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THE HAMILTON SURFACE PLANER.

We present herewith illustrations of a new surface planer, manufactured by the enterprising firm of Bentel, Margedant & Co., of Hamilton, Ohio, a concern which has gained an enviable reputation for the multiplicity as well as the value of the improved machines numbered among its recent products. Two views, end, Fig. 1, and side, Fig. 2, of the device are given, from which its uses will be readily recognized; while its symmetrical form and compact construction will commend it to the practical mechanic.

There are two planing tables, located respectively above and below the cylinder, both of which are adjustable. The upper table is made in two sections to plane above the cylinder, and the lower table or bed serves for thickening from five or six inches, if desired, down to one sixteenth of an inch below the cylinder.

In front of the knives the table rests on inclines, and can, by a hand screw shown in the engravings, be changed from a one sixteenth to one and a half inches below the cutting line. The back table remains for planing out of wind, etc., at the extreme height of the cutting line. A triangular cutter head of a peculiar form is provided; and although the knives are straight, similar to those generally used, they make a drawing cut, thereby insuring a smooth surface. The machine, thus arranged, can be used for planing out of wind, smoothing, squaring, making a glue joint, beveling, cornering, and tapering. Among other advantages claimed for this tool is that the material to be planed out of wind does not need to be leveled, fastened, and run back and forward before the cut is taken; for, since it rests on a level adjustable table before the cutter cylinder will operate upon it, the planed part glides upon the back table as soon as it passes the cutter cylinder. The tool, therefore, planes economically, not cutting away any more than is necessary to secure a smooth surface out of wind. After the work is planed out of wind, it is in the right position to be operated upon by the cutting cylinder to plane it to the required thickness (below the cylinder), requiring no re-handling to other machines used for this purpose only. Very short, narrow, and thin material can be planed out of wind by passing it over the cutter cylinder. Circular, oval, and square framed stuff, without regard to the running of the grain, can be passed over the cutter cylinder, planed, and finished.

Fig. 2 shows the machine arranged for planing boards or timber to the required thickness. The upper table, back of the knives, is swung back and brought forward by the hand screw. This part of the table is so constructed that it forms on the lower side a bonnet to direct the upright flying shavings toward the table in front of the cutter head, from which they are blown by the wind created by the revolving cutter head.

The work done above the cylinder is easily fed toward the knives by hand; while the feeding toward the cylinder, below the cutter head, is performed by geared feed rollers, which can be started or stopped by means of a tightening pulley connected with the feed lever. The latter is held in its position by a spring. The feed of the machine can be changed from fast to slow, or *vice versa*, to suit for hard or soft wood. An adjustable pressure bar, roller scraper, and a gage admit of the lower table being accurately set for any thickness of cut.

The machine is covered by several patents which have been secured through the Scientific American Patent Agency. The manufacturers, to whom further inquiries may be directed, as above, make several sizes and kinds of the tool, from 24 to 16 inches.

The right to manufacture the planer in the Eastern and Pacific States is, we are informed, open to purchasers.

We see, by the late report of the judges of the Cincinnati Industrial Exposition, that the merits of this machine won for it a first premium. Judging from samples of remarkably thin planing and other work, performed on the appara-

tus and sent for our examination, there is no question but that the distinction was well deserved.

Utilization of Tin Waste.

The process includes the following operations: Boiling the waste with water acidulated with hydrochloric and nitric acid, until the tin is completely dissolved. To 2,200 pounds

of lead and oxide of tin; this is mixed with double its weight of coke, and heated in a zinc furnace. Chloride of tin distills over, and metallic lead remains. The iron scrap, freed from tin, can be used in the manufacture of copperas, or in metallurgical operations. The process shows a profit.—M. Künzel.

Spontaneous Combustion in Hay.

There are doubtless many farmers who have experienced sudden and destructive conflagrations in their hay lofts, which could not be ascribed to any exterior agency. Barns have been known to burst into flame, almost without warning, save perhaps a significant odor, for a few days previously, around the places where the hay was stored, and a summer's harvest is swept away in as many minutes as it has taken days to gather it. These unexpected conflagrations are generally accredited to tramps who have made the hay loft their sleeping resort, but it is now asserted that such calamities are frequently due to the spontaneous combustion of the hay, a circumstance theoretically quite possible, but rarely considered. Abbé Moigno, in *Les Mondes*, gives the following as the theory of the phenomenon: Hay, when piled damp and in too large masses, ferments and turns dark. In decomposing, sufficient heat is developed to be insupportable when the hand is thrust into the mass, and vapors begin to be emitted. When the water is almost entirely evaporated, the decomposition continues, and the hay becomes carbonized little by little; and then the charred portion, like peat, peat cinders mixed with charcoal, sulphurous pyrites and lignite, etc., becomes a kind of pyrophorus, by virtue of its great porosity and of the large quantity of matter exposed to high oxidation. Under the influence of air in large amount, this charcoal becomes concentrated on the surface to such a degree that the mass reaches a temperature which results in its bursting into flames.

The preventives for this danger are rare that the hay in the lofts is kept perfectly dry, that it is well packed, and that it is stored in small heaps rather than in large masses.

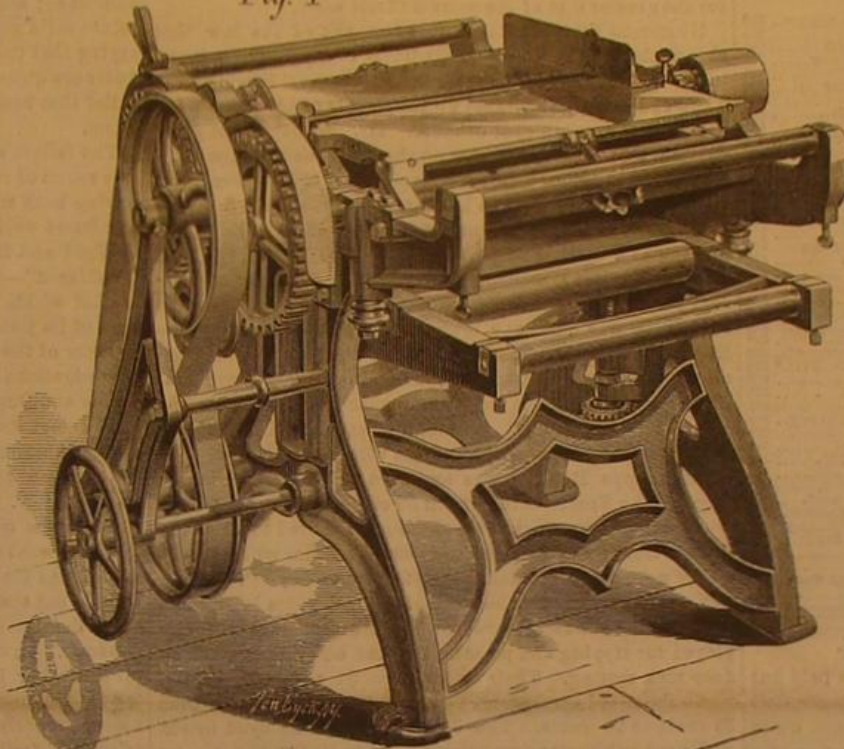
The Preservation of Wood.

A new work, exhaustively treating the above topic, has recently appeared in France from the pen of Maxime Paulet, a quite eminent chemist. The author advocates especially the use of sulphate of copper and creosoted oil, according to the circumstances under which the wood is employed. Sulphate of copper has a poisonous action upon the animal and vegetable parasites which appear at the beginning of organic decomposition. In treating wood which is to be buried in the earth or submerged in fresh water, the solution should be applied in excess, since the effect of moisture is slowly to dissolve the salt. Sea water acts in this manner so rapidly that sulphate of copper should not be employed for piles or similar marine structures. In wood soaked with the salt solution, a portion of the latter unites closely with the ligneous tissue, and another part, in excess, remains free. This last, first dissolved by the exterior liquids, slowly retards the removal of that combined with the wood; but the combined portion itself, though more stable, does not entirely escape subtraction, accelerated or retarded according to the rapidity of renewal of the dissolving liquid.

On the other hand, for wood destined for aerial structures, the quantity of solution should be diminished in order to prevent the mechanical effect of intervascular crystallizations.

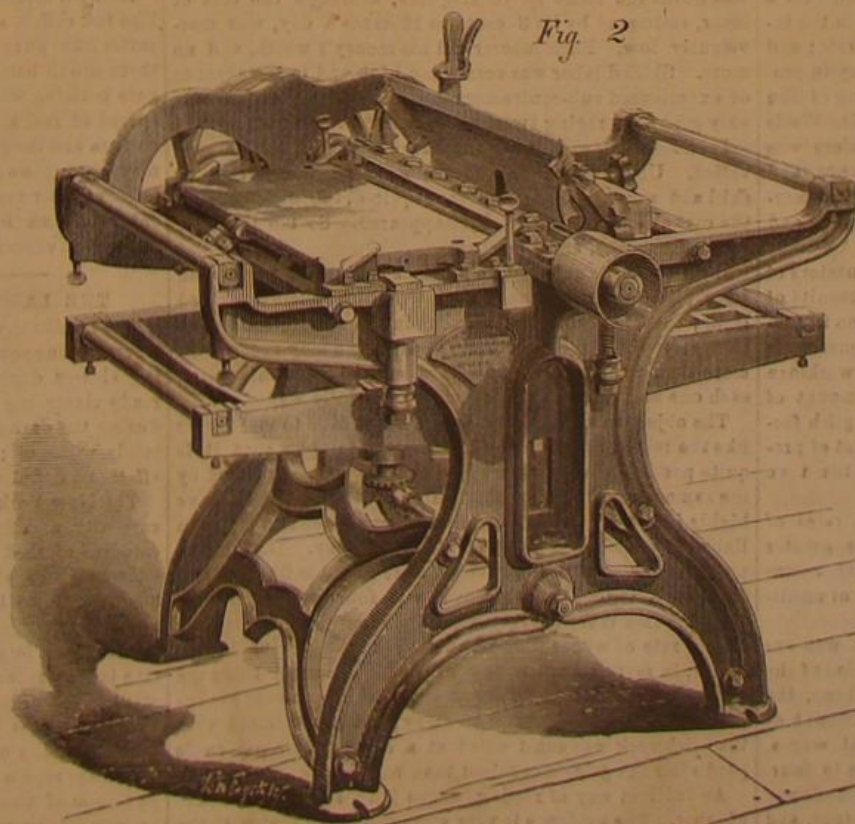
Regarding creosoted oil, M. Paulet states that the tarry and carbolic compounds are much preferable to the metallic salts for wood exposed to sea water, because the naphthalene, aniline, and notably the carbolic acid exercise an antiseptic action, coagulating the albumen and thus destroying both the circulation of the sap and also that in the organic parasites. It is pointed out, however, that these substances render the wood inflammable, while the metallic salts have just the contrary effect.

Fig. 1



THE HAMILTON SURFACE PLANER.

Fig. 2



the scrap iron washed, and the washings used in treating the next lot. The tin is precipitated in a spongy state by means of scrap zinc, 70 parts of which serve for 100 of tin. The precipitated mass is washed, and at once dissolved in hydrochloric acid. There remains a mass composed of chloride

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CHEAP WORKMEN MAKE DEAR WORK.

It is a common complaint, among those who have paid but superficial attention to the relations of work and wages, that high wages in this country make it very hard, if not quite impossible, for our farmers and manufacturers to compete successfully with the cheap labor of other countries. Such complainers fail to comprehend the economic paradox that the cost of labor affords no criterion of the cost of work. Of course there are limits both ways. Labor must not be so cheap that the laborer cannot subsist on the proceeds of his toil, nor so dear that the product is swallowed up in wages. Within these limits, especially where machinery is involved, the economic law is universal; the cost of production, roughly speaking, varies inversely as the wages paid.

This fact comes out very strongly in the special report of Commissioner Wells to Congress in 1868, wherein the relation of work to wages is discussed in minute detail. As a rule the productiveness of the laborer increases with the increase of his pay, and generally at a more rapid rate; and—though modified by other conditions—the economy in production increases accordingly. Taking the puddling of iron as the representative process of the iron trade, Mr. Wells found the average price of labor per day for puddlers was from \$1.80 to \$1.88 in Staffordshire, \$1.38 in France, and from \$1.14 to \$1.25 in Belgium. The average price of merchant bar iron was \$32.50 in England, \$35 in Belgium, and \$40 in France.

In an address read before a meeting of the ironmasters of the north of England, Mr. Lowthian Bell gave the results of his investigations as to the cost of smelting pig iron in several countries of Europe. Everywhere cheap workmen were associated with dear work. I. required forty-two workmen in a French establishment to carry out the same amount of work which twenty-five men were able to do in English factories. With labor twenty per cent cheaper, the cost of producing pig iron in France was \$5 to \$6 more per ton than at Cleveland.

In Germany, as in France, though the nominal rates of wages were still lower, the actual cost of work was greater than in England. Thus in Westphalia, where labor was twenty-five per cent less than in England, the cost of smelting a ton of iron was \$3.75 more than on the Tees.

The same contrast of cheap labor and dear work was exhibited in the report of Mr. Redgrave on the condition of the textile industries in England. Where labor is cheap, the number of hands required to perform a given amount of work more than offsets the advantage in individual wages. In France, one person is employed on the average to four teen spindles; in Russia one to twenty-eight; in Prussia one to thirty-seven; in Great Britain one to seventy-four, and not unfrequently mules containing 2,200 spindles are managed by one minder and two assistants. Wages were less in Germany and the hours of labor longer, yet the weight of work turned off was less than would be produced by the same machinery in England, with much fewer operatives. In Russia the inefficiency of the operatives as compared with

those of England was still more strikingly manifest. Their wages hour for hour were less than one fourth the amount earned in England; yet the productive power of the English operatives throws the advantage greatly in their favor.

The same condition of things is noticed by Mr. Wells, who shows that, while female labor in the cotton manufacture is paid from \$3 to 3.75 a week in Great Britain, from \$1.67 to \$2.30 in France, Belgium, and Germany, and from 56 cents to 70 cents in Russia, the one thing most dreaded by continental manufacturers everywhere is British competition.

In the carrying-out of his railway and other contracts in every quarter of the globe, the late Mr. Brassey had occasion to employ great numbers of laborers of almost every nationality, at widely different rates of daily wages; yet it was found to be the almost invariable rule that the cost of executing a given amount of work was everywhere much the same. If anything, the advantage in cheapness lay where labor was dearest. Thus the wages paid in England were higher than in any other country; yet bridges, viaducts, tunnels, and all works of art on railways were executed there more cheaply than in any other part of the world. Where labor was plentiful and very cheap, as in Italy or India, simple earth works might be erected at a cheaper rate than in England; but this advantage could not more than make up for the greater cost of the more difficult work.

Numerous illustrations of this fact, and of the law that cheap labor does not necessarily imply cheap work, are given in the interesting volume "Work and Wages," in which Mr. Thomas Brassey, M.P., sums up the results of his father's experience as an employer of labor. Mr. Brassey's first great contract on the continent was on the Paris and Rouen Railway. About 10,000 men were employed, 4,000 of them being Englishmen. The French laborers, working from 5 A. M. to 7 P. M., were paid 60 cents a day; the English navy, beginning at 6 A. M. and leaving off at 5 30 P. M., received \$1.25 a day; yet it was found on comparing the cost of adjacent cuttings, in precisely similar circumstances, that the excavation was made at a lower cost per cubic yard by the English than by the French. In the same quarry, at Bonnières, Frenchmen, Irishmen, and Englishmen were employed side by side, receiving respectively 60 cents, 80 cents, and \$1.20 a day. The high priced Englishman was the most profitable workman of the three.

The Depeche Railway was executed principally by native labor. The French earned from 50 cents to 60 cents a day; when doing piece work their earnings advanced to 70 cents. A large number of Belgians, somewhat familiar with railway work, were employed and earned 90 cents a day. The English were considered to be worth \$1. Ten years later, when the Caen line was constructed, Englishmen were still employed for tipping and plate laying, and on difficult work on deep rock cutting. Their wages were \$1 a day as before, while the usual earnings of the French laborers ranged from 55 cents to 70 cents. The English were employed by experienced sub-contractors directly interested in the closest possible reduction of expenditure. Similarly on the Grand Trunk Railway, in Canada, where a large number of French Canadians were employed at 84 cents a day, English navvies were paid from \$1.25 to \$1.50 a day, and did the greatest amount of work for their money. Extending the investigation to Mr. Brassey's other contracts in France, Italy, Austria, Switzerland, Spain, Germany, Belgium, and Holland, the approximate uniformity of cost for railway work is exhibited in all cases, notwithstanding great differences in rates of daily wages. So, too, in India. On the Delhi and Umritzer Railway, it was found that, mile for mile, the cost was about the same as in England, although the cost of labor, estimated by its 8 cents to 12 cents a day, was marvelously low. Each laborer did his money's worth, and no more. Skilled labor was scarce and high, and in the absence of experienced sub-contractors the cost of supervision was very great, averaging twenty per cent on the entire outlay.

In Southeastern Europe the same state of things prevailed. Unskilled labor was cheap; but in proportion as skill and manual dexterity were required, the difference in the cost of engineering work disappeared. So too in Italy, in the Mauritius, and elsewhere.

But, it may be objected, in all these examples weak men were pitted against strong men, unskilled against skilled labor; there is nothing paradoxical in the assertion that one hearty, well trained, and well fed workman may accomplish more than two or three untrained and ill fed men, costing each one half or one third as much for daily wages.

The objection may be well taken, but it fails to meet cases like the following, given by Mr. Brassey to show that it is quite possible that work may be more cheaply executed by the same workmen, notwithstanding that their wages have highly increased. At the commencement of the North Devon Railway, the laborers received 48 cents a day. During the progress of the work their wages were raised to 60 cents and 72 cents a day. Nevertheless it was found that the work was executed more cheaply when the men were earning the higher rate of wages than when they were paid the lower. Again, in carrying out a part of the Metropolitan Drainage Works in London, the wages of the bricklayers were gradually raised from \$1.50 to \$2.50 a day; yet it was found that the brickwork was constructed at a cheaper rate per cubic yard after the price was raised than before.

An indirect way of raising wages is to reduce the hours of labor. The evidence is very strong to prove that, with the same men, such advances in the cost of labor do not necessarily increase the cost of work. Indeed it may be said to be the universal rule that beyond ten hours a day the production diminishes as the time increases. With proper diligence, eight hours are enough for a man to do all he is capable of doing daily, with profit to himself and his employer.

THE RELATION OF ALCOHOL TO PHYSICAL STRENGTH

A correspondent asks: (1) Is there not a clashing of authorities in regard to the relation of alcohol to physical strength, as indicated in our recent article on alcohol, food, and force? (2) Whose experiments were therein referred to? (3) How it is possible for a dose of alcohol to increase one's working power, if, as Todd and Bowman state, "the use of alcoholic stimulants retards digestion by coagulating the pepsin of the gastric juice, thereby interfering with its action?" He adds that he does not find in his text books any authority for the position that alcohol is a force producer.

There is a serious clashing to be observed among current opinions in regard to the action of alcohol in the human system, due very largely to the fact that the effects of alcohol vary immensely with the dose, but more perhaps to the tendency of men to come to decided conclusions from one-sided or insufficient evidence, and to hold to such conclusions in spite of every evidence to the contrary.

Regarding authority in the only sense admissible in Science—that is, as the overwhelming weight, not of human testimony, but of facts, critically determined—we cannot say that the alleged clashing is at all serious. The physiological action of alcohol has been determined with as close an approximation to accuracy, probably, as that of any other substance; and while it is never possible to speak with absolute certainty in such matters, we are justified by fact in saying that the grounds for regarding alcohol as a force producer are quite as substantial as those on which we rest our belief that beef, or bread, or any other food is a force producer.

The failure of our correspondent's text books to recognize this result of recent investigations is due very likely to their having been written before the investigations were made. The latest work of eminence in this field—Pay's "Treatise on Food and Dietetics, Physiologically and Therapeutically Considered"—gives a very good discussion of the role of alcohol within the organism, and admits that, up to the time of its publication, the probabilities were, on the whole, in favor of the belief that alcohol is a force-producing food. Investigations still more recently published, notably by Drs. Anstie and Dupré, carry the discussion to the point of practical demonstration, as we have shown in another column.

The experiments, about which our correspondent inquires, were those narrated by Dr. Hammond in the address then under review.

As for the quotation from the works of Todd and Bowman, the facts would seem to prove it perfectly correct, with the addition of the first two letters of the alphabet. It is not the use but the abuse of alcoholic stimulants which has the effect described, as every drunkard's stomach shown after a debauch. In excess alcohol arrests digestion, as it arrests all the other bodily functions. In excess it is a poison, a very dangerous narcotic poison. Nevertheless in proper doses, properly administered, its use has quite the contrary effect. It facilitates digestion, and is otherwise strikingly beneficial. Its indiscriminate use, however, is always and everywhere to be deplored, since only the few are able to use it without abusing it and themselves at the same time.

Because a little at the proper time is good, too many people are apt to infer that a great deal at any time must be better. It is the logical weakness, so happily hit off in *Æsop's* fable, of the old woman with her hen. Because with one measure of barley the hen laid an egg a day, the thrifty dame reasoned that two measures of barley would make her lay two eggs a day. But they didn't. The hen simply got fat, and quit laying altogether.

As with alcohol, so with tobacco, so with articles of food like tea, coffee, spices and the rest, so with common necessities like pure air, cold water, exercise, sleep, pleasure, there are ill balanced people who are never able to discriminate between wholesome use and excess. In time, with the spread of real knowledge, with increasing mental and moral culture and the general elevation of the race, such weaknesses may be outgrown. Till then they must be borne with. To attempt their repression by force is more likely to be mischievous than beneficial, more likely to hinder than help the real advancement of society.

THE LABOR PROSPECTS FOR THE WINTER.

The condition of the labor market in this city is such as to warrant the apprehension of serious trouble among the working classes during the coming winter. Thousands are already clamoring for work. So far from being better than during the darkest days of the panic, the laborers are certainly worse off; and for this gloomy and stagnant state of affairs no definite and certain reason can be assigned.

The New York World has investigated this subject very carefully, and the long detailed report which appears in the columns of that journal bears out by actual figures the sinister opinions above given. In rough numbers, there are 30,000 ordinary laborers in this city, on whose work the existence of an aggregate of 150,000 people depends. To determine how large a proportion of this part of the population is idle, recourse has been had to the sources of employment of the greatest numbers, beginning with the city itself. The employees in the municipal service, it appears, have fallen off fully one third; or in other words, 2,000 men, out of the aggregate formerly employed, are out of work. The pay rolls of the Fourth Avenue Underground Railway improvement, by reason of the approaching completion of that work, have been reduced by about the same number; and further examination shows that the ratio of reduction in these two largest sources holds in the cases of smaller operations. Building is stagnant, and but few improvements are being made on lot property; contractors are hampered for funds, owing to the difficulty in raising security, and the

disagreements among the heads of the city government have exercised no small influence in the cessation of small jobs, which employed men by the fifties and hundreds. Taking, then, the ratio of decrease as above noted, and applying it to minor operations, a total of ten thousand men are shown to be out of employ—fully one third of the unskilled laboring population. These are the day laborers, who work, by the score or more, under contractors.

Turning next to the manufactories, we find a class of men who are not connected with the industry as pursuers of the same. They are not mechanics, nor do they fulfil such special functions as the teamsters or porters. They are mere workers, using their muscles at whatever job they are set to perform. Of these 8,000 are idle, for, from the 7,624 establishments about New York, they were the first to be discharged, and so added to the roll of the unskilled unemployed.

From careful investigation it further appears that, on each able bodied man of the class of society to which these people belong, no less than four persons are dependent. Hence there has been added to the pauper population not merely 18,000 men, but five times that total, or 90,000 souls, and this in November. Compare this aggregate with that of February of the present year—the closing month of winter, when the drain upon the public and private charities is always greatest. Then the total was 80,000; now, at the opening of winter, the figures are 10,000 higher. With regard to wages, in all departments of skilled labor and in all factories the standard has been maintained, with a few isolated exceptions. In coarse and unskilled labor, the reverse is the case. Up to the panic, the usual rates were \$3 per day, or \$12 per week; at the present time, very few contractors are paying over \$1.50 per day. The Italian laborers are getting but \$1.25; and railroad contractors in adjoining States are paying that sum, and picking men beside. The comparison between this state of affairs and that of fourteen months ago is a striking one. The pay roll then was: 30,000 laborers at \$2, \$60,000; 8,000 laborers employed by factories, etc., \$16,000; total, \$76,000. The pay roll now is 4,000 laborers on city work at \$1.75, 7,000; 16,000 laborers on private enterprise at \$1.50, \$24,000; total, \$31,000. Difference between 1873 and 1874, 45,000. Average share then to each man, \$2; now, 67 cents.

It is a fact that the necessities of life are not a whit less costly now than they were a year ago, so far as the poor man is concerned. The wholesale dealer buys his goods in gross, perhaps, cheaper; but the retailer, with lessening sales to contend with, has no reason to reduce his prices. In rent, a week's wages generally pays for one month; but this relation was adjusted before wages were cut down, so that, to provide shelter for himself and family, the working man pays not twenty-five per cent of his earnings, but fully thirty-one per cent. Coal is dearer than a year ago; if it remains at ruling rates, and counting the consumption in each family of five persons at seven paifuls per week, fifteen per cent of wages after the rent is paid must be devoted to its purchase; and thus we might continue through the necessities of life, showing that not merely is utter pauperism staring the unemployed in the face, but even those who look to their day's work for their day's living are menaced with privations and suffering.

One result of this condition is beginning to be apparent in the diminution of immigrants from Europe, and the remarkable increase in steerage passengers leaving this country, avowedly to seek labor in England. Five hundred souls left this port in an Italian steamer a week or two ago, and on one Saturday 2,000 working people sailed for Great Britain, Germany, and France. This is a bad showing, and raises questions relative to the existing tariff and the national finances, which the coming Congress must take into very serious consideration. The immediate relief is in the hands of the charitable. Public institutions are destined to be taxed far beyond their capabilities, and private charity will be called upon within the next six months as never, we think, before. Provision for meeting the outcry for food should begin at once, not delayed until the sad tales of starvation and misery fill the police reports.

It is, moreover, a serious question for capitalists and moneyed institutions to reflect upon, whether they would not serve their own ends of gain best at this time by giving these thousands of idle men the means of helping themselves. It is certain that a large number of deserving poor are, within a few months, to be thrown as a charge upon the city and county. They must be supported, and that in idleness, since, as we have already said, municipal employment offers no opening whatever. Would it not be wise for some of our great moneyed institutions to put out some of their money in aid of desirable local enterprises which will give the workmen employment? We can think of no better example than the case of the Broadway Underground Railway. The road is a direct continuation down town of the tracks of the splendid Underground Railway on Fourth avenue, and the approaching completion of the latter marks not only the feasibility and advantages of such a route within corporate limits, but also suggests the present as the best period for proceeding with the work. The plans of the route are complete, are approved by the best engineers, legislative sanction has been accorded to the project, and nothing remains but the acquisition of capital sufficient to initiate operations. A source of labor will thus be opened during the winter for eight or ten thousand men, and forty thousand people, nearly half of the total number of unemployed, will be furnished with a means of sustenance. As an investment, a first mortgage on a line through the very heart of the city, none better exists. In fine, it would be difficult to conceive of any other project now extant, capable of offer-

ing three such great benefits as work to the unemployed, relief to a population earnestly seeking a means of rapid transit, and a safe investment for capital contributed to its promotion.

