod, connecting rod, and crank in the positions referred to, the piston having moved from the end, A, of the cylinder. While the crank is moving the next quarter of its revolution, the piston will move 5¼ inches only, thus completing its stroke of 12 inches. Moving the crank the third quarter of its revolution, we find the piston to have moved back 5¼ inches, standing in the same position as it did at the end of its first movement of a quarter revolution. During the last quarter revolution of the crank, the piston moves 6¾ inches, both piston and crank returning to the respective positions from which they started.

STEAM SUPPLY.

The inequality of the comparative piston and crank movements here disclosed causes the supply, expansion, and exhaust of the steam (in common or simple slide valve engines) to be irregular and unequal at one end of the cylinder as compared to the other, as shown by the following example, taken from a working engine of 12 inches stroke, the eccentric and connecting rods being each 23¾ inches long, the steam ports ¾ inch wide, the width between the steam ports being 3 inches and the valve having ⅝ steam lap, with neither lap nor clearance on the exhaust side. The stroke of the valve was 2½ inches, or just sufficient to permit the steam ports to open to their full extent. Commencing, then, when the piston is at the front end of the cylinder, that is to say, at the end farthest from the crank, we find the following respective movements.

TABLE 1.—FRONT STROKE.

Piston moved inches	Port open inch
1	9/16
2	¾ barely
3	13/16
4	⅞
5	⅞
6	⅞ barely
7	¾
8	11/16
9	9/16
10	⅜
11	⅛
11¼	closed, and expansion begins.
11¾	" " " ends.
12	exhaust open ⅛ inch

TABLE 2.—THE RETURN OR BACK STROKE

Piston moved inches	Port open inch
1	11/16 full
2	⅞
3	⅞
4	⅞
5	⅞
6	13/16 full
7	¾
8	⅝
9	7/16
10	3/16 full
10¼	closed, and expansion begins.
11¼	" " " ends.
12	exhaust open ⅛ inch.

It will be at once observed that the supply of steam to the piston is much greater, from the very first inch of piston movement, in the back stroke as compared with that of the front stroke; but this inequality is somewhat compensated for by the fact that the cubic contents of the steam space in the cylinder is greater in the case of the stroke tabulated in No. 1 than it is in No. 2, because of the space occupied during the latter by the piston rod.

The expansion commences earlier in the stroke, and ends earlier; and the distance moved by the piston under expansive steam is ½ inch more in the back than in the front stroke. The effect of the irregularity will, however, be more correctly understood by comparing the movements, as shown in the following table

TABLE 3.

Movement of crank	Movement of piston	Average port opening
1st. quarter	6¾ inches	125/160
2d "	5¼ "	86/160
3d. "	5¼ "	134/160
4th "	6¾ "	64/160

A comparison of the first and third quarter revolutions of the crank: during each of which it moved from a dead center into about full power, and during each of which the piston moved from one end towards the middle of the cylinder: shows that, while the piston moved the greatest distance in the first, it received the least amount of average port opening, and hence the least supply of steam. A comparison of the second and fourth quarter revolutions of the crank, during each of which the piston moved from near the middle of the cylinder towards one end, discloses that, while the piston traveled the least distance in the second, it received the most steam during the fourth quarter revolution. Now let us compare the second and third quarter movements of the crank with the piston movement and steam supply. During each of these movements, the piston traveled an equal distance; but we find the average opening of port for the admission of steam to be 5/16 of an (inch nearly one third) greater in one case than in the other. So likewise a comparison of the first and fourth quarter revolutions of the crank shows that, while the piston and crank moved an equal distance in both cases (namely, the crank a quarter revolution and the piston 6¾ inches of the stroke), the average port opening for the supply of steam was very nearly double in the first quarter of what it was in the fourth. So far, then as we have considered these movements, the steam supply has been (in consequence of the area of the port opening) in each case the least, in proportion to the distance moved by the piston, where it should have been the most, and *vice versa*.

The first quarter movement, considered in relation to the second, shows the steam supply to be the greatest when the piston movement is the greatest; but the third quarter movement, as compared with the fourth, discloses the greatest discrepancy of all, since not only was the port opening more than double in one case of what it was in the other, but the greatest amount of port opening was given to the least amount of piston movement.

Considering the port opening with reference to the crank movement only, it would seem to be desirable to have an equal average of opening for each quarter movement; but when considered with reference to the piston movement (that is, with reference to the amount of steam which is required to pass through the port in a given time), it becomes self-evident that the area of the port should be greater when the piston is traveling fast than when it is traveling slowly.

We must, however, consider that, during the second and fourth quarter revolutions, the piston is at that end of its stroke where the exhaust takes place; so that the piston is not under steam (during each respective quarter movement) for the whole of the movement. Hence the smallness of the opening of steam port is not so disproportionate (considering each quarter movement of itself, and not comparatively with another) as it would at first sight appear to be.

It must also be remembered that, since the ports are of rather larger area than they would be if employed as steam ports only, instead of as steam and exhaust ports alternately, the inequality of port area during the movement, shown in the above tables, is not experienced to so serious an extent as it otherwise would be. It is, however, felt by the engine to a sufficient extent to render it of great advantage to give to the valve (when it has not more steam lap than one half the width of the steam port) more travel than is absolutely necessary to open the ports to their full width; because not only does a small amount of increased valve travel more nearly equalize the average steam port area, but it gives to the engine a much better and quicker supply of steam. It may thus be accepted as a positive rule that such a valve should always have this increase of travel, as will be hereafter shown, there being advantages due to this increase on the exhaust as well as on the steam side of the piston.

Testing and Mounting of Lenses.

Mr. E. L. Wilson, describing a visit to the establishment of Ross & Co., London, says, in the Philadelphia *Photographer*: "The number of tools or curves in this establishment is very great, consisting of upwards of two thousand, all of them being ground with such accuracy that the curvature of each is known to the fourth place of decimals, their respective radii extending from 80 feet down to 0·1 inch (a hundredth of an inch). The curvature to which any particular lens is to be ground is calculated mathematically to suit the refractive and dispersive ratios of the glass of which it is to be formed; and after the lens is finished, if, on examination, it fails to come up to the standard of sharpness, the particular surface which exercises control over the shortcoming is reground in a tool one degree deeper or shallower in curvature, to suit the requirements of the case. The most intense sharpness is insisted upon as a *sine qua non* in this establishment, no portrait lens being allowed to pass into stock unless it can produce a picture with open aperture sufficiently sharp to bear a large degree of magnifying. Such an idea as diffusion of focus is not recognized, the reason assigned being that, if once a lens is made that will produce absolute sharpness, perfection of definition can at will be destroyed in any special case by the mere interposition of a transparent pellicle, or even a sheet of homogeneous paper, between the negative and the print, the latter of which will thus possess that quality known as diffusion, although from the very same negative may be obtained an enlargement of the greatest sharpness and perfection. One large shop in this factory is devoted to brass turning and fitting, and numerous workmen are here engaged in making the new small symmetrical lenses. In this kind of lens the Messrs. Ross have effected a reformation that has, for a long time, been much desired by photographers, namely, the reduction of the diameter of the lenses to the smallest possible size, and the causing of the whole series of twelve to screw into one flange, one cap also fitting all of them. This series of lenses consists of twelve separate combinations, all, as I have said, of the same diameter in mount, which, by the way, is very small, owing to every superfluous portion of glass being removed from the lenses, which are thus reduced to scarcely more than the size of the stop. Their foci range from 3 inches to 21 inches, a lens of the latter focus covering a plate 21 x 25 inches. So small and light are they that a photographer may without any inconvenience carry several of them in his pocket, and screw into his camera any one of them which, from its focus, is best adapted for the representation of any special view. It would be well if this system of having one standard flange for all lenses up to a certain size were more prevalent, for it would prove a boon of inestimable value to photographers. The system of universality of screw has for many years been in use in connection with the object glasses of microscopes; and no matter now in what countries either microscopes or objectives may have been made, all are fitted to one gage. The varying diameters of photographic objectives will ever, of course, prevent the adoption of one individual flange for all purposes; but what can and ought to be done is the adoption throughout the world of a series of flanges, as few as possible, of recognized and standard sizes. Notwithstanding the small dimensions of the symmetrical lenses, they work with greater rapidity than those of large size, when used under similar circumstances of lighting and aperture.

The racks used for portrait lenses are toothed in the solid, so to speak, and are sawn asunder afterwards, three dozen being made at a time.

The cutting of screws, in the tubes, cells, and flanges, is effected both by hand and by mechanism attached to the turning lathe, the special mode to be adopted in each case being determined by the size of the article. The screwing of the tube of a lens of ten or eleven inches in diameter would never be undertaken by hand alone; while on the other hand the services of the lathe screwing machine would never be had recourse to in the case of a small symmetrical lens.

When two achromatic lenses are to be mounted, they are first of all placed in a trial mount, so adapted as to permit of an approximation or separation of the lenses. The test object is a watch dial placed at the extreme end of the testing room, and the image of this dial is examined through a powerful eyepiece. Unless it can divide the closest lines upon this dial, the lens is rejected. In this trial both the central and oblique pencils are examined, and the exact amount of separation of the lenses from each other is now determined by experiment and marked upon each pair, as the instructions for the workman to whom is intrusted the duty of the final adjustment of the length of tube, an operation which influences materially the performance of the lens, when it is considered that so nicely poised are the qualities, in some of the combinations of more recent production, that a deviation of a fortieth part of an inch from the exact distance, required and determined in the way described, will affect its performance and be detected by the manager in course of the final trial, which is made after the lenses have been finished.

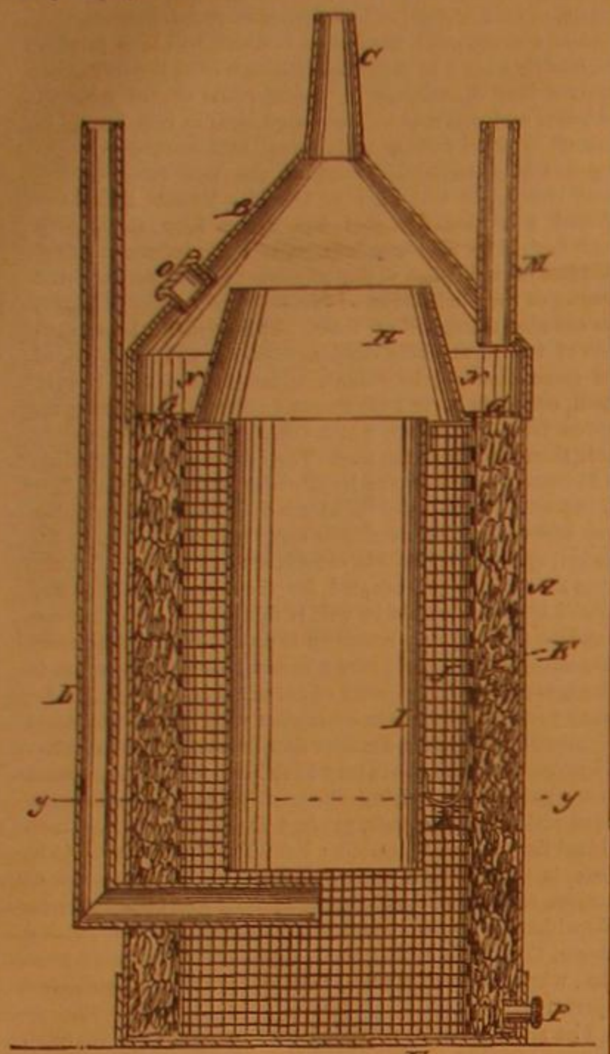
The consulting engineer of the firm of Ross & Co. is Mr. F. H. Wenham, who has apartments upon the premises. Most of the modern improvements in the microscope owe their existence to the genius and executive skill of this gentleman, who, by his invention of the binocular microscope, his simplification and improvements of the object glasses, which throughout the world are all now made upon his principle, his parabolic condenser, and other inventions, has acquired a name which will ever be associated with the highest department of optical science, both mathematical and applied.

Turkish Steam Engineering.

Some ironclad ships were recently built in England for the Turkish government, and sent out under the care of English engineers. On arriving at their destination these were discharged, and Turkish mechanics substituted. Like all other persons who undertake matters which they have no fitness for or knowledge of, these persons came to grief at once. Being required to start the engines of the Mahmoudieh, much delay ensued; the engines did not start, they were pronounced "all wrong," and one officious party, growing impatient after having moved every movable lever, spied some cocks, which he thought must be the right thing to work, and went for them at once. He was scalded by receiving a jet of steam full in the face, which precipitated not only matters, but himself and several other Turkish gentlemen backward down a pair of iron stairs leading to the fire room.

A NEW GAS CARBURETTER.

The novel features in the device represented in the annexed diagram consist in arrangements whereby a part of the gas is allowed to pass through fibrous material saturated with a carburetting liquid. This increases the illuminating power of the gas while economizing the hydrocarbon. The appliance may be made of any size and shape, and be profitably employed, it is claimed, in gas works.



The fibrous substance is packed in the space between the outer casing, A, and an inner wire cloth cylinder, the annular chamber between being covered with a perforated plate, G. L is a central cylinder within the wire gauze, suspended and held out from the latter by springs, K. Above this cylinder is a truncated cone, H, which opens above just below the discharge tube, C.

The carburetting liquid is poured into pipe, M, the orifice, O, being previously opened. It then flows into the annular trough, N, and filters through plate, G, into the packed material. The gas is admitted through the pipe, L, under cylinder, I, a portion rising through said cylinder and combining in the upper part of the apparatus with another portion which passes up through the saturated substance and thus absorbs the hydrocarbon vapor.

This invention was patented Nov. 3, 1874, through the Scientific American Patent Agency, to Messrs. H. Venners and G. H. Judy, of Cumberland, Md.

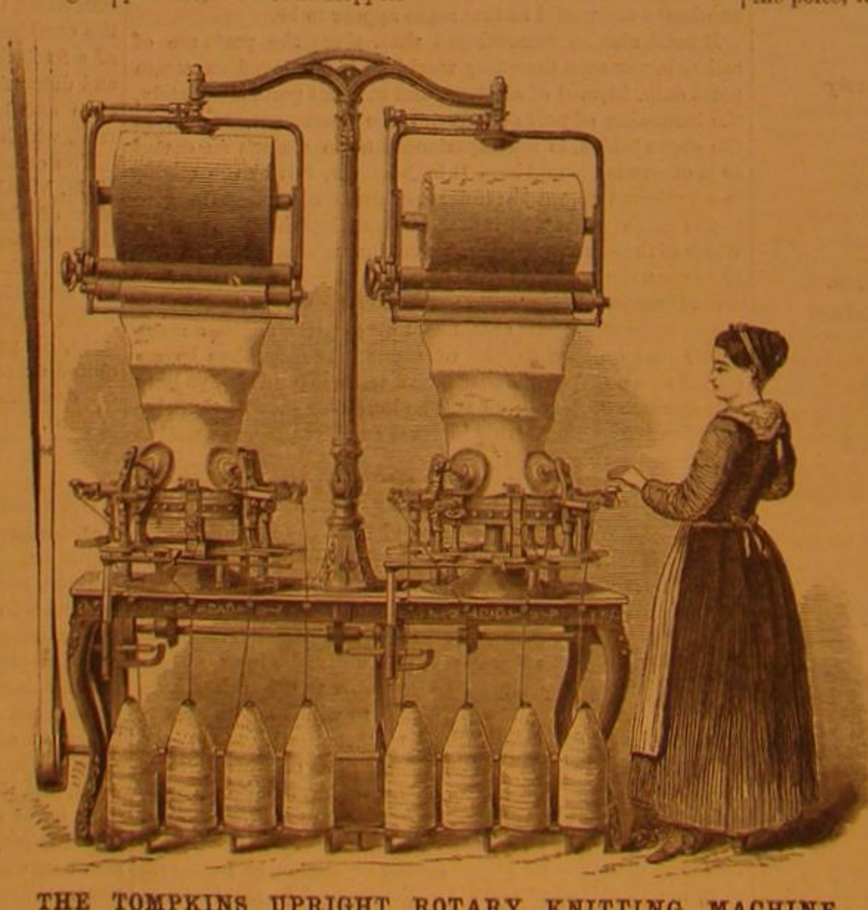
THE TOMPKINS UPRIGHT ROTARY KNITTING MACHINE.

The claims which this machine has upon present public favor cannot be more forcibly pointed out than in stating at the outset that it is a standard apparatus—if we may so term one which has been in successful use for nearly twenty years—remodeled, made from entirely new patterns, and provided with all the improvements which its long trial has suggested to the original patentee. For an idea of its simplicity, and at the same time beauty, of design, we refer the reader to the annexed engraving, in connection with the following detailed description:

The table is of iron, paneled; the shaft bearings long and well Babbitted, and the counter pulleys are large in diameter and narrow faced, so as to allow of ready shifting of the belt by the stop motion.

The cylinder has a long, large bearing, and the principal wear is at the lower end of the hub. The metal is thick where the cap screw enters, and there are three arms, which enables the attendant to reach the burr adjuster without the necessity of cutting a hole in the cloth. The cap screws are turned out of solid seamless iron.

The slotted circle which supports the feed stands is firmly bolted, and allows the attendant to nicely adjust his stands to any sized cylinder. The bedplate and tube are cast together, instead of separate, securing perfect rigidity. The center shaft is held up to its place by a single set screw, which, when loosened, allows the shaft to drop down, and so gives room without disturbing the take-up to take off the cylinder with needles in their places. The sinker and presser wheel stands have been made heavier, and an excellent stop motion is provided, which does not allow the needles to load up. By means of a new inside plate and burr adjuster, after the burr is set for angle, radial position, and depth, which can be done before the cloth is put on, the burr may be raised or lowered to a nicety without losing the other positions. For this purpose a two sized double-threaded set screw is employed, cut right and left hand, and so placed as to be regulated from under the cylinder without cutting the cloth, and so connected as to have no lost motion in its thread; it is so cut that the burr may be varied or depressed any number of hundredths of an inch.



THE TOMPKINS UPRIGHT ROTARY KNITTING MACHINE.

The take-up is a light iron frame, and hangs and turns on a hardened steel step, so shaped as to form of itself a self oiler. It is driven by a gear motion instead of the usual cam; said gear has a hunting tooth, which gives to the taking motion an ever changing movement, which, contrary to the cam, tends to keep the cylinder true and steady. The emery rolls are not geared together, but are so placed as to get the same result. The swing rod is squared at each end where it enters the sustaining arms to equalize the strain on the cloth, in case one of the long spiral springs is drawn out more than its mate. The arrangement to raise the dogs and loosen the cloth is instant in its effect. In changing from a sleeve cylinder to body size, a new take-up is not required.

A machine or table complete has two cylinders or heads, each head generally knits four threads at once, and each thread, or the machinery necessary to knit it, is called a feed. The machines are finished ready to belt except the needles. The same table does nicely for a single cylinder. One girl can attend to six cylinders. The table occupies a space of 6 feet 6 inches in length by 2 feet 4 inches in width; total hight over all is about 9 feet; weight, all told, is 1,340 lbs.

The needles used are the spring beard, and, for convenience, preparatory to putting them in the cylinder, are placed in a mold in pairs, and leaded by having a composition, resembling solder, poured around them while so held. The gage is determined by measuring the needles, and counting the leads when set in the cylinder. For instance, 14 gage has 14 leads, or 28 needles in 3 inches in length, measured on the circumference. To change from plain to rib requires only four new presser burrs. In regard to the proper speed of the needles for the different sized cylinders, needles, and yarn, some believe a quick speed to be best, and others consider it policy to use more machinery and run it more slowly.

As examples of the capabilities of the machine, the manufacturer informs us that a single cylinder apparatus of 22 inches diameter, 20 gage, 4 feeds, knitting common hosiery yarn, cotton and wool mixed, running 45 revolutions, has 920 needles, thus making 165,600 stitches per minute. A 16 inch cylinder, 20 gage, 4 feeds cotton yarn, is running 79 revolutions, and making 212,352 stitches per minute; the same cylinder has been run as high as 85 revolutions on the same yarn, at which speed it made, per minute, 228,480 stitches. Another cylinder, 19 inch, 30 gage cotton yarn, is running 38 revolutions, has 1,193 needles and is making 181,374 stitches per minute. Usually an 18 inch cylinder, 15 gage, is run 45 revolutions, and a table of 2 heads, which turns off, per day of 11 hours, 160 lbs. of knit cloth, averaging 15 dozen goods, exclusive of waste, is considered as doing fair. The machine is so geared within itself that 113 revolutions of the receiving shaft will give 45 revolutions of the cylinder. The receiving pulley is 10 inches in diameter, and is made for a $2\frac{1}{2}$ inch belt.

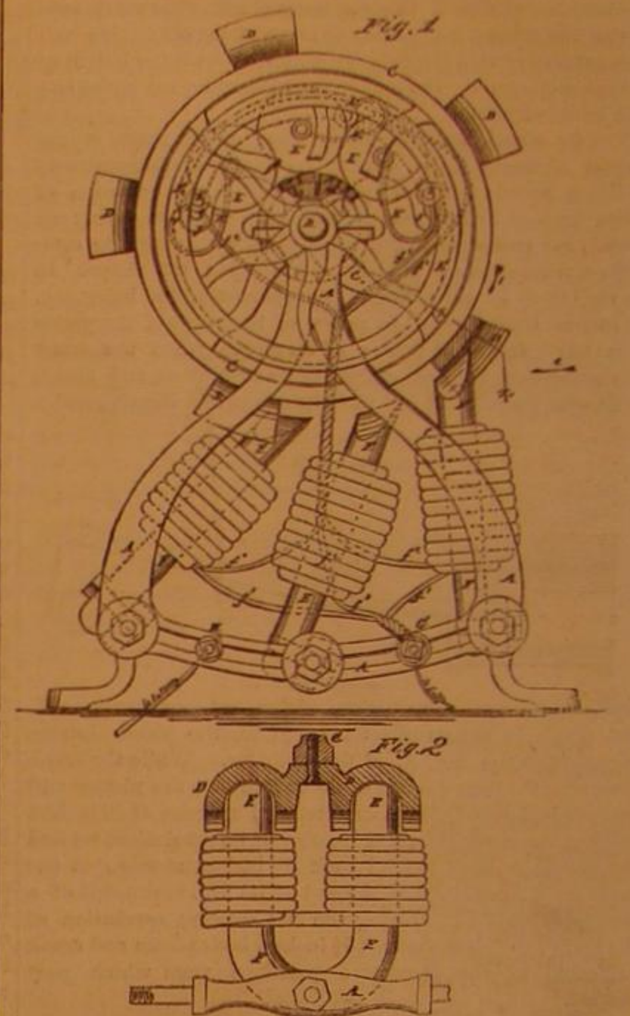
For further particulars address the manufacturer, Mr. C. Tompkins, Troy, N. Y.

To move a tight glass stopper, hold the neck of the bottle to a flame, or take two turns of a string and seesaw it. The heat engendered expands the neck of the bottle before the expansion reaches the stopper.

A NEW ELECTRO-MAGNETIC MOTOR.

The novel electro-magnetic engine illustrated in the annexed diagram is adapted for driving sewing machines or other light apparatus. The inventor claims that it is so constructed that the magnets and armatures are held in contact for a sufficiently long time for the magnets to exert their full power between the opening and closing of the circuit, even when the armature wheel is revolving rapidly.

The armatures, D, are secured to the rim of wheel, C, which rotates the shaft, B, from which motion is imparted to



the machinery to be driven by the pulley, E. F are the magnets, from each of which a wire, f, leads to a clamp, G, to which a wire connecting with the battery is secured. The other battery wire is fastened to clamp, H, so that the frame, A, forms part of the circuit.

From each magnet a wire leads to adjustable bolts, I, which are arranged in an arched slotted plate, J. These bolts carry springs, which in turn support wheels, L, the peripheries of which are in contact with the rim of the wooden disk, M, on shaft, B. The edge of this disk is covered with wide and narrow strips of metal, ranged alternately and insulated from each other, which strips are connected by wires with shaft, B, so that when one of the wheels, L, passes upon the narrow pieces the circuit will be closed; or when a wheel reaches a wide strip, the circuit will be broken.

The parts already described are also so arranged that the circuit will be closed as each armature passes upon each magnet, and will be broken when the reverse takes place. The armatures are made in the form of a double U, and are so secured to the wheel as to overlay the sides of the rounded ends of the magnets. The magnetic force on all sides of the poles, it is claimed, is thus utilized.

Patented through the Scientific American Patent Agency, Nov. 17, 1874, to Mr. C. J. B. Gaume, of Brooklyn, N. Y.

Making Coffee.

Les Causeries Scientifiques states that M. Doyen has been investigating this subject, and has proposed the following method, which is simple and can be easily tried by any housekeeper:

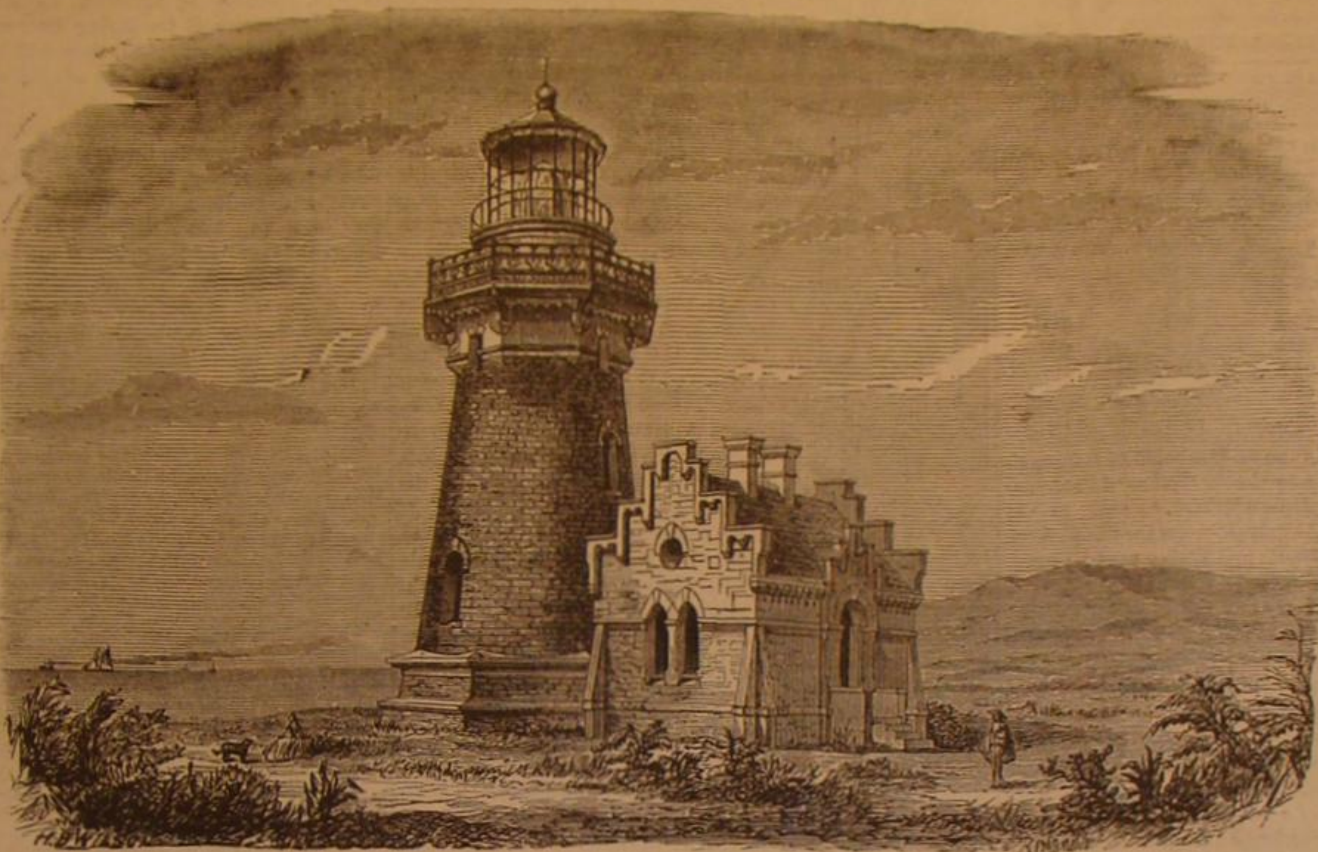
He uses 15 grammes (about half an ounce avoirdupois) for two cups. The berries are to be powdered just before they are used. Three fourths of the powder is thrown into cold water, which is made to boil, and kept boiling for ten minutes. Then the remaining fourth of the powder is cast in; the pot is removed from the fire, covered up, and allowed to remain five minutes. The liquid is now ready; but it may, if desired, be passed through linen. So prepared it is brownish, not black, and slightly turbid from the fatty matter, of which coffee contains 12 per cent. When coffee has to be carried on a journey, as by an army on the march, M. Doyen has the roasted berries ground into an impalpable powder, which is then slightly moistened, combined with twice its weight of sugar, and pressed into tablets like chocolate. These are dried and wrapped in tinfoil, and the coffee ration thus prepared may be used very speedily; for if cast into boiling water, the coffee is ready. Precious time and the necessity of having coffee mills is thus saved.