THE SENSATION OF PAIN IN THE LOWER ANIMALS.

Does the insect, which we thoughtlessly crush under foot, suffer as much pain as we should were we similarly destroyed? It is generally conceded that the proper answer to the question is in the negative; and in fact it would seem much more in accordance with the wisdom displayed throughout the creation of animated nature, that those beings which from their very essentials are subject to wholesale destruction should be spared the pangs incident to the throes of dissolution. No one, except perhaps that most refined of humanitarians who had scruples about drinking water on account of the sufferings he might cause to the animalculæ therein, supposes that any real sensation of agony is experienced by the zoöphyte which we tear from the rock, or by the oyster as we cut it from its shell; but there are many who contemplate the sport of the angler with horror, and who see, in the writhings of the worm on his hook or in the struggles of his finny victim, all the tortures of human mutilation. Where then, at what particular class of being, is the dividing line to be drawn? Are only radiates and mollusks apathetic to dismemberment, or do they also experience sensation, and how far in the ascending scale does the insensibility to pain extend in its decreasing ratio?

It seems to us, and we have no doubt biological fact will bear us out in the view, that the accidental influences of cultivation, of breed, of education in human beings, and also of differences in delicacy of nervous organization, play an important part in determining the degree of suffering. It is well known that a savage will bear pain, not merely in absolute stoicism but apparently unmindfully, which if inflicted on a refined and cultivated individual would produce death or syncope. And this is not merely confined to the barbarian but extends through all grades of society. Physicians state that the sufferings of childbirth are as nothing to the squaw, or to the woman who constantly performs coarse manual labor, when compared with those of the delicate females of our upper classes. The same general rule applies to the lower animals; a finely bred horse winces under a lash that the dray brute would not notice, and the trained hound will yelp at a blow of which a street cur would think nothing. With this distinction in varieties of species before us on one hand, and the fact that both reason and general belief point to the insensibility of lower animals on the other, we are brought to the consideration of an interesting argument, raised by Dr. Crosby of this city, in defence of the practice of vivisection. It is advanced, as a generally received proposition, that the sense of pain is designed for the self preservation of all animals, and further that each is endowed with this sense to an extent only sufficient to ensure the result. That is, in other words, that an insect, for example, has a sufficient sense of suffering to keep him from walking on a hot coal; but if we threw him into the fire, his agony would be comparatively nothing as compared to that of some higher animal in whom the sense of pain is implanted for a greater and more complicated variety of purposes.

It is very difficult, almost impossible, to judge of the existence of pain in an animal by its mere physical contortion. A human being under the influence of ether, during an operation, often writhes and screams as if in great torture, and yet nothing is felt; similarly people in convulsions show every external sign of suffering, and yet, beyond mere muscular soreness due to exertion, none is present. Nor is the cry a proof of pain, for, as Dr. Crosby says, a pig will yell just as lustily, if he be merely held as he will under the infliction of a severe wound. We may judge, however, with greater security, from coincident actions on the part of the creature, as to whether suffering is or is not present. If a man, for example, while undergoing a surgical operation, should, as in a case we once saw, coolly assist the surgeon, and complacently munch an apple while the knife was penetrating his flesh, ordinary reason would lead us to the belief that his assertion that "it did not hurt" was true, and this even did dumbness prevent his stating the fact. If such be true in the one case, and in that of the animal which we know to be most acutely sensible, then it is logically true in the instances of lower orders which we are sure possess sensibility in a less degree; and hence if a horse, as in one of the cases cited by Dr. Crosby, have a fore leg shot off in battle, and thirty-six hours afterward be found quietly grazing, although the stump is horribly mutilated, then it is reasonably certain that the pain is not proportionate to the lesion, if indeed present in any degree whatever.

It is well known that animals often inflict on themselves injuries which apparently must cause suffering, and yet every indication proves the same to be absent. Rabbits have torn themselves free from traps, and been found feeding minus two legs. Rats when pressed by hunger will eat their own tails. We have seen pigs, after their throats have been cut, cease their cries and attempt to eat, and it is said that the same animals when stuck unawares often pay no apparent attention to the wound. It is curious also to notice that rabbits and rats, which can support themselves even if their locomotive process be injured, will bite off their feet if caught in traps, but that a carnivorous animal like the fox will never do so, for, once unable to run, he would starve to death. In the first case there appears to be no sense of pain to prevent the action; in the second, the sense certainly exists.

Again, crabs and lobsters drop their claws when frightened, and seem unhurt. There is a little lizard in Sicily, which, when suddenly alarmed by the blow of a cane on the rock

near to it, will break off from its tail and scuttle away, running into obstacles in its path, acting very like a ship without a rudder. Sir Humphrey Davy came to the conclusion that in fishes the sensation of pain was very trifling and the view seems proved when it is considered how infinitesimal the number of fishes which arrive at maturity is, compared to the myriads of eggs deposited.

A wasp will eat after it is cut in two; so will a dragon fly when impaled; and that the insects should suffer to any degree seems on its face impossible, particularly if the millions and millions which the birds eat be thought upon.

There is besides a very curious provision of Nature which is little understood, and which comes into play, it would appear, in all animals in the presence of imminent destruction or in cases where great pain presumably exists, either to be inflicted by a natural enemy. We allude to the action of a mouse when in the power of a cat, or of a rabbit when seized by a weasel. In the last instance the rabbit remains motionless, without a sign of pain while being killed; he is apparently, as the expression is, "paralyzed by fear." So also a mouse, and precisely so with man, for Dr. Livingstone's description of his sensations while being shaken by a lion exactly accords with such as we might imagine would be the experience of the mouse, when in the claws of the cat.

But while there is every evidence that the suffering of the lower animals is certainly less than that of man under similar circumstances, we cannot, however, coincide with the idea that it is so far absent, in the case of the brutes ordinarily sacrificed by vivisection, as Dr. Crosby seems to convey. As he states, however, an anæsthetic disposes of the question at once; and in general it is much more humane (and besides is an error on the safer side) to give the unfortunate beasts the benefit of the ether, as well as that of the doubt as to their sensibility.

Straw Lightning Rods.

The *Journal of the Society of Arts*, London, and other papers have given currency to a statement, derived from a prominent French paper, to the effect that lightning rods made of straw had been used in France, and found quite as effective for protection as metal rods, and far cheaper. President Henry Morton, of the Stevens Institute, has written an interesting reply to this statement, given in another column, in which he shows the utter absurdity of the straw lightning rods, and also takes occasion to point out, in a very clear and satisfactory manner, what kind of a rod is necessary to ensure protection, how it should be arranged upon the building, etc. This article will, we are confident, be studied with interest by all who are really desirous of possessing correct information upon the subject.

SCIENTIFIC AND PRACTICAL INFORMATION.

FALL SICKNESS.

In a lengthy article on the above subject, Dr. Hall concludes that if persons in the country where intermittent fevers prevail would adopt the precaution, in early fall, to take their breakfast before going out of doors, and keep a blazing fire upon the hearth in the living room during the morning and evening, fevers and chills would almost entirely disappear as a prevailing disease.

The importance of ridding apartments of the dampness and sharpness of the morning and evening air, and the expulsion of all miasmatic particles, cannot be over estimated by those who would have good health.

THE FRENCH AND ENGLISH TUNNEL.

The project for the tunnel under the English channel has been officially transmitted from the French Government to the English Foreign Office. Among other plans, it is suggested that the means of inundating the entire bore should be placed in the hands of each government, so that, in case of war breaking out between the two countries, the work may be rendered useless. It is calculated that a force of 2,000 horse power, operating for two months, would be sufficient to pump the water out of the tunnel.

A NEW WHITE ALLOY.

This metal, recently invented by M. Delalot, is said to be very cheap, and to possess qualities rendering it suitable to replace the various white alloys now in use. The proportions are pure red copper 80 parts, oxide of manganese 2 parts, zinc 18 parts, and phosphate of lime 1 part. The copper is first melted and the manganese added little by little. When the latter is dissolved, the phosphate is similarly mingled. The scoria is removed and finally the zinc is added about ten minutes before casting. To accelerate the fusion of the manganese, $\frac{1}{2}$ part fluoride of calcium, $\frac{1}{2}$ part borax, and 1 part wood charcoal may be used as a flux.

THE Boston Board of Fire Commissioners, taught by the recent calamity at Fall River, have issued a circular calling the attention of persons who have on their premises apparatus for preventing the spread of fires, to the necessity of a regular inspection of and instruction and drill in the same. They advise that printed cards, explaining the construction, arrangement, and use of such appliances, be posted where they cannot fail to be seen, and that the occupants be drilled as often as once a week in the use. Where fire escapes are attached to buildings, the board recommend that they be frequently used and examined.

MR. THEODORE J. HARBACH, of Philadelphia, has designed and executed, for the great Centennial event, a set of medals, of a number of historic subjects, such as Old Independence Hall, the Old Cracked Liberty Bell, a Head of Washington, etc. On the obverse sides, persons can have their business cards, making a novel and durable advertisement, which the possessor is likely to keep.

THE AUTOMATIC GAS SAVER.

It has been calculated that the average consumer of illuminating gas, in large cities, is subject to a waste which costs him from one quarter to one third more for gas than is really necessary to produce the requisite light. The reason is obvious from the fact that the pressure, as transmitted from the works, must always be sufficient to insure a full supply, not merely to the highest places, whither the gas rushes at greatest velocity, but to the lowest localities. The normal pressure, therefore, never falls to a point at which no waste at the burner can take place. Nor is it, indeed, possible for the manufacturer to supply each customer with the proper pressure to insure the greatest luminosity, for he is prevented, both by difference of situation of points of delivery and by the constant variation in the quantities drawn from the works by individual consumers. Cutting off at the service cock or using check burners simply reduces the light without affecting the proportional degree of waste; so that the only valid means of avoiding the latter lies in an apparatus which will automatically control the pressure, keeping the same uniformly at the most advantageous point, as the gas leaves the meter.

A new machine for this purpose has lately been patented (May 19, 1874), and engravings of the same are presented herewith. The noticeable feature is the absence of the straight diaphragm, heretofore commonly employed, forming a flat dish, with the valve rod secured to its center, and governing the valve through its being forced upward as the pressure is augmented. The difficulty, due to the hardening of this appliance and consequent loss of its vibratory power, is, it is claimed, obviated in the present apparatus, by making the device of leather, covered with graphite, and in telescopic form, so as to have from one and a half to six inches vibratory motion, according to the size of the machine.

The operation will be understood from the sectional view, Fig. 1.

An increase of pressure, whether it occurs in the mains or service pipe, by putting out lights, is instantly communicated to membrane, A, the tension of which is thereby increased. As the membrane expands it is forced upwards, carrying with it the rod, C, which works the valve, E, and contracts the aperture through which the gas enters chamber, G; the quantity now admitted in a given time being exactly equal to that which passed when the pressure was less and the opening greater. When the pressure again diminishes, the tension of the membrane is of course relaxed, and being forced downwards by the weight in the cup, B, again carries with it the rod, C, and the aperture to the chamber, G, is enlarged. Thus it will be seen that the saver is a self-acting valve, the operation of which depends on the equalization of antagonistic forces, namely, the pressure of the gas within the chamber, G, impelling the membrane outwards, and the weight without impelling it inwards. By the combined action of these very dissimilar agents, the area of this aperture, by which the gas enters chamber, G, is exactly adjusted to the velocity with which it moves. From the chamber, G, the gas escapes by the outlet pipe.

The comparative size of the apparatus and its mode of adjustment to the meter are shown in Fig. 2. The effect upon the flame will also be noticed. The construction is substantial and durable, the best quality of sheet copper, without seam, being used to confine the gas. The valves are ground and fitted so as to control a single burner, and may be readily cleaned of impurities.

The manufacturers add that whoever pays six or eight dollars, or even less, a quarter for gas, will save at the rate of from twenty to forty per cent on his gas bills by using this machine.

Further particulars regarding sales, and also relative to inducements to agents, may be obtained by addressing G. S. Lacey & Co., 615 Broadway, New York city.

Action of Sulphuric Acid on Iron and Steel.

Iron or steel wire which has been acted on superficially by sulphuric acid is usually found to be altered in its properties. Its weight is increased, its tenacity is injured, so that, originally soft and flexible, it easily breaks; and when a freshly broken end is moistened by the tongue, it effervesces as if acted on by a mineral acid. These effects after a time disappear. Professor Osborne Reynolds, of Manchester, has ascertained that they are owing to the absorption of hydrogen generated during the chemical reaction which takes place when the wire is immersed in the acid. He found that if an iron tube, closed at one end, be immersed in a dilute solution of sulphuric acid, hydrogen passes through

cases were, however, so entirely different that a scheme, which might succeed with the comparatively small barge, and sluggish current of the Seine, would be a total failure with ships and steamers from 1,500 to 3,500 tons burthen drawing from 20 to 23 feet of water, contending against a volume and velocity of water that, in the event of "taking a shear," will "whip" a 1,500 ton ship to and fro across the current with almost the speed and as little apparent effort as when a current of air plays with a boy's kite.

In designing the new machinery, Mr. Nish, assisted by Captain Wright, the mechanical engineer to the trust, decided that every part should be constructed as strong, and of as few pieces, and as little liable to derangement, as possible.

With this end in view, Captain Wright abandoned entirely the wheel gearing used in the wire rope and chain systems of Europe, either as a means of obtaining purchase or connecting the chain drums. The power was obtained by a pair of long stroke engines, and the connection of the chain barrels by coupling rods, set at right angles, similar to those used in locomotives.

With these instructions, Mr. E. E. Gilbert, of the Canada Engine Works, Montreal, was intrusted with the work of completing the designs and working out the details. The engines are non-condensing, with cylinders 22 inches by 5 feet stroke. The frames are of the Corliss type, extended to receive the bearing of the outer chain barrel shaft. The weakening effect of lowering the first barrel shaft to the center line of the cylinder is counteracted by using a sufficiently heavy pillow block cap, well fitted in the gibs, to maintain the full section of the

Fig. 1.

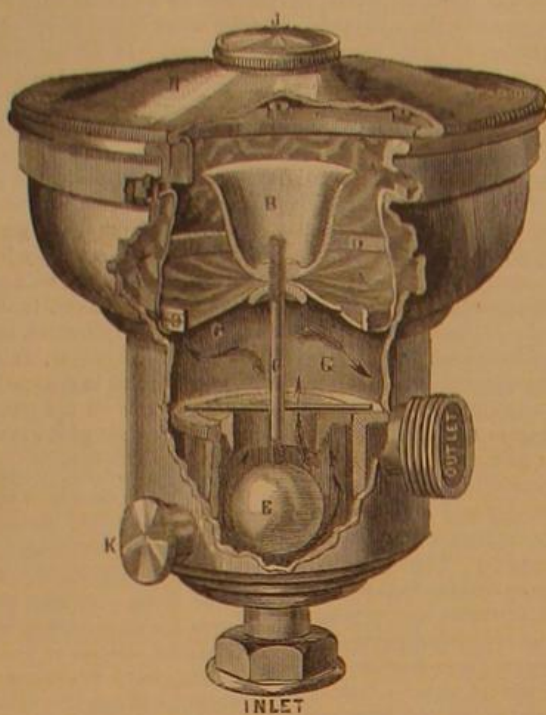


Fig. 2.



THE AUTOMATIC GAS SAVER.

the walls of the tube into the interior, and may be collected by attaching an india rubber tube to the open end of the iron one, and passing it under a gas holder. Professor Reynolds concludes that, whenever iron undergoes oxidation under water, it becomes saturated with hydrogen, and thus loses tenacity—an important consideration in the case of iron steam boilers on iron ships.

CHAIN TOWAGE ON THE ST. LAWRENCE.

By some oversight of our forefathers (not, however, made by the aboriginal Iroquois, whose town of Hochelaga was at the foot of the current), the city of Montreal was built at the head of the rapids; and as, year by year, the trade of the city has increased, the number of vessels and their size has kept pace, until the difficulty of getting ships into the harbor became most formidable, involving great expense in

frame; the brasses are closed by side keys in the usual manner. The chain barrels are 2 feet in diameter, carrying nine tons of best 1½ inch short link crane chain, the total length of the chain being 7,000 feet. The two sides are bolted together by heavily flanged cross-tie boxes, forming a very rigid structure, which, so far, has proved unyielding under the severest strains. The platform is of cast iron plates, reached by steps from the rear of the cylinders. The whole arrangement has a strong, compact appearance, and works quietly and without vibration under full steam and the severest strains.

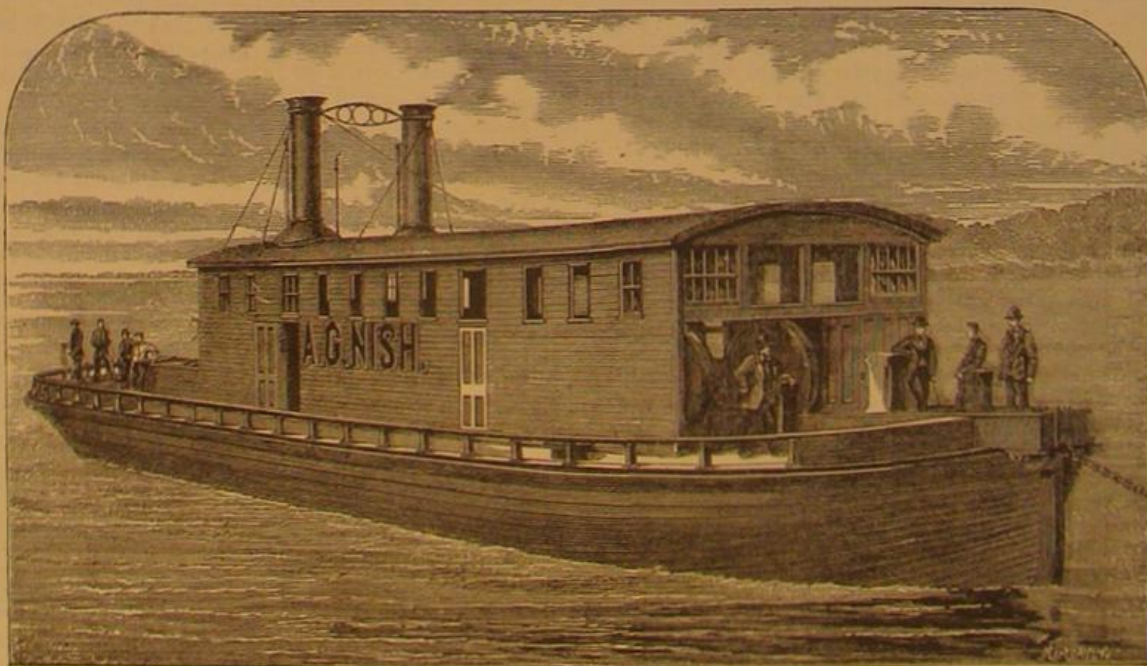
The cable was laid early in July, 1873, and the tug brought a large steamer up the rapids on her return trip from laying the chain. She was worked daily until the closing of navigation in November, 1873, without the slightest breakage, delay, or mishap of any kind, and proved in every respect a

perfect success, and, in the single instance of hauling the steamer Precursor (which would otherwise have been abandoned) off the rocks, saved her own cost five times over. In hauling off the Precursor, as the usual boiler pressure of 60 or 70 pounds did not appear sufficient to move her, the pressure was gradually increased until, at a little over 90 pounds, the stranded steamer began to slide into the deeper water. As the engines kept barely creeping round, stretching the hawsers as the pressure increased, it is probable that the pressure in the cylinders was nearly that of the boilers.

The speed of the tug against the current is from four and a half to five miles per hour, and the speed of the engines from 55 to 60 revolutions per minute. The expense of fuel, etc., is very small. The principal expense of hands is caused by the number of men required to haul aboard, in a strong current, 100 fathoms of tow line.

This, however, it was, when we last heard of the vessel, intended to remedy by the substitution of a donkey engine for manual labor. The total cost of this vessel, of which we here give a perspective view, has been \$25,000, including the 7,000 feet of chain.—Engineering.

THE iron establishments of the United States, including furnaces, rolling mills, steel works, forges, and bloomeries, are as follows: 681 completed blast furnaces, 343 rolling mills, 51 steel works, 37 forges, and 47 bloomeries.



CHAIN TOWAGE ON THE RIVER ST. LAWRENCE.

towage, and, in the case of large sailing vessels and light-powered steamers, no inconsiderable delay from the impossibility, with unfavorable winds, of getting tugs enough about a large ship to drag her up the pitch.

Various schemes were suggested for avoiding the difficulty: a ship canal coming in behind the city, piers at different points with stationary winding engines, etc.; but eventually Mr. A. Gilbert Nish, the engineer of the Harbor Commissioners, determined, under instructions from the board, to make a trial of the submerged continuous chain system, as used on the Seine below Paris. The circumstances of the two

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER II.

(Continued from page 308.)

In our preceding article we gave a map diagram of the city of New York, showing the general position of the Underground Railway. We also gave a profile of the railway, exhibiting the grades and the various kinds of work along the line; also a view of the first bridge, in front of the Grand Central Depot. We likewise gave a general description of the work from 45th street to 116th street. The last section of open cut begins at this point, and extends to 133d street, where the railway grade rises to the bridge over the Harlem Railway. Referring to the profile given on page 308, it will be seen that this open cut, from 116th to 133d street, which here passes through the most thickly settled portion of Harlem, is arranged at such a depth that it may hereafter be covered over and converted into a beam tunnel should it be deemed necessary, like the beam tunnels now existing on

hydraulic cement and clean fine sand, in the proportion of one part of the former to two parts of the latter, the ingredients being thoroughly mixed when dry. After water has been added, the mortar is not allowed to stand for any length of time.

Along the top of the retaining wall runs a parapet wall of first class cut granite, with joints and beds dressed to lay three eighths of an inch. The dimensions of this wall are, in general, a breadth of two feet at bottom, eighteen inches on top, and a height of two feet six inches. On the parapet is placed the coping of granite, ten inches thick by twenty two wide, pene hammer dressed on the outside faces, and beveled on the sides, and prepared to lay quarter inch joints. All this is surmounted by a light wrought iron railing. Over this cut the street crossings, with the exception of those of 52d and 53d streets, are iron plate girder bridges, to be hereafter described. To accommodate the cross street traffic at 52d and 53d streets, one bridge is constructed midway in the block bounded by these streets, the approaches being placed at right angles to the length of the bridge, an expedient ren-

Precipitation of Zinc by Water.

Zinc may be added to the list of metals which can be precipitated by means of water. The conditions seem to be these: If, to a solution of zinc chloride, just sufficient only of ammonia be added to re-dissolve the precipitate at first formed, the addition of water throws down zinc in the form of a gelatinous and bulky precipitate. In the cold, the whole of the zinc is not thus precipitated, but possibly with continued boiling it might be.—J. L. Davies—*Chemical News*.

Influence of Gas Refuse on Fish.

Professor Wagner, of Munich, has recently investigated the above named subject, and the conclusions he reaches are as follows: Fish put in water to which one per cent of gas refuse had been added became at once very restless, tried to jump out, turned on their backs after they had been in the polluted water for one minute, and were dead after the lapse of six minutes. In water containing one half per

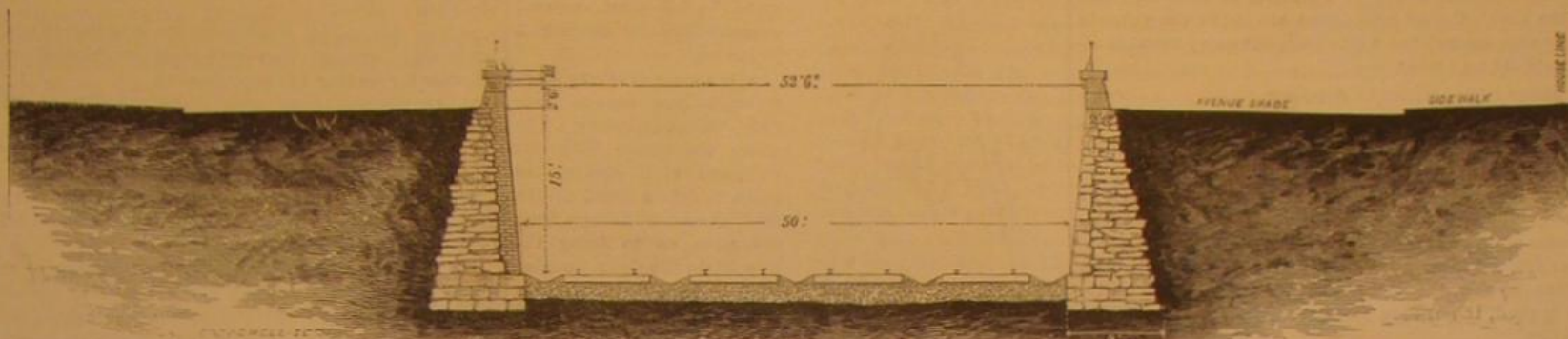


Fig. 4.—THE UNDERGROUND RAILWAY IN NEW YORK. CROSS SECTION OF THE OPEN CUT ON FOURTH AVENUE.

other portions of the line. At present there are bridges at cross streets over the open cuts. The total length of the work, from the beginning of the first open cut at 49th street to the ending of the last open cut at 133d street, may be put down in round numbers at 22,463 feet, of which 6,937½ feet consist of open cut, 4,562½ of viaduct, and 10,963 of tunneling, of the three kinds already mentioned.

This tunneling consists of three parallel and separate tunnels, a large one in the center, and on either side a smaller one. In the central tunnel, which has a span of twenty-five feet, are two tracks for the use of the express trains passing north and south; through each of the side tunnels, which have a span of thirteen feet, is a single track for the use of way trains, that on the east for trains passing north, and that on the west for those passing south. These latter tunnels have abundant arched openings for ventilation and light, and are provided at convenient points along the line with passenger stations, to accommodate the local traffic. These stations will be hereafter described.

Such, in brief, is an outline of the general plan of the whole work, and with this sketch we pass to the detailed description of the parts, taking up the work section by section, and limiting our attention to one of these divisions at a time.