THE LIGHTHOUSES OF THE UNITED STATES.

We have heretofore called attention to the efficient system of beacons which is being completed along our Atlantic and Pacific coasts, as well as on the shores of the great lakes. Most of the lighthouses are modern structures, and are commendable for their thorough efficiency and the engineering skill shown in their construction; and many of them possess considerable architectural merit.

We publish this week two more examples of American lighthouses, both on the coast of California. The first of these is at Piedras Blancas, a point about midway between the lighthouses on Points Conception and Pinos, and is distant about 150 miles from each. An appropriation of $75,000 was made for this work, which has a first-order light and fog signal.

The second illustration shows the lighthouse for the Straits of Karquines, California. An appropriation of $20,000 was made for this structure, which is to mark the entrance of the Straits of Karquines. A location on the southern shore, just opposite Mare Island, was recommended; but as none suitable was found, the final selection of site was made on the southern end of Mare Island.



LIGHTHOUSE AT PIEDRAS BLANCAS CALIFORNIA.

LIGHTHOUSE AT THE ENTRANCE OF KARQUINES, CALIFORNIA.

The French Meter.

Sir Edmund Beckett is a true Englishman, and does not love the French measure. He says: "The polar axis is estimated at 7,899½ miles, or 500 millions of inches a thousandth part longer than our present standard inch, which probably only came by accident to be what it was when the standard was taken, and might just as well be a thousandth more. True, the other European nations have inches too, and some of them are rather longer than ours. The French meter, 39·371 inches, is the worst measure in the world, because it is inconsistent with any natural one: whereas our yard is the long stride of a man of good hight, and the natural length of his walking stick, and half his hight or half the stretch of his arms; and the meter is not even what it pretends to be, the 40-millionth of a meridian of the earth, for the measure taken was erroneous; and if it were, such a standard is of no more real value than the distance of the moon. Yet there are people who have engaged in the crusade of trying to force on us this bad, erroneous, arbitrary, and revolutionary measure of a nation which tried also to abolish the week and make a new one of ten days, and whose language is declining over the world, while ours already prevails over more regions of the world than any other, and is evidently destined to advance more and more."

Sir Edward, we think, is about right. The good old yard stick is a better measure than the meter.

Giant Beaver.

Drawings and specimens of the remains of the great extinct beaver, *castoroides Ohioensis*, an animal closely allied to the beaver of modern times, but of giant size, being about five or six feet in length, and weighing probably from 200 to 400 pounds, have been exhibited before the Lyceum of Natural History in this city. This specimen was found at Nashport, on the Ohio canal, in a bed of peat, which was buried under strata of clay and sand, and apparently belonged to the same age as the forest bed found in the middle portions of the drift deposits of Ohio.

Rapid Transit.

Mr. Ebenezer Hawkins, of Islip, N. Y., has recently obtained letters patent for a railroad for taking and leaving passengers without stopping the train, a desideratum which, if it could be effected, is of great importance in city and suburban railways, as a large share of the time of traveling on such roads is lost by stopping and the previous and subsequent slow travel. Mr. Hawkins' plan consists in starting from each depot an auxiliary train on a side track, to be coupled to the main line through train as soon as the former has attained a similar speed. Passengers can step from the main line train to the auxiliary, and the latter will be uncoupled in time for stoppage at the next depot, and the process will be continuous.

A REMARKABLE result has recently been obtained by Messrs. Brown & Co., of Sheffield, Eng., with a disk made from a rail saw and rotated at 3,000 revolutions per minute. As the disk was 9·6 feet in diameter, the velocity of its circumference was in the neighborhood of 86,400 feet per minute. Steel rails were cut with astonishing rapidity, and even melted. Millions of sparks were thrown off, but no heating of the disk could be detected after the cutting.

Society of Telegraph Engineers.

At a recent soirée of this Society, London, the greatest features of the evening were the electro-motograph exhibited by Mr. R. S. Culley, Engineer-in-Chief to the Post Office Telegraphs, and some specimens of boring worms exhibited by Mr. Browning under his microscopes.

The electro-motograph was discovered by Mr. Thomas A. Edison, of Newark, N. J., who, in a letter published a few weeks ago in the SCIENTIFIC AMERICAN, described his experiments in chemical telegraphy, wherein he met with the peculiar force he obtained; from that letter and the ideas contained in it, the instrument exhibited was made. It has been known for years that marks could be made on chemically prepared paper by passing currents of electricity through a style resting on the paper, which passed over a metal drum, these marks being produced by chemical decomposition. In his experiments Edison noticed that with certain compositions motion was produced in the lever holding the stylus, which was caused apparently by the sudden decrease of friction of the paper. It was found that paper prepared with caustic potash and a stylus tipped with tin gave the most favorable results. In the electro-motograph exhibited by Mr. Culley, the stylus was of tin, but held in a peculiar form of clip, which brought a very great amount of friction on the paper, so much so that, when the instrument was started, the great friction carried the stylus forward. Immediately a current was passed through it, decomposing the paper, all friction seemed to cease, the clip, by the strong force of its springs, was drawn back; and this occurred each time the current passed, and so long as the current existed the clip remained in its normal position. Immediately, however, the current ceased, the friction of the paper showed itself, and the stylus was drawn forward.

This motion was made audibly manifest by the position of a small bell which was struck loudly each time a current passed and destroyed the friction. So perfect was it that the Morse signals sent by the key were perfect and accurate as recorded on the bell. This little instrument attracted crowds all through the evening, and it may be fairly characterized as one of the most interesting scientific novelties produced for a long time.

Engineering says: "It may undoubtedly be termed a new discovery in Science."

The specimens of boring worms were found in the cable between Holyhead and Dublin belonging to the Post Office, and were picked up inside the cable not far from Holyhead. They were of three varieties, two of which are of somewhat large type, ranging from one inch to three inches long, and they appear to have strong proclivities in favor of hemp. Through the slightest opening they penetrate and enjoy themselves among the covering, which they utterly destroy. The third variety is small and apparently insignificant, but to submarine cables it is a dreadful enemy; passing straight through the hemp and boring at once into the gutta percha, it finally produces a fault. These specimens were sent by

Mr. Culley to Mr. Browning, who mounted them so as to show their leading peculiarities. Close to these microscopes were placed some specimens of gutta percha insulated wire freely marked by them.

Another novelty was an electrical gas-lighting apparatus exhibited by Mr. Thompson. This consisted of a very small portable apparatus, held easily in the hand. At the upper part was a curved rod with a bell cup to it, which was placed over the gas to be lighted; the lower part, near the handle, contains a small electrophorus, the upper plate of which was lifted by the thumb or finger of the hand holding the handle. The electric spark from this is arranged to pass across a small space where the gas has mixed with the atmosphere in such proportions as to become explosive. Immediately the spark passes, the gas is lighted. This instrument, though new in London, has been in use here for some three years.

OCEAN TELEGRAPHY.

BY GEORGE B. PRESCOTT.

Number II.

The working speed of ocean cables with the mirror system is as follows:

NUMBER OF WORDS PER MINUTE.

Weight of copper strands, lbs.	Knots, 1,000.	Knots, 1,500.	Knots, 2,000.	Knots, 2,500.
100	18·3	8·1	4·6	2·9
150	27·5	12·2	6·9	4·4
200	37·0	16·4	9·2	5·9
250	46·0	20·4	11·2	7·4
300	55·0	24·4	14·0	8·8
350	64·1	28·5	16·0	10·3
400	73·2	32·5	18·3	11·7

The apparatus employed in the transmission of communications through ocean cables is the invention of Professor Sir William Thomson. Ampère suggested, as early as the year 1820, the employment of a galvanometer for the purpose of telegraphing, and in 1833 Gauss and Weber used a reflecting galvanometer as an indicator upon a line about one mile in length, uniting the Observatory and the Physical Cabinet at Göttingen. Their alphabet was made up of combinations of right and left deflections. This apparatus, the first ever employed for practical telegraphy, has lately, in the hands of Professor Sir William Thomson, become the most sensitive of all telegraphic instruments. His reflecting galvanometer is the only instrument at present with which a cable 2,000 miles in length can be successfully worked by a battery of low tension. It consists of a needle formed of a piece of watch spring, three eighths of an inch in length. The needle is suspended by a thread of cocoon silk without torsion. The needle lies in the center of an exceedingly delicate galvanometer coil. A circular mirror of silvered glass is fixed to the needle, and reflects at right angles to it in the plane of its motion. It is so curved that, when the light of a lamp is thrown through a fine slit on it, the image of the slit is reflected on a scale about three feet off, placed a little above the front of the flame. Deflections to the extent of half an inch along any part of the scale are sufficient for one signal. In so delicate an instrument, the sluggish swing of the needle in finally settling into any position would destroy its usefulness. To rectify this, a strong magnet, about eight inches long and bent concave to the instrument, is made to slide up and down a rod placed in the line of the suspending thread above the instrument. This magnet can be easily shifted, as necessity may require. The oscillations of the needle due to itself are, by the aid of the strong magnet, made so sudden and short as only to broaden the spot of light.

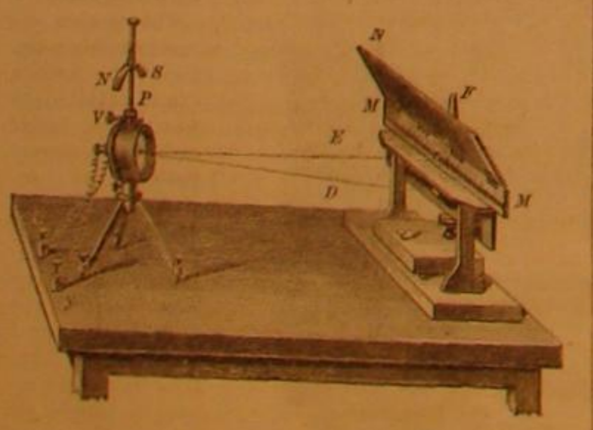


FIG. 6.

The above illustration (Fig. 6) shows the construction of the instrument. The galvanometer, P, contains the multiplication wire, divided into several layers and so arranged that it can be used for weak or strong currents, according to the requirements of the instrument. In the center of the coil the magnetic needle is suspended, to which is attached the tiny mirror, and close before it is to be found a small collective lens, whereof the focal point lies almost in the mirror, in order to produce a sharp figure of the prism on the scale.

The magnetic needle has a length of only $\frac{3}{8}$ of an inch, a breadth of $\frac{1}{12}$ of an inch, and a thickness of $\frac{1}{12}$ of an inch. The mirror connected with the needle has a thickness of only $\frac{1}{210}$ of an inch. The magnetic needle is made from a small piece of a very fine watch spring, and the little mirror, from one of the thinnest microscopic cover glasses. The magnetic needle and mirror used for signaling across the Atlantic weigh only $1\frac{1}{2}$ grains.

The entire box which encloses these parts is hermetically closed. The ends of the multiplicator wires are soldered inside the box to two screw posts, *x y*, wherewith the instrument is connected with the cable.

A curved steel magnet, N S, is fixed to a brass bar, P, in such a way that, by turning the micrometer screw, V, any required removal, upwards or downwards or to the right or left, can be given to it; and by this means the magnetic needle, when in a state of rest, is kept in such a position that the picture of the slit, D, which is reflected from the middle of the mirror, and likewise returns through the lens, appears upon the zero mark of the scale, M M.

Opposite the galvanometer, the scale, M M, and the lamp, F, are to be seen. The light from the lamp penetrates through the slit, D, in an oblique direction to the looking glass, and is thrown back from it to the scale somewhat upwards, in the direction, F, where the picture of the slit is to be seen as a fine light line. The screen, N, can be turned up and serves to keep the lamp light from the scale. The instrument is necessarily used in a darkened room.

The transmitting key is shown in Fig. 7. It consists of two separate levers, L and E, moving on axes at the upper end in the figure. They are kept, by springs, pressing against the cross plate, C, which is in connection with one of the poles of the battery. L is connected with the cable and E to the earth. When either key is pressed down, it falls on the plate, Z, in connection with the other pole of the battery. In the normal position of the key, the cable is connected, through L, C, and E, to earth, and Z is insulated; and it is easy to see how a positive or negative current is put to line according as L or E is depressed.

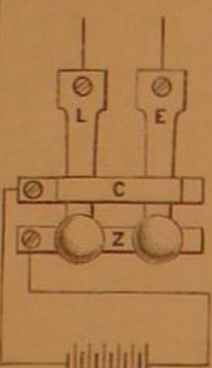


FIG. 7.