Section 1. From 49th to 79th streets. F. S. Deyo, Division Assistant Engineer. Starting at 49th street, which may be taken as the southern boundary of the work, we enter the first open cut, which, gradually deepening as we proceed northward, extends to the south side of 56th street, a distance of 1,775 feet, at which point it attains its greatest depth of 13 feet. The shape of the cut, therefore, is that of an irregular wedge (the base at 56th and the edge at 49th street), with a breadth at bottom of 50 feet in the clear, from retaining wall to retaining wall, a breadth at top from parapet wall to parapet wall, of 52 6 feet, and a greatest depth of 13 feet. Of this cutting a cross section is given in Fig. 4. It is lined throughout with retaining walls of first class rubble masonry, dressed to a moderate degree of smoothness on the face, well bonded and thoroughly drained with broken stone, the drains occurring about every fifty feet and provided with openings 4 inches by 6 inches. [The open cut, from 116th to 133d streets, is similar to this, except that it is lined with brick masonry. Our engraving, Fig. 4, represents stone linings one side and brick on the other.] In general the walls extend three feet below the grade of the road, and are nine feet thick up to grade, where the thickness changes to seven feet, and then tapers off toward the top with a batter of one inch to the foot. Although the thickness of the retaining wall, both at top and bottom, will, of course, vary with the height, the thickness at the top is in no case greater than four feet, or less than two feet six inches; or, at the bottom, greater than thirteen feet, or less than four feet, the greatest thickness at top and bottom occurring in the retaining walls of the viaduct at 104th street, where the dimensions are 29x13x4. The general proportions of the walls, in the open cut below 56th street, may be given as 15x7x2'6". The stones in the face of the wall are laid with vertical and horizontal joints in cement mortar, and plastered on the back with half an inch of cement mortar well rubbed down. This mortar is composed of the best quality of Ulster county hy-

dered necessary by the impossibility of constructing them in the usual way, on account of the height and length of the bridge and the narrowness of the avenue, the span of the former being fifty-two feet six inches, and the width of the avenue one hundred and four feet. Our engraving, Fig. 5, is a perspective sketch of this bridge.

At the south side of 56th street begins the first of the beam tunnels, which extends thence to the south side of 67th street, a distance of 2,862 feet.

In our next article we shall illustrate the construction of these tunnels, which are somewhat novel and peculiar.

In our last number a typographical error occurred in connection with the name of the draftsman of the Underground Railway. Mr. William H. Hornum is the chief draftsman, under whose supervision the labor of preparing the working drawings for this great work has been done.

Changing Smooth Bore Cannon to Rifles.

A series of important experiments is now in progress at Sandy Hook, for the determination of the merits of the new plan of changing smooth bore guns to rifles by the insertion

cent or one quarter per cent of gas refuse, the fish were killed in half an hour and an hour and a half respectively. The addition of one tenth per cent of the substance killed the fish in about seven hours.

Professor Wagner recommends that, instead of throwing the refuse into streams in quantities at a time, it should be allowed to flow in very gradually, at a rate not exceeding five quarts per minute. By this means, these small amounts would be at once diluted to such an extent as to become comparatively harmless, chemical decomposition of their elements in the river water setting in at the same time; and then injurious influence on pisciculture need no longer be feared.

Steel Direct from the Ore.

The system of Ponsard, for producing steel direct from iron ore, has attracted much attention, and *La Metallurgie* gives the following account of a recent experiment made on this system.

The apparatus consists principally of a gazogene, which transforms the fuel in a series of large chambers, and of an apparatus in brick, called the recuperator of heat, which receives the flames from the furnace, and restores the caloric in the form of hot air. The compartments of the chamber serve successively for the reduction of the ore, for the reactions which are effected, and, finally, for the fusion of the whole charge in such a manner that the separation of the component parts is effected by the difference of density. These various phases of the operation require very different temperatures, and the production of these is the special object of the apparatus. On the side of the furnace doors the temperature is only that of red heat, while beyond the heat is so great that the eye is unable to support the intensity of the glow. This extraordinary heat is estimated at 3,632° Fah.

The success of the experiment is reported to have surpassed all expectation, and the result obtained is considered to demonstrate the possibility of producing steel direct from the ore without any of the transformations necessary under existing systems. Of course this is a fresh revolution in the history of metallurgical industry; and it is almost unnecessary to add that, should the system justify the report, it will prove a revolution indeed.

The Most Eminent American.

The most eminent living American is William Cullen Bryant, of New York city, poet, author, editor, and publisher. Born in 1794, in Massachusetts, he is now in the 81st year of his age, still active and vigorous both in body and mind. His first volume of poems was published in 1808, in his fourteenth year, and from that time to the present, a period of 66 years, he has been a constant contributor to the literature of the world. For the past 48 years he has been editor and proprietor of the New York Evening Post newspaper. On the recent occasion of his 80th birthday, November 4, 1874, he was waited upon by a number of our most prominent citizens, and heartily congratulated for his continued health and long and useful life. He spoke, in reply, of the remarkable changes that had taken place in the political affairs of the world during his lifetime. What marvelous discoveries have been made, too, in the world of Science during the same period!



FIG. 5.—THE UNDERGROUND RAILWAY IN NEW YORK. BRIDGE OVER THE OPEN CUT ON FOURTH AVENUE, BETWEEN 52d AND 53d STREETS.

of a coiled wrought iron cylinder, secured in position by a collar at the muzzle of the gun. A 10 inch smooth bore is thus converted into an 8 inch rifle. If the system proves successful, it will enable the Government to utilize a large number of guns now useless. The casemates of almost all the fortifications of the United States have been built of a size admitting no larger piece than the 10 inch cannon, and it has been suggested that, by a steel cylinder instead of one of wrought iron, a gun of the above caliber may be altered even to a 9 inch rifle.

Experiments thus far made demonstrate that, while the 10 inch smooth bore uses a projectile weighing 127 pounds, the same gun, altered, gives nearly double the force, a more even rate of speed, greater penetration, and increased accuracy, with a shot of 186 pounds.

Correspondence.

Straw Lightning Conductors.

"Straw is about the last material one would think of using for a lightning rod," but according to a French journal, it answers the purpose admirably. It had been observed that the straw had the property of discharging Leyden jars without spark or explosion, and some one in the neighborhood of Tarbes got the idea of constructing lightning conductors, which were formed by fastening a wisp or rope of straw to a deal stick by means of brass wire, and capping the conductor with a copper point. It is asserted that the experiment has been tried on a large scale around Tarbes, eighteen communes having been provided with such straw conductors, only one being erected for every 60 arpents, or 750 acres, and that the whole neighborhood has thus been preserved from the effects, not only of lightning, but of hail also. *The Journal of the Society of Arts* says: This statement comes from a respectable source; and the apparatus being extremely simple and inexpensive, it is at any rate worth the trial. Copper conductors are out of the question in ninety-nine cases out of a hundred, but every cottager almost could set up a straw one."

To the Editor of the Scientific American:

On reading the above account of straw lightning rods which you sent me, I made the simple experiment of measuring the electrical resistance of a small bundle of straws, and found it to be very high indeed, say a million or two times as great as a copper wire of the same size. This really disposes of the question of usefulness for lightning conductors; for, not to mention other considerations, with such a resistance as this, the straw rod, if struck, would be instantly ignited, if not even blown to pieces by an explosive combustion.

The real question of most importance to a lightning rod is, however, not what will become of it after it is struck, but, strange as it may sound when first stated, what certainty there is of its being struck. Thus: Suppose it to be proved that a given rod if struck would carry to the ground all the electricity entering it, but that this same rod was far less likely to be struck than the adjacent gable of the house: What use would such a thing be as a protection? Evidently we have first to consider the conditions which will secure the striking of the rod in preference to anything else near it, and then it will be time to inquire as to its capacity to carry off the fluid when it gets it.

I have already indicated, on a previous occasion, and you have ably discussed, the very simple conditions involved in this first and most important problem. Briefly they are these: That the lightning rod should offer a path to the earth presenting many hundred times less resistance than any of the neighboring accidental paths, made up of metal pipes, rods, nails, bolts, hinges, stove pipes, gutters, and the like, interspersed with woodwork, human beings, and other destructible matter. The electric fluid, when it finds presented to it two equally good roads, impartially divides itself and sends half its substance by each route. If it finds two routes where the obstructions or resistances are as one to ten, then it sends ten times as much of itself by the easy as by the difficult road. In order that a rod, therefore, should keep all of a flash to itself, it must offer immensely superior inducements in the way of conduction to the ground. If it does this, then it is an absolute protection to all around it, and not otherwise. Now experiment has proved beyond a question that the conducting power of a given substance varies with its cross section or weight per running foot; and therefore, when we take a rod of some good conductor, such as copper, and make it thick and connect it thoroughly with the earth, we get an easy path to the earth, for any cloud-collected electric fluid. What we must do, moreover, is to make this path so easy that no chance road shall come anywhere near it for easiness.

Under the existing state of affairs, with the large quantity of metal used in our buildings, this can only be done when we have either a very thick rod or its equivalent obtained by uniting the rod near the roof to the very water, gas, and other pipes which would otherwise be its rivals. A conductor fulfilling the above conditions will always be easily able to carry all the electricity that strikes it. We constantly see recommendations of this or that form of rod because it has more surface, and electricity of high tension travels chiefly on the surface. Grant that this last statement applies in full force to lightning, yet we see that it is of no practical importance. Increase of surface will not diminish resistance or improve conducting power. This we know by countless experiments, and the opposite is not even claimed. If, therefore, a certain rod has not substance enough in it to make it an efficiently good conductor, squeezing or twisting it into any possible form will not do it any good in the direction of securing the attention of the lightning to it; and if it is not struck, of what comfort is it to believe that, if the lightning (which went into the house and set fire to it or killed the inmates) had only gone to the rod, it would have traveled to its own delight on the outside of the same? Lightning is not to be outmaneuvered cheaply in this way, either by a thin piece of metal, whose insufficient conducting power is not increased by giving it a ribbed surface or a spiral twist, nor by a non-conducting straw.

I have said nothing here of another way in which the low resistance of a lightning rod is effective, namely, in facilitating induction and thus charging itself and the air above it oppositely to the thundercloud, by which means the discharge is still further determined in the line of the rod. But this only adds to the force of my former argument in favor of good and abundant conductors.

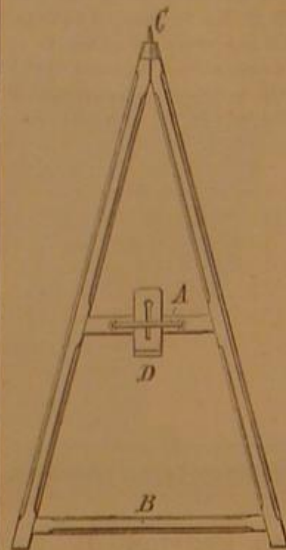
In conclusion, I can only regard the French straw theory as a canard, though if it had originated in this State (New Jersey) I should have considered it only the consequence of a verbal ambiguity, as we know that New Jersey lightning, moderately diluted, passes with great facility along a straw. Stevens Institute of Technology. HENRY MORTON.

(Possibly some of our readers may not be familiar with the fact that apple whisky is known by the name of New Jersey lightning.—Eds.)

Grinding Plane Irons.

To the Editor of the Scientific American:

Seeing in a recent number of your paper a description of a device for equalizing the wear on grindstones, I send you an illustration of a holder for plane irons, chisels, etc., with which one man can both turn the stone and grind the tool much more accurately than by holding it in his hand.



A is a piece of spring steel, 8 inches long, bent at each end, with thumbscrew. You grasp the holder with the left hand, at B, sticking the point, C, into a board or the wall, at such a distance from the stone as to bring the iron, D, in the right position on the stone. By raising or lowering C, the bevel is regulated.

J. M. RICHARDSON.
East Cleveland, Ohio.

Cable Telegraphy.

To the Editor of the Scientific American:

In your issue of November 7, 1874, you publish a communication from Mr. T. A. Edison, Newark, N. J., referring to a paper read before the British Association by W. K. Winter, on an improvement in cable telegraphy. Mr. Edison says that the principle shown was invented by himself, and patented both in England and in this country some three years ago, and that it is used by the Automatic Telegraph Company. Permit me, as the consulting electrician of that company (and as owner of all the electro-chemical automatic telegraph patents used by said company), to deny in toto the above assertion, and to show how the case really stands, in order that Mr. Edison (as well as other parties) may know how it is himself.

In the first place, the party referred to, Mr. W. K. Winter does not claim any improvement in automatic telegraphy, but simply an improved method of operating a galvanometer or other receiving instrument by means of the induction coil and earth contact, wherein he uses the primary and secondary wires of an induction coil as a balance or Wheatstone bridge, whereby the increase of the current through the primary wire not only induces a current in the secondary wire, but causes a self-induced current to flow, being in fact an equivalent for the condenser with shunt helix. Mr. Winter's patent bears date December 6, 1872.

In the second place, Mr. T. A. Edison professes to claim (in an English patent under date April 26, 1873) one or more electro-magnets in the shunt circuit, to neutralize the attenuations of the pulsations in the main line circuit, and bring the line to a normal condition, to prevent tailing upon the chemical paper of a chemical telegraph: in fact, an equivalent for a condenser with shunt helix.

In the third place, I claim (under patents of dates October 18, 1870, August 29, 1871, April 9, 1872, April 23, 1872, September 10, 1872, September 2, 1873) the use of electro-magnetic rheostats, rheostat overflow dams, condensers with shunt helices, or accumulators *per se*, in a shunt or branch circuit, in combination with an electro-chemical automatic telegraph, to bring the line to a normal condition, prevent tailing, and produce rapid work.

As a twenty years' subscriber to your valuable journal, I ask that you will do me the justice of inserting this my reply. Pascaic City, N. J. GEORGE LITTLE, C. E.

A SIMPLE PLAN OF VENTILATION.—The following simple method for ventilating ordinary sleeping and dwelling rooms is recommended by Mr. Hinton in his "Physiology for Practical Use": A piece of wood, three inches high and exactly as long as the breadth of the window, is to be prepared. Let the sash be now raised, the slip of wood placed on the sill, and the sash drawn closely upon it. If the slip has been well fitted, there will be no draft in consequence of this displacement of the sash at its lower part; but the top of the lower sash will overlap the bottom of the upper one, and between the two bars perpendicular currents of air, not felt as draft, will enter and leave the room.

IN causing anesthesia by subcutaneous injections of chloral, M. Collin states that weak solutions should be used; and when forced into veins, the operation should be performed very slowly, so as not to cause syncope. Veins near to articulations should be avoided.

M. HANNECKER uses for the oxyhydrogen light (and obtains increased brilliancy) a cylinder composed of carbonate of lime, magnesia, and olivine, compressed by hydraulic pressure. The olivine used is a natural silicate of magnesia

Institution of Naval Architects.

The Institution of Naval Architects, John street, Adelphi, London, have issued the following list of subjects on which communications are desired:

1. On the construction and armament of ships of war.
2. The effect on naval construction of torpedoes or other modes of submarine attack.
3. On the life and cost of maintenance of merchant steamships.
4. On the preservation of the hulls and cargoes of ships from the effect of bilge water, leakage, condensation, and other causes of internal decay and corrosion.
5. On the disposition and construction of bulkheads, and on their attachment to the sides of iron ships.
6. On the masting of ships, and on iron and steel masts and yards.
7. On the ventilation of ships by natural and forced drafts, with details of any system in actual operation.
8. On the fouling of ships' bottoms and its prevention.
9. On machines for the economizing of labor in the construction of ships.
10. On the use of machinery for economizing labor on board ship, whether merchant ships or ships of war, and whether for loading or manœuvring.
11. On telegraphic or other communication of orders on board ship.
12. On the construction of slips and launching ways, and on the launching of large ships.
13. On the present state of knowledge of the strength of materials as applied to shipbuilding, with especial reference to the use of steel.
14. On methods for the proper strengthening of ships of extreme proportions, and on the precautions necessary to insure their safety at sea; also on the lengthening of ships.
15. On the straining effect of engines of high power on the structure of ships, and the arrangements necessary to obviate them.
16. On legislative interference with the construction, stowage, and equipment of ships.
17. The design, construction, and measurement of yachts.
18. On floating structures other than ships, such as docks, lighters, pontoons, and so forth.
19. On ships for special purposes, such as light ships, telegraph ships, cattle and special passenger ships, and others.
20. Actual measurements or records of sea waves; their height, length, periodic time, and speed of advance; or their profiles.
21. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements, such as surface condensation, superheating, compound engines, and the like; also the value of each of these taken separately, and especially the results of any actual experiments to test this point.
22. On the friction developed in marine steam engines of different forms; and on the difference between the gross indicated horse power developed in the cylinder, and the net effective horse power available for the propulsion of the ship after working the air pump, slide valves, and other moving parts of the engine.
23. On economy of fuel in marine engines, with detailed results.
24. On methods for starting, stopping, and reversing marine steam engines of high power.
25. On marine boilers, their form, rate of combustion, and the proportion of their various parts.
26. Information as to the alleged rapid deterioration of marine boilers supplied with water from surface condensers, and the remedies for the same.
27. Exact information—either experimental or theoretical—on the efficiency of propellers.
28. On any novelties in the construction, equipment, or fitting of ships.
29. On any novelties in the construction, arrangement, or details of marine engines and propellers.

Iron Ore Bed in New York City.

We find it stated in several of our English contemporaries (and it will be news to most of our residents) that "some excitement has been aroused in New York by the discovery of a rich vein of hematite iron ore in the heart of the city, by some workmen who were digging foundations for a new building. The vein, which is 30 feet wide, was found at a depth of only 4 feet from the surface." We expect to hear, by the next foreign mail, of the erection of a smelting furnace at the mine "in the heart of the city."

We were led, by this startling announcement from across the water, to inquire into the facts of the remarkable discovery; and we learn that some laborers, engaged in digging a foundation on the corner of Washington and North Moore streets, struck a layer of scoria and cinders, the debris of some furnace, which had been used for filling in the ground a long time ago. Our reporter was shown some specimens of the "ore," deposited in barrels by the workmen, who seemed quite delighted at the sensation which their discovery had created abroad.

Curious Apples.

Doubts are entertained by some pomologists as regards the truth of the statement made that apples have been grown in which two or more varieties were blended into one, that is, apples having one section sweet and the other sour. We have seen such fruit and therefore know that it has been produced. A tree bearing apples of this nature formerly stood in a gentleman's garden in Georgetown, Mass. It was of large size, and in some years produced several bushels of

ruit. The owner sold the apples as curiosities, and frequently individual specimens brought large prices. It was exceedingly interesting to examine the crop, as one apple differed widely from another, and there was difficulty in finding two precisely alike. A few were found in which almost exactly one half was sweet and the opposite sour, but a majority were made up differently. Sections, one quarter or one sixteenth, more or less, would be sweet or sour, and the remainder would be of the opposite kind. The line of demarcation on the skin was distinctly defined, the sour portion having a reddish color, while the sweet was of a pale green. There was no mistaking the flavor; the sour portion was very sour, and the sweet very sweet. On the same tree apples grew which were uniform in kind, some being entirely sweet and others entirely sour.

This pomological freak was brought about by a careful process of budding, two buds of different varieties being divided, and one half of each joined together, so as to adhere and grow in that condition. As none of this fruit has been seen of late years, we conclude that the tree has perished.—*Boston Journal of Chemistry.*

We can corroborate the foregoing, having ourselves seen them growing, and tasted apples that were sweet on one half and sour on the other. This was several years ago. The tree which produced this curious fruit was upon the premises of the Rev. Dr. Ely, of Monson, Hampden county, Mass.

PRACTICAL MECHANISM.
NUMBER XIII.
BY JOSHUA ROSE.
PISTON RINGS.

The tension referred to in our last (see page 293) is, in all probability, caused by the unequal cooling of the ring after it is cast.

Iron and brass molders generally extract castings from the mold as soon as they are cool enough to permit of being removed, and then sprinkle the sand with water, to cool and save it as much as possible. The consequence is that the part of the casting exposed to the air cools more rapidly than the part covered or partly covered by the sand, which creates a tension of the skin or outside of the casting. The same effect is produced, and to a greater extent, if water is sprinkled on one part of a casting and not on the other, or even on one part more than on another.

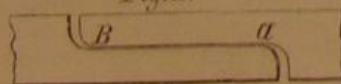
It has already been stated that brasses contract a little, sideways, in the process of boring, and that work of cast metal alters its form from the skin of the metal being removed; this alteration of form, in both cases, arises in the case of a piston ring from the release of the tension.

It sometimes occurs that a piece of work that is finished true in all its parts may unexpectedly require a cut to be taken off an unfinished part (to allow clearance or for other cause), and that the removal of the rough skin throws the work out of true in its various parts, as, for instance: a saddle of a lathe being scraped to fit the lathe bed, and its slides finely scraped to a surface plate; or the rest itself being fitted and adjusted to the cross slide of the saddle. If, when the nut and screw of the cross slide are placed in position, the nut is discovered to bind against the groove (of the saddle) along which it moves (the nut being too thin to permit of any more being taken off it), there is no alternative but to plane the groove in the saddle deeper, which operation will cause the saddle to warp, destroying its fit upon the lathe bed, and the trueness of the V's of the cross slide, and that to such an extent as to sometimes require them to be refitted.

The evil effects of this tension may be reduced to a minimum by taking the castings from the sand and placing them in a heap in some convenient part of the foundry, and covering them with sand kept in that place for the purpose: and by roughing out all the parts of the work which are to be cut at one chucking before finishing any one part.

Piston rings are turned larger than the bore of the cylinder which they are intended to fit, and, as before stated, sprung into the cylinder. The amount to which they are turned larger depends upon the form of split intended to be given to the ring; if it be a straight one, cut at an angle to the face of the ring, which is the form commonly employed, the diameter of the ring may be made in the proportion of one quarter inch per foot larger than the bore of the cylinder, sufficient being cut out of the ring, on one side of the split, to permit the ring to spring in to the diameter of the cylinder, when the ring may be placed in the cylinder and filed to fit, taking care to keep the ring true in the cylinder while revolving it to mark it. But if the ring is intended to be of the form here illustrated, the ring must be made of a larger proportionate diameter, the proportion depending upon how much the ends of the ring are intended to lap each other, the lap being from a to B , in Fig. X.

Fig. X.

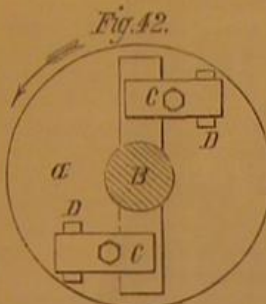


There is more work entailed in giving a piston ring this form of split, but it is undoubtedly superior to the plain one. Another plan to give spring to a piston ring is to turn it to the same diameter as the bore of the cylinder, and then to plane it all round on the inside face (that is, the bore), the result being that, when the ring is sawn in two (which is all that is necessary in this case), it will spring open and be of a larger diameter. When, however, it is placed in the cylinder, it will require to be sprung together again to the diameter to which it was turned (the split being open to the width of the split cut by the saw), so that it will not require much, if any, filing to fit it to the cylinder.

LATHE WORK.

When bolts and plates are employed to hold rough work, care must be taken to place the plates over those parts of the work which touch against the chuck or face plate against which the work is bolted; or the pressure of the plates on the work will spring it, and when it is taken out of the lathe (or other machine) it will spring back to its original position, and the part that has been cut will be no longer true, causing in many cases a great deal of unnecessary vice work. If it is not practicable to so place the plates, then those parts of the work which stand off from the face plate or chuck should be kept from springing by having wedges driven between them and the plate, which is of great importance in light work.

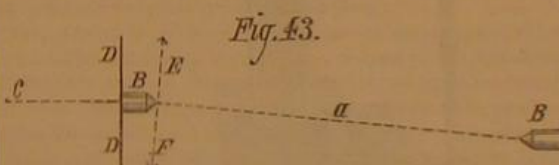
The plates (or clamps) should be so placed that the ends gripping the work travel in advance, the bolts being kept as close to the work as possible and the packing at the other end of the plates, as shown in Fig. 42. aa represents the



chuck plate, B is the work, CC are the plates, and DD are the packing pieces. Heavy cast iron work requiring much turning to be done to it between the centers should have wrought iron plugs screwed on the ends, and the centers put into the wrought iron; because centers, if of cast iron, cut, and soon run out of truth. Before boring or turning work that is chucked, if there is sufficient room, put a rod of iron between the centers to counteract any end play there may be in the spindle of the lathe. In applying a steady rest, be careful not to put an unequal strain on the work by screwing any of the jaws tighter than the others, or it will spring the work out of the straight line, in which case the cut taken by the tool will not be parallel. When there is sufficient room, use a boring bar with a small tool in it for boring holes; for the extra strength of the boring bar enables the tool to take a heavy cut, which a boring tool having a slight body would not do, in consequence of the springing.

If work chucked in a lathe is much heavier on one side than on the other, bolt a weight on the chuck (near the light side of the work) sufficiently heavy to counterbalance it, otherwise the centrifugal force generated by the revolutions of the heavy side of the work will cause it to revolve eccentrically, and to be in consequence turned untrue.

In turning a cone on anything which is held between the centers of the lathe, the dog or clamp used to drive the work must be so placed as to be able to move to accommodate the varying angle of the center line of the work to the center line of the poppet head of the lathe, as illustrated in Fig. 43.



The dotted line, a , represents the center line of the work; BB are the lathe centers. C is the center line of the poppet head of the lathe, DD is the chuck plate, E is the position of the center line of the dog or driving clamp at one side of the lathe center, and F is its position when the lathe has made one half of a revolution; from which it will be perceived that the tailstock of the lathe, being moved out of the center line of the headstock of the lathe, the end of the dog or clamp which is driving the work advances toward and recedes from the chuck plate at every revolution, and liberty must therefore be given it to move in that manner.

In boring brasses for journals, place a piece of sheet tin in the joint of the brasses, and bore them the thickness of the tin too large, which will make them fit well on the crown when the tin is taken out; for brasses bored with the joints close together always bind on the sides, and will not fit down on the crown without being filed.

The same end may be attained by boring the brasses a trifle too large, so that filing a little off the faces of the joint will let them together and down on the crown; but the above described plan is the best.

The amount of shrinkage to be allowed for contraction, on holes in cast iron of two or less inches bore, should be so little that the outside callipers being gaged to touch the shaft very lightly and the inside callipers or gage to touch the hole only sufficiently to feel the touch, you can just see plainly between the two when they are placed or gaged together.

For larger sized bores, proportionately increased allowances should be made, so that a hole of 12 inches diameter will have less than $\frac{1}{16}$ of an inch of shrinkage. Wrought iron may be given a little more shrinkage, and steel one half less in the case of the 12 inch hole.

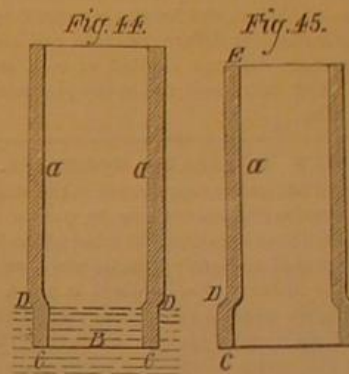
EXPANSION AND CONTRACTION.

Much labor and expense may often be saved by employing the principles of expansion and contraction to refit work. For instance, suppose a bolt has worn loose: the bolt may be hardened by the common prussiate of potash process, which will cause it to increase in size, both in length and diameter. The hole may be also hardened in the same way which will decrease its diameter; and if the decrease is more than necessary, the hole may be ground or "lapped" out by means of a lap. A lap is a mandril used to grind holes which are not quite true, are a trifle too small, or have been hardened

and cannot therefore be cut by a tool. A lap may be simply a piece of rod copper, or an iron mandril with tin or lead cast around it. The diameter of a lap should be turned to be an easy fit at both ends in the hole and a trifle larger in the middle, so that the hole which it is intended to grind will fit tightly on the middle of the mandril, the latter being about three times the length of the former.