The alphabet is made by opposite movements produced by one or other of the keys. The signals need not be made from zero as a starting point. The eye can easily distinguish, at any point in the scale to which the spot of light may be deflected, the beginning and the end of a signal, and when its motion is caused by the proper action of the needle or by currents. It is thus that the mirror galvanometer is adapted to cable signaling, not only by its extreme delicacy, but also by its quickness. The deflections of the spot of light have been aptly compared to a handwriting, no one letter of which is distinctly formed, but yet is quite intelligible to the practised eye. Signals in this way follow each other with wonderful rapidity. A low speed of from twelve to sixteen words per minute is adopted for public messages; but when the operators communicate with each other, a speed of twenty-four words per minute is sometimes attained.

Condensers are used at both ends of the Atlantic cables, by means of which the speed is very considerably increased. The term condenser has long been used among electricians to denote an arrangement, in a moderate compass, equivalent to a Leyden jar of enormous capacity. It is composed of alternate layers of mica or parafined paper and tinfoil. One coating of this Leyden jar is put in direct communication with the conductor of the cable, and the other is joined to the sending key. At the other end of the cable one coating of the condenser is connected with the cable and the other coating with the receiving instrument. The condensers are each equal to about 70 miles of the cable. The condenser serves two purposes: it lessens the delay caused by induction, and prevents the disturbance of the signals by earth currents. The cable and condenser being insulated, there is no voltaic circuit, and no way whereby earth currents can enter and leave the line.

The question is often asked: "What is the velocity of electricity?" or "how long does electricity take to go across the Atlantic Ocean?" Electricity cannot properly be said to have a velocity, but differs with the circumstances under which it travels. For about two tenths of a second after contact is made with the conductor of an Atlantic cable, no effect is perceptible on the opposite side of the ocean, even by the most delicate instrument. After four tenths of a second, the received current is about 7 per cent of the maximum permanent current which the battery could produce in the circuit. One second after the first contact, the current will reach about half its final strength, and after about three seconds its full strength. The current does not arrive all at once, like a bullet, but grows gradually from a minimum to a maximum.

The Direct United States Cable, which is now being laid between Ireland and Nova Scotia, and thence to Rye Beach, New Hampshire, is 3,060 nautical miles in length. The core is composed of a thick copper wire encircled by eleven very fine copper wires, weighing 480 pounds per mile, and is served with four coatings of gutta percha, measuring about three eighths of an inch in diameter. After the serving with gutta percha comes a serving with manilla hemp, which brings the core up to a thickness of three fourths of an inch; and then follows the sheathing with iron wire, which forms the outer covering of all. Ten iron wires are employed for this purpose: but before being applied to the cable, they are each wound with five strings of manilla hemp, so as to impart greater strength, and protect them from the action of water. The hemp covered wires are served with a species of black compound resembling tar or pitch; and after being twisted around the core, they are again served in this manner, and finally whipped with Italian hemp, which, however, can scarcely be said to do more than hold the strands in their places until the whole becomes hard and dry. This is the deep sea portion of the cable. The shore ends are of varying sizes, graduating from about $2\frac{1}{4}$ inches down to $\frac{3}{4}$ of an inch.

The Direct United States Company expect to obtain a speed of about nine words per minute, or about one half that of the present Newfoundland and Ireland cables.

The French Atlantic Cable, laid in 1869 between Brest and St. Pierre, has 400 pounds of copper per mile, is 2,584 knots in length, and has a working speed of fifteen words per minute.

The contract price of the Direct United States Cable, laid down, is $6,055,000. The cost of the Anglo-American Cable —between Ireland and Newfoundland—laid down, was $1,500 per mile.

The Direct United States Cable has been laid from Ireland to within a distance of about 200 miles of Nova Scotia; but owing to unfavorable weather it had to be cut and buoyed. It will probably be recovered again as soon as favorable weather ensues, and its laying be successfully completed. When this is accomplished, there will be five working cables across the North Atlantic and one across the South Atlantic oceans.

Submarine telegraph cables now extend across the North and South Atlantic, Indian, and German Oceans; the Mediterranean, Red, North, Baltic, Chinese, Oriental, Japan, Java, and Caribbean Seas; the Gulfs of Biscay, Bengal, Mexico, and St. Lawrence, and the straits of Bass and Malacca: thus placing North and South America, the West Indies, Europe, India, Java, Australia, Tasmania, and Siberia in constant and instantaneous telegraphic communication, as well as affording communication with the most important ports in China and Japan.

The following is a list of the more important cables which are in working order at the present time:

Date.	From	Length in Miles.
1851.	Dover, England, to Calais, France	25
1852.	Holyhead, Wales, to Howth, Ireland	65
	Port Patrick, Scotland, to Donaghadee, Ireland	25
	Prince Edward Island to New Brunswick	12
1853.	Denmark, across the Belt	18
	Dover, England, to Ostend, Belgium	80½
	Port Patrick, Scotland, to Donaghadee, Ireland	25
1854.	Port Patrick, Scotland, to Whitehead, Ireland	27
	Sweden to Denmark	12
	Holyhead, Wales, to Howth, Ireland	65
1856.	Prince Edward Island to New Brunswick	1
	Crete or Candia to Syra, Greece	170
	St. Petersburgh to Cronstadt, Russia	10
	Across the Amazon	105
1857.	Ceylon to Hindostan	30
	Norway across the Fiords	49
1858.	England to Holland	140
1859.	Denmark to Heligoland	48
	Isle of Man to Whitehaven, England	36
	Sweden to Gottland	64
	Folkestone, England, to Boulogne, France	24
	Malta to Sicily	60
	Jersey to Pirou, France	21
1860.	Great Belt, Denmark (two cables)	14
	Cape St. Martin, Spain, to Iviza	76
	Iviza to Majorca	74
1861.	Corfu to Otranto, Italy	90
	Dieppe, France, to Newhaven, England	80
1862.	Wexford, Ireland, to Aberman, Wales	63
	Lowestoft, England, to Zandvoort, Holland	125
1864.	Fao, Persia, to Bushire, Persia	204
	Bushire, Persia, to Masandam, Persia	450
	Masandam, Persia, to Gwadar, Beloochistan	447
	Gwadar, Beloochistan, to Kurrachee, British India	346
	Otranto, Italy, to Avlona, Turkey	50
1865.	Trelleborg to Rugen, Germany	55
	South Foreland, England, to Cape Grisnez, France	25
1866.	Ireland to Newfoundland	1,896
	Lyall's Bay to White's Bay	41
	Crimea to Circassia	40
	Colonia to Buenos Ayres	30
	England to Hanover	224
	Cape Ray, Newfoundland, to Aspee Bay, Cape Breton	91
	Leghorn, Italy, to Corsica	65
	Persian Gulf	160
1867.	South Foreland, England, to La Panne, France	47
	Malta to Alexandria, Egypt	925
	Placentia, Newfoundland, to St. Pierre	118
	St. Pierre to Sydney, Cape Breton	126
	Arendal, Norway, to Hirtshals, Denmark	68
1868.	Italy to Sicily	5
	Havana to Key West, Florida	125
1869.	Peterhead, Scotland, to Egursand, Norway	250
	Grisselhamm, Sweden, to Nystadt, Russia	96
	Newbiggin to Sondervig	334
	Malta to Sicily	54
	Tasmania to Australia	176
	Scilly Isles to Land's End, England	27
	Ithaca to Cephalonia	7
	Bushire, Persia, to Jask, Beloochistan	505
	Brest, France, to St. Pierre	2,584
	St. Pierre to Duxbury, U. S.	749
	Moen to Bornholm, Sweden	80
	Bornholm, Sweden, to Libau	230
1870.	Scotland to Orkney Isles	37
	Salcombe, England, to Brignogan, France	101
	Beachy Head, England, to Cape Autifee, France	70
	Suez, Egypt, to Aden, Arabia	1,460
	Aden, Arabia, to Bombay, India	1,818
	Porthcurno, England, to Lisbon, Portugal	823
	Lisbon to Gibraltar	331
	Gibraltar to Malta	1,120
	Marseilles, France, to Bona, Africa	447
	Bona, Africa, to Malta	386
	Madras to Penang	1,408
	Penang to Singapore	400
	Singapore to Batavia	557
	Malta to Alexandria, Egypt	904
	Batabano, Cuba, to Santiago, Cuba	520
	Jersey to Guernsey, Channel Islands	16
	Guernsey to Alderney, " "	18
	Santa Maura to Ithaca	7
	Zante to Trepito	11
	Sunium to Thermia	25
	Patras, Greece, to Lepanto	2
	Dartmouth, England, to Guernsey	66
	Guernsey to Jersey	15

Date.	From	Length in miles.
	Porto Rico to St. Thomas	110
	Santiago, Cuba, to Jamaica	140
	Port Patrick, Scotland, to Donaghadee, Ireland	25
	Anjer, Java, to Telok Betong, Sumatra	55
	Banjoewangie, Java, to Port Darwin, Australia	1,082
	St. Thomas to St. Kitts	133
	St. Kitts to Antigua	90
1871.	Javea to Iviza, Balearic Islands	53
	Majorca to Minorca	35
	Villa Real to Gibraltar	155
	Marseilles, France, to Algiers, Africa	447
	Singapore to Saigon, Cochin China	620
	Key West to Punta Rassa	120
	Saigon to Hong Kong	975
	Hong Kong to Shanghai	1,100
	Shanghai, China, to Nagasaki, Japan, thence to Wladiwostock, Siberia	1,200
	Rhodes to Marmarice	22
	Latakia to Cyprus	86
	Samos to Scala Nuova	11
	Mytelene to Aivali	13
	Khania to Retimo	32
	Rhetimo to Candia	41
	Candia to Rhodes	201
	Chios to Chesmeh	6
	Zante to Corfu	150
	Zante to Cephalonia	18
	Lowestoft, England, to Greitseil, Germany	223
	Antigua to Demarara, connecting the West India Windward Islands	1,028
	Porto Rico to Jamaica	582
1872.	Lizard, England, to Bilbao, Spain	460
	British Columbia to Vancouver Island	18
1873.	Falmouth England, to Lisbon, Portugal	1,150
	Caithness to Orkney	8
	Valencia to Newfoundland	1,900
	Key West to Havana	100
	Placentia, Newfoundland, to Sydney, Cape Breton	300
	Heligoland to Cuxhaven, Germany	40
	England to Denmark	450
	France to Denmark	550
	Denmark to Sweden	10
	Pernambuco, Brazil, to Para, Brazil	1,382
	Alexandria, Egypt, to Candia or Crete	390
	Candia to Zante	240
	Zante to Otranto, Italy	190
	Alexandria, Egypt, to Brindisi, Italy	930
1874.	Lisbon, Portugal, to Madeira, Madeira Islands	633
	Madeira to St. Vincent, Cape de Verde Islands	1,360
	St. Vincent to Pernambuco, Brazil	1,953
	Jamaica to Colon, South America	660
	Pernambuco, Brazil, to Bahia, Brazil	450
	Bahia, Brazil, to Rio Janeiro	1,240
	Italy to Sicily	7
	Jamaica to Porto Rico	582
	Rio Janeiro to Rio Grande do Sul	840
	Rye Beach, U. S., to Tarr Bay, Nova Scotia	550
	Barcelona, Spain, to Marseilles, France	200
	Shetland to Orkney	60
	Valencia to Newfoundland	1,900

The following is a list of the principal submarine telegraph companies, with the amount of their capital:

Anglo-American Telegraph Company: Ireland to Newfoundland; Newfoundland to Cape Breton; Brest to St. Pierre; St. Pierre to Duxbury, U. S. (five cables)—$35,000,000.

Brazilian Submarine Telegraph Company: Portugal to Brazil—$6,500,000.

Cuba Submarine Telegraph Company: Santiago to Havana—$800,000.

Direct Spanish Submarine Telegraph Company: England to Bilbao, Spain—$650,000.

Direct United States Submarine Telegraph Company: Ireland to Nova Scotia; Nova Scotia to the United States—$6,500,000.

Eastern Submarine Telegraph Company: England to Bombay *via* Mediterranean and Red Sea—$15,000,000.

Eastern Extension, Australian and China Submarine Telegraph Company: Madras to China and Japan; Java to Australia—$8,315,500.

Great Northern of Copenhagen Telegraph Company: England to Denmark, Norway, Sweden, and Russia—$2,000,000.

Great Northern China and Japan Extension: Siberia to Hong Kong and Japan—$3,000,000.

International Ocean Telegraph Company: Florida to Havana—$1,500,000.

Mediterranean Extension Telegraph Company: Sicily to Malta and Corfu—$760,000.

Montevidean and Brazilian Telegraph Company: Montevideo to Brazilian Frontier—$675,000.

Platino-Brazilian Telegraph Company: Rio Janeiro to Uruguay—$2,000,000.

Submarine Telegraph Company: England to France, to Belgium, and to Holland—$2,093,200.

Western and Brazilian Telegraph Company: Coast of Brazil—$6,750,000.

West India and Panama Telegraph Company: Cuba to West India Islands and South America—$9,590,000.

Sanitary Sense.

Dr. W. W. Hall, in his *Journal of Health*, says a great many truthful things in his peculiar way. These are, and certainly should be, extensively read; for they include so much excellent advice that their influence can be for nothing else but good. The last number of the *Journal* is before us now, opened with the intention of clipping an article here and there; but after reading it all through, we really cannot decide that any one subject is better treated than the rest. Consequently, we have culled a few ideas which strike us as especially good and interesting, and these we give below:

Dyspepsia—says the opening paragraph of a short sermon on that wretched malady—means a difficulty in preparing the food eaten so that the nutriment can be extracted from it to supply the wants of the system. Eating too fast and too much are prolific causes; the first because the food, being swallowed in too large pieces, begins to ferment before it can digest, and the second because the stomach cannot cope with the quantity forced upon it. A limited supply of gastric juice is another cause, and this implies bad blood. Out of door life, moderate exercise until hungry, and simple food are the best remedies.