The operation is to place the lap through the hole which it is to grind and then between the centers of the lathe; then, while the lathe is running at a high speed, supply the lap with oil and grain emery, moving the work back and forth along the lap until it will pass easily from end to end, when the lathe may be stopped and the lap indented with a cold chisel, and supplied with oil and emery, and the grinding operation proceeded with as before. The work should be held upright and on each side of the lathe alternately, so that its weight shall not cause the grinding to be excessive on one side of the hole. Only about $\frac{1}{16}$ of an inch of shrinkage can be obtained on a hole and bolt by hardening, which, however, is highly advantageous when it is sufficient, because both the hole and the bolt will wear longer for being hardened.

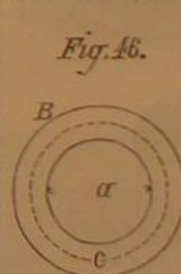
For closing long holes, boxes, etc., the water process may be employed, as represented in Fig. 44. aa is the section of



a wrought iron square box or tube, which is supposed to be made red hot and placed suddenly in the water, B , from its end, C , to the point, D ; the result is that the metal in the water, from C to D , contracts or shrinks in diameter, and compresses the hot metal immediately above the water line, as the small cone at D denotes. If then the box or tube is slowly immersed in the water, its form, when cold, will be as described in Fig. 45, that part from C to D maintaining its original size, and the remainder being smaller.

It must then be reheated and suddenly immersed from the end, E , nearly to D , until it is cold, and then slowly lowered in the water, as before, which will contract the part from D to C , making the entire length parallel but smaller, both in diameter and bore, than before it was thus operated upon.

Small holes to be reduced in bore by this process should be filled with fire clay, and the faces nearly or wholly covered with the same substance, so that the water will first cool the circumference, as shown in Fig. 46. a represents the hole, B



the circumference of the washer supposed to be operated on, and the dotted line, C , the fire clay filling the hole and nearly covering the face; so that the part not covered will cool first, and, in contracting, force inwards the metal round the hole, which is prevented from cooling so quickly by the clay and therefore gives way to the compressing force of the outside and cooler metal. This principle may be made use of for numerous purposes, as for reducing diameters of the tyres of wheels, reducing the size of wrought iron bands, or for closing in connecting rod straps to refit them to the block end, the mode of operation for which is, in the case of a rod whose strap is held by bolts running through the block and strap, to bolt the strap on the rod to prevent it from warping, to then heat the back of the strap, and (holding the rod in a vertical position) submerge the back of the strap in water to nearly one half its thickness.

If the bolts are not worn in the holes, or if the strap is one having a gib and key, they may be merely put into their places without placing the strap on the rod. Even a plain piece of iron shrinks by being heated and plunged into water, but only to a slight degree, and the operation cannot be successfully repeated. Eccentric rods which require to be shortened, say $\frac{1}{16}$ of an inch, may be operated on in this manner, in which case care must be taken to immerse them evenly so as not to warp them.

Prizes for Essays.

The Academy of Arts, Science and Belles Lettres of Caen, France, offers a prize of eight hundred dollars for an essay on the subject of the functions of leaves in the vegetation of plants. A dissertation on the present state of science on this question, including the results of personal experiment, showing new facts tending to confirm or modify the doubtful points in theories now admitted, is required. The papers must be submitted before January 1, 1876.

Another prize, of one hundred dollars, is offered by the Academy of Sciences of Rouen, for a treatise on the advantages to be obtained by the conservation and improvement of cider by the employment of the processes of heating now applied to wines. The award will be made during the coming year.

Tests for Oils.

The testing of oils, in a simple mode, has always been a desideratum. Miss Kate Crane, in the *American Journal of Pharmacy*, gives an account of a series of experiments instituted by her, which tend to show that much reliance can be placed on the cohesion figures produced by dropping oils on the surface of clean water. In her experiments, a single drop of oil was allowed to fall from a burette held at a distance of four inches from the surface of a dish of clean water. The time required for the production of certain figures was carefully noted, as it appears that several oils will produce very similar figures ultimately, if sufficient time be given. Oil of turpentine spreads out instantly and begins intestine motions, and lastly forms a beautiful lacework. Oil of cinnamon forms a figure not more than half the size of the above. In a few seconds, small portions are detached and separate into distinct drops. Oil of nutmeg forms a large figure instantly, the edge showing a beaded line. Poppy seed oil spreads instantly to a large figure, retaining an unbroken form for a few seconds; then holes appear round the edge, and soon the whole surface is broken up with curved lines. Cod liver oil spreads into a large film; a little way from the edge small holes appear, and in a minute or two the surface is studded with them. These gradually enlarge, assume irregular shapes, and become separated by branching lines. As these oils give different figures, and behave differently when mixed with one another or with lard oil, this method may be of very great use in the preliminary testing of suspected oils.

A NEW DETACHABLE HORSESHOE.

The improved horseshoe represented in the annexed illustration is so constructed that it may be put on or removed from the hoof without requiring the labor of the blacksmith. When constructed of malleable iron, its cost need not be over half that of the ordinary shoe, while it is much more durable, there being no wearing out of the rim, if that portion be constructed, as it easily may be, of steel. The inventor suggests that the device is especially adapted for use in the army, and that it might be made in various sizes, and thus issued, nothing further than a rasp, in the hands of a cavalry soldier or artilleryman, being needed to fit the shoe to the horse's hoof.

The invention, as shown in section, in Fig. 3 of our engraving, is made in two parts, A and B, fastened together by dovetails, C, at the heel, and a screw, D, at the toe. The lower part has toe and heel calks, and the foot of the horse rests upon its upper side. The portion, B, forms a metallic rim around the hoof, covering the edge of the same, so that

Fig. 1



Fig. 2



Fig. 3



when the parts are screwed together by screw, D, the shoe is firmly held. By placing a cloth or rubber cushion beneath the foot, the fit of the shoe may be tightened, and of course, by loosening the screw, the shoe may be easily removed.

Exterior views of the device, from above and from underneath, are given in Figs. 1 and 2. By its use, the horse's feet are left in their natural state, only requiring to be rasped off occasionally as the hoof grows. The shoes may be removed when the animal is turned out to pasture or when in the stall.

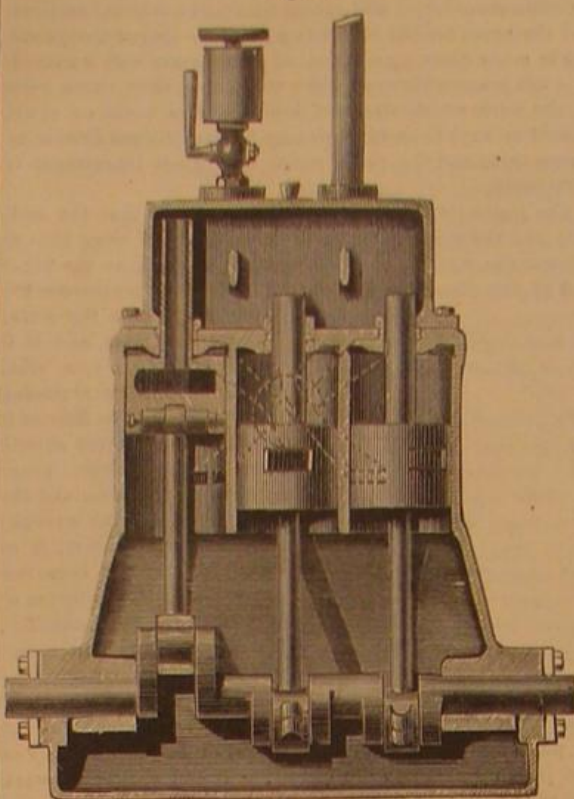
The inventor states that the entire shoe, ready for use, can be made for from twenty to thirty cents, and that, even if it be provided with a fancy polished rim of brass or other metal, its cost will not be so great as that of the common shoe.

Patented through the Scientific American Patent Agency, August 25, 1874. For further particulars address the inventor, Mr. Luther W. Griswold, Marshalltown, Marshall county, Iowa.

A VALUABLE GIFT.—The Cincinnati *Gazette* states that Thomas H. Yeatman, Esq., has presented to the Young Men's Christian Association Free Library, of that city, a complete set of the volumes of the *SCIENTIFIC AMERICAN*. They comprise thirty bound volumes, and extend from 1859 to 1874. This is a rare and valuable gift.

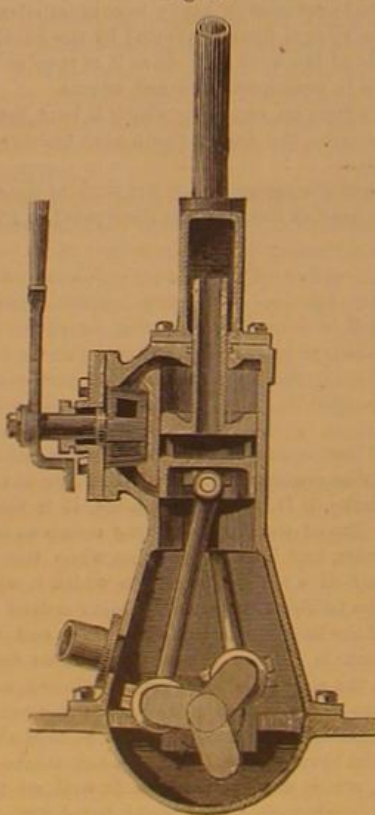
WILLANS' THREE-CYLINDER ENGINE.

We illustrate herewith an ingenious and very neat arrangement of three cylinder engine, designed by Mr. P. W. Willans, of Greenwich, England, which is now in use for driving a fan, etc., at the works of Messrs. John Penn & Co., of Fig. 1.



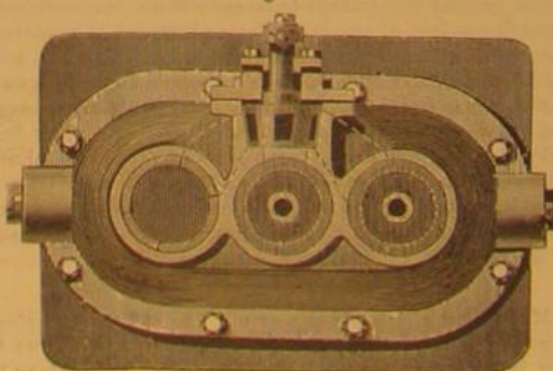
Greenwich, an establishment with which Mr. Willans is connected. In the engine in question three cylinders are used, and each cylinder is single-acting, receiving its steam upon the upper side only of the piston. The connecting rods are attached directly to the pistons, and actuate a three-throw crank shaft.

Fig. 2.



Each piston serves as a steam valve and controls the supply of steam to one or the other of two remaining cylinders. There is a steam chamber in each piston and a port in its side (see Figs. 1 and 2). Steam is supplied from the boiler by means of a hollow rod passing through the top of the

Fig. 3.



cylinder into a steam chest. When the piston has reached about three fourths of its downward stroke, the steam port in it overlaps a port formed in the side of its cylinder, and steam then passes to the top of another of the cylinders; when, on the other hand, the piston has reached about one half its return stroke, it uncovers the port in the side of its cylinder and allows the steam to escape, from the cylinder

into which it was previously admitted, into a casing round the crank shaft, from which the exhaust steam is taken either to a condenser or to the air, as the case may be.

In an engine which is required to run only one way round, the port in the side of each cylinder passes direct to the top of one of the other cylinders; but where it is desired to reverse the engine, as in the one illustrated, the ports to the top of each cylinder and those to the sides of each cylinder meet in a three-way cock (see Fig. 2); and this cock, by connecting the port in the side of any one cylinder with that to the top of either one or other of the other cylinders, reverses the engine. It will be seen that the wear upon the connecting rods and crank shaft bearings is always in one direction, namely, downwards, so that no moderate amount of wear affects the working of the engine, and the whole machine is perfectly noiseless. The tubes through the tops of the cylinders, besides forming guides for the pistons, allow a great number of revolutions to be made without any loss of power in stopping and setting in motion again, the amount of dead weight in motion being small; and the pressure upon the three tubes keeps them in equilibrium, but still maintains a constant pressure upon all the bearings. All the lubrication is done through a steam lubricator on the steam chest (Fig. 1), and whatever oil is wasted in the cylinder passes down to the bottom of the casing, and lubricates the lower ends of the connecting rods as they pass round. The upper ends of the connecting rods receive their lubrication direct from the steam chamber in the piston by way of small holes drilled through the bottom of the chamber. As the stroke of the engine is so large in proportion to the width of the steam ports, the latter are opened and closed very quickly, and there is little or no back pressure in the cylinders. By some slight modifications the engine may be made compound, and the crank shaft may, if necessary, be kept outside. A plan of the arrangement is shown in Fig. 3. When there is a casing round the axle, the feed water may be heated by being pumped through pipes passing through that casing.

We have examined the engine at work at Messrs. Penn's (says *Engineering*, to which we are indebted for the engravings), and have found it work with admirable steadiness at very high speeds. Some indicator diagrams have also been taken from this engine, showing a very good distribution of the steam. The whole arrangement is, as will be seen, very simple and compact, and there appears to be a wide field for the application of such an engine.

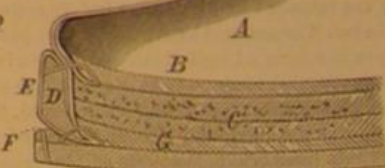
IMPROVED CORK-SOLED BOOTS.

Represented in the annexed engraving is a novel plan for making boots and shoes with cork soles, which, judging from some completed articles which the inventor has submitted

Fig. 1



Fig. 2



ted to us, is an invention both valuable and timely. A very thick but very light sole is provided, which effectually keeps out the cold and wet of winter, and in summer shields the foot from the excessive heat of the sun-baked pavements. The device is as easily repaired as the common sole, and its use in bad or rainy weather would obviate the wearing of overshoes, to most persons a disagreeable necessity.

In Fig. 1 a view of the finished boot is given, from which it will be seen that there is no detracting from the neat appearance of the covering. In Fig. 2, a sectional view of the sole shows the mode of attachment of the various portions of the same. The upper, A, is attached to the inner insole, B, by a seam. C is the cork, which is made in two layers, superposed, this construction preventing dampness passing through, however thin the material itself may be. Around the edges of the cork is placed a band of sole leather, D, covered with fine calfskin, E. This cover and the upper edge of the band are sewn in with the upper to the inner insole. By a second seam the upper, the lower edge of band, D, the cover, E, and the welt, F, are attached to the middle sole, G. The upper is taken up in both seams, giving great strength and firmness to the sole. The outer or main sole is secured to the welt by a third seam in the ordinary manner.

Patented through the Scientific American Patent Agency, June 16, 1874, by Mr. E. A. Brooks, of 1,196 Broadway, New York city, who may be addressed for further particulars.

THE BUILDINGS FOR THE CENTENNIAL EXHIBITION.

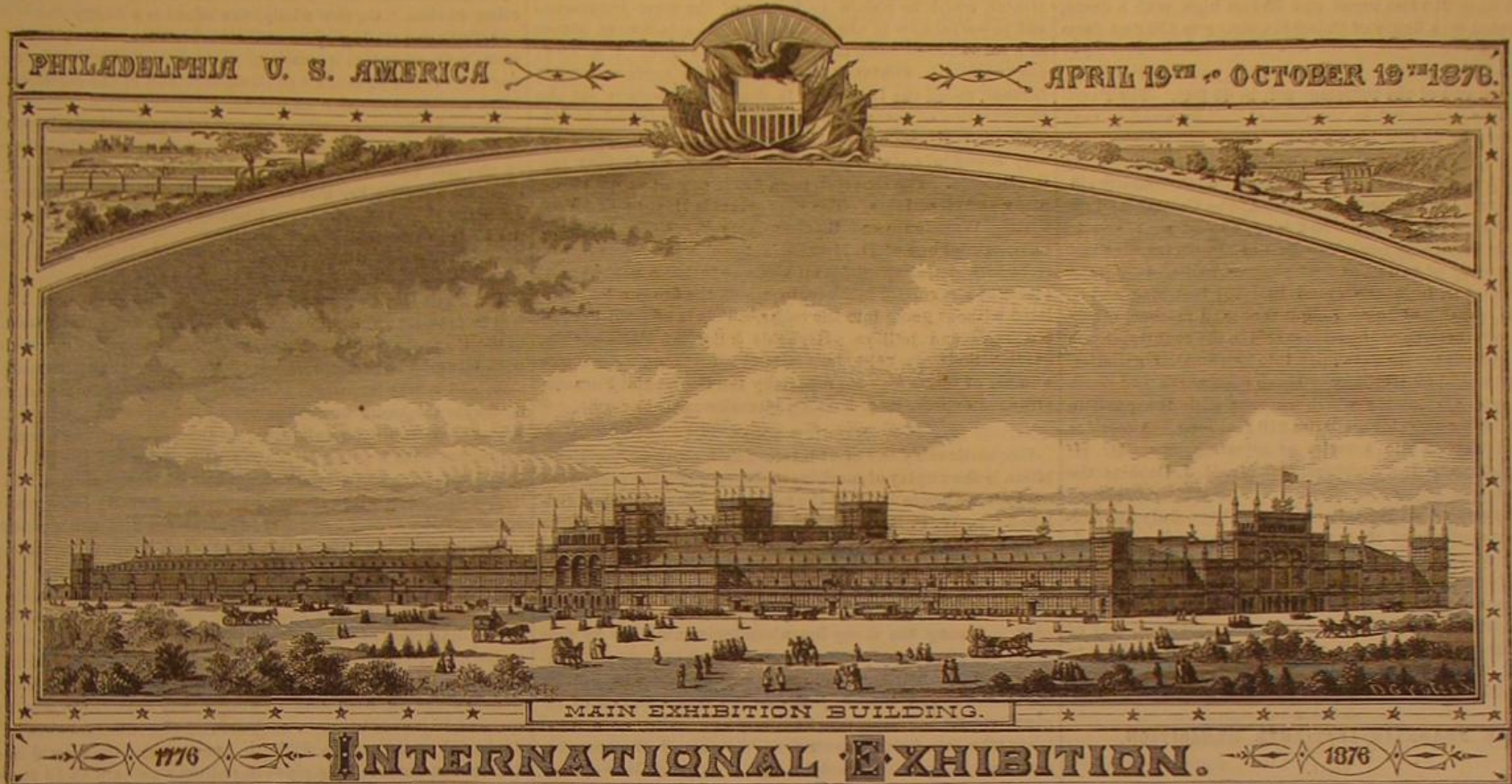
The Commissioners who have charge of the arrangements for the Centennial Exhibition, to be held at Philadelphia in 1876, have recently given to the public definite details of the buildings to be erected in Fairmount Park for the purpose. The structures are five in number, the Main Building, the Art Gallery, and the Machinery, Agricultural, and Horticultural Halls. We publish herewith views of the first two, which give an excellent idea of their general appearance and proportions.

between the long lines of exhibited articles, will be mainly 30 feet wide.

The foundations for this structure, which promises to be admirably light and convenient, as well as graceful in appearance, are to be piers of masonry, the superstructure consisting of wrought iron columns, with roof trusses of the same material. The columns are to be of rolled channel bars, with plates riveted to the flanges, and the roof trusses are straight rafters, with struts and tie bars. The columns are to be 24 feet apart; and timber panelling, to the height of

ments for the person. 4. Furniture and manufactures of general use in construction and in dwellings. 5. Tools, implements, machines, and processes. 6. Motors and transportation. 7. Apparatus and methods for the increase and diffusion of knowledge. 8. Engineering, public works, architecture. 9. Plastic and graphic arts. 10. Objects illustrating efforts for the improvement of the physical, intellectual, and moral condition of man.

In the Main Building will be located portions of all of the above departments, except No. 6, which will be placed in the



The Main Building is to be 1,880 feet long and 464 wide, covering 20 03 acres of space. The whole will consist of one floor only, except in the projections and towers, where galleries, giving additional space, will be provided, adding 1 45 acres to the available area. The great length of the building has rendered advisable the breaking of the roof lines by the addition of three transepts or cross avenues. The roof is chiefly of the height of 70 feet from the ground, the towers at the corners being 75 feet high. The central portion, 184 feet square, rises to an elevation above the rest of the building, and is surmounted by four towers 120 feet high. The central avenue will be 120 feet wide, with another, 100 feet wide, on each side of it. The passages for promenade,

seven feet, is to be filled in between the outer columns. Above the panelling, glass sashes are to rise to the top of the building, portions of the sashes being removable for the purpose of ventilation.

The engineers and architects of the structure are Messrs. Henry Pettit, Consulting Engineer of United States Centennial Commission, and Joseph M. Wilson.

Every product exhibited in any part of the entire Exhibition will be considered as belonging to one of the following ten departments: 1. Materials in their unwrought condition, mineral, vegetable, and animal. 2. Materials and manufactures, the result of extractive or combining processes. 3. Textile and felted fabrics. Apparel, costumes, and orna-

Machinery Hall, and No. 9, to which the Art Gallery will be especially devoted.

The departments will be arranged in parallel zones lengthwise of the building, the zones being of different widths, according to the bulk of the products exhibited in the particular department. The States and countries exhibiting will be arranged in parallel zones crosswise of the building, these zones also being of different widths, according to the amount of space required for the exhibits of each country. Between each department and each country will be passage ways distinctly marking the limit of each. The result of this dual system will be that any visitor or student, desiring to compare the products of the same kind from different parts



THE ART GALLERY FOR THE CENTENNIAL EXHIBITION.

of the world, may do so by passing through the building lengthwise, keeping in the zone devoted to the particular department; and any one desiring to examine only the products exhibited by any particular country or State may do so by passing through the building crosswise, in the zone devoted to the particular country or State.

THE ART GALLERY

is of a highly ornate design, and is intended to be the best and handsomest building yet erected on this continent for the purpose. It is to be constructed of granite, glass, and iron, and will be thoroughly fireproof. Its dimensions are 365 feet long, 210 feet broad, and 73 feet high, with a dome, surmounted by a figure of Columbia, rising to 150 feet from the ground.

The Central Hall will be 95 feet long, and the Pavilions, one at each end of the building, will be 45 feet. The Pavilions will be connected to the Central Hall by arcades, each 90 feet long by 40 feet high.

The lighting arrangement, the most important point in the construction of an art gallery, appears to be thoroughly efficient. From the east and west sides of the Central Hall extend the galleries, each 98 feet long, 48 feet wide, and 35 feet in height. These galleries admit of temporary divisions for the display of paintings. The center hall and galleries will altogether form one grand hall 287 feet long and 85 feet wide, capable of holding eight thousand persons, nearly twice the dimensions of the largest hall in the country. From the two galleries, doorways open into two smaller galleries, 28 feet wide and 89 feet long. These open north and south into private apartments which connect with the pavilion rooms, forming two side galleries 210 feet long. A corridor 14 feet wide opens into a series of private rooms. Mr. H. J. Schwarzman is the architect, and Mr. R. J. Dobbins the contractor.

It will be seen that the Commissioners have duly appreciated the magnitude of their undertaking, as well as the advisability of appealing to modern taste, culture, and refinement. If these two structures, the erection of which is being vigorously prosecuted, are finished as they are represented in our engravings, and the other three are equally worthy of their noble purpose, we shall, as a nation, have something to be proud of in our Centennial Exhibition, and among our best exhibits will be the buildings themselves.

THE FRANKLIN INSTITUTE EXHIBITION.

No. II.

PUMPS.

The huge water tank in the southeastern corner of the building attracts crowds of visitors. Clustered around it is to be found almost every variety of steam and hand pump. All the steam pumps are in operation, and together discharge immense quantities of water. Among the exhibitors we notice Potter & Hoffman, C. A. Conde & Co., William Cramp & Sons, Henry C. Hall & Co. (pulsometer pumps), Cooper, Jones & Cadbury, J. H. Billington & Co., and last, but not least, Thomas Shaw. The pump shown by this gentleman is one of the largest ever exhibited, and deserves especial notice. He calls it a compound propeller pump, and he claims for it especially simplicity of construction: it contains no valves, and consists essentially of but three pieces, namely, the column pipe, shaft, and propeller; therefore it is economical, costing much less than any other equally powerful pump. Its enormous power is a feature peculiar to it. The one exhibited is a 20 inch pump, and lifts 10,000 gallons per minute; with a greater speed it can lift 14,000 per minute. A 7 inch pump yields 1,000 gallons, and an 8 inch pump, 1,200 gallons, per minute. It can be used either as a force or a lift pump; can be placed at any angle; will lift sand, mud, sticks, and dirt off sunken lands without serious hurt. The light to which the water can be lifted depends only upon the power employed. A serious difficulty was at first experienced in obtaining a bearing suitable to sustain without injury the enormous weight of the column of water, together with the shafts and propellers. This has, however, now been successfully met by Mr. Shaw's effective water bearing, which consists essentially of a cast iron beam resting on the top elbow of the pump, upon which pillars are secured, supporting a stationary disk carrying an ordinary stuffing box, penetrated by the propeller shaft. A dome rises from the stationary disk, and inside of this a second disk is attached to the propeller shaft and revolves with it. Water is forced below these two disks, under a pressure equal to the weight sustained. In this way the entire weight of the revolving machinery and the greater part of the water column is supported on a film of water on which the revolving disk floats. When too much water is forced between the disks, the revolving disk is raised and the surplus allowed to escape. The water is raised into a large tank 16 feet long, from which the water falls 10 feet to the tank below. The pump is driven by a beautiful engine built by Nesbitt & Levy, of Philadelphia.

IRON AND STEEL.

The Union Iron Company of Buffalo exhibit a heavy 15 inch beam weighing 66½ pounds per foot, 52 feet 6 inches long, rolled in one heat; and a light 15 inch beam, weighing 50 pounds to the foot, 60 feet 6 inches long, also rolled in a single heat.

The Midvale Steel Works, of Nicetown, Philadelphia, make a beautiful display of their manufactures of cast steel. Several cold twisted rails are exhibited, showing the excellent quality of the steel. Forgings of various forms are also to be seen. A steel axle made of Siemens Martin steel was submitted to the following tests: A weight of 1,640 pounds, falling 20 feet, was allowed to fall on the bar, placed on

bearings three feet apart. The bar was reversed after each blow. The following deflections were observed: The first blow produced a deflection of 7 inches; the second, of ½ inch in the opposite direction; the third, 6½ inches in the opposite direction; the fourth, 1½ inches; the fifth, 5¼ inches and the sixth, 2¼ inches, each in the opposite direction.

HEATERS AND STOVES.

In heaters and stoves a very large display is made. Liebrandt & McDowell exhibit, among other novelties, the Radiant Parlor Cook, Our Mutual Friend, and the Great Centennial Range. Samuel Kirby exhibits the Phoenix Double Heater, which he claims to be one of the most economical and powerful now in use. A small grate attachment serves as a consumer in cleaning clinkers from the fire. J. A. Lawson exhibits a combined self-feeding and surface burning furnace, called the Pearl. It is designed especially for the consumption of anthracite. Other firms are adapted to bituminous coal and wood. Fuller, Warren & Co. exhibit a very beautiful open front Franklin stove, which they call the Howard. The cheerful, open fire is combined with economy and cleanliness. The Pennsylvania Heating and Ventilating Warehouse and Blacksmithery Works, of Philadelphia, exhibit one of D. Merhoun's Sons' wrought iron airtight furnaces, adapted for all kinds of fuel. A novel application of a regulator is made, by which the fire can be regulated without going into the cellar. This is effected by simple levers and pulleys. Reynolds & Son, of Philadelphia, exhibit their wrought iron airtight furnaces. Among a number of forms we note especially the Centennial Furnace, arranged expressly for burning bituminous coal or coke.

MACHINE TOOLS.

Unquestionably the most interesting feature of the Exhibition is the display of machine tools. Among the prominent exhibits we notice those of the following firms: William Sellers & Co., W. B. Bement & Son, Van Haagen, Shopper & Bro., Faris & Miles, E. Harrington & Son, and many others. As it will be impossible in the limited space of a single letter to do justice to all these exhibits, we therefore select one of the most prominent, namely, that of William Sellers & Co., of Philadelphia. Among the many ingenious tools exhibited by this firm none attract more attention, both from experts and non-experts, than their automatic gear cutting and wheel-dividing machine, and indeed justly so, for it is a marvel of ingenuity. Its movements are entirely automatic, no manual labor whatever being required on the part of the operator, save the oiling of the machine. It is impossible to convey a clear idea, in a brief description, of the number of beautiful motions of the machine. The gradual advance of the cutter, its quick return and final stop, the automatic starting of the dividing mechanism which brings the wheel around to the exact position for the next tooth, must be seen to be fully appreciated; and when once seen, there is a kind of fascination about it that makes a visitor spend a length of time in examining its beauties.

Alongside of the gear cutter is one of their self-acting slide lathes for turning and screw-cutting, the arrangements of which secure great convenience for working. The top of the shears is a plane surface. The saddle carrying the slide rest is guided on the front edge, the heads moving between the parallels. The cone pulley is furnished with five steps, giving fifteen rates of speed, rising proportionally from the slowest to the most rapid. The feed movement is especially novel. By means of an ingenious combination of friction disks, invented and patented by Mr. C. Sellers, the rate of speed is altered by the simple turning of a milled screw, no stoppage or change being necessary. The importance of this feature will be instantly recognized.

A nut shaper of entirely new design is also on exhibition. All six sides of the nut are finished at the same time, by means of a peculiar arrangement of cutters. A continuous stream of oil is supplied, to the surfaces cut, by a pump beneath, run by the machine. Nuts finished by this machine have a beautiful and characteristic appearance imparted to them. We also notice a radial drill, with adjustable arm capable of a five foot swing. The tool is so arranged that the spindle can be accurately adjusted to any point of the lathe, thus avoiding the moving of heavy work. A section of the latter is susceptible of vertical adjustment, thus adapting the machine to the performance of small work. The spindle is driven by a belt running horizontally, giving the remarkably smooth motion so characteristic of the Sellers' upright drills.

Another interesting feature of their exhibition is a lathe in which are two small grinding machines, one for drills and the other for straight edges and other hardened work requiring true surfaces. The drill grinder produces the required edge on the drill with no other labor than is needed to set it in the required position. Though a small tool, it deserves especial mention. The slotting machine is also remarkable for the originality and excellence of its construction. A vertical adjustment to the connection of the slotting bar enables it to be easily set for different heights of the work. The feed movements are readily controlled by the workman, without leaving a position favorable for watching his work. A number of other novelties are exhibited by this firm, among which might be mentioned their improved forms of Gifford injectors for feeding boilers, but want of space prevents any further notice.

Messrs. Riehle Brothers make a fine display of their scales and testing machines. They have on exhibition one of their 75 tons upright testing machines for ascertaining the tensile strength of round, flat, or square specimens of any material from 18 to 32 inches long; also one of Professor Thurston's new testing machines.

Fairbanks & Ewing, of Philadelphia, have on exhibition

a large number of their standard scales for different purposes, as well as scales graduated to the Russian, French, Chinese, Spanish, and other standard scales. Messrs. Howe, Fairbanks & Co. also make a fine display.

As an unusually fine specimen of wood work, we note the Union table, made by Samuel McCracken, of Philadelphia. It contains some 35,000 pieces of wood. Among the varieties employed are the following: oak, pine, walnut, coco, tulip, amboyna, lance, locust, mahogany, Hungarian and American ash, cedar, white holly, French walnut, satin, and rose. The American eagle is in the center, surrounded by thirteen stars, and in circles beyond this are stars and other devices. On the whole, the effect is a happy one.

A Bullock printing press and a machine for making envelopes, both in actual operation, draw large crowds of the curious. Working models of Chambers' and of the Excelsior brick machines are also exhibited.

The exhibition of drugs, dyestuffs, and chemicals is one of the most attractive features of that portion of the building on the left hand side of the main entrance. The Pennsylvania Salt Works, Powers & Weightman, Henry Bauer, John Lucas & Co., Harrison Brothers, and Rosengarten & Sons have exceedingly large displays.

Sheet Iron Gas Mains.

The Paris Gas Company have lately laid down a main 32 feet in diameter and 1,093 yards in length, from St. Maude to the Place du Trône. Hitherto sheet iron pipes covered with bitumen have not been applied to mains of that dimension, and it was important to ascertain how such pipes of a moderate thickness would answer beneath the public roads, where they would be subjected to the permanent and accidental pressure tending constantly to produce deformity.

The company had already adopted sheet iron pipes of 27.55 inches diameter, without any important deformity being produced, and it was only necessary to submit the 32.8 inches pipes to similar pressure to ascertain what effect it would produce, all theoretical calculation being deemed untrustworthy. A comparative trial was therefore made with the aid of an apparatus planned for the special purpose. A pipe of 27.55 inches diameter, of the ordinary thickness of 0.157 inch, and a pipe of 32.8 feet diameter, 0.197 inches thick, were laid in the ground in the mode adopted for the mains in Paris, the trenches having been dug in such a way that there was a space of 10 inches between each side of the tube and that of the trench, and that the filling-in above each pipe should be 3.28 feet in depth. The pipes in ordinary use are 13.12 feet in length; but in order to spread the weight over a large surface, pipes 19.68 feet long were adopted for the experiment, and one end of each was left open to allow of access to the interior.

The trial was made by placing on the soil above them pipes of lead, from four up to twenty tons weight, which were supported on a platform composed of timber, and having a surface of 86 square feet. This platform was laid upon two pieces of timber, each 19.7 inches long and 9.85 inches wide, and placed 6.90 feet apart, which represented the tyres of the two wheels of one of the axles of a locomotive of forty tons. The apparatus for the indication of the deformities produced consisted of a circular disk of sheet iron with nine radial rods, each supported by two small guides screwed to the disk, and provided with a spiral spring which kept its outer end pressed against the inner surface of the pipe. The guides of the rods were each provided with a set screw to hold the latter in place while the apparatus was being placed in the pipe. The only object of the rods at the lower part of the disk was to maintain the center of the latter in the axis of the pipe, and when the apparatus was in place both the guides of these lower rods were screwed firmly to the disk. Thus any alteration in the vertical diameter was measured from the center. In the center of the disk was an opening 7.87 inches in diameter, fitted with a piece of iron covered with leather, which carried a circular piece of paper. Each iron rod on the upper part of the disk was fitted with a pointer held in a small tube by a spring, and provided with a copper button. When the apparatus was in its place a finger was pressed on each button, and the position indicated by pricking through the paper, the leather behind preventing the point of the needle being turned. When a load was laid on the platform above, the position of the pointers was again pricked through the paper, and the difference between the two marks showed the amount of deformity produced. The results obtained were then transferred to a diagram of the same section as the pipe itself.

By comparison of the diagrams obtained, it was found that, with a load of twenty tons pressing on the pipes for 130 hours the 32.8 feet pipe had given way vertically to the extent of 2.85 per cent, and the smaller pipe of 4.30 per cent. The conclusion was that a pipe 32.8 feet in diameter and 0.197 inches thick offered greater resistance than a pipe 27.55 inches in diameter and 0.157 inch in thickness, which had already proved itself satisfactory in practice. It was found by further experiments that, when a pipe had once been deformed by a heavy load, it only recovered itself to the extent of a fraction of an inch when the load was removed. After these experiments a main 32.8 feet in diameter was laid from the gas works at St. Maude to the Place du Trône, and as the joints were made they were tried with compressed air under a pressure of 2.755 inches of the mercury manometer, the pipes themselves having been previously tested under a pressure of 75 pounds to the square inch. These trials revealed a few defects which were easily repaired. Since that time the main in question has been in use constantly, without exhibiting anything contrary to the results of the several experiments which we have above recounted.—*The Engineer.*

Etching Iron.

Much time and attention has been devoted by Professor Kick, of Prague, to the subject of etching iron with acids. His method is not a new one for arriving at a knowledge of the quality of iron or steel, having been used with some success for a long time, but the care with which the professor has conducted his experiments makes them exceedingly valuable.

Some kinds of iron exhibit what is known as the passive state, and are unacted upon by acids until this state has been destroyed by heating. The surfaces thus prepared were inclined to rust very soon. After a series of experiments with nitric, sulphuric, and hydrochloric acids, and etching solutions of copper salts, Professor Kick found that a mixture of equal parts of hydrochloric acid and water, to which was added a trace of chloride of antimony, was the best etching solution. The chloride of antimony seems to render the iron less inclined to rust, so that, after washing thoroughly in warm water, and applying a coat of dammar varnish, the etched surface may be kept quite clean.

The smooth surface that is to be etched is surrounded with a ridge of wax an inch high, as is done in etching copper plates, and the acid is poured into the dish thus formed. At a temperature of 55° to 65° Fahr., the action soon begins, as shown by the gas evolved; in winter the etching is poor. The time required is from one to two hours, but the etching should go on until the texture is visible. Every half hour the acid can be poured off without removing the wax, the carbon rinsed off, and the surface examined. If too much chloride of antimony is added to the acid, a black precipitate will soon form, which can easily be distinguished from the carbon. One drop of chloride of antimony to the quart of acid is sufficient. When the etching is finished, the wax rim is removed, the iron washed first in water containing a little alkali, then in clean water, brushed, dried, and varnished. If in a few hours it begins to rust, the varnish should be removed with turpentine, which will also take off the rust, and then varnish again.

The appearance of different kinds of iron when etched is essentially as follows: Soft or sinewy wrought iron of excellent quality is attacked so equally by the acid, and so little carbon is separated, even after several hours' action, that the surface remains bright and smooth. Fine grained iron acts the same; the surface is still smoother, but a little darker. Coarse grained and cold short iron is attacked much more violently by acid than the above. In ten minutes, especially with the latter, the surface is black. After thirty minutes a black slime can be washed off, and the surface will remain black in spite of repeated washings, and exhibits numerous little holes. Certain parts of the iron are usually eaten deeper, while others, although black and porous, offer more resistance. By allowing the acid to act for an hour or so, then washing, drying, and polishing with a file, a distinct picture is obtained. Malleable cast iron, we know, rusts more easily than wrought iron, and it is interesting to know that the action of acids is also violent, the surface being attacked very violently. Gray pig iron acts like steel; the etched surfaces have quite a uniform gray color. In puddled steel, the color, after etching and washing, is gray, with quite a uniform shade, and the lines are scarcely visible. Cement steel has a very similar appearance, the lines being very weak. In Bessemer and cast steel the etched surfaces are of a perfectly uniform gray color, with few, if any, uneven places. The softer the steel, the lighter the color.

On etching, the finest hair-like fractures are rendered prominent. A piece of steel, which looked perfect before etching, afterwards exhibited a hair-like fracture throughout its whole length. When different kinds of iron are mixed the acid attacks that for which it has the greater affinity, while the other is less acted upon than if it were alone. Etching is exceedingly valuable to all who deal largely in iron, as it enables them to determine with comparative accuracy the method of preparing the iron, as in the case of rails, etc., as well as the kinds employed.

New Phosphor Bronzes.

Dr. Kunzel, whose name will be recalled as the joint discoverer, with M. Montefiore-Levy, of the well known phosphor bronze, now announces the additional discovery that when phosphor bronze is combined with a certain fixed proportion of lead, the phosphorized triple alloy, when cast into a bar or bearing, segregates into two distinct alloys, one of which is hard and tough phosphor bronze, containing but little lead, and the other a much softer alloy, consisting chiefly of lead, with a small proportion of tin and traces of copper. The latter alloy is almost white, and, when the casting is fractured, it will be found nearly equally diffused through it; the phosphor bronze alloy forming, as it were, a species of metallic sponge, all of whose cavities are occupied by the soft metal alloy segregated from it. This phenomenon of the segregation into two or more alloys of combinations of copper with tin and zinc has long been known; and from the fact that such separation is generally massive, and not equable throughout the mass, it has been a source of great annoyance to the founder. Dr. Kunzel, however, seems to have succeeded in causing the segregation to take place in uniform distribution throughout the casting, and has taken advantage of the properties of the product, which he obtains in this manner, to construct therefrom bearings of railway and other machinery.

In heavy bearings, such as those for marine engines, the valuable properties of Babbitt metal, and similar anti-friction alloys, are well recognized; but these, being generally soft, are open to the grave objection that, where they are

subjected to considerable pressure, or even moderate pressure accompanied by continued vibration, they become distorted in form, and then fail to sustain the journals in their proper places. The device is, therefore, resorted to by the machinist of casting a hollow cage of hard metal, of proper form for the intended bearing, the cavities of which he then fills up by casting into them the soft metal alloy, which thus forms the actual rubbing surface of the bearing. The hard metal cage thus supports the soft metal within, and prevents its distortion or escape, save by surface abrasion. Dr. Kunzel claims to effect the same result by the peculiar constitution of his new phosphorized alloy for bearings. This forms its own supporting cage for the soft bearing metal, which, as alluded to at the outset, separates from it in the process of cooling. He claims that these bearings combine the very small friction and non-abrasion of the journals with the firm resistance to pressure and stability of form of bearings of hard metals. The test of practice, however, alone can decide the value of these claims, though they seem very plausible.—*Iron.*

The Waste of Power in Cotton Mills.

The winter session in connection with the Manchester, Eng., Scientific and Mechanical Society was lately opened by a paper by Mr. Evan Leigh, C. E., on the waste of power in cotton mills.

During the course of his paper, Mr. Leigh said that it might naturally be thought that England would not allow herself to be surpassed by any foreign country on any point relating to her principal and favorite manufactures. On one or two points, however, England has been most decidedly excelled by inventions originating in America. He alluded to ring spinning and belt driving, both of which were eminently calculated to save power, and consequent waste of fuel. Referring to ring spinning, he said that it had been introduced into England as an American invention more than forty years ago, but for some reason it was not generally adopted by the English spinners. Perhaps that was owing to the recent failure of the Danforth throstle, another American invention of great promise, that had been adopted by several spinners. Although the principle of the two frames was totally different, the English spinner was not to be caught again, so he fought shy of the ring frame, and it was believed that for more than thirty years not one frame on that principle was used in Great Britain. The solid advantages of this method of spinning were, however, duly appreciated in America, and the system was cultivated until the difficulties and exact mechanical requirements attending its construction were thoroughly mastered, and the result was the production of a frame that took only half the power of an ordinary flyer throstle, besides being capable of working practically at a much higher speed. At the Laconia Mill, Biddeford, Me., Mr. Leigh saw, last year, a girl minding, apparently with ease, 1,344 spindles of these frames, with the front rollers running seventy revolutions per minute, spinning No. 26 yarn, and found it quite common for such pieces to run 1,100 or 1,200 spindles with so little hurry that they had plenty of time to avail themselves of a seat which was provided for each spinner, on which she sat and leisurely watched the frames spin. He (Mr. Leigh) did not think that this arose from superior ability in the American, but simply that in foreign countries spinners are less jealous of one another, and band themselves together to discuss and test scientifically all alleged improvements.

In Boston, Mass., the Cotton Manufacturers' Association had a semi-annual meeting, at which papers were read relating to new inventions in cotton spinning and manufacturing, and a discussion followed, in which each related the results of his own experience in testing any invention in question. In that manner, every particular subject was thoroughly ventilated, and the truth arrived at, establishing a safer basis for the investment of capital than would otherwise be the case. Should opinions be divided as to the merits or demerits of a new thing, the question was adjourned to the next meeting, and, if need be, a number of experts went round to the different mills and tested the machine in question impartially, by the results produced and power consumed, which were carefully measured by the dynamometer. A report followed, and another meeting generally settled the point.

Going on to speak of the comparative advantages of belts and gearing, Mr. Leigh said that the proper application of driving belts to the machinery was a most important question. To be rightly applied, a main driving belt should move through 4,000 or 5,000 feet of space per minute, and be sufficiently wide to drive all the machinery and shafting quite easily when running in a slack state. After a new belt had been once tightened up, it should work many years without wanting any further tightening, and would do so if made of good material and properly applied, saving in the meantime a large amount of power and all the grease and labor of putting it on, to say nothing of the noise heavy gearing makes. The speaker then adduced some practical instances of the extent to which belt power might be used in connection with machinery, giving examples from the various mills he had visited in America, showing the durability and ease with which large belts did their work. The lesson taught by the big belt was imperative, namely, that there should be very light shafting run at a very high speed, with larger drums and pulleys; then very little would be heard of strap-piecing, or wear and tear of belts, working with less power and steadier production all the while. The simplest and best, and also the cheapest and most durable, method of driving by belt was to convey the power from the main driving shaft direct to each room by a separate strap, and, if more than one shaft was wanted in any room, to drive

it from the other direct by a separate strap, apportioning the width of each strap to the power it was required to drive, and, whenever a belt was necessarily short, allowing a little extra width.

Schools for Engineers.

Within the past ten years, schools for engineers have increased rapidly in this country. They are, to speak exactly, eclectic schools, where most of the positive and some of the abstract sciences are made a part of the regular course. They are not purely theoretical in their instruction, but have workshops attached, wherein the usual tools of a modern machine shop are found, and where substantial work is undertaken and subsequently sold in open market in competition with that of the trade. These schools or colleges have teachers thoroughly skilled in their professions, many of them being themselves graduates of machine shops in the most honorable and praiseworthy sense, who have from humble beginnings raised themselves to posts of importance and responsibility. Associated with these men are others of special prominence in the sciences they preside over, so that, by the union of practical example and pure theory, a student may graduate from any branch of science he selects.

It is scarcely necessary to say that such schools are of the very greatest importance to the country; and in view of this fact, it is proper to remind young men that engineering, which is largely and carefully taught there, is a profession which greatly needs thoroughly educated men. There cannot be too many in it, for the future of this country is so vast, its resources so utterly undeveloped, that there will be need of all who have fitness for engineering pursuits. Civil, mechanical, mining, hydraulic, and architectural engineers will be in demand in the future, and will find ample room for the exercise of their professions without interfering with one another. Nowhere can they find better facilities to become acquainted with the best modern practice of their callings than in these industrial schools. The ordinary colleges afford no such advantages as can be obtained at Cornell University and the Stevens Institute of Technology at Hoboken, and some others. These are well appointed establishments, with complete workshops, where Science and the practical development of it go hand in hand; where the natures, peculiar qualities, and modes of working various metals are shown in processes carried on by the student himself; not with a view of dabbling in the pursuit as a sort of experiment or recreation from dryer studies, but to produce works which are valuable.

Professor Sweet, of Cornell University, for example, sent out at one time circulars of face plates, straight edges, and angle plates of guaranteed excellence and accuracy, all of which were offered at low prices and made at the University workshops. It is notable also that, in the Stevens Institute of Technology, for example, the terms for a course of any branch are so low as to be almost nominal. By the munificence of Edwin A. Stevens, who left a large sum of money to found the Institute, residents of New Jersey are received as pupils at \$75 per year for instruction only, and non-residents at \$150. With such facilities, it is to be hoped that the rule-of-thumb engineers will gradually become extinct, and their places supplied by men who have a reason to give for their opinions, and can tell why they make a piston rod six inches in diameter, or why they sink shafts where there are no surface indications to warrant them in the outlay.

The men who practised their calling without a thorough education in it were pioneers in the profession, and are entitled to respect and consideration for their eminent services. Where there was no thoroughfare, they boldly made one; where there were no precedents, they made precedents; they were a law unto themselves, and by their native talent and sagacity established works which more timid men would never have undertaken. They made few costly mistakes; and though they may have used a few tons too much of iron or other material, it was cheap in the end, and experience has to be bought in some shape. Now, however, that a more perfect and direct road to the acquisition of professional knowledge is open through these industrial colleges, it will be the fault of parents and guardians if the coming generation does not reap the benefits of them.—*New York Sun.*

Effect of Ammonia Fumes on Flowers.

Professor Gabba has been examining the effects of ammonia on the color of flowers. It is well known that the smoke of tobacco will, when applied in sufficient quantity, change the tint of flowers; but Professor Gabba experiments by pouring a little ammonia liquor into a saucer and inverting a funnel over it. Placing the flowers in the tube of the latter, he finds that blue, violet, and purple colored blossoms become of a fine green; carmine and crimson become black; white, yellow; while particolored flowers such as red and white are charged to green and yellow. If the flowers are immersed in water, the natural color will return in a few hours. Professor Gabba also found that asters acquire a pleasing odor when submitted to the fumes of ammonia.

A new potato, known as the white queen (*reine blanche*) is being cultivated in France. In good soil, from ten to fifteen tubercles are formed, many of which attain or exceed the weight of 22 pounds. The flavor is said to be very fine. Planted in February or March, it becomes ripe in July.

Engineering learns that a rolling mill at Columbus, O., has recently contracted to furnish a large quantity of rails to a railroad company at \$33 per ton. This is said to be \$3 per ton less than the price at which the same quantity of rails could be delivered from England to the same part of the United States.

Recent American and Foreign Patents.

Improved Latch.

Edward Halsey, San Jose, Cal.—This invention consists in a pivoted and hinged gravity latch, provided with a projecting pin or lug, and so attached to a gate adapted to swing in either direction laterally that, when the gate is being swung shut, said latch will turn on its pivot, and the pin or lug ride up one of the inclines of a striker plate, which is fixed to the post, and engage a notch formed therein.

Improved Seamless Rubber Nipple.

Charles B. Dickinson, Brooklyn, N. Y.—This invention relates to the seamless rubber nipples employed upon the mouth and neck of bottles from which infants are expected to suck some liquid nourishment, and consists in an improved construction whereby they may be more conveniently cleaned out by a swab, may be more quickly taken from the mold, and be able to shut out or exclude all passage way for the air when the child bites or closes its gums upon it.

Improved Process of Treating Natural Oils.

Julius Schubert, Parkersburg, W. Va.—This invention consists in combining, with a vessel in which oil is to be purified by the action of hot water, of a heating coil having an exit pipe for any steam that may be generated. This simple improvement enables the imparted heat to be restrained within a degree of temperature that will not injure the oil, while the impurities are precipitated with equal certainty.

Improved Car Coupling.

John Carpenter, of Mariner's Harbor, N. Y.—The coupling link engages with jaws on the ends of two levers. The drawhead is made in two parts. The levers extend back between the parts of the drawhead, and are held together by springs. The jaws lap past each other; but a space is left between the levers, in which is placed a spreading bar. This is on a horizontal rod, which passes through the drawhead. On the ends of the rod are levers, attached by square sockets, by means of which the rod and opener are turned for spreading the jaws and uncoupling the cars. The coupling link has springs, which allow it to be varied from the horizontal in either direction, up or down or laterally, as may be necessary, in entering the mouth of the opposing drawhead.

Machine for Burnishing the Edges of Boot and Shoe Soles.

Levi Hussey, New York City.—This is a machine for burnishing or polishing the edges of the soles. The improvement consists in a gage which may be adjusted according to the thickness of the sole, and held in position by a screw rod which works through a stand. A spiral spring takes up any slack of the screw, and always holds the gage evenly up to the polisher.

Improved Raker and Lender.

Samuel D. Muse, Monticello, Miss.—This is a rake on a wheeled truck, combined with a vehicle having a rearwardly tilting body, the former being movable within the body of the latter. The object is to provide a simple and efficient means for gathering pine straw to be used as a fertilizer.

Improved Reed Organ Attachment.

Simon B. Shoninger, New Haven, Conn.—A *voix celeste* stop draw connects with mechanism so as to slightly raise the bar of the octave coupler, so that when a key is pressed down it will slightly open a valve of the octave below, giving the reed just enough air to sound, but not quite on the same pitch as when the coupler stop is drawn out. The coupler bar is divided so as to operate both sections when the lower section is used, but enabling the upper to be operated singly.

Improved Car Coupling.

Gillman H. Ames, Fort Fairfield, Me.—In this invention, the drawhead is provided with an upper and lower chamber. In the upper one of which is a coupling bar having lateral projections which secure it to the drawbar. These projections work in slots in the sides of the drawbar, which have an upward and somewhat receding direction. The coupling bar within the head of the drawbar rests on hook-shaped feet. The slots in the drawhead, in which the projections on the coupling bar work, serve a fourfold purpose, namely: 1. They let the bar rise to allow the coupling bar of the opposite car to pass under the outer hook, the said hook immediately dropping down into the slot in the end of the approaching car. 2. They give the bar a tendency to draw downward, thus preventing the cars from being casually uncoupled. 3. They allow the draft to be raised to fit higher cars of the old style. 4. They give the bar a receding motion when it comes in contact with obstacles, thus breaking the force of the collision. In the lower chamber is a link, fastened by a pin, to adapt the same drawbar to be used with the ordinary drawbars.

Improved Stocking Supporter Clasp.

Bachel Eberle, New York City.—This invention applies specially to a catch which takes hold of the stocking, which catch is attached to the end of the supporting strap. Button holes in the top of the stocking are thus obliterated.

Improved Sofa Bed.

William Livingstone, Springfield Store, N. Y., assignor to Denzer, Medicus & Co., New York City. This is a movable head piece of the sofa or lounge, which moves in suitable supporting slides on the main frame, and gives a rigid support to the binged section when thrown open. The intermediate space between the head piece or back is provided with flexible bands, which are stored into a recess of the back and covered by a pivoted face piece.

Improved Washing Machine.

William Hilton, Agency City, Iowa.—Half bearings rest upon the journals of the roller. Upon guide pins attached to said bearings are placed coiled springs. The upper ends of said pins pass up through ends of a wooden spring, to the center of which is attached a guide pin, upon which is placed a coiled spring. The upper end of the pin passes through the center of another wooden spring, which rests upon the coiled spring, and the ends of which pass through slots of the standards. Several holes are formed in the standards to receive holding pins, so that the tension of the springs, and consequently the pressure upon the clothes, may be regulated at will.

Improved Screw Press.

Cyrus W. Crenshaw, Athens, Ala., assignor to himself and J. M. Townsend, same place.—The screw has a semicircular groove. The nut also has a semicircular groove, instead of the usual thread, and, besides, has a circular spiral channel connecting each end of the spiral groove, which has a hollow spiral flange to provide for the passage. Balls, with which the spiral groove and the return channel are filled, form a continuous row on which the screw rolls, instead of sliding on threads, to lessen the friction. When the screw turns downward, the balls roll down into the channel and return to the top of the nut, those being forced down by the screw pushing them in the channel up to the top; and when the screw turns upward, the balls roll up in the groove and pass down in the channel.

Improved Quilting Attachment for Sewing Machines.