Bitters, the names of the multitudinous varieties of which disfigure the fences and scenery of the country, come in for severe handling, on account of their alcoholic composition. A list of thirty-four of these mixtures is given, including all we ever heard of and a great many which we did not know existed; and in every instance they are shown to contain alcohol. In brief, while persons are using bitters as a medicine, they are often drinking, three times a day, a more concentrated form of alcohol than is found in the purest whiskies and brandies. It should be set down as a settled rule that bitters in any form is alcohol in disguise.

Localities of life should be high. Elevated stations are generally exempt from the ravages of consumptive disease. The air is lighter and contains less oxygen; but as the lungs live on oxygen, as it is the oxygen which they bring in contact with the blood at every breath, it is that which purifies and gives it its life-giving power. If each breath of air does not give a sufficient amount of oxygen, instinct prompts a fuller breath; this distends the lungs more fully, and thus develops and strengthens them. A statement is given of the elevation of several American cities: New Orleans is relatively given as 10, New York and Philadelphia 35, Boston 40, Chicago 585, Nebraska City 1,000, and Winona, Miss., 1,500.

Many a family mansion, says the editor, speaking of healthy houses, has been built with the accumulations of the savings of half a lifetime to make the graves of half the household in a few months, from neglect of the precautions for thorough drainage and a proper water supply for drinking and cooking. Never select a house over a filling; prefer sandy soil or the top of a hill.

In Munich, the bodies of the dead are kept for forty-eight hours before burial, and the fingers are connected with a wire so that, in case the person should revive, his least movement will ring a bell and so give warning. This is not applied to babies; but it is suggested that, if the plan be adopted here, the wire should be attached to the child's toes, as all babies begin to kick as soon as awake.

With reference to winter garments, sufficient clothing, it is said, should be worn to keep off a feeling of chilliness when about usual avocations. Less than that subjects one to an attack of dangerous pneumonia at any day or hour. More than that oppresses. Steadily aim, by all possible ways and means, to keep off a feeling of chilliness, which always indicates that a cold has been taken.

Instinct teaches that less exertive power is required to keep moving than, after coming to a standstill, to set the body in motion again. The frequent stoppages of stages and street cars kill off the horses. Instinct also teaches the requisite expenditure of strength according to the circumstances of the season. No one walks as fast in summer as in winter. We get up in the morning with a certain amount of strength, and much may be gained by economizing during the day.

Spectacles become necessary when you first notice yourself going to the window instinctively for a better light, or when your eye gets tired by looking at any small thing near at hand, or a dimness or watering is manifested, so as to cause indistinctness. First purchase No. 20; and as you observe the symptoms above named, get No. 18, and so on. The glasses should be near enough to the eye almost to touch the lashes; they should be washed every morning in cold water and carried in a pocket by themselves. Brazilian pebble makes the best lenses. Avoid reading before sunrise and after sunset. Read as little as possible before breakfast, or by artificial light; do not sew on dark material at night, and use no other eyewash then pure, tepid, soft water. Babies' eyes are often injured by allowing the glaring sunlight to fall upon them.

Exercise is worth more than all the medicines in maintaining health. If it rains, take an umbrella and let it rain on; if it is cold, walk or work faster; if it is windy, turn around and go the other way; if it rains, hails, snows, and blows, all at once, so that you have to stay indoors, then live on bread and water that day, not an atom else, and you will need no exercise to work it up.

It should always be borne in mind that a large share of our little aches and pains would pass off about as soon by letting them alone as by doing or taking something; and the more we "take," the greater is the necessity for "taking."

The best way to enjoy things is to use them, and thus get the worth of our money out of them. There is no sense in gorgeous parlors kept in darkness.

Sometimes the reading of a single sentiment in a newspaper makes an impression on the mind which tinges the whole subsequent life for good.

The Musconetcong Tunnel.

The tunnel through Musconetcong Mountain, New Jersey, for the line of the Easton and Perth Amboy railroad, was opened on the 16th of December. The work was begun on April 10, 1872, from which date to August of the same year labor was devoted to making an open cut on the west side of the mountain. Tunneling was then started at both ends through formations of limestone and syenitic gneiss. Considerable trouble was experienced during the progress of the boring by irruptions of water from a subterranean lake. The tunnel is almost exactly one mile in length.

ERRATUM.—In our article on the hydrocarbons produced on iron and steel, published in our last week's issue, it is stated that the least volatile portions of the bromated product were "set aside to be treated with an alcoholic solution," "of potassa" should be added to complete the sense.

[For the Scientific American.]

THE ARITHMETICAL OPERATIONS OF MULTIPLICATION AND DIVISION.

We think that most of our readers will agree with the assertion that there is less probability of mistakes, on the part of the ordinary calculator, in making additions and subtractions of numbers than in multiplying and dividing. The reason is that the latter operations are more complex, requiring the use of all the fundamental rules of arithmetic. There is a simple artifice, employed by many in multiplying and dividing, which reduces these operations to cases requiring the application of the rules of division and subtraction only. The method referred to is tolerably well known, but not as generally as it should be; and we think that there are many of our readers who will be interested in receiving an explanation. The method finds its principal application in cases where different numbers are to be multiplied or divided by the same number, as, for instance, in the preparation of tables. We can best illustrate it by giving an example.

According to our observation, a question frequently arising with those who are engaged in mechanical pursuits is the determination of the circumference of a circle when the diameter is known. It is not always convenient or practicable to consult a book in which the properties of circles are given, but one can nearly always carry a few cards upon which useful numbers are written. Let us suppose that one of these cards contains the following:

CIRCUMFERENCE OF CIRCLE.

Diameter. Multiplied by	Diameter. Multiplied by
1= 3·1416	6=18·8496
2= 6·2832	7=21·9912
3= 9·4248	8=25·1328
4=12·5664	9=28·2744
5=15·7080	

and that the circumference of a circle whose diameter is 130·0402 feet is required. Below is the solution:

```
     3·1416
   130·0402
   --------
      62832
    1256640
   9424800
  31416
  ------------
  408·53429232
```

It will be observed that the multiplier is placed beneath the multiplicand, as in the ordinary method; but that instead of actually performing the operation of multiplying the multiplicand by each term of the multiplier, the several products are taken at once from the card and placed in their proper positions, so that we have only to add them to get the whole product. It will be advisable, in following this plan, to use small cards, with only one set of numbers on one side of each, to avoid confusion; and in preparing a card for a given number, it is well to form the several multiples by adding the number first to itself and then to each successive sum, repeating this operation nine times, so as to check the accuracy of the work. Below is given an illustration:

Areas of circles.	Square of diameter multiplied by
	0·7854=1
add 0·7854	1·5708=2
" "	2·3562=3
" "	3·1416=4
"	3·9270=5
" "	4·7124=6
" "	5·4978=7
" "	6·2832=8
" "	7·0686=9
" "	7·8540=10

It is evident, from simple inspection, that the last quantity is ten times the first, and this affords a strong presumption that the intermediate calculations are also correctly made.

An example is appended, showing the application of this method to division:

REDUCTION OF CUBIC INCHES TO CUBIC FEET.

Cubic in. Divided by	Cubic in. Divided by
1= 1,728	6=10,368
2= 3,456	7=12,096
3= 5.184	8=13,824
4= 6,912	9=15,552
5= 8,640	

Question: How many cubic feet are there in 901,314,564·268 cubic inches?

```
1,728)901,314,564·268(521,594·076+
      8640
      ----
       3731
       3456
       ----
        2754
        1728
        -----
        10265
         8640
        -----
         16256
         15552
         -----
           7044
           6912
          -----
          13226
          12096
          -----
           11308
           10368
           -----
             940
```

A simple inspection of the card shows the successive figures of the dividend, and gives the products of the divisor by these figures, so that the operation is reduced to a series of subtractions. It takes very little practice to render any one expert in this method, which combines the advantages of quickness and accuracy. By preparing cards from time to time, as occasion requires, one will find that he has, ere long, a pretty good stock of numbers, which, if carefully indexed, will prove very serviceable. The values of a few useful factors are appended:

Reduction of pounds to kilogrammes: Pounds × 0·454.

Reduction of kilogrammes to pounds: Kilogrammes × 2·205.

Reduction of inches to meters: Inches × 0·0254.

Reduction of meters to inches: Meters × 39·37.

Reduction of square feet to square meters: Square feet × 0·0929.

Reduction of square meters to square feet: Square meters × 10·76.

Reduction of cubic feet to cubic meters: Cubic feet × 0·028.

Reduction of cubic meters to cubic feet: Cubic meters × 35·32.

Reduction of U. S. gallons to cubic feet: U. S. gallons × 0·134.

Reduction of cubic feet to U. S. gallons: Cubic feet × 7·48.

Reduction of imperial gallons to cubic feet: Imperial gallons × 0·1604.

Reduction of cubic feet to imperial gallons: Cubic feet × 6·25.

Reduction of U. S. gallons to imperial gallons: U. S. gallons × 0·834.

Reduction of imperial gallons to U. S. gallons: Imperial gallons × 1·2.

ABOUT two thirds of the New State Capitol at Albany, N. Y., is now completed. The building thus far has cost $5,000,000, and it is estimated that about $7,000,000 more will be required to finish it entirely. If the State Legislature appropriate funds promptly, there is a prospect of the roof being in place by May, 1876.

Recent American and Foreign Patents.

Improved Safety Lock for Elevators.

Henry Carlile, Steubenville, Ohio.—This invention consists in providing an elevator with a pair of clamping jaws, which are actuated by the weight of the cage to seize the guides and arrest the downward movement of the carriage whenever the lift rope slacks or breaks. By the novel means employed in effecting this purpose, all chance of accident is removed, while the carriage may be held automatically at different elevations and stories. It seems admirably calculated for use in connection with the elevators employed by hotels, warehouses, and stores.

Improved Feed Water Heater and Filter.

George F. Jasper, Freeburgh, Ill.—The supply pipe passes downward through and beneath the filtering material, and the water discharged therefrom passes upward through the said material, and flows over into a series of sediment troughs or pans, and thence into the heating tank proper, from which it is conveyed to the boiler. The arrangement of the filter below the tank increases the surface available for application of heat in the furnace, when desired or necessary, as well as gives easy access to it for removal of the sediment when the furnace is fired up.

Improved Seed Planter.

Jacob R. Sample, Liberty, Miss.—This invention relates to the simultaneous distribution of comminuted manures and cotton or other seed, and consists in a peculiar shape of the opening and covering plows, together with the standards by which they are attached to the frame. This insures great uniformity and accuracy in the application both of seed and manure to the soil.

Improved Rotary Harrow and Roller.

Louis Belly, St. Anne, Ill.—This is an improvement in cultivating machines wherein rotary harrows are employed. The novel feature consists in an arrangement of parts whereby the harrows are supported entirely by the rollers and front wheels of the frame, and the revolution of the harrows arrested when raised from the ground.

Improved Stereoscope.

Absalom H. McClintock and Henry J. W. Barker, Fort Scott, Kan.—This is an improved stereoscopic apparatus designed especially for use in object teaching in classes, so constructed that a copy of the picture may be before each pupil. All the pictures may thus be exhibited, replaced by others, and moved to bring them into focus at the same time and by the same operation. Several pairs of lenses are arranged in a box, and the pictures are raised and held before the former by suitable devices. The supporting frame moves transversely to bring each picture into focus.

Improved Bale Tie.

Sewall J. Leach, Tuscaloosa, Ala.—A plate with a right-angled flange at each end is attached to one end of the hoop, and is a little narrower than the breadth of the latter. The flange is notched transversely on the inner faces to lock the free end of the hoop, which is correspondingly notched on its edges to fit the notches of the flanges. The latter are inclined in the direction to cause the hoop to draw to the bottom of the space between the flanges, and thus insure the holding of it so as not to work loose. There is also a loop on one end of the tie for the free end of the hoop to pass through, to be kept in position at the time of fastening until secured by the notches.

Locomotive Attachment for Towing Canal Boats.

Charles Howard, New York city.—The driving wheels of the locomotive are constructed with a V-shaped groove in the periphery, so as to bring the bearing diagonally on the sides of rails without touching the tops. This adds to the traction in proportion to the angle or sharpness of the groove. The towing bars are applied on the bottom of the frame, are pivoted equidistant from the wheels near the center of the frame, and are of curved shape, extending beyond the wheels. They are bent at their ends into upward and slightly forward turned hooks, and swing toward the canal, allowing thereby a free adjustment to the different positions of the towing line. Suitable guide pieces applied to the bottom of the frame control the swing of the tow bars, and a spring forces the latter sideways, when there is no strain on them, preventing the obstruction of the track by the slackened tow line.

Improved Corn Coverer and Cultivator.

James Copeland, Bloomingdale, Ohio.—The vertical arm of a standard is slotted to receive a wheel that supports the forward part of the machine when adjusted as a coverer or double shovel plow. When the machine is to be used as a cultivator, the standard may be removed and replaced by a similar standard, the lower arm of which is without a slot, is curved slightly forward, and has a hole formed through it to receive a bolt for holding a cultivator plow.

Improvement in Manufacturing Shoes.

Charles F. Hill, Baltimore, Md.—This invention consists in a shoe in which an insole, receiving the lasting nails, is covered by another insole, and the whole united by a line of stitching passing through the outer sole, upper, and the two soles.

Improved Office Door Plate.

Thomas S. Kennard, Exeter, N. H.—This invention consists in the application of time-indicating wheels and an inscribed slide to a slotted recessed plate, in such a manner that, when said slide is in a certain position, the device will indicate that the occupant of the office is out, and also the time of his return: and when in another position, that he is in, the name of the day of the week being indicated and the wheels locked in position in each case.

Improved Hydraulic Safety Valve.

John F. Taylor, Charleston, S. C.—This invention relates to certain improvements in hydraulic safety valves, whereby the valve is weighted with great convenience and facility by the fluid employed. It consists in a valve chamber provided with openings in its seat connecting with the escape pipe, in combination with a valve having different areas of pressure upon its opposite sides, the chambers upon the opposite sides of the valve being connected by a channel through the valve, so that the unit of pressure upon the valve is the difference between the opposite areas of pressure.