William H. Nail, Blandville, Ill.—The quilting rollers are arranged in a beam, so that they can be readily lifted out of their bearings, and the hangers of that beam are so pivoted to the frame that the beam can be readily swung up to pass over the head of the sewing machine to allow of passing one of the quilting rollers under the arm and behind the needle bar and presser. The friction is applied to the quilt rollers by the lever, tightening pulley, and belt, and the pulley has teeth working in holes in the belt, and also a dividing wheel on its axis to govern the shifting of the quilt on the rollers for graduating the spaces between the seams, by means of arms on the wheel, and a stop spring for arresting and holding the wheel.

Improved Needle Threader.

John M. Stamp, Washington, D. C.—The object of this invention is to provide a means of easily threading the needle of a sewing machine. It consists in the peculiar construction of a hook which passes through the eye of the needle and seizes the thread, the said hook being attached to a shank, which is of a size barely small enough to allow its passage through the eye, and the hook being so cut away on both sides as to reduce the thickness to that of a knife's edge, so that the thread will bend short and to a point around the edge, and also have room to flatten itself on the sides of the hook when passing through the eye of the needle.

Improved Cotton Scraper.

William Sandlin, Minden, La.—This scraper, the lower edge of which is so formed as to fit upon the collar of the plow, is provided with two lugs, one of which rests against the land side of said collar, and the other upon its upper side. The scraper is so formed as to guide the soil and weeds removed by it back to the mold board of the plow, along which they pass, and are covered by the soil. Upon the rear end is formed a shank, which extends up to the plow beam, and may be secured to it.

Improved Sun Dial.

David B. Seefeld, Auburn, Oregon.—This is an adjustable, pivoted, graduated sun dial, having the upper edges of the meridional gnomon straight, and a northern face provided with beveled edges, and graduated to denote the time upon the face.

Improved Middlings Purifier.

John T. Wright, Richmond, Va., and Eikanah Bateman, Howardsville, Va.—This invention relates to certain improvements in middlings purifiers. It consists in the combination of a polygonal reel having bolting cloths of different degrees of fineness and ribs attached forming buckets with the diagonally set vanes of a fan by which a blast is made in the direction of the vent. It consists further in the arrangement of a suction fan and roof in the top of the case and a compartment in the end of the same, whereby the lighter and more worthless particles of the middlings are separated from the heavier gralus, and the latter left in a better condition for regrounding.

Improved Life Preserving and Diving Apparatus.

John P. Schmitz, San Francisco, Cal.—This invention relates to certain improvements in life-preserving and diving apparatus. It consists in the peculiar construction of a floating air receiver in combination with an elastic hose, and also in the combination with said elastic hose of sections of metallic tubes for the purpose of preventing the collapse of the hose when subjected to the pressure of the water.

Improved Lubricating Compound.

Charles F. Benedict, Richmond, Va.—This invention consists in a process of preparing a lubricating grease for car axle journals by first boiling oil or fatty matter until it loses its spongy appearance, next boiling the resultant in a solution of soda and carbonate of lime until it saponifies and thickens up, and finally passing it through a grinding mill; also in a new article of manufacture consisting of saponified axle grease or lubricant of a waxy consistency.

Improved Fifth Wheel.

Paul La Belli, Monroe, Iowa.—This invention relates to certain improvements in fifth wheels, designed to dispense with the use of kingbolts and perch plates, and make a neater finish. It consists in an upper plate having a flange bent around for the double purpose of forming a guide and a stop.

Improved Clothes Wringer.

Leander Becker and Stephen M. Smith, York, Pa.—This invention relates to certain improvements in the construction of wringer frames. The improved frame consists of three pieces: the piece forming the bearing of the lower roll, the piece forming the bearing of the upper roll, which is pivoted to the first piece, and a third centrally pivoted lever, at one end of which is a clamping screw for attaching the wringer to the tub, and at the other end a rubber spring that bears against the middle of the piece forming the bearing of the upper roll, by means of which arrangement the pressure of the rolls is regulated by the clamping screw.

Improved Pocket Book.

Gabriel Jasmagy, Brooklyn, N. Y.—This is a pocket book, the partition or pocket part of which is attached to the gussets by means of an interior lining of the latter, provided with as many projecting loops of a band or strip as there are partitions of the pocket book. These are drawn through slots of the lining, and pasted between the double partition walls.

Improved Machine for Mining Coal.

Michael Wright, Clinton, Pa.—In this device the stock will turn on its fastening screws, and the drill on the trunnions, so that a hole may be bored in almost any direction. The operating crank is made in two parts, so that it can be lengthened or shortened to adapt it to the strength of the operator. This machine is especially designed to be operated by hand, but other power may be applied.

Improved Car Axle Box and Lubricator.

John M. Brosius, Richmond, Va.—This invention consists in the journal gate with excisions at the lower end, and placing in the guide groove the triangular blocks or inclined strips, so that the gate does not require to be held by hand, wedge, or other device, but will rest in position until the journal is inserted in the box, and then rise as the journal is pressed inward; also in forming a box or projecting plate on the inside of axle box, and at the end where the journal enters, so as to prevent the lubricant from being splashed out at the joint; also in making an annular recess or groove in the axle, and near the journal, for the purpose of receiving an elastic ring that serves to form a packing to prevent the escape of the lubricant, and to exclude grit and dirt from working into the axle box; also in making the piece that is intended to hold the lubricating fabric up to the journal of a single longitudinal metallic plate spring, so that it may be readily bent to accommodate itself to any inner conformation of axle box, be easily fastened by the screw in front, and be prevented from lateral play by a simple plate or cross bar which may have a turned-up end. In order to cause the lubricating fabric to slide readily with the journal in passing from one gate of road to another, it is attached to a piece or holder which is slotted, with subjacent dovetail tenon, and thus allowed to slide within the dovetail groove or channel of the bent plate. It also consists in pivoting the latter on a crosspin in lugs of the spring, so that the fabric will automatically adjust itself to and bear always along the whole length of the journals.

Improved Railway Switch.

Nathan F. Carter, Orford, N. H.—The object of this invention is to cause the switch to be automatically shifted in advance of the engine by a device on the engine under the control of the engineer. The switch rails are connected to a switch bar, to which is applied a toothed rack, with which a segmental wheel gears to shift the switch rails forward and backward, the said wheel being geared with a toothed bar for being turned by it. This bar extends along the track each way from the switch a suitable distance for being worked by the locomotive, and it gears at each end with upright shafts. Each upright has an arm, with one of which a cam on the locomotive is to come in contact as it advances toward the switch to set the bar in motion for shifting the switch. The switch bar carries a locking bolt which drops into a hole immediately after the rails have been shifted to hold them fast while the cars pass, and arrangements are provided which afterward lift the bolt out and free the switch.

Improved Water Elevator.

Edmond P. Le Blanc, Rouma, La.—This invention consists of a series of buckets moving about in a circular channel below a horizontal wheel by which they are actuated. The channel at one side descends to a cavity, into which the water flows, and then rises to the place of exit for the water. The buckets are contrived so as to be raised off the bottom of the channel immediately after passing the exit, and lodged on the wheel, to be carried thereby without friction until they return to the point where they take the water again, when they are tripped and let fall again to the bottom of the channel. The machine is designed to afford a simple and cheap means of raising water short distances for irrigation, drainage, and the like.

Improved Parlor Cooking Stove.

E. Mortimer Deey, New York City.—This invention relates to improvements in parlor cooking stoves of the kind for which a patent was granted to same inventor July 16, 1872, being a fire grate with a top, which may be used for cooking, and may be converted into a self-feeding top, and a couple of ovens behind the grate, one being above another. The back plate rests on the front edge of the bed plate, and has corrugations in its front face which correspond with passages through the bed plate, over which is a register to open or close them at will, for causing the draft to pass down through the fire grate or through the back, as may be required. The upper oven may be readily removed for the application of a false top plate with pot holes in it for use in supporting cooking pots and the like. A pot hole in the top, and under the removable top, is fitted in a circumscribing groove for preventing the escape of gas.

Improved Device for Suspending Pictures.

Charles Mason, New York City, assignor to Carl Most, Greenville, N. J.—This invention consists of a suspension cord, which is passed through the side staples of the picture frame, and then through a hollow tapering socket to a tapering key with central and side perforations and grooved or ribbed surface. The ends of the cord are drawn through the central and side perforations of the key, and formed in a knot below, to be easily adjusted by drawing back the key, being then firmly locked in position in the socket.

Improved Picket Fence.

Robert H. McGinty, Moulton, Tex.—This is an improvement on the fence for which the same inventor obtained letters patent dated October 14, 1873. The posts are connected and supported at their top ends by wires. At certain distances are placed bracing posts in pairs, having their lower ends spread apart and their upper ends beveled and brought together, and fastened by bolts. The supporting wires connect with these bracing posts. Short stakes are driven into the ground, from which stay wires extend and connect with the bracing posts. The supporting wires cross each other between each two of the posts.

Improved Corn and Feed Mill.

Lauritz Meland, Iowa Falls, Iowa.—This mill is intended merely for grinding corn and feed, and is adapted to be driven by horse power. The operation is as follows: The grain is first cracked as it falls between cylinders at one end, and is carried against a blade and then pulverized between the cylinders and esse, while, at the same time, it is gradually transferred to the discharge openings at the upper and lower sides of the chamber containing the cylinders. The latter have corresponding acute-angled spiral furrows and edges, and the blade projects up intermediately nearly or about to their middle.

Improved Crank.

William Henry Phillips, Bridgeton, N. J.—The end of this shaft is made to receive a round crank and a square crank. The crank is made in two parts. One part is fitted to the round portion of the shaft, and the other part is made open, so as to fit on and enclose three sides of the square portion. The open part will readily slide on the other portion sufficiently far to detach the open end from the square of the shaft. The motion of the open part is limited by a mortise and pin. The crank handle is also in two sections, one attached to one part and the other to the other, each being a semicircle, and forming an entire round handle when the shaft is being turned for elevating. There may be a spring to force the two parts from each other when they are not grasped by the hand. This crank may be used in perfect safety, as no serious accident can happen should the handle slip from the hand in elevating.

Improved Vehicle Spring.

Milton Newell, San Francisco, Cal.—This consists of the carriage body jointed at each end to arms of a transverse rockshaft, and also connected by a spring with an arm of the rockshaft at the opposite end in such a manner that the revolving action of the weight of the body on the rockshaft is opposed by the springs. An easy up-and-down motion is thus produced without any forward and backward or side motion whatever, and the apparatus employed is all of a simple and cheap character.

Improved Seed and Grain Drill.

Asa Canterbury, Gibson City, Ill.—In this seed drill, there are sharp, deeply furrowing wheels and curved spouts to drill the grain, reversely curved spouts to drill the grass seed on the nearly filled furrow, and small blunt wheels that press the pulverized soil to and shallowly over the grass seed.

Improved Machine for Bending Bolster Stake Irons.

Bernhard Jensen and Nicholas Huetter, Kenosha, Wis.—This is a machine for bending bolster stake irons in cold state, for farm, lumber, and other wagons. It consists mainly in the arrangement of a strong swinging lever with obliquely slotted end, and a bending roller pivoted to the main supporting block, which is firmly set into a vise. An adjustable main roller for bending (in connection with the lever end and a curved guide frame with side extending curved supporting part) the bolster stake irons by the different operations of the machine.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF METALLURGY. By William Henry Greenwood, Associate of the Royal School of Mines, England, F. C. S., etc. Volume I, containing Fuel, Iron, Steel, Tin, Antimony, Arsenic, Bismuth, and Platinum. Illustrated by Fifty-Nine Engravings. Price \$1.50. New York: G. P. Putnam's Sons, Fourth avenue and 23d street.

The literature of metallurgy has long needed popularization, more on account of its diffuseness than its deficiency. Mr. Greenwood has succeeded, in the treatise before us, in condensing the labors of many writers more or less precise and authentic, into a handy book of reference, containing well digested information and trustworthy formulae. The work is especially adapted for students, for whom it is intended, being Volume I. of No. 19 of Messrs. Putnam's Advanced Science Series.

THE INTERNATIONAL REVIEW. Published Six Times a Year. Volume I, No. 6. Annual Subscription, \$5. New York: A. S. Barnes & Co.

We are pleased to observe that this serial maintains its uniform excellence. The issue now before us contains a thoughtful and original essay by Philip Gilbert Hamerton, a rising star in critical literature, as well as an exhaustive treatise on the iron resources of the United States by Professor J. S. Newberry, which we commend to the perusal of manufacturers and statisticians.

SURVEY OF THE WEST OF THE HUNDREDTH MERIDIAN.

Report upon the Ornithological Specimens collected in 1871, 1872, and 1873. Catalogue of Plants collected in 1871, 1872, and 1873. Washington, D. C.: Government Printing Office.

THE HEATHENS OF THE HEATH, a Romance, Instructive,

Absorbing, Thrilling. By William McDonnell, Author of "Exeter Hall." Price, in paper, \$1; in cloth, \$1.50. New York: D. M. Bennett, 335 Broadway.

EULOGY ON CHIEF JUSTICE CHASE, delivered by W. M.

Evarts, before the Alumni of Dartmouth College, N. H. Price 25 cents. Hanover, N. H.: J. B. Parker.

ANNUAIRE DE L'UNIVERSITE LAVAL, POUR L'ANNEE 1874-75.

Quebec, Canada: A. Coté et Cie.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 30 to October 15, 1874, inclusive.

BOILER WATER INDICATOR.—J. E. Watson, Louisville, Ky.
CLEANING SUGAR, ETC.—J. O. Donner, New York City.
CRUSHER, ETC.—T. A. Weston (of Philadelphia, Pa.), Birmingham, England.
FLOOR CLOTH FABRIC.—H. B. Meech (of New York City), London, England.
JOURNAL BEARING.—C. A. Hussey, New York City.
LAMP.—I. R. Forbes, New Orleans, La.
LOOM.—C. H. Chapman, Shirley, Mass.
LOOM.—L. J. Knowles, Mass.
LUBRICATING JOURNAL BOX.—C. T. Pierson, Rimapo, N. Y.
MAKING OXYGEN, HYDROGEN, ETC.—N. H. Edgerton, Philadelphia, Pa.
MUCILAGE BRUSH.—C. A. Hussey, New York City.
PENCIL CASES, ETC.—A. T. Cross, Providence, R. I.
PRINTING MACHINERY.—R. M. Roe, New York City.
SEWING MACHINE EMBROIDERER.—R. M. Rose, Williamsburg, N. Y.
STEAM PUMP, ETC.—E. Cope and Co., Hamilton, Ohio.
STEAM REGULATING VALVE.—J. E. Watts, Lawrence, Mass.
VARIABLE EXHAUST FOR ENGINES.—O. Stewart, East Cambridge, Mass.

Business and Personal.

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

Agricultural Implements, Farm Machinery.—Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N. Y.
Engine Governor Dealers, please send descriptive circulars to Stover & Matheson, White Rock, Mich.
"Workshop Receipts" for Manufacturers, Mechanics, and Scientific Amateurs. \$2, mail free. Send stamp for Illustrated Catalogue. E. & F. N. Spon, 446 Broome Street, New York.

For Sale—Baldwin's Hand Planer, planes 22 inches. Address Wm. E. Lewis, Cleveland, Ohio.

Boiler Rolls and Shears Wanted.—Car Wheel Borer and 30 inch Slotter for Sale. A. G. Brooks, 422 Vine St., Philadelphia, Pa. Cheapest Injectors and Damper Regulators.

New 24 in. Turbine for Sale. N. Stowell, Leominster, Ma.

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Johnson's Universal Lathe Chuck. Address Lambertville Iron Works, Lambertville, N. J.

Best Philadelphia Oak Belting and Monitor Stitches. G. W. Army, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for new circular.

Answers to Correspondents.

A. R. can copper iron castings by the process described on p. 155, vol. 26.—F. C. M. will find a recipe for black ink on p. 203, vol. 26, and for copying ink on p. 59, vol. 25.—G. S. will find directions for making wax into sheets for flower making on p. 50, vol. 30.—W. P. can brown gun barrels by the method described on p. 266, vol. 26.—T. W. W. will find details of a process for steeling or case-hardening iron on p. 251, vol. 27.

(1) H. L. B. asks: Does the locust, that comes every seventeen years in Pennsylvania, come in the same year all over the world? A. No.

(2) C. D. W. asks: How can I make chloride of copper? A. Chloride of copper (Cu Cl) may be obtained by the spontaneous combustion of copper in chlorine gas; but it is more advantageously prepared by dissolving the oxide or carbonate in hydrochloric acid, when, on evaporation, it crystallizes in green needles. A concentrated solution of chloride of copper is of a green color, but it becomes blue on dilution; and when the salt is anhydrous, it is liver-colored.

(3) J. Y. asks: What is meant by a microscope which magnifies 10,000 times? How large would a human hair appear under this power? A. Human hair varies considerably in different persons. An ordinary specimen magnified 100 diameters, or 10,000 times in surface, would seem $\frac{1}{4}$ of an inch in diameter. If magnified 10,000 diameters, it would appear 2 feet in diameter, which no microscope now made could cover.

(4) J. H. asks: How can I keep protosulphate of iron from oxidizing? I keep it corked, but this is no use. A. Place the protosulphate in a large glass bottle, fit a cork very tightly and seal up with paraffin or sealing wax. In this manner, large quantities are kept in a perfect condition.

Does the light injure canned fruit? A. In some instances it may be injurious. Upon some canned fruits, light does undoubtedly produce slight chemical changes.

1. Would tallow at 8 cents per lb. be a cheap article to make soap with, or would "cracklings" at 4 cents per lb. be cheaper? A. We should think that tallow at 8 cents would be preferable. 2. Please give me a recipe for making hard soap with tallow. A. Take freshly sieved lime, sal soda, and tallow, of each 2 lbs.; dissolve the soda in 1 gallon boiling soft water; now mix in the lime, stirring occasionally for a few hours; after which let it settle, pouring off the clear liquor and boiling the tallow thereto until it is all dissolved. Cool it in a fat box or pan, and cut into bars or cakes. It can be scented with sassafras oil by stirring the oil in when the soap is cooling. When any form of soda is used in making soap, it is necessary to use lime to give it causticity, which gives it much greater power upon the grease, by removing the carbonic acid; hence the benefit of putting lime in the bottom of a leach when making soap from common ashes.

(5) A. W. R. asks: How can I get rid of dandruff in hair? A. The most results follow the use of warm baths, taken daily and prolonged for an hour or more, and the subsequent friction with a soothing and sheathing pomade, such as that of the benzoated ointment of oxide of zinc.

Is there a cure for bunions? A. "When the bursa which lies toward the plantar surface of the metatarsal bone of the great toe becomes enlarged, or when a new sacculus is formed upon the inner and posterior aspect of this bone, the disease termed a bunion occurs. In this affection, the enlargement of the bursa is usually secondary to an alteration in the shape and position of the great toe, which, in consequence of the pressure of narrow-pointed boots, has been thrown outwards in an oblique direction (that is, towards the little toe), so as to lie over or under some of the contiguous digits; in this way a sharp angle is formed at the junction between the first phalanx and the metatarsal bone of the great toe. This angle, being constantly pressed upon

by the boot, becomes irritated, and, for its protection, the bursa that is there naturally situated becomes enlarged, or an adventitious one forms. From time to time the bursa and the projecting angle become inflamed, and the morbid action there set up may run to suppuration of a very troublesome kind, a thin, unhealthy pus being formed, which is discharged through an opening that speedily becomes fistulous, and may degenerate into a most troublesome indolent sore. Treatment: In the treatment of this affection, the first thing to be done is to change the direction of the toe by wearing properly shaped boots, made with the inner side of the sole straight from the toe to the heel. If accidental inflammation be excited in the part, it must be allayed by the application of leeches, warm foot baths, and poulticing; the cutaneous irritation that is left may best be removed by painting the surface with a strong solution of nitrate of silver. The faulty direction of the toe may best be remedied by using an ingenious contrivance, the action of which consists in drawing the inverted end of the toe inwards by the constant action of a slender steel spring."—Erichsen. Should these means fail, consult a surgeon.

What will remove flesh worms? A. The flesh worm (*acarus folliculorum*) is supposed to be caused by a deficiency of expulsive power in the follicles and ducts of the sebaceous glands, by condensation of the secretion, which renders the expulsive power nugatory. For treatment, see p. 251, vol. 31.

(6) G. E. W. asks: Are there minute insects in the human blood? A. When the blood is in a normal condition, there are no parasites present; but they are found in some cases if it be diseased.

(7) S. M. asks: What is a good method of whitening ferns? A. By exposing them for a short time to the action of sulphurous acid gas, obtained by burning a little sulphur.

Is there anything that will remove moles from the skin? A. "They are easily removed by the knife, care being taken to direct the incisions in the line of the ordinary folds of the skin. Better perhaps is *potassa fusca* a point of which is introduced in the center of the *nævus*; it diffuses itself through the areolar mass, the disorganized tissue dries up in a scab, and falls off in ten or fourteen days, leaving very little trace of its existence. This method of treatment is applicable to *nævi* (or moles) of small size only. When of considerable extent, they are beyond the control either of knife or caustic."—Wilson.

(8) B. E. D. asks: What ingredients are used to set the colors in muslins, calicoes, etc., making them proof against water? I wish to make colors on papers, such as marbled papers, waterproof. A. Insoluble colors are obtained by taking advantage of known chemical changes; thus chromate of lead (chrome yellow) is precipitated by dipping the stuff into solutions, first of acetate of lead, and then into bichromate of potassa. Mordants are bodies which, by their attraction for organic matter, adhere to the fiber of the stuff, and also to the coloring matter. They are applied first, but in domestic dyeing they are often mixed with the dyestuff. By the use of a mordant, a dye which would otherwise wash out is rendered permanent. Some mordants modify the color; thus alum brightens madder, giving a light red, while iron darkens it, giving a purple. The principal mordants are alum, cubic alum, acetate of alumina, protochloride of tin, bichloride of tin, sulphate of iron, tannin, and stannate of soda.

(9) C. A. B. & Co. ask: How can we make explosive picrate salts, particularly those of lead? A. We can find no mention of any of these salts (except that of potassa) being used as explosives.

(10) D. F. J. asks: 1. How can I make paper adhere to whitewashed walls? A. The usual and perhaps the best method is that of removing as much of the whitewash as possible by scraping, and moistening the wall with water before applying the paper (previously coated with the paste). 2. What is the best method of removing old wall paper to prepare for new? A. Moisten the paper with water for a short time, when it can be removed without difficulty.

(11) W. R. asks: What is the weight in ounces of the largest diamond? A. The largest known diamond formerly belonged to the Great Mogul, and when found weighed 286 $\frac{1}{2}$ grains, or nearly six ounces; it had the form of half a hen's egg.

(12) W. L. P. asks: What are the constituents of natural phosphate of lime? A. The composition varies much. That obtained from Searum, Norway, contained phosphoric acid 41.54, sesquioxide of iron 1.79, calcic oxide 53.48, and chlorine 2.66, per cent. That from the Ural Mountains contained phosphoric acid 41.99, calcic oxide 53.90, chlorine 0.01, and fluorine 4.20 per cent. The phosphatic limestone found in this country would contain nearly the same as the above; certainly it would not vary much in the amount of phosphoric acid. It is found in Maine, New Hampshire, New York, New Jersey, Pennsylvania, Maryland, and Delaware. A shaft has been sunk near Hurdstown, N. J., and the phosphate of lime (apatite) mined.

(13) G. F. F. asks: With what preparation can I color white ivory chessmen red? A. They may be stained with the ordinary dyeing materials. The ivory should first be steeped in a solution of bichloride of tin as a mordant, and then in a hot bath of Brazil wood or cochineal.

What will remove oil from paper? A. Scrape finely some pipe clay (the quantity will be easily determined on making the experiment); on this lay the sheet or leaf, and cover the spot, in like manner, with the clay. Cover the whole with a sheet of paper, and apply for a few seconds a heated iron box, or any substitute adopted by laundresses. On using India rubber to remove the dust taken up by the grease, the paper will be found restored to its original whiteness and opacity. This simple method has proved much more effectual than the use of turpentine.

(14) C. H. C. asks: 1. Has there ever been manufactured a glass that will stand a red heat and not melt? A. No. 2. Is there any substance that can be put into glass to render it flexible? A. Nothing, to our present knowledge, accomplishes this, although this (supposed) lost art has been much sought after.

(15) H. J. asks: 1. Will three boilers, each 24 inches long by 7 inches diameter, supply enough steam to run a 325 engine, carrying 60 lbs. pressure and making 300 revolutions per minute? A. They would be rather too small. 2. How heavy and how large should the flywheel of an engine of the above size be? A. Diameter 15 inches, weight from 70 to 80 lbs. 3. What pressure would boilers of the above size stand? They are made of 1-16 steel. A. About 90 lbs. per square inch.

(16) A. F. asks: Can any musician inform me how a cornet can be blown completely out of tone? A. It can, be done by hard blowing.

(17) R. R. S. says: 1. I use a tin cup to make my tea is. I put cold water into the cup with the tea and set it on to the stove to steep. The cup keeps smooth and bright, but has the tea stain upon its surface. I use this cup very often to boil water in, and it keeps smooth and free from scale. If I use another cup to boil water in, it will become covered with scale in three or four heatings, visible to the sight and perceptible to the sense of feeling. What is the cause of this phenomenon? A. The water undoubtedly contains a large amount of lime, magnesia, soda, etc., in solution. Upon boiling, these would be precipitated and form the scales you speak of. But the presence of tea has a different effect. Tea contains tannin and other substances which exert, doubtless, an influence upon the solubility of the alkalies. In most cases they are very soluble, but, if an excess of the bases be present, rapidly attract oxygen and become brown by the destruction of the gallo-tannic acid. 2. Would not a decoction of tea prevent the formation of scale in steam boilers, if it was applied while they were new, and also on the surface of tea kettles? A. There is a preparation in market, tannate of soda, used for this purpose, which probably acts in a similar manner. The decoction of tea would be too expensive.

(18) J. A. M. asks: What is the quickest method of finding the distance between two circles, as A E, without the aid of the radius or diameter of either circle, by the application of the square, on the outside line A C, or the inside line E D? A. Suppose that A B C D E represents material to be cut, and

you wish to find a radial line at the point, A. Draw any chord, A F, and from the point, F, another equal chord, F G. Also connect the points A and G by a straight line. Place a square on the chord, A F, and draw a perpendicular line, H I, at the middle point of this chord. Then place the square upon the line, A G and draw a perpendicular, F K, through the point, F continuing it to L. Make F E equal to F L, and draw the line A E, which will be the direction in which to make the cut. The same construction can be used for finding the direction of the cut at the other end.

(19) Z. S. says: I should like to try Siemens' process of silvering glass, described in *Science Record* for 1874, pp. 64, 98. How is acetic aldehyde made, and how is dry ammoniacal gas made and passed through it? A. Aldehyde may be obtained by the gradual oxidation of alcohol in various ways. It is formed when the vapor of alcohol mixed with air is transmitted through a porcelain tube heated to low redness, or when alcohol is acted upon by dilute nitric or chromic acid; owing to the effects of nitric acid upon the elements of alcohol, it is produced during the preparation of the fulminates of silver and mercury, and it is always present in nitrous ether; it may also be procured from the dry distillation of lactic acid, or lactate of copper. Aldehyde is, however, usually prepared by Liebig's method of distilling, in a capacious retort, a mixture of 6 parts of sulphuric acid, 4 parts of alcohol (specific gravity 0.850), 4 of water, and 6 of finely powdered black oxide of manganese. The product, being very volatile, must be condensed in vessels cooled with ice, and the process must be stopped when the distillate becomes acid. Since, however, it is in a very dilute and impure condition, it is to be rectified from an equal weight of chloride of calcium, in order to free it from alcohol and water. This operation is repeated twice, or even three times. Take equal parts of quicklime and chloride of ammonium (sal ammoniac) separately powdered, and intimately mix; transfer to a retort and gently heat. Abundance of pure ammonia, as a transparent, colorless gas, will be given off. It should be passed through a tube containing recently prepared quicklime. The gas is allowed to pass through the liquid in the usual way, which must be kept cool with ice. Prismatic needles of snowy whiteness are thus formed, which is the compound of ammonia and aldehyde required.

(20) D. W. B. asks: 1. How can I make alcohol without distillation? A. We cannot tell you. There is a quality of iron or iron salt not attracted by the magnet; it is called allotrope, and is soluble in water. How is it made? A. There is no known oxide or form of iron that has the properties you state.

How can oleic acid be made? A. The isolation of this acid in a state of purity is a matter of some difficulty. In order to obtain the pure acid, Varrentrapp recommends that almond oil be saponified with potassa or with soda, and that the soap be decomposed with hydrochloric acid. The mixed fatty acids are then to be digested with half their weight of finely powdered oxide of lead. On digesting the mixed salts of lead with twice their volume of ether for 24 hours, the oleate of lead is dissolved and separated from the other salts. The ethereal solution is to be mixed with dilute hydrochloric acid, which decomposes the oleate. The oily acid is dissolved by the ether and rises to the surface. The ether is to be expelled by heat.

How can oil of brick be made? A. Oil of brick is made by saturating fragments of brick with oil, and distilling at a red heat.

Can pyro-acetic spirit be made without distillation? A. No.

Where can red resin be obtained? A. Ask any drug gist or dealer in varnishes for it. As to the difficulty of dissolving rubber in ether, see p. 251, vol. 31.

(21) L. K. L. says, in reply to F. H. B.'s question as to which vessel has made the fastest time across the ocean: The Italian steamer City of Brussels left Sandy Hook at 9.15 on the morning of December 4, 1869, and dropped anchor in Queenstown harbor after a run of 7 days, 30 hours, 22 minutes. She has since (June 1872) crossed in 7 days, 13 hours, 55 minutes. The Adriatic's best time, May, 1871, was between Queenstown and Sandy Hook 7 days, 18 hours, and 55 minutes.

(22) N. A. K. says, in reply to J. C.'s query as to size of sail for a boat: I think he could have a larger sail on his boat than you recommend. I have a boat 12 feet long, 3 feet wide, and 1 foot deep. She is pointed at the bows, and made of pine boards, $\frac{1}{2}$ inch thick, bent dry, without sawing. Her keel is 6 inches wide, hinged so that it will lay flat to the boat when released from an upright position. Her sail is 8 feet on the mast, 9 feet from the end of the boom to the gaff boom is 11 feet and gaff 7 feet. The boat will carry persons, and is perfectly safe.

COMMUNICATIONS RECEIVED.

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

On a Letter from Faraday. By H. W. C.
On Alcohol. By J. D. P.
On a Miniature Locomotive. By F. S.
On some Special Tools. By W. P. P.
On Diamonds. By G. H. W.
On the Potato Bug. By J. J. S.
On Demoniacal Possession. By W. S. H.

Also enquiries and answers from the following:

R.-D. E. J.-J. H.-P.-W. J. McG.-F. S. R.-A. K.-W. N. H.-F. S. 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: "Who sells a composition for removing ink stains from the hands and clothes? Who sells artificial butter? Who sells Martini-Henry rifles?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is especially 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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APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

31,477.—STEAMBOAT STAGING.—A. J. Bell. January 6.

31,153.—NEEDLE & COOPER. January 6.

31,172.—FLOWS.—W. Jarrell. January 6.

31,182.—WOOD-BENDING MACHINE.—H. McDonald. Jan. 6.

31,189.—CURRY COMB.—S. J. Wheeler. January 6.

31,233.—SEWING MACHINE.—F. D. Ballou. January 6.

31,314.—SEWING MACHINE.—Q. Rice. January 6.

EXTENSIONS GRANTED.

30,650.—RUBBER CAR SPRING.—T. F. Alys.
30,651.—CLOTHES SQUEEZER.—F. Arnold.
30,652.—CAR WHEEL.—G. S. Bosworth.
30,653.—PUMP.—W. J. Johnson.
30,654.—CAR SEAT AND COUCH.—F. Burke.

DESIGNS PATENTED.

7,504.—HORSE BLANKET FABRIC.—G. B. Ayer, Phil., Pa.
7,505.—TYPE.—T. W. Smith, London, England.

TRADE MARKS REGISTERED.

3,028.—SALTS.—Salts Manufacturing Co., Crab Orchard, Ky.
3,029.—PERFUMES.—Fisher & Co., New York City.
3,030.—FLOUR.—Hesselsbittel & al., Brooklyn, N. Y.
3,031.—MEDICAL SERUP.—J. J. Lawrence, Wilson, N. C.
3,032.—FERTILIZERS.—E. Whittman & al., Baltimore, Md.
3,033.—COTTON GOODS.—Joy & Co., Passaic, N. J.
3,034.—EMERY WHEELS.—Lehigh E. W. Co., Westport, Pa.
3,035.—TEARS.—A. Man & Co., San Francisco, Cal.
3,036.—SHEETINGS.—Naumkeag Cotton Co., Salem, Mass.

SCHEDULE OF PATENT FEES.

On each caveat.....\$10
On each Trade Mark.....\$25
On filing each application for a Patent (17 years).....\$15
On issuing each original Patent.....\$20
On appeal to Examiners-in-Chief.....\$10
On appeal to Commissioner of Patents.....\$20
On application for Reissue.....\$30
On application for Extension of Patent.....\$50
On granting the Extension.....\$50
On filing a Disclaimer.....\$10
On an application for Design (3 1/2 years).....\$10
On application for Design (7 years).....\$15
On application for Design (14 years).....\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, OCTOBER 22 TO 29, 1874.

3,269.—J. L. O. Vidal, Parish of St. Louis of Lotbinière, Lotbinière county, P. Q. Extension of No. 109. "Charrue avec orifice à base élargie à même, on rapportée." (Improvements in plows.) Oct. 22, 1874.
3,270.—William Muir, Montreal, P. Q. Extension of No. 94, called "Muir's Improved Multiple Sewing Machine." Oct. 24, 1874.
3,271.—R. W. Soper, London, Middlesex county, Ont. Improvement on breech-loading rifles and shot guns, called "Soper's Improved Breech Loading Rifles and Shot Guns." Oct. 25, 1874.
3,272.—J. G. Scott, St. Thomas, Montmagny county, P. Q. Improvements on car-coupling apparatus, called "Scott's Safety Car Coupler." Oct. 25, 1874.
3,273.—William H. Collins, Whitby, Ontario county, P. Q. Improvements in stone pipe couplers, called "Collins' Stone Pipe Coupler." Oct. 26, 1874.
3,274.—William B. True, Silver Islet, Ont. Improvements in a machine for washing or separating the heavier ores or metals, called "True's Improved Vanishing Machine." Oct. 26, 1874.
3,275.—L. W. Neade, Toronto, Ont. Improvements on boring bars, called "Neade's Improved Boring Bar." Oct. 26, 1874.
3,276.—J. Nassian, Strass, Hungary, Austria. Improvements in the manufacture of rock candy, called "Nassian's Process of Making Rock Candy." Oct. 26, 1874.
3,277.—J. Nassian, Strass, Hungary, Austria. Improvements on the process of clarifying sugar, called "Nassian's Process of Clarifying Sugar." Oct. 26, 1874.
3,278.—William Tucker, Tiskdale, Worcester county, Mass., U. S. Improvements on apparatus for dropping the cuts of augers and auger bits, called "Tucker's Apparatus for Dropping Cuts of Augers and Auger Bits." Oct. 26, 1874.
3,279.—L. F. Bally, Matland, Hants county, Nova Scotia. Improvements on potato diggers, called "Bally's Potato Digger." Oct. 26, 1874.
3,280.—J. W. Hamore, Newburgh, Orange county, N. Y., U. S. Improvements in jacketing of steam boilers, etc., called "Hamore's Patent Combination Non-Conducting Jacketing." Oct. 26, 1874.
3,281.—J. Plummer, London, Middlesex county, Ont. Improvements on spoke lathes using three centers, called "Plummer's Improvement on Spoke Lathes Using Three Centers." Oct. 26, 1874.
3,282.—G. J. Wardwell, Rutland, Rutland county, Vt., U. S. Improvements in oscillating steam engines, called "Wardwell's Oscillating Steam Engine." Oct. 26, 1874.
3,283.—C. V. Michell, Pickering Township, Ontario county, Ont. Improvements in machinery for the purpose of unloading rots, etc., from the wagon or other carriage when hauled therein, called "Michell's Self Root Unloader." Oct. 26, 1874.
3,284.—L. A. Dessaulles, Montreal, P. Q., assignee of H. H. d'Abregeon. Améliorations dans les appareils à équilibrer les meules de moulins, dits "Appareil d'Abregeon pour Equilibrer les Meules de Moulins." (Improvements on apparatus for equilibrating millstones.) Oct. 28, 1874.
3,285.—J. G. Scott, St. Thomas, Montmagny county, P. Q. Improvements in car brake couplers, called "Scott's Car Brake Self-Acting Coupler." Oct. 28, 1874.
3,286.—D. L. Newcomb, Kenton, Hardin county, O., U. S. Improvements on augers, shaft coupling, tube-lining setters, and derricks for boring wells, called "Newcomb's Well Boring Apparatus." Oct. 18, 1874.
3,287.—J. H. Cowherd and F. Cowherd Brantford, Brant county, Ont. Improvement on saves trough and machines for making the same, called "Cowherd's Combined Eaves Trough Machine." Oct. 28, 1874.
3,288.—C. Kinney, Denham township, Oxford county, Ont. Improvements on ash holders and fasteners, called "Kinney's Improved Automatic Ash Holder and Fastener." Oct. 28, 1874.
3,289.—E. E. Everett, Philadelphia, U. S., and W. S. Haywood, Rochester, Monroe county, N. Y., U. S. Improvements on bedsteads, called "Everett's Parlor Bedstead." Oct. 28, 1874.
3,290.—J. Munson, Collingwood, Simcoe county, Ont. Extension of No. 113, called "Munson's Dominion Bee Hive." Oct. 29, 1874.
3,291.—J. Call and J. T. Robinson, Richmond, Sagadahoc county, Me., U. S. Improvements on center boards for vessels, called "Call's Flanged Center Board." Oct. 29, 1874.
3,292.—Wm. Tucker, Tiskdale, Worcester county, Mass., U. S. Improvements on saw gummers, called "Tucker's Improved Saw Gummer." Oct. 29, 1874.
3,293.—Wm. Tucker, Tiskdale, Worcester county, Mass., U. S. Improvements in machines for twisting augers and auger bits, called "Tucker's Machine for Twisting Augers and Auger Bits." Oct. 29, 1874.

3,294.—G. F. Godley, Philadelphia, U. S. Improvements on railroad car and other spiral springs, called "Godley's Improvement on Spiral Springs." Oct. 29, 1874.
3,295.—L. Crofoot, Pavilion, Genesee county, N. Y., U. S. Improvements on combined bag holders and trunks called "The American Bag Holder." Oct. 29, 1874.
3,296.—L. S. Chickster, New York City, U. S. Improvements in building, cooking, and preparing cereals for use, called "Chickster's Prepared Cereals." Oct. 29, 1874.
3,297.—G. J. Wardwell, Rutland, Rutland county, Vt., U. S. Improvements in reciprocating crosshead engines, called "Wardwell's Reciprocating Crosshead Engine." Oct. 29, 1874.
3,298.—A. Wilder, Augusta, Kennebec county, Me., U. S. Improvements in oilcloths, called "Wilder's Improved Oilcloth." Oct. 29, 1874.

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SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 22.
[NEW SERIES.]

NEW YORK, NOVEMBER 28, 1874.

\$3 per Annum,
[With Postage, \$3.20]

THE SHAPLEY ENGINE.

A new portable engine, which is claimed to possess the advantages of cheapness and economy, in addition to those of simplicity and compactness, is the subject of the annexed illustrations. The principal features of the invention, which render it an improvement of value, lie mainly in the construction of the boiler, since the engine proper is, as will be seen from the large perspective view, a single upright cylinder with the ordinary slide valve mechanism. There are some minor arrangements in connection with the engine, notably improved stuffing boxes and a neatly contrived feed water heater, which add to the general efficiency; but these, as well as the build of the machine as a whole—except, perhaps, to note that this last is substantial in all respects—may be passed over, in order to direct attention at once to the novelties in construction of the steam generator.

The idea is to build the boiler to generate the greatest amount of steam, and, at the same time, to have a sufficient reservoir for the same. From the sectional view, Fig. 2, it will be seen that the fire box is conical in shape. The heat thus concentrated in the upper portion passes through the horizontal cross tubes, A, thence, following the course of the arrows, down the vertical tubes, B, and finally into the hollow base, at the rear of which it escapes up the flue. This arrangement gives an unusually large amount of heating surface in comparatively small space, the result of which is an economy in consumption of fuel. From actual tests, we are informed that the fuel used does not exceed two and one half lbs. per horse power per hour, and in some cases less than two lbs. has sufficed.

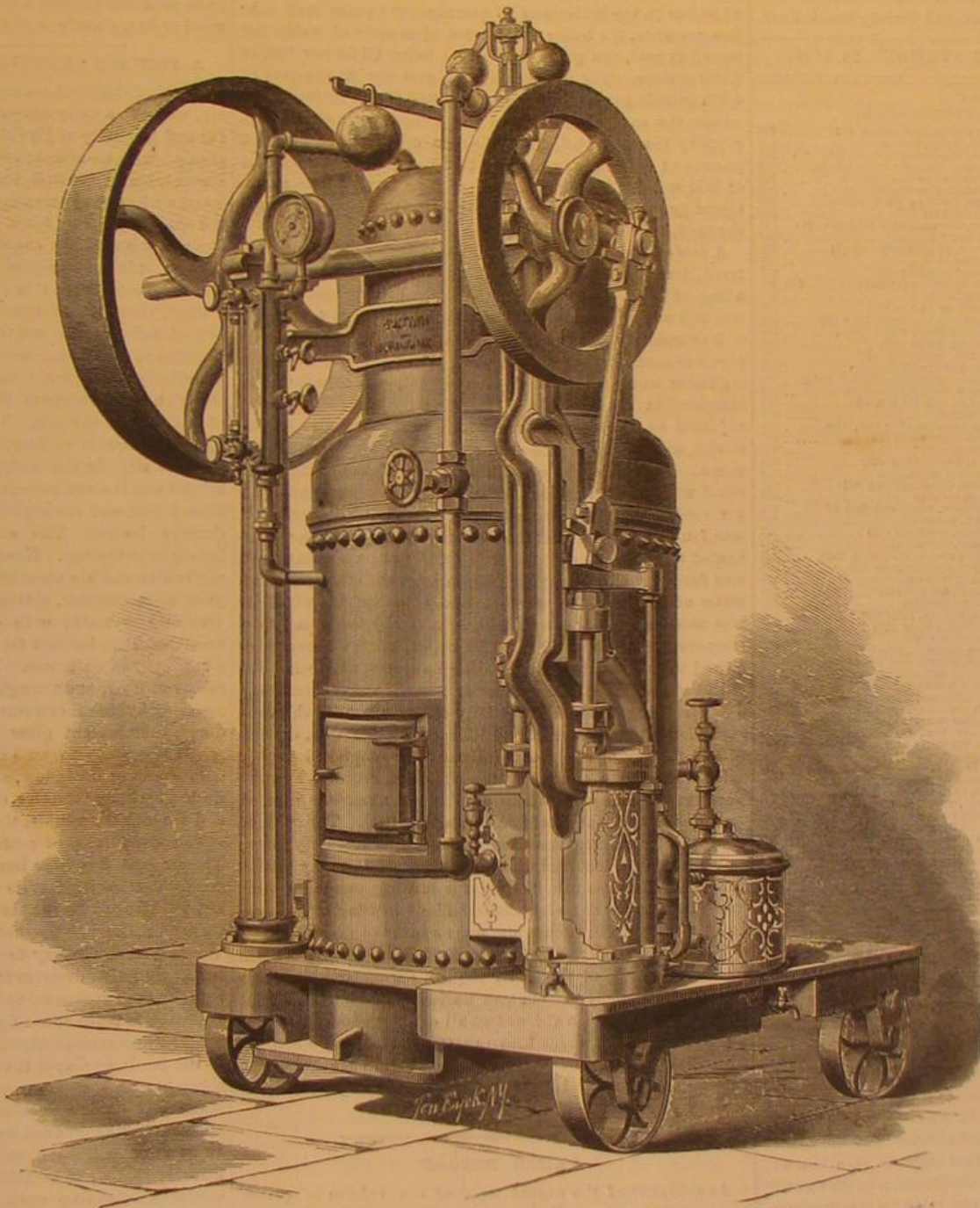
In order to provide for cleaning the tubes, a detachable jacket is placed between the two sections of the boiler, at C. This can be very easily removed by taking out the bolts, since it is made in two parts. The tubes are then cleaned with a short flue brush, the jacket replaced, and the joints filled with wet clay.

So far as material is concerned, we are informed that none but the best is used. The boiler is thoroughly stayed over the crown sheet of the fire box; and since all the heating surface is below the water line, there is very little chance of its burning out. Sixty pounds of steam is the calculated pressure, but one hundred pounds may be safely carried, since all the boilers are tested to a cold water pressure of one hundred and thirty pounds. They are inspected and provided with certificates by the State Inspector of New York.

The spark trouble—a matter of considerable moment where a boiler is fired in the neighborhood of inflammable material or buildings—is effectually done away with. The sparks are drawn down through the upright tubes and dropped in water on the base; and, as an additional preventive, the exhaust steam passes through the heater into the smoke stack, also giving aid to the draft.

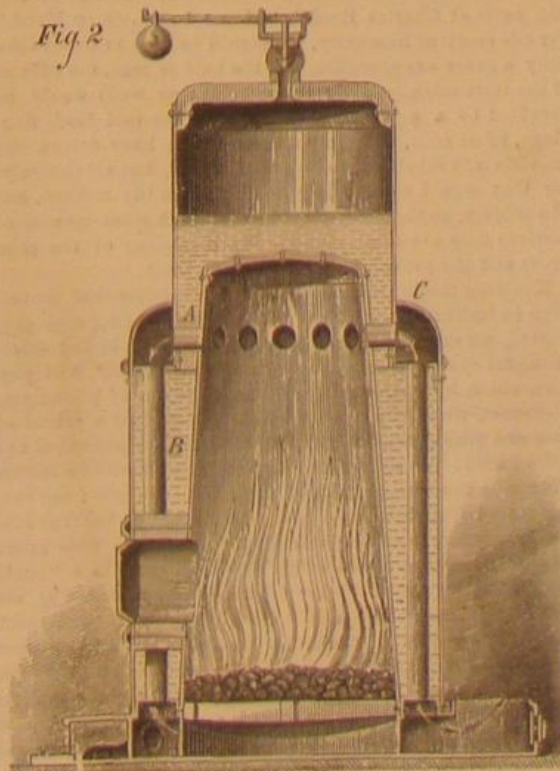
Nothing in the shape of gages, oil cups, fittings, etc., is omitted to render the machine complete. All parts are made in duplicate. The various portions of the engine may be easily adjusted, even when steam is on, thus avoiding delay. The sizes made are 5, 8 and 12 horse power.

Patented February 10, 1874. For further particulars, address Messrs. Tully & Wilde, General Agents, 20 Platt street, New York city.



THE SHAPLEY PORTABLE ENGINE.

Fig 2



Chinese or Indian Ink.

Although the Chinese prepare their ink from the kernel of some amygdalaceous fruit, yet, by the aid of our present chemical appliances, we are able to produce a composition in no way inferior to the best Chinese ink, by the adoption of a formula which is given in Riffault's treatise on the "Manufacture of Colors." The following is the formula:

Calcined lampblack, 100 parts; boghead shale black, in impalpable powder, 50 parts; indigo carmine, in cakes, 10 parts; carmine lake, 5 parts; gum arabic (first quality) 10 parts; purified oxgall, 20 parts; alcoholic extract of musk, 5 parts.

The gum is dissolved in 50 to 60 parts of pure water, and the solution filtered through a cloth. The indigo carmine, lake, lampblack, and shale black are incorporated with this liquor, and the whole ground upon a slab, with a muller, in the same manner as ordinary colors; but in this case the grinding takes much longer. When the paste is thoroughly homogeneous, the oxgall is gradually added, and then the alcoholic extract of musk. The more the black is ground, the finer it is. The black is then allowed to dry in the air, until it has acquired sufficient consistency to be molded into cakes, which in their turn are still further dried in the air, out of the reach of dust. When quite firm, these cakes are compressed in bronze molds, having appropriate designs engraved upon them. The molded ink is then wrapped in tinfoil, with a second envelope of gilt paper. The ink which has been prepared in this manner possesses all the properties of the real Chinese article. Its grain is smooth; it flows very well, mixes perfectly with many other colors, and

becomes so firmly fixed to the paper that other colors may be spread over it without washing it out.

Cultivation of Castor Beans in California.

The method of gathering and preparing for market is as follows: Every day the ripe spikes are gathered by hand, put in sacks, and hauled to the "popping ground," which is a space of about an acre, made smooth and hard, like an old fashioned buckwheat threshing ground. Here the spikes are spread; and during the day they pop open, from the heat of the sun, throwing out the beans. Each morning the straw is raked off, the beans shoveled up, cleaned in a fanning mill, and sacked, ready for market. By the time the field is once picked over, it is ready for another picking, like cotton, and the season, commencing in August, is not yet over. The yield is estimated at fifteen hundred pounds per acre, worth four cents per pound, or a gross yield of \$60 per acre. The expense of cultivation, etc., is estimated this year at one half this amount, but is greater than it probably will be another season, owing to inexperience and preparing new land. There is probably no crop so easily raised that will yield so large a return.

THE AMERICAN ELECTRICAL SOCIETY.—An association to be known under the above name was recently organized at Chicago, Ill. The objects are an interchange of knowledge, professional improvement of members, the advance of electrical and telegraphic science, and the establishment of a central point of reference. General Anson Stager, of Chicago, was elected president, and Mr. C. H. Haakins, of Milwaukee, vice president.

Scientific American.

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NEW YORK, SATURDAY, NOVEMBER 28, 1874.

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EXHAUST STEAM FOR HEATING PURPOSES.

In a previous article, reference was made to the gain to be derived from the use of a feed water heater, in connection with a non-condensing engine. It must be evident, however, from the figures given in that article, that the heater is far from utilizing all the heat that escapes into the exhaust. When water is converted into steam, a large amount of heat is required, which does not raise its temperature, and, not being shown by the thermometer, is commonly called latent heat. Thus, if a pound of water at the temperature of 60° Fah. is heated until it is evaporated under the pressure of one atmosphere, the temperature of the steam will be 212°; but the heat which has been imparted to it is as much as would have sufficed to raise the temperature of more than 7½ pounds of water from 60° to 212°. On the other hand, to convert this steam into water, a similar amount of heat must be abstracted, from which it will be seen that the exhaust steam—which only heats about an equal weight of feed water—pays with but a fraction of its heat. But, as before remarked, if the steam can be cooled sufficiently to convert it into water, or condense it, it gives up to the cooling medium all the heat that became latent when it was changed from water into steam. These facts have suggested to some the idea of turning the exhaust steam into places where it would be cooled and condensed, giving up its heat where it was wanted, as, for instance, in warming a building. The ordinary manner of effecting this is to turn the exhaust steam into heater pipes that are fitted up throughout the building to be warmed, and draw off the water of condensation, to be used for supplying the boiler. Under such circumstances, the exhaust steam encounters an increased resistance, in passing through the heating coils, and this has the effect of increasing the back pressure on the piston. In order to fix some limit to this increase of back pressure, it is usual to attach a loaded valve, opening into the atmosphere, to the pipe leading from the exhaust to the heating coils, so that, when the limit of back pressure is reached, the valve will rise and the exhaust steam will escape into the air. In order to diminish, as much as possible, the back pressure created by the passage of the exhaust steam through the heating coils, they require to be fitted up

with the greatest care. Neglect of this precaution has induced many persons to abandon the use of exhaust steam for warming purposes. In the construction of the heating coils, the principal points to be observed are: First, to have sufficient area of pipe to permit the free passage of the exhaust steam; and secondly, to arrange the pipes in such a manner, with suitable traps, that the condensed water or air cannot accumulate in them, but will be continually drawn off. If these provisions are attended to, the heating pipes can be extended over a considerable distance, with but little increase of the back pressure. An example, representing the results of average practice, will illustrate the foregoing remarks more fully:

A non-condensing engine of 60 horse power, exhausting into the atmosphere, had a back pressure on the piston of 1 pound per square inch. The feed water was pumped into the boiler at a temperature of 65°, and the average pressure of steam in the boiler was 75 pounds per square inch. At this pressure, the boiler evaporated 62 pounds of water per pound of coal, the price of the coal being \$6.50 per ton of 2,000 pounds. The consumption of coal was at the rate of 4,450 pounds per day, costing about \$14.46. The factory in which the engine was located was heated with steam supplied by the same boiler, requiring a consumption of 1,000 pounds of coal per day, costing \$3.25, so that the total cost of fuel was \$17.71 per day. These facts having been ascertained by careful experiment, the heating arrangements were changed, in the manner described below.

A few of the connections about the heater pipes were altered, for the purpose of obtaining more direct circulation, a trap of improved form was attached, a back pressure valve was put on the exhaust pipe, arranged to open at a pressure of 3 pounds per square inch above the atmosphere; and this pipe was connected with the heating apparatus, and a damper regulator was put in. It was found that, on account of the increased back pressure, the cut-off of the engine had to be adjusted so as to admit steam for a greater portion of the stroke, so that the engine required about 12 per cent more steam. If this had been the total result of the change, the effect would have been to increase the coal consumption 12 per cent, in addition to the expense of the alterations. It was found, however, that the exhaust steam from the engine heated the building quite as well as, if not better than, this was formerly effected by live steam from the boiler; and the water of condensation was led into a tank, from which it was used to feed the boiler, being taken by the pump at a temperature of about 200°. The boiler, being no longer required to furnish steam for heating purposes, and being fed with hot water, gave much better results than before, the damper being generally partially closed—so that the consumption of coal was only 4,100 pounds per day, costing \$13.33, the saving in the coal bill per day being \$4.38.

Such extensive alterations are not often required as were necessary in this case, where all the arrangements seemed to be made with the intention of wasting fuel. The gain, of course, after making the change, was proportionately large, but the expense incurred was considerable. In many places, the exhaust steam can be used for heating purposes, with very little outlay for alterations. Many heating coils, however, are put up in such a manner as to have very little circulation, and require a high pressure of steam to make them effective. Cases of this kind require extensive alterations before the exhaust steam can be turned into them. But there are numerous owners of small engines and boilers who have small shops which they can easily heat in the manner described. Our hints will probably be sufficient for such ordinary cases, but it is impossible to lay down general rules for every case.