Improved Combined Hoe and Chopper.

Charles H. Gaylord, Osceola, Ark.—This invention consists in a tool by which the workman may cut up the soil on each side of a row of plants as he passes along, and then, giving it a half revolution, cut the weeds or surplus plants in the front and rear; the first operation being effected by a chop toward himself, while the second is produced by a chop from himself. The construction of the tool is such that the two effects are secured without changing the position of the workman, consequently with much less labor and fatigue, as well as with a great saving of time.

Improved Extension Table Slide.

James Plenkharp, Columbus, Ohio.—The grooved slides are connected by castings of angular form, with a dovetailed base. The lower half of each casting is provided with a projection or shoulder at its angle, the same being notched to receive a fastening screw or nail. Thus the castings are secured to the slides without being weakened and hence rendered liable to break at their angle, under the strain put upon them by the weight or pressure supported by the table top.

Improved Car Coupling.

Henry C. Chapman, Port Jervis, N.Y.—The outer end of the coupling link is raised or lowered by a looped rod, in which the link rests, and by which the said link may be elevated or depressed to suit the various hights of drawheads on different cars. By having a recess made in the face of the drawhead, into which the looped rod which supports the link may recede when the cars bump together, the said rod is prevented from being injured in the collision. The loop rod is suspended from a U crank of a long rod which extends across the end of the car, and which is readily turned from the side of the latter.

Improved Clamping Attachment for Tinners' Machines.

William H. Burnett, Stanfordville, N. Y.—A standard is cast with a ribbed socket-shaped top part and clamp screw for supporting firmly the operating machine parts, and with an enlarged base. For the purpose of dispensing with the permanent attachment of the standards, and for making them detachable, a strong clamping device, with circular top part fitting closely around the base of the standard, is applied by a clamping screw. The standard may be secured to any part of the bench, and also turned readily into any direction over and beyond the latter.

Improved Blind Bridle.

Francis Schwaim, Clarksville, Cal.—This invention consists in forming the cheek pieces of the bridle so that they operate as cranks on the blinds, which blinds are attached to their upper ends. By means of this improvement, the blinds may, at the will of the driver, be drawn tightly over, and so as to close the horse's eye, and held in that position until the danger is passed.

Improved Exhaust Regulator.

Charles C. Gregory, Fredericton, Can.—As the steam enters a receiver it forces up a spring piston. It then expands until the pressure is equal to that at the nozzle, when the spring will begin to react on the steam, and, while steam remains in the receiver to be forced out, will maintain a continuous uniform blast at the nozzle. A valve in the nozzle is provided for opening and closing it, to regulate the escape by opening the passage wider when the greatest pressure exists in the receiver, and closing it when the pressure decreases. This valve is operated by the piston. In case the steam should, at any time, enter the receiver in excess of the means of escape by this apparatus, the excess will be automatically allowed to escape through a pipe by the opening of a valve lifted by the piston, when the last arrives at a certain predetermined hight.

Improved Gas Heater and Condenser.

Sylvanus Warren, New York city.—This is an improved apparatus, to be placed between the exhauster and the purifier of a gas-making mechanism, for beating or scrubbing the gas, and condensing from it the tar and ammonia. By suitable construction, while the gas is passing through the central compartment of a drum, cold, tepid, or warm water or air may be forced through the end compartments and small connecting pipes, to regulate the temperature of the gas as it passes to the purifier.

Improved Shingle Bolting Machine.

William A. Fletcher, Beaumont, Texas.—The pivoted rest for the bolt is provided with two clamps, operated by a single shaft, having right and left screw threads. Said clamps are worked by a single crank for opening and closing them.

Improved Steak Tenderer.

Daniel J. Shuits, Mount Union, Pa.—This is a device by which steaks may be easily and rapidly made tender. It consists of two toothed plates, which are hinged at one end, to be adjustable to greater or less thickness of steak, and closed by means of a lever with sectional pinion pivoted to the inner plate, and gearing with a toothed stationary arm of the lower plate. Both plates are carried toward each other by swinging the lever to the front, and act with considerable power on the steak placed between them.

Improved Target and Toy Pistol.

Warren Lyon, Mamaroneck, N. Y.—The first invention is a toy, for use with pea shooters and the like, for the amusement of children. It consists of two or more self-adjusting targets of equal weight, arranged on the ends of radial arms of equal length secured to a rotary shaft. The target is self-righting, and may include several grotesque figures. The same inventor has also devised a toy pistol which may be used in connection with the toy target just described. A piston is arranged in the barrel, and its rod connected at the rear end with a lever. The rod has a coiled spring on it to throw the piston forward. The lever is arranged in a vertical slot in the breech, above which it projects. The lower end has a notch below the pivot, in which a spring catch drops to hold the piston spring, and to be used for tripping it by the trigger. A stop is combined with the spring catch and trigger, to prevent damage to the catch by pulling the trigger too hard.

Improved Grain Separator.

John Gordon, St. Catherine's, Can.—The novel feature in this invention is a hinged valve which may be arranged to connect at will the carrier board leading to the discharge with the carrier board leading to the suction channel. This is useful in case the separation of the wheat into lighter and heavier grades is not desired.

Improved Pump.

J. C. Chambers and S. Chambers, Dallas, Texas.—This invention consists in combining, with three bottom-valved cylinders, three valved connecting pipes, and a single discharge pipe, three differential pistons, of which one is always forcing water into the discharge pipe. This produces a continuous and uniform flow of water, and not only greatly lessens the time usually required, but also very considerably diminishes the labor.

Improved Sack Scale.

Pascal P. Parker, Parkersburgh, Iowa, assignor to himself and Milton L. Powers, same place.—To the inner edge of the scale pan are attached two standards, to which is secured an oval band having an inwardly projecting flange formed upon its lower edge, and which is provided with an open spring ring for supporting a bag, and holding the mouth open while being filled.

Improved Land Roller.

Benjamin S. Healy, Cohocton, N. Y.—The new feature in this invention is an arrangement of the double tree and draft bars whereby the draft will always be applied to the front part of the frame in whatever position the tongue may assume.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

PAPER BOX PATENT.—UNION PAPER BAG MACHINE COMPANY *vs.* LUTHER CRANE *et al.*

[Before Clifford and Lowell, J. J.—May Term, A.D. 1874—to wit: October 6, 1874.]

Lowell, J.:

The bill is brought under section 58 of the consolidated Patent Act of 1870, 16 Stat., 207, alleging that the plaintiffs own a patent granted to them December 24, 1872, as assignees of Lorenzo D. Benner, for an improvement in paper bags, of which said Benner was the original and first inventor; that the defendants hold a patent dated February 20, 1872, for an improvement alleged to have been invented by Luther C. Crowell; that the patents interfere, and the plaintiffs pray that the patent of the defendants may be declared void.

The answer denies that Benner was the original and first inventor of the improvement patented to the plaintiffs; insists that Crowell was the inventor of that held by the defendants; does not explicitly confess or deny the interference between the two, and concludes with a prayer that the plaintiffs patent may be adjudged void.

It appears to us, on a comparison of the specifications, that they describe and claim the same invention, and the evidence proves that the plaintiffs intended that their patent should cover the same ground as the defendants. The Patent Office decided in favor of the plaintiffs, after an interference had been regularly declared with Crowell's patent, which had already issued; upon the hearing, Crowell produced no evidence excepting his own statement, and Benner examined several witnesses, and both parties were heard in argument.

Two points of law are taken by the plaintiffs: First, that the decision of the Patent Office is final between these parties; second, that the defendants are estopped by the statement made by their assignor Crowell to the Patent Office respecting the date of his invention to introduce evidence in this cause carrying his invention back to an earlier time than that which he specified in that statement.

1. The decision of the Patent Office is never final upon the question of the novelty or priority of an invention. The rule may have been adopted at first from a consideration of the *ex-parte* character of the proceedings at Washington, but it has never been confined, as is now maintained by the plaintiffs, in cases in which no contest was had; and it is obvious that it cannot be so limited, because, if one party to an interference is concluded as against the other party, the result may be that the patent is valid as against him, which is void against all the rest of the world. If, for instance, Crowell's invention was, in fact, earlier than that patented to the plaintiffs, the latter patent is conceded to be void as against every one who had no hearing before the Patent Office, while the defendants' patent would be void as against the plaintiffs, and all persons claiming under them; so that the only person who could not practice the invention would be he who had made it, and his assignees.

The statute is not ambiguous. It gives a court of equity power to decide between interfering patents without any exception or limitation. This is substantially a re-enactment of section 16 of the act of 1836, under which Mr. Justice Nelson is said to have decided the very point. Atkinson *vs.* Boardman; Laws's Dig., title, Construction of Statutes 13. See, also, section 50 of the act of 1870.

By the act of 1793, interfering applications were to be passed upon by three arbitrators, and upon this act Mr. Justice Story said:

The award or decision of the arbitrators would have been final between the parties only so far as respected the granting of the patent.

The sole object of such an award is to ascertain who is *prima facie* entitled to the patent. But, when once obtained, it is liable to be repealed or destroyed by precisely the same process as if it was issued without opposition. Stearns *vs.* Barrett, 1 Mason, 173, 4.

Upon reasoning and authority, then, the new patent granted after a hearing merely makes out a *prima facie* case for the plaintiffs, shifting the presumption that would otherwise exist from the earlier date of the defendants' deed.

2. There is no ground for holding the statement of Crowell an estoppel. It was not made to the plaintiffs, nor intended to influence their action, and the evidence is clear that they did not act upon it.

We have examined, with great care, the evidence concerning priority of invention, and are of opinion that Crowell was the true and first inventor. He neglected his case before the Patent Office, and the examiners were led to believe that he might have obtained hints or suggestions from the drawings of Benner for a patent that was issued to him a short time before that of Crowell. It is true, those drawings were left with Mr. Coffin, one of the persons interested in Crowell's invention, and in the shop where Crowell was at work on his machines; but the evidence in this case does not prove that any use was made of them, but tends to prove the contrary. But a wholly decisive consideration, as to which the course of proceedings before the Patent Office led the examiners into error, is that those drawings do not contain the invention, and, if they had been seen and studied by Crowell, would be no answer to his claim of priority. This is now admitted by the plaintiffs, and was well known to them while the interference was going on, as appears by a letter from their counsel to the president of the company, which they have printed on page 41 of the record. As their argument before the Patent Office is not given, we do not know whether the admission was made at that time; but the fact that the decision was very largely influenced by this mistake is shown by the record, and must detract much from the weight of the adjudication.

Upon the principal point of fact we are well satisfied, not only that Crowell's invention was actually made by him, but that it was completed in 1867. The plaintiffs, not denying that Crowell made the invention, insist that he was not the first inventor, and have introduced evidence which they rely upon to prove that Benner made it in 1868, and that Crowell was not earlier than 1871. The defendants, on the other hand, insist that they have thrown doubt upon the claim of Benner to have made the invention at all, though he may have approached it. As we are satisfied that Crowell really made the invention before Benner or any of his witnesses say that Benner made it, we have not examined the question whether Benner ever made it at all.

Decree for defendants.

United States Circuit Court.—District of New Jersey.

FLUTING MACHINE PATENT.—SUSAN R. KNOX *et al.* *vs.* ARTHUR H. LOWERRE *et al.*

[In equity.]

Nixon, J.:

The bill filed in this case charges the defendants with infringing four different patents belonging to the complainants—to wit:

1. Patent issued to Susan R. Knox and W. D. Corrister, April 3, 1866, and reissued to Susan R. Knox, assignee, April 1, 1870, No. 3,901.

2. Patent issued to Susan R. Knox, November 20, 1866, and reissued to her April 26, 1870, No. 3,938.

3. Patent issued to Samuel G. Cabell, July 17, 1866, and reissued to Flora B. Cabell, assignee, March 1, 1870, No. 3,856.

4. Patent issued to Flora B. Cabell, assignee, November 10, 1868, No. 83,924, and reissued to Flora B. Cabell and Susan R. Knox, assignees, November 28, 1871, No. 4,653.

The defendants, in their answer, deny the validity of these patents on various grounds. They allege that the complainants were not the original and first inventors of the said inventions or of any material or essential parts thereof; that there was a prior knowledge, use, and public sale, in many parts of the United States, of machines embodying all the principles and combinations claimed as new by the complainants; that the invention had been mentioned and described in certain printed publications; that there had been an abandonment by the inventor to the public; and that there had been no infringement by the defendants of the rights and privileges alleged in the bill to be secured to the complainants by their several letters patent.

Held by the Court:

A patentee held to have made his invention when he had a machine embodying it completed and in operation and actual use, though the use was private.

Delay in filing an application is no ground for charging the inventor with abandonment if he was residing in the insurrectionary States during the war.

Making the lower roll in a fluting machine adjustable is an infringement of a patent for making the upper roll adjustable by similar means and for the same purposes.

Making the roll adjustable by means of a rack and pinion instead of a screw is also an infringement.

Decree for the complainants against the defendants for the infringement of the first and third claims of the reissued patent No. 3,856, and of the first and second claims of the reissue No. 4,653; but without costs.

[*J. J. Coombs* and *F. W. Leonard*, for complainants.
N. Perry, Jr., for defendants.]

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

M. J. will find the recipe for diamond cement on p. 90, vol. 30 (cementing whalebone to wood).—W. H. H. and T. E. C. will find directions for bronzing iron on p. 283, vol. 31, and for tinning iron on p. 362, vol. 31.—W. L. D. can make a magnet by following the directions on p. 218, vol. 31.—J. G. M. & Co. will find a recipe for paste for use on tin on p. 253, vol. 30.—J. E. H. can nickel plate steel by following the instructions on p. 174, vol. 30.—L. T. can repair his rubber boots by following the directions on p. 203, vol. 30.—C. McE. can make a carmine red ink by the recipe given on p. 200, vol. 30.—F. M. H. and many others will find directions for nickel plating on pp. 43, 90, 346, vol. 31.

(1) E. C. asks: 1. In the present Atlantic telegraph cable is there a floating battery, or has there been one at any time since it was laid, in mid-ocean? A. No. 2. What is the size of the batteries used at the shore ends of the cable? A. Quart cells. 3. How small a battery is it possible to use and send a communication over the cable? How small a battery has been tried, which showed indications at the other end? A. A battery composed of a single percussion cap, in each case. 4. Would it be possible in taking up the cable, beginning in mid-ocean, to communicate with the shore, unless they first separated the cable or outer coating? A. It would not.

(2) N. N. asks: What is the best battery for running a revolving armature? A. A large size Daniell, battery or the modification of it known as the gravity or Callaud battery.

(3) S. E. T. says: 1. I wish to convey water from a stream to a tank 1,000 feet distant and 30 feet higher than the stream. Will I get as good a supply of water with the same power if I lay a 3 inch pipe over the first 300 feet, a 2 inch pipe over the next 200 feet, and an 1½ inch pipe over the remainder, as with a 2 inch pipe over the whole distance? A. The data are not complete, but it would be better to have the pipe the same size throughout. 2. Will chestnut sticks, with a 2½ inch hole bored through them lengthwise, united with iron couplings, answer the purpose for pipe? A. Yes. 3. How many horse power will it require to give a supply of 10 gallons per minute? A. From 2 to 2½ times the power required to lift the water, neglecting friction.

(4) N. N.—A very pretty magnified view of an aquarium or other object is obtained through a telescope when the objective and eyepiece are very far apart, in a tube of extra length.

(5) I. F. J. asks: How can I repair an opera glass of which the plating is discolored and the ivory broken? A. Nickel plate the metal surface, and cover with morocco leather attached with marine or other glue.

(6) S. D. E. says: 1. Eight months of labor and patience have rewarded me with a splendid reflector. I used Draper's method of silvering on glass, as described in your answers to correspondents. Any one who follows the formula must succeed. My reflector is 12 inches in the clear, with 10 feet focus. I want to set the reflector at an angle, so that I can view direct instead of using an angle mirror; and I wish to leave the tube 2 feet longer than the focus, so that my head will not be in the way of the light. Will this answer? A. If your mirror gives sharp definitions, mount it as a Newtonian; if not, mount it as an aerial, as figured by Dick. 2. Please tell me what the focal distances and diameters of the two eyepieces should be (the focus spot by the sun covers about half an inch). A. To construct a battery of eyepieces, take the highest power, say 600, and divide it by 1·5=400, the next power; 400÷1·5=266÷1·5=177, ÷1·5=59; or begin with the lowest, say 60, and make each power ½ greater than the one below it. 3. How far should the first glass (next to reflector) be beyond the focus? Should it be plano-convex or double convex? A. Focus is within the Huyghenian eyepiece. See No. 48, October 17, 1874. A Ramsden or positive eyepiece, for micrometer or reticule, is constructed thus: The focus of the field lens=twice the focus of objective divided by the power required. Focus of eye lens is 0·555 or ⅝ that of field lens. Distance apart is ⅜ or 0·444 of focus of field lens. Equivalent single lens is ½ focus of field lens. Apertures are ⅙ of focal length. Image is $\frac{1}{16}$ of focus of field lens in front of it. Both lenses are plano-convex, the convex sides facing each other.

(7) Z. T. R. says: I wish to convey the water of a spring to my dwelling, which is at a distance of 600 yards; the pipe will have to cross a creek and swamp, making the lowest point of the pipe 40 or 50 feet below the fountain head. The spring affords water enough to fill a 2 inch auger hole through a weir with a 6 inch head. What size of pipe will be required for the work, the discharge being 15 or 20 feet below the receiving point, and consequently at a head of 15 or 20 feet at the house all the time? A. A one inch iron pipe will serve your purpose, and, notwithstanding the friction of so long a line, give water enough for a family's use. The salts in the water will very likely coat it so as to prevent the rusting of the iron. The usual thickness of a one inch wrought iron pipe will be strong enough for the pressure at the lowest point. The exterior may be covered with a wash of coal tar. 2. Who makes the best pipes, to keep water free from all poisons and rust? A. Tin-lined lead pipe is supposed to be the best pipe for the purpose. All pipe should be laid below the reach of frost. The power of a water wheel is best ascertained by experiment.

(8) J. G. H. says: I have a sawmill boiler in which the distance from the bottom of the boiler to the top of the arch is 8 inches from the arch. The brickwork is gradually sloped. We fire with sawdust, but have to use some dry slabs to get steam enough. An engineer tells me that if I make the arch 10 or 12 inches from the boiler, and leave the space from the arch to the brick wall empty instead of filling it up, I will be able to burn more sawdust and refuse and keep up steam, without using slabs. I want to burn all the sawdust and refuse I can, and at the same time have steam enough. Which is the better way? A. We do not think that the change will produce any decided advantage, unless you make a combustion chamber, by admitting air into the space back of the bridge wall.

(9) D. N. B. asks: 1. Is it economy of fuel to buy a 10 horse power engine and work it up to 15 horse power rather than work a 15 horse engine at its nominal capacity? How much work could a well made nominal 10 horse engine be made to do without over working or straining? A. We cannot tell you anything about nominal horse power, as it varies with different makers; nor is it possible to give general rules for the most economical manner in which to run all engines, as it depends upon a number of variable quantities. 2. How might the relative value of coke and Illinois bituminous coal be stated for making steam? A. It can readily be determined by experiment. Keep account of the fuel consumed and word done. 3. What power of engine would you advise putting in, to run machines requiring (according to manufacturer's representations) an aggregate of 10 horse? A. An engine of 10 effective horse power.

(10) H. L. says: 1. I wish to construct a two inch achromatic telescope and use it both as a terrestrial and astronomical one. What would be the best object glass, and what length of focus should it have? A. See answer No. 27, October 24, 1874. 2. How should I construct the eyepiece to match? A. Put the smaller plano-convex lens next the eye. 3. What are the names, distances, magnitudes, and masses of about ten of the nearest fixed stars whose distance has been roughly ascertained? A. 61 *Cygni* has a parallax of 0′45″, distance 44 millions of millions of miles; diameter of orbit 17 times that of the earth; light period 7 years. Sirius and *α Lyræ* have each a parallax of ¼ second; they are about 800,000 times as distant as the sun. 4. Please give the rates at which they appear to travel in their orbits, and towards what star they appear to travel, as well as the rate at which others move away. A. Stars approaching us are: Arcturus, 55 miles per second, Vega 44, *α Cygni* 39, Pollux 49, *α Ursæ Majoris* 46 to 60. Stars receding are: Sirius 18 to 22 miles per second, Betelgeux 22, Rigel 15, Castor 23 to 28, Regulus 12 to 17. The two fourth magnitude components of *γ Virginis* revolve round their center of gravity in 169 years; major axis, 7″. *Xi Ursæ Majoris* fourth and fifth magnitudes, 61 years, 5″. *ζ Herculis* third and sixth magnitudes, period 36 years; major axis 2½″. 5. What time does it take Sirius's companion to go round him? A. Four hundred years, 10th magnitude; mass of satellite=half mass of Sirius. Sirius is over three million miles in diameter. 6. What are the diameters of Saturn's moons? A. Titan is larger than Mercury. It can be seen with 1 inch aperture, Japetus with a two inch. 7. In what constellations can I find five of the largest nebulæ that have been found to be gaseous? A. Great nebula of *Orion*: Right ascension, 5h. 29m., declination S. 5° 29′. Nebula in *Andromeda*: 4° long, 2½° broad, R. A. 0h. 36m., D. N. 40° 30′. Dumb bell nebula, R. A. 19h. 54m., D. N. 22° 22′. Annular nebula in *Lyra*: R. A. 18h. 49m., D. N. 32° 52′. Horseshoe nebula, R. A. 18h. 13m., D. S. 16° 15′. Two copies of SCIENTIFIC AMERICAN for 1 year and two of *Science Record* will cost $10.

(11) J. McD. asks: 1. Is there any place in America or Europe where crude petroleum is used for making gas? A. There have been many attempts to employ it, some of which are still in progress. 2. Does such process pay economically, in comparison with coal? A. As yet, the various inventors have not succeeded in perfectly overcoming the practical difficulties.

(12) A. A. N. asks: Is there any way of preparing the sympathetic inks which are visible only when heated, such as solutions of $Co(NO_3)_2$, $CoCl_2$, etc., so that they can be used for printing or stamping? A. We do not know of any such method.

(13) J. G. S. asks: How can I make a cheap paste for putting up paper exposed out of doors, making it impervious to any kind of weather? I should like it to form some kind of hard surface similar to varnish. A. We know of no material that will answer all these requirements.

(14) C. W. asks: 1. Are the saltpeter deposits in the Big Bone Cave, Tenn., extensive? A. It is probable that saltpeter has been obtained by lixiviation of the earth in the cave. 2. Is it true that large quantities were obtained here for the rebel army? A. The amount, though considerable, would not cause this source of supply to supersede others.

How can I preserve guns with least trouble? A. Cover the iron with a mixture of tallow and white lead.

How must I treat brier root to prevent splitting, and how can I color it for a pipe bowl? A. Boil the wood for an hour or two in water, and dry slowly. To color, hold near the fire so as to gently warm, and by means of a feather coat the surface with dilute aquafortis; oil and polish.

How can I dye hair switches dark brown? A. To a saturated solution of sulphate of copper (blue vitriol) add ammonia until the precipitate which falls is redissolved. For a mordant, to be first applied, use a saturated solution of ferrocyanide of potassium.

(15) J. B., of Wells, England, says: On removing a sheet of tin which had been placed immediately behind a looking glass plate (exposed to the sun) I discovered several circular spots, varying from two to four inches in diameter, with a dull silvery appearance and very smooth. If this was a coating of silver, can you explain how it was conducted from the plate to the tin, as the mercury on the plate did not come in contact with the tin, except at the edge of the plate? A. They were probably spots produced by a small amount of mercury volatilized from the back of the mirror, acting upon the tin.

I have two small pine trees (which I brought from America last winter) and wish to preserve. One especially is looking sickly, although both have grown a little. They were planted in a rich red soil in a low situation. Can you tell me what locality or soil would be most congenial to their growth? A. In this country, pine trees do not grow in rich moist bottom lands, but upon arid, sandy soils.

(16) S. asks: What is a solvent of oxidized linseed oil? A. Turpentine.

(17) J. H. asks: What is a durable cement, for cementing burlaps to the edges of a frame made of building paper? A. Edmond Davy prepares a cement, which is well spoken of, by melting in an iron vessel equal parts of common pitch and gutta percha. It is kept liquid under water, or solid to be melted when wanted. It is not attacked by water; and it adheres strongly to wood, stone, glass, porcelain, ivory, leather, paper, feathers, wool, hemp, and linen fabrics, and even to varnish.

(18) H. W. asks: What is the best preparation to put upon the wood floor of a public building which is daily much used? A. In cases of this kind, the general practice is to use some cheap durable paint.

(19) J. H. A. asks: 1. Will oil in which steel is repeatedly hardened lose its hardening property? A. No. 2. Which is the best kind of oil for hardening steel? A. Common machine oil may be used; but for fine work, olive or cotton seed oil will be more satisfactory.

(20) J. W. asks: What materials are used to make amber-colored glass, beside manganese? A. Different shades of yellow may be imparted to the glass by the addition of the oxides of silver and antimony, and by finely divided charcoal; also by the presence of peroxide of iron in quantities not exceeding one per cent. The tints may be tempered by the addition of minute quantities of the purple of Cassius.

(21) J. K. asks: If a mixture of steam and air, after passing through red hot pipes, were admitted, by means of the draft, to a coal fire, would it insure a more complete burning of the smoke than if air alone were so used? A. It would be a dangerous experiment, as such a mixture (if a sufficient amount of heated iron were presented to the steam to liberate a part of the hydrogen) might be rendered explosive.

Why do the rays of the sun warm the air more in the valleys than they do on the top of high mountains? A. The air receives its warmth by contact with the earth; as the valley offers to the lower strata of air greater surface, the contact is more frequent and intimate. Something is also due to evaporation.

(22) H. A. G. asks: 1. Are glass tumblers made in molds? A. Yes. Many forms of glass ware are made by blowing into molds. 2. How is window glass made? A. In the manufacture of common window glass, the workman dips an iron tube into the melted mass, a portion of which adheres to it. This is blown into a pear shape, which becomes elongated by swinging like a pendulum. By reheating, blowing, and rolling, it is worked into the form of a cylinder, which is cut off around the top and bottom and split down the side. After again softening in the furnace, it is opened and spread out into a flat plate. 3. There is a recipe for crystal glass which states: White sand 15, red lead 10, refined ashes 4, and niter 1, parts. What are these parts? A. Parts by weight.

(23) D. H. R. asks: How can I relieve canaries from the attacks of a very small red parasite? A. Allow the birds to bathe frequently, and keep the cage very clean, with plenty of sand at the bottom.

(24) H. E. B. asks: 1. In re-sharpening files will any other kind of battery answer the same purpose as the Bunsen? A. Yes. 2. Will a zinc and porous cup battery, excited by nitric and sulphuric acids, be sufficient, and how many cups are needed? A. No doubt any kind of battery will answer the purpose, provided the electromotive force be equal to that of twelve Bunsen cells, the number employed by Mr. Werdermann in his experiments. 3. Are the files placed horizontally or in a perpendicular position? Should the positive pole connect with every file separately in the bath, or do they project above the bath and make a dry connection with the positive pole? A. Perpendicularly. The handle end of the file should project above the liquid, and connection may be made by means of a binding screw with the positive pole (copper or carbon) of the battery. 4. Will a small battery of medium strength be sufficient to sharpen a few files at a time, or even one, with a longer period of immersion? A. Possibly. The experiment is easily made.

(25) J. J. B. asks: I have been making some magneto-electric apparatus, and to insulate the wire I wrapped it with silk thread. Is there not a cheap silk thread made especially for this purpose? A. Yes. The wire is covered with raw silk floss, called untwisted silk for covering telegraph wire.

(26) I. J. S. asks: 1. Is there any way which will effectually destroy magnetism in the steel parts of watches, except passing them through the fire? A. There is no practicable method of destroying it. 2. Why do watchmaker's small tools get magnetized when there is no magnet about the shop? A. It is possible but not probable that the tools may have become magnetized by friction. It is more likely that your tools have accidentally got in contact with a magnet.

(27) M. D. says: Will you give me the simplest process of nickel-plating small objects like surgical instruments? A. Use chloride of nickel for a solution with a nickel positive electrode, and proceed as in silver plating.

(28) J. M. D. asks: Do you know of anything that will cut off the attraction of a magnet? A. Place a brass plate between the poles of the magnet and the armature.

(29) W. T. B. says: I have learned from several that there is a mode of increasing negative electrical attraction, relative to the positive, in other words, of having a great attraction and slight repulsion. Is this so? A. It is probably erroneous.

(30) S. D. asks: What is the explanation of the term squaring the circle? A. Calculating the exact superficies of a circle whose diameter or radius is given, so that the side of a square of the same area may be known.

(31) C. W. says: Please state the composition and properties of croton chloral. A. Ordinary chloral is an aldehyd; it is the hydride of trichloracetyl, C_2Cl_3OH. Croton chloral is the hydride of trichlorocrotonyl, $C_4H_2Cl_3OH$, or the aldehyd of crotonic acid, C_4H_6OH, in the radical of which three atoms of hydrogen have been replaced by three atoms of chlorine. Anhydrous croton chloral is a colorless, oleaginous liquid, having a peculiar odor, recalling that of ordinary chloral. It is insoluble in water, but, like ordinary chloral, it combines with water to form a crystallized hydrate. The hydrate of croton chloral crystallizes in white nacreous spangles. It is slightly soluble in cold water, more freely soluble in warm water, and extremely soluble in alcohol. It dissolves more readily in glycerin than in water.

(32) F. M. H. asks: Will five Callaud batteries be enough to plate with? A. Yes.

(33) N. B.—If the moon's node be less than 9° 37' from the center of the earth's shadow, there will certainly be an eclipse of the moon. If the sun be more than 12° 4' from the node, there cannot be an eclipse. The moon crosses the ecliptic 19° further west each year.

(34) W. M. D. asks: 1. In what manner are the connections usually made or attached to the pendulum of a regulator beating seconds, to convey a current of electricity to another clock? In other words, how can I make and break connections at each second, and at the same time take no power that would disturb the pendulum as regards its rate? A. The pendulum in swinging passes through a small cup of mercury. 2. What form of battery will convey a weak current for a year without attention? A. The Leclanché or the gravity battery.

Has mercury any effect on platinum when brought in contact with it? A. It will adhere to the platinum, but will cause no injury.

(35) W. T. H. asks: Is it darkest just before daylight? A. No.

What is a good cement to stick rubber coat seams together with? A. Dissolve a small quantity of pure rubber in hot naphtha.

(36) W. E. S. says: I think my eyes are getting weak, but am not sure. Will you please tell me how I can test them? A. By comparing with some one whose eyes are undoubtedly good.

(37) F. H. W. asks: 1. How can I make a soft iron core for a magnet? A. Bend a rod of iron into the shape of a horseshoe. 2. Should the wire be wrapped tight around the soft iron? A. Yes. 3. Would a battery made of a common tin can lined with lead, with zinc hung in the top, make a battery of any strength? A. Yes. 4. What fluid should I use for such battery? A. Put crystals of sulphate of copper in the bottom of the can, and fill with water.

(38) S. H. B. asks: Will the Leclanché battery answer for an electrical clock in which the impulse is to be given to the pendulum at each return to one side, the pendulum beating in half seconds? A. Yes.

(39) W. H. M. asks: Is electricity a substance? A. That question still remains to be solved. The present opinion seems to be rather inclined to regard it as a force.

(40) T. C. H. asks: Will you please give me a good recipe for separating silver and gold when melted together? A. Melt the alloy, and while in a fused state pour it from some height into a vessel of water to which a rapid rotary motion is given. By this means the metal may be obtained in a finely granulated state. Add to the metal thus obtained a quantity of chemically pure nitric acid, and heat gently. When the solution ceases, which may be known by the discontinuance of effervescence, the liquid may be poured off. If any grains appear entire, more acid must be added until the silver is all dissolved. The remaining gold will have the appearance of black mud or powder, which must be thoroughly washed and melted. The silver is recovered by precipitation with muriatic acid and reduction. The precipitate of silver must be well washed with boiling water, and may be fused with niter or tested off with lead.

(41) C. L. W. asks: What will restore the color of a book slate which has turned white? R. Try a thin coat of lampblack in alcohol.

(42) I. F. M. asks: Would not the attractive force between two magnets with the opposite poles in contact be greater than that with which both magnets, with like poles adjacent, would attract an armature? In other words, would one magnet attract another of the same power with more than twice the force that it would the armature? A. No.

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

C. I.—They are iron pyrites.—J. W. W.'s specimen did not come to hand.—L. S. R.—It is a fine sand, consisting mostly of silex and alumina. It can be used for grinding and polishing powder. It would not be easy to grind it finer, except by suitable steel rollers; but the finer particles could be separated from the coarser by suitable sieves and bolters, and then the coarser could be ground, if necessary.—L. G. D.—There is nothing peculiar about this earth, except that it is quite white from being unstained by iron, and that it is in a fine powder. It consists principally of silicate of alumina. —J. H.—Both the specimens contain sulphuret of iron.—J. T. T.—It is sulphuret of iron (iron pyrites).—J. H. M.—They are worms growing from germs in organic tissues, like the interior portion of feathers.—J. J. J.—Your specimen is fine sand with scales of mica. The powder marked P is a mixture of particles of metallic lead with oxide of lead, carbonate of lead, chloride of lead, and sulphate of lead.

C. F. A. asks: How can I construct the sliding or guiding parts of a self-supporting drawer, so that it may be drawn out its full depth, from under a bench?—E. J. Q. asks: 1. What is laminated steel? 2. A gunsmith in Boston says he can take any gun barrel and make a laminated steel barrel of it. Can it be done?—W. H. B. Jr. asks: How can I make artificial firebrick?—L. K. Y. asks: What is Vienna lime?—C. H. M. says: 1. It is observed that the putty used in stopping up the nail holes in boats where galvanized nails are used soon becomes soft and friable, and ceases to afford adequate protection. To what is the change due? 2. What can be used, in place of putty, that will remain hard and firm in covering galvanized nails while exposed to salt water? T. H. D. asks: 1. How can I get rid of the red spider which infests house plants? I have tried tobacco water and smoke, but without effect. 2. How can I get rid of moths in carpets?—J. C. asks: 1. How can I cause a quick fermentation, to prepare molasses for distillation? 2. How can I take the taste of molasses from the spirit after distillation?

COMMUNICATIONS RECEIVED.

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Lining Engine Cylinders. By F. G. W.

On Splicing Large Belts. By T. G. B.

On Hydrophobia. By J. R.

Also enquiries and answers from the following: W. A. T.—J. S.—T. F. M.—W. H.—H. D. D.—C. G.—A. J. B.—H. E. B.—G. B.—G. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Where can illustrations of new designs for furniture be obtained? Who sells the best feed water heater and filter? Why do not makers of glue advertise in the Scientific American?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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Whiffletree attachment, R. Mansfield ... 157,849
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Windmill, W. C. Nelson ... 157,757

DESIGNS PATENTED.

7,922.—COFFIN HANDLE TIP.—A. B. Bailey, Cobalt, Conn.
7,923 & 7,924.—JEWELRY DROP.—L. S. Beals, Astoria, N. Y.
7,925 to 7,928.—BREASTPIN.—L. S. Beals, Astoria, N. Y.
7,929.—BRACELET.—L. S. Beals, Astoria, N. Y.
7,930.—SOAP.—D. S. Brown, New York city.
7,931.—GAS GLOBE GALLERY.—T. Trudeau, Ottawa, Ca.
7,932.—BUTTONS.—L. S. Davis, Waterbury, Conn.
7,933.—REVOLVING FIRE ARMS.—C. B. Richards, Hartford, Conn.
7,934.—INKSTANDS.—L. Rosenfeld, New York city.
7,935.—ADVERTISING WAGONS.—O. F. Sage, Boston, Mass
7,936.—TYPES.—G. W. Witham, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,113.—CIGARS, ETC.—F. Dufoure, New York city.
2,114.—MEDICAL COMPOUND.—J. X. Quigley, Shippensberg, Pa.
2,115.—WHISKY.—G. P. Simonson, Jersey city, N. J.
2,116.—CHAIRS.—Delaware Chair Company, Ohio.
2,117.—CANNED GOODS.—Evans & Co., Baltimore, Md.
2,118.—BAKING POWDERS.—H. F. Griswold & Co., Chicago, Ill.
2,119.—MUSTARD.—H. F. Griswold & Co., Chicago, Ill.
2,120 & 2,121.—TOBACCO.—Liggett *et al.*, St. Louis, Miss.
2,122.—CORSETS.—S. A. Moody, New York city.
2,123.—STARCH.—C. Morningstar & Co., New York city.
2,124.—STATIONERY.—Rowland & Co., Washington, D. C.
2,125.—CIGARS.—J. Schroeder & Co., Baltimore, Md.
2,126.—SOAP.—N. Sheldon, Providence, R. I.
2,127.—COCOANUT PREPARATIONS.—California C. N. Co., San Francisco, Cal.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

DECEMBER 11 to DECEMBER 17, 1874.

4,166.—J. O. Grove, Bluffton, Wells county, Ind., U. S. Improvements in differential pulleys, called "Grove's Differential Pulley." Dec. 11, 1875.

4,167.—S. White, Belleville, Ont. Improvements on a machine for attaching horses to plows, harrows, etc., called "White's Suspended Whiffletree." Dec. 11, 1874.

4,168.—E. L. Fenerty, Halifax, Nova Scotia. Extension of Patent No. 180, called "An Improved Method of Making, Adjusting, and Fastening Skates." Dec. 11 1874.

69.—G. Fournier, Ste. Julie, Megantic county, P. Q. Améliorations aux boutons pour les habillements, dit 'Bouton de l'Industrie et des Familles de Fournier." (Improvements in buttons for coats, etc.) Dec. 15, 1874.

70.—S. C. Redgrave, Lyons, Wayne county, N. Y., U. S. Improvement on liquid measure, called "Redgrave's Transparent Liquid Measure." Dec. 15, 1874.

171.—H. Hollingshead, Howick Township, Huron county, Ont. Improvement in land roller, called "Hollingshead's Improved Land Roller." Dec. 15, 1874.

.172.—E. O. Brinckerhoff, New York city, U. S. Improvement on steam condensers, called "Brinckerhoff's Steam Condenser." Dec. 15, 1874.

4,173.—F. W. Tuerk, Jr., Berlin, Ont. Improvements in water wheels, called "Tuerk's Inverted Overshot." Dec. 15, 1874.

4,174.—D. Jones, Millburn Inverness, Inverness county, Scotland. Improvements in lubricators, called "Jones' Lubricator." Dec. 15, 1874.

.175.—C. C. Roe, Hamilton, Ont. Steam man or steam walking wachine, called "Roe's Steam Man or Steam Walking Machine." Dec. 16, 1874.

4,176.—R. Thomas, Toronto, Ont. Improvement on cooking stoves, called "Ladies' Aid," or "Thomas' Improved Cooking Stove." Dec. 15, 1874.

4,177.—J. Campbell, Almonte, Lanark county, Ont. Improvements on churns, called "Campbell's Oscillating Combination Churn." Dec. 15, 1874.

4,178.—G. A. Keene, Lynn, Essex county, Mass., U. S., and F. A. Sawyer, Boston, Suffolk county, Mass., U. S. Improvements on carriage and car steps, and threads for stairs, etc, called "The Rubber Safety Step." Dec. 15, 1874.

4,179.—W. B. Laberge, Montreal, P. Q. Improvements on ironing tables, called "Indispensable Ironing Table." Dec. 15, 1874.

180.—D. Bissell, Detroit, Wayne county, Mich., U. S. Improvements on arm splints, called "Bissell's Arm Splint." Dec. 17, 1874.

4,181.—C. Parham, Valleyfield, Parish of Ste. Cecile, Beauharnois county, P. Q. Improvement in suction and force pumps, called "The Valleyfield Improved Pump." Dec. 17, 1874.

4,182.—F. Moses, Toronto, P. Q. Improvement on heating apparatus, called "The Coal and Wood Economizer." Dec. 17, 1874.

4,183.—C. Cluthe, Hamilton, Wentworth county, Ont. Improvements on truss pads, called "Charles Cluthe's Self-Adjusting Spiral Spring Truss Pad." Dec. 17,

.184.—H. E. Rowe, Brockville, Leeds and Grenville counties, Ont. Improvements on feather renovators, called "Rowe's Improved Feather Renovator." Dec. 17, 1874.

4,185.—A. D. Griswold, New York city, U. S. Improvement on feather dusting brushes, called "Griswold's Improved Feather Duster." Dec. 17, 1874.

4,186.—M. Thibault, Hull, Ottawa county, Can. Améliorations aux cabestans, dits "Le Cabestan Amélioré de M. Thibault." (Improvements on capstans and windlasses.) Dec. 17, 1874.

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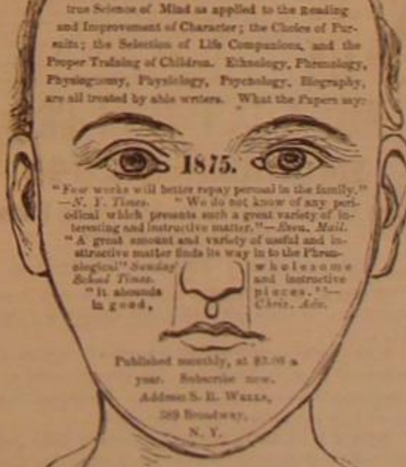

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