PRISON REFORM.

As evidence of the urgent need of the reform in prison management suggested in our article on "The Scientific Treatment of Criminals," a friend in St. Louis sends us a printed account of recent doings in the State Penitentiary of Missouri, the horrid details of which remind one of certain parts of Charles Reade's "Never Too Late to Mend." For the credit of humanity, we should be glad to believe the story a gross exaggeration. If the half is true, the officers of the institution (and its management as well) would be benefited by a personal experience of the foul food, floggings, blind cells, and other abuses which have driven the convicts into rebellion, to be administered, not vindictively, for that would be contrary to the scientific method, but educatively, so that they might understand what manner of motives they are employing for the discipline of the prisoners and the probable moral effect of them.

Knowing the brutal and brutalizing practices that prevail even in institutions which have the name of being well conducted, we can understand how keepers such as our correspondent describes may, through ignorance, fear, and passion, aided by a thoroughly perverse system of prison employment, gradually convert a penitentiary into a school of vice and vengeance, rather than a place for penitence and reformation. We appreciate, too, the crying need of a radical change in the management of all such institutions: but that the prison system of the country can be made what it should be, by any burst of individual enthusiasm, we very much doubt. It may be true enough that there is a "noble band of Howards" ready to undertake the reform "at the call of the American people": the hitch lies in the indisposition of the people to make the call. Not until the masses—upper as well as lower—have been educated up to the scientific level, and have learned to consider social problems as scientific problems, to be solved on scientific principles, will they be able to treat this question dispassionately and

wisely. When that time comes, there will be little need of Howards to stir the sensibilities of prison keepers.

To the question: "Can you not set some means at work to release these thousands of mismanaged criminals from the pernicious system which thwarts their reformation?" we can only reply that we have already, to the best of our ability, set such a means at work, and that is the SCIENTIFIC AMERICAN. It does not set itself up as a mouthpiece of social or moral reform; yet, by spreading abroad the results of scientific research, by familiarizing the reading public with the spirit and methods of scientific thinking, it is doing its share toward educating the community up to the level required for the scientific consideration of all questions of social policy—the prevention and cure of crime with the rest. The process is necessarily slow; but the appreciative responses that have been made to our bare suggestion of a scientific treatment of criminals—an idea that could not have been entertained a few years ago—are proofs that progress is being made in the right direction.

A POSSIBLE IMPROVEMENT IN HOUSE HEATING.

At this delightful season of genial sunshine and crisp cool air, we have a daily illustration of perfect, because healthful and intensely enjoyable, heating. While the lungs are regaled with an atmosphere which seems to stimulate every pleasurable sense and activity of the body, the sunshine warms without oppressing, and heightens our enjoyment of the sparkling air by force of contrast. If we could imitate—much more if we could reproduce—the same conditions indoors, it is obvious that the perfection of house heating would be attained. Can either be done?

First, let us notice what the conditions are, on a sunny day of fall or early winter, that is, the conditions which combine to make such weather so refreshing. Pure air is practically transparent to radiant heat. In summer time, the high temperature of the air comes as an indirect effect of the heat of the sun. The sun rays heat the earth and the objects on its surface, and these, by contact or otherwise, heat the air. In the fall, the period of daily sunshine is briefer and the sun rays fall more obliquely. The ground is heated less, and the nightly periods of radiation are proportionally longer. The air in consequence remains cool throughout the day. Nevertheless, when the sun rays strike our bodies and are absorbed, their heating power is almost as great as in summer, giving us the simultaneous sensation of vivifying warmth, with delicious coolness in the air we breathe. Pass indoors from such an atmosphere to that of a furnace-heated house. How great the change! The air seems stifling, and though the temperature of the room, as recorded by the thermometer, is much higher than that outdoors, the pleasant glow which was felt in the sunshine soon gives place to an extreme sensitiveness to chill. Sit near a wall or a window, and an unpleasant coolness creeps up the back, as though a cold wind were blowing across it, and we look for a draft, though the air is motionless.

The conditions of perfect heating have been reversed. The air is at dog days heat. The walls and furniture are cold. The bodily heat is depressed by breathing the hot air, yet streams of heat must flow out from us in all directions to make up the deficiencies of surrounding objects. The thermometer may declare that such a room is warm, but every nerve declares that it is not comfortable. Substitute for the furnace an open fireplace with a blazing fire. An approach is made toward perfect heating. The radiant heat passes like sunshine through the air without heating it; and if the fire is so placed that its radiations impinge on a considerable area of the enclosing walls, the walls will be warmed as they cannot be by hot air; the furniture will be warmed in like manner, and the occupants of the room will enjoy the cheerful influence of live heat while having sufficiently cool air to breathe. The great expense and inconvenience attending open fires must ever greatly restrict their general use. Only about one tenth of the heating power of fuel is developed by its combustion in an ordinary fireplace, and much of that escapes unused. Besides, to heat a room of considerable size uniformly, it would be necessary to have an open fire at each side, or better, at each corner; an arrangement not to be tolerated as a matter of economy.

To burn fuel economically, it is necessary to burn it centrally and in mass. The coal that would supply a number of separate fires would furnish an immensely greater amount of heat if burned in a single furnace, a fact more or less recognized in every contrivance for heating houses by hot air, hot water, or steam. But in all such arrangements it is deemed essential to distribute, not heat directly, but matter more or less highly heated. In other words, we first heat our air or water, and trust to the cooling of that to furnish the heat required, overlooking the well known fact that heat will travel alone quite as well as in company, and that it can be much more easily controlled than air or water.

Radiant heat, the sort required for perfect heating, obeys the same laws as light. By proper arrangements of reflectors and lenses, heat radiations can be massed into beams of parallel rays and sent where we will, with little or no wasting. It is not until the radiations are arrested that they become manifest as heat; a fact put to practical use two thousand years ago, when Archimedes burnt the fleet off Syracuse with mirrors. A stream of heat vibrations, intense enough to fuse gold, would pass through a tube of ice without affecting it, provided the air in the tube be sufficiently pure and dry. There appears to be no good reason, therefore, why we should not warm our houses by the direct distribution of pure heat, and so gain all the benefits of an open fire in each room, with none of its disadvantages.

Briefly described, the plan would involve (1) a central fur-

nase, constructed of course with a view to the development of the greatest amount of heat from a given amount of fuel. (3) A system of tubes leading to the different rooms, terminated by radiators in each room. (3) A system of reflectors to throw the heat of the furnace into the conducting tubes in beams of parallel rays, with other reflectors at the bends and angles of the tubes to direct the course of the radiations properly. The radiators in the rooms might be placed so that every portion of the room would be flooded with heat rays, yet no part be heated beyond what would be enjoyable. As nothing would enter the rooms from the furnace save pure heat, the effect would be like that of a room warmed by direct sunshine. The surplus heat of the furnace might be utilized in warming, say to 50° or 60° Fah., and an abundant supply of fresh air led in from out doors; a steady circulation being kept up, from the ventilating chamber, through the rooms, by the draft of the furnace. We should have then (theoretically) perfect heating combined with perfect ventilation, and at the same time the most economical combustion of our fuel.

Possibly there may be mechanical difficulties to prevent the successful carrying out of a plan of house heating of this sort. We do not anticipate any, and the advantages it promises, on the score of health, comfort, and economy, certainly justify its trial by any one possessing the requisite means. The plan could be easily tested in the laboratory of any institution having a few lenses and reflectors.

MECHANICAL AESTHETICS AND PRACTICAL MEN.

We met our practical man, him of the street car, who "never learned nuthin' from books", at the American Institute Fair the other night. He was slowly trudging through the machinery department, apparently devoting his attention to the steam engines. We noticed that, as he scrutinized the large driving engine, his brow clouded; by the time he had reached the nickel plated Baxter, the cloud deepened into a frown; and when he arrived opposite the Myers rotary a fierce scowl overspread his features. Suddenly turning on his heel, he recognized us, and, without further preamble, burst out with: "Now, look here, boss, I want to know if this is'n't cussed nonsense, all this 'ere frippery, nickel plate and red paint, and gildin', and stuff, about a masheen! What for, anyhow? Do'n't make the thing run no better, does it? What's the use er ahinin' that Baxter like a lookin' glass? I do'n't fuss over my engine that way; much as I can do to keep the green off the brass. Have'n't had no paint near it for ten years. Do'n't see that it works any worse, either."

We remarked that we supposed the exhibitors desired to attract public attention by uniting artistic beauty with mechanical excellence, and that the certainly augmenting tendency toward æsthetic refinement was— "Which? Oh, keep them big words for yer paper; I never was no shakes on the dictionary. Just you tell me what's got inter people, that they waste stamps on what aint no use? Look at this, now." And here he fished from his overcoat pocket a dilapidated copy of the SCIENTIFIC AMERICAN of a few weeks back, containing the engraving of the new mold-ramming machine on the front page. "What's that feller in that picture for? Or that heap er dirt and the shovel? Could'n't any practical man understand that masheen without that chap a pullin' the handle? S'pose a mee-chanic wants all that shadin' and prospectiv' and figgers? When I see a masheen, I want to see drawins', nice plans and things drawed out. Why do'n't yer print them, not pictures, only fit ter hang in the parlor?"

"Advantageous advertisement," we insinuated. "No t'aint, nuther," he rejoined; "no more than these ere circ'lars and books with fancy covers that these fellers is givin' away so loose for nuthin'. Nor them blue signs, nor that shiny engine. I do'n't do no advertisin'. Do'n't believe in it. Did'n't I try it? Did'n't I pay a dollar for puttin' my name in a pious paper printed out in Milwaukee, or Oregon, or somewhere? The chap that wheeled me in said he'd throw in a ten dollar chromo and a book about saint's rest by a man named Baxter (that engine feller, I s'pose). Did'n't get nary an answer. Catch me gettin' fooled by any nooze-paper agin'!"

"No, I aint got nuthin' showin' in this Fair. Anybody that wants ter see my work can come to my shop. There aint no gold and silver and red paint there, nor patent invenshuns, nuther. Feller wanted me to buy one er them new fangled emery wheels t'other day. But I said: 'No, sonny, I used this old grindston' and others like it goin' on thirty year; and I guess I can make it do a little longer. No sir, when I git any money to waste on advertisin' or fancy paint or blamed invenshuns, then I'll shut up shop. Good night. Come see us, sometime. Aint got no cards; shop's in the alley, fourth door back on— street. There aint no sign. Just stand in the entry and yell; and if one of the boys hears yer, he'll let yer in."

Our meditations, as we watched our friend elbow his way out of the crowd, took about the following shape: Anything akin to beauty or taste, when brought in connection with the mechanical, is, by the self-called practical individual, resented as an unwarrantable encroachment. When the purpose of ornamentation is (besides gratifying the eye) thus to draw attention to the merits of an object, both end and means meet his wholesale condemnation. Strictly and purely utilitarian, he fails to see any benefit in a measure which does not instantly bring in pecuniary returns, or to perceive that increased gains are or can be due to the keeping of certain facts constantly before the world, or to presenting the same in some manner so unique as at once to attract the popular gaze. Since he cannot appreciate matters so clear to every rightly thinking observer, it is manifestly impossible for

others more refined to impress him. He and his kind see nothing to praise in the fact that our American mechanics and manufacturers (though the country is destitute of museums of industrial art, those great educators of the Old World) nevertheless contrive to mingle the beautiful with the useful, with a delicacy and true art feeling elsewhere almost unrivaled. The visitor at any of our great fairs will find this æsthetic selfculture making itself everywhere felt. It appears in the graceful figures and neat proportioning of the ordinary implements of labor, in the exquisite finish of the metal and wood work, in the thousand tasty forms of the commonest minor appliances, in the dainty traceries which embellish the safes, the carriages, and the massive portions of the engines, in a bit of carving here, a dot of bright color there; and thus through all the different productions, gathered as representatives of the varied industries.

We may here be pardoned the apparent egotism of a word as to the artistic merit of the pages now under the reader's eye, and this with reference to the "pretty pictures" objected to by our practical friend; not merely as to their intrinsic beauty, but to suggest the influence which they must exert in elevating the standard of popular taste. A diagram of mere lines may be intelligible to the professional engineer; but the man who proposes to buy a machine asks and needs a representation, showing it as it will appear when set up in the shop. True, a rough sketch would convey an idea, but we prefer to call in the aid of artists (to whom in their specialty there are no superiors), to employ the highest skill attainable in the engraving of their works, and thus to maintain a standard of artistic excellence, of the public appreciation of which we have abundant evidence.

If a little nickel plating or a neat coat of paint will render a machine (without detriment) more pleasing to the eye, it is not false economy to add such embellishment. A bright bit of glass will take the attention when a rough diamond may be a hundred times passed unnoticed; and even if ornamentation be deemed unnecessary for its attractive power, let the beautiful, where possible, be cultivated for itself alone. True art is both refining and ennobling; and it may be found in the harmony of tints in the decoration of an engine, as well as on the canvas colored by a master hand; in the molding of a tool, as well as in the forms which assume all but life under the sculptor's chisel.

SCIENTIFIC AND PRACTICAL INFORMATION.

PAINTING ON ZINC WITHOUT PAINT.

M. Pucher, of Nuremberg, has lately invented a simple process for coloring sheet zinc, based on the employment of acetate of lead. On applying this substance, mixed with a minium preparation, a reddish brown tinge is obtained. The cupola of the synagogue at Nuremberg was thus colored as an experiment over a year ago, and, to all appearance, is yet unaffected by the weather. By adding other bases, lighter or darker tints of gray and yellow may be obtained, giving the zinc work the appearance of carved stone. With a solution of chlorate of copper, the preparation turns the sheets of zinc black.

FISH BONES AS FERTILIZERS.

The *Moniteur Industriel Belge* states that German manufacturers are purchasing the fish bones gathered along the Norwegian shores, which result from the extensive fish-curing stations there located. These bones make a fine fertilizer, and, when pulverized by suitable machinery at the points of collection, are readily transported. The same journal suggests the more extended utilization of the bones from the establishments in Newfoundland, and estimates the product from American fisheries at twenty million pounds a year.

THE HOURLY DEATH RATE.

Dr. Lawson, an English physician, has recently published some curious observations regarding the time of the day when the greatest and least number of deaths occur. He finds, from the study of the statistics of several hospitals, asylums, and other institutions that deaths from chronic diseases are most numerous between the hours of eight and ten in the morning, and fewest between like hours in the evening. Acute deaths from continued fevers and pneumonia take place in the greatest ratio either in the early morning, when the powers of life are at their lowest, or in the afternoon, when acute disease is most active. The occurrence of these definite daily variations in the hourly death rate is shown, in the case of chronic diseases, to be dependent on recurring variations in the energies of organic life; and in the case of acute diseases, the cause is ascribed either to the existence of a well marked daily extreme of bodily depression, or a daily maximum of intensity of acute disease.

PEAT PAPER.

M. Bertmeyer has recently exhibited, in the Polytechnic Society of Berlin, specimens of paper and pasteboard obtained from the products of the peat beds about Kögigsberg, the quality of which is said to be excellent. The pasteboard was 2 1/4 inches thick, and sufficiently hard and solid to admit of planing and polishing. The paper made from peat alone was brittle, like that manufactured from straw; but the addition of fifteen per cent of rags produced the requisite toughness.

ARTIFICIAL EBONY.

This material is made of sawdust mixed with other substances and powerfully compressed in molds. The following is the process of manufacture, as now largely carried on by Messrs. Latry & Co., of Paris: The sawdust, reduced to a

fine powder, is mingled with a suitable quantity of water and blood, and dried at about 112° Fah. The albumen of the blood is thus agglomerated with the powder. The compound is then packed in heated molds, into all the crevices of which it is forced by strong hydraulic pressure.

A NEW RUSSIAN CANAL.

The Russian Government, says the *Revue Industrielle*, has recently completed negotiations with a Russo-English company for the construction of a canal from Cronstadt to St. Petersburg. The work is to occupy six years in accomplishment and will cost \$5,530,000. This will render St. Petersburg the finest port on the Baltic, and besides greatly benefit the city as a commercial center, since the railways to Moscow, Warsaw, and all parts of Russia will be in direct communication with the docks.

A CURIOUS PROPERTY OF SAND AND ITS APPLICATIONS.

If a quantity of dry silicious sand be placed in a bag of canvas or thin box of sheet iron, the mass, after slight compression, forms a conglomerate, capable of resisting pressures of over 60 tons. So far as the envelope is concerned, the sand within acts as if it were an enclosed solid, producing no effect on the covering except a trivial amount where the contact occurs with the load. The sand, however, remains perfectly divisible, and, no matter what may be the superincumbent weight, escapes freely though slowly out of a small aperture made in the bag or box. A simple piece of paper, however, placed over the orifice, is sufficient to stop the flow, even under the load above noted.

M. Beaudemoulin, who discovered this peculiar property several years ago, has lately published in France a work suggesting various modes of its application. For building walls it is well adapted, since the filled bags or boxes need merely be held in place by a framework; while, being very thick, they would form a protection, in case of being used for dwellings, against variations of temperature. Such walls, beside, would be fireproof. It is also suggested that for lowering heavy weights or even entire buildings, which, by a change of street level, have become located too high above the roadway, the sand bags could be placed beneath, and their contents allowed gradually to escape, thus letting the load slowly settle down.

NATURAL ANTISCORBUTICS.

General Sherman says that the *agave Americana*, or Spanish bayonet, the fruit of the common prickly pear, and the succulent leaves of some of the varieties of the cactus that abounds on the deserts of Texas, New Mexico, and Arizona, furnish excellent specifics for that horrible disease, the scurvy.

BROMHYDRIC ACID.

M. Mellies states that a much simpler way of making this acid than that now employed, and which besides ensures a more copious supply, consists in passing a current of sulphuric acid into a small flask containing bromine. Bromide of sulphur is formed and bromhydric acid disengaged.

Intercolonial Exhibition at Sydney, New South Wales.

We have received from M. Jules Joubert, Secretary of the Agricultural Society of New South Wales, the first number of the society's *Journal*, in which are published full particulars of an exhibition to be held at Sydney in April, 1875. There is a long list of premiums, to be awarded for merit in all branches of agriculture and manufactures, the prizes for wines, sugar, and silk indicating the growth of three important industries in the Australian colonies. Agricultural implements are much required in Australia, and competition by American manufacturers is especially invited, communication *via* San Francisco being rapid and convenient.

The Secretary writes us that the Agricultural Society and the Chamber of Commerce of Sydney are, together, making liberal arrangements for an adequate representation of Australian products at our Centennial Exhibition of 1876.

An Early Opinion of Railroads.

An old copy of the *English Quarterly Review* of the year 1819 contains an account of a scheme for a railroad, on which it is proposed to make carriages run twice as fast as stage coaches. The editor evidently failed to appreciate the idea, or to believe in its possibility, for he comments upon it thus wise:

"We are not partisans of the fantastic projects relative to established institutions, and we cannot but laugh at an idea so impracticable as that of a road of iron upon which travel may be conducted by steam. Can anything be more utterly absurd or more laughable than a steam propelled wagon moving twice as fast as our mail coaches? It is much more moving to travel from Woolwich to the arsenal by the aid of a Congreve rocket."

M. De Lesseps' plan of changing the Algerian shotts or lakes into an inland sea is shown, by a French engineer, to be little value. He has recently visited the country, and reports that the lakes are higher than the Mediterranean, and that a canal would merely drain them. Beside, the project would cost \$60,000,000, and it is difficult to see, even were the scheme feasible, any prospect of substantial returns.

PROFESSOR PURSER believes that the moon, in revolving around the earth and drawing the tides behind her, causes the latter to act as a brake on the revolution of the globe, and he considers that it may be mathematically shown that this action is slowly but surely checking the earth's speed of rotation, so that the days and nights are gradually lengthening. In a thousand million years or so, they may become each a month long.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER III.

[Continued from page 323.]

In our paper for November 14, page 307, we began our description of this great engineering work, giving a diagram of New York city and the adjacent territory, showing the position of the Underground Railway, now nearly completed through the northerly portion of the city, $4\frac{1}{2}$ miles, and the route of its authorized extension down town, under Broadway to the Battery, $4\frac{1}{2}$ miles. We also gave a profile of the

59th street to 76th street, and shows the appearance of the surface of the street under which these tunnels pass, and the ventilating openings of the tunnels. Fig. 7 is a cross sectional elevation of the same, showing the mode of construction.

This iron beam tunneling is only resorted to where sufficient headway could not be obtained for the arched brick tunnels. By again referring to the profile (page 308), it will be seen that it has been found expedient to use this latter kind of tunnel only where the difference of railroad and avenue grades is greater than 19 feet, while the beam tunnel is used, with a slight alteration of the street grade, at points where this difference is as small as 11 feet, and, as a

the wall, which, in general, is fifteen feet above grade. The top course of this masonry is composed of stones fourteen inches thick, two feet wide, and three feet long, with pointed beds and joints.

Between the two outer walls and thirteen feet distant from them in the clear, are placed the two inner walls of brick, resting on a stone or gneiss rubble foundation, three feet thick and three feet wide below railroad grade. The walls which rise from these foundations are built of brick without batter, are twenty inches thick and high enough to receive the roof beams, and are tied with fine courses of North River blue stone, five inches thick and well dressed.

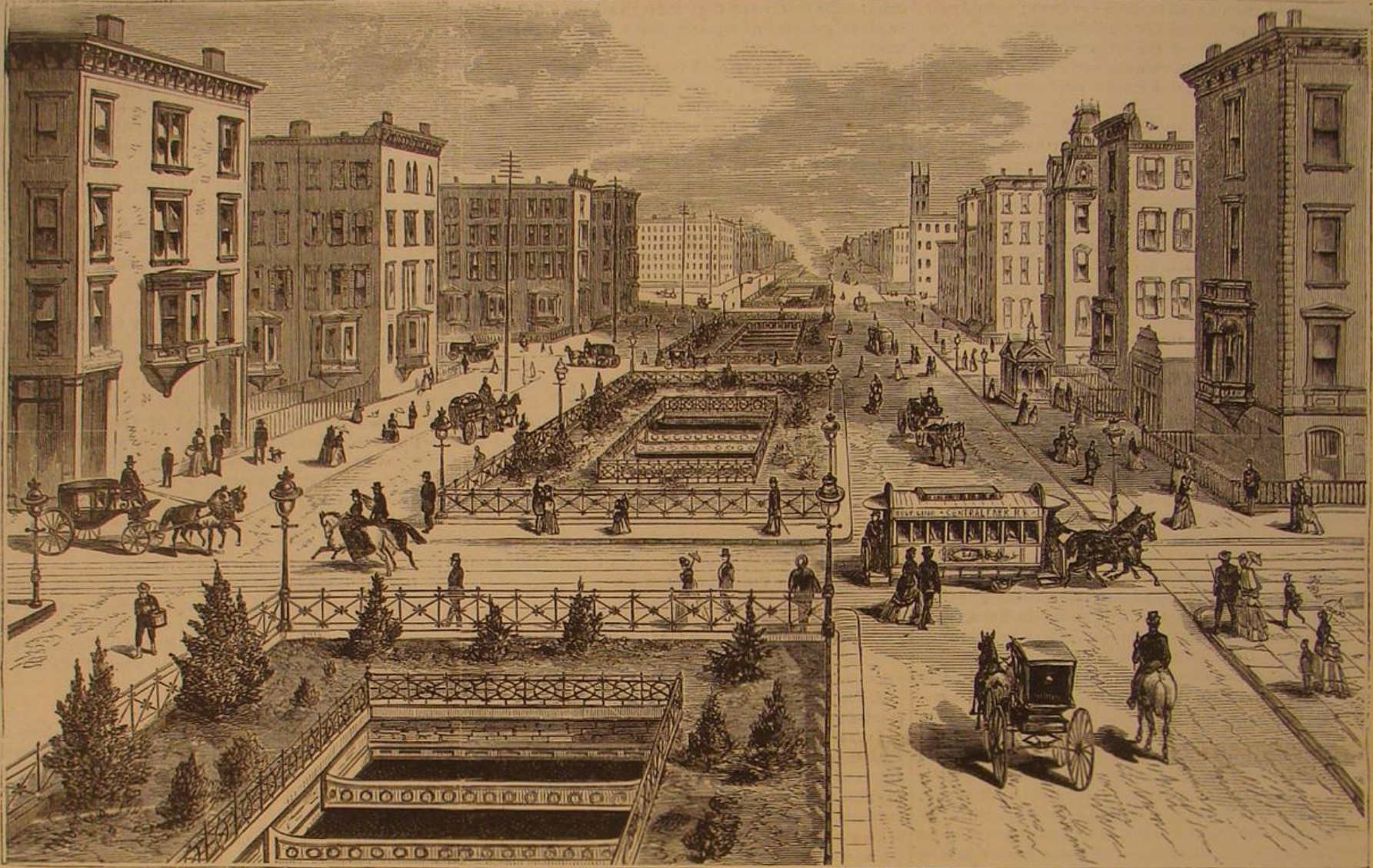


Fig. 6.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—BEAM TUNNEL OPENINGS ON FOURTH AVENUE, 59th TO 76th STS.

railway, showing its grades, depths below surface, street grades, character of the work, etc.; also the contract prices paid for the work, outline of the law for construction, names of the official supervising engineers, names of the engineers in charge, contractors, etc. We also gave a view of the first bridge over the railway, at 45th street. In our following number, November 21, page 323, we gave a cross sectional elevation of the open cut of the railway on Fourth Avenue, with a view of the bridge over the open cut between 52d and 53d streets, with a description of this open portion of the line, dimensions, etc. We now come to that section of the railway passing entirely under the surface of the ground, where the construction of what are known as the beam tunnels begins.

Fig. 6 is a view on Fourth avenue, looking north, from

consequence, more than five thousand feet, of what would otherwise have been open cut, has been covered in with beam tunnels.

Like most of the other tunnels used on the work, the beam tunnels are divided into three separate tunnels, contained within four walls, two outer and two inner, upholding the roof, which is composed of wrought iron beams with turned brick arches between them; the roof, in its turn, sustains the earth and paving of the street. The two outside walls are a continuation of the retaining walls of the open cut, described in our last paper, and are built of gneiss rubble masonry of the same class as that used in the before described retaining walls, seven feet thick at railroad grade, and sloping off thence with a batter, on the inside face, of one inch to the foot, to a thickness of three feet at top of

Along the top of each of these two inner walls run, side by side, the flanges touching, two H-shaped wrought iron girders, twelve inches deep and bound together by half inch bolts, in the manner shown in Figs. 10, 11, which illustrate the method of binding together the girders, and of fastening the roof beams to the girders. These longitudinal girders are of the best wrought iron, weighing one hundred and twenty-five pounds to the linear yard, and are joined longitudinally in such wise that, should any portion of the brick wall supporting them be by any accident thrown down, the longitudinal girders will offer a rigid support to the roof beams and the earth resting upon them. On top of the longitudinal 12 inch girders and bound to them by half, in bolts passing through the flanges, as shown in Figs. 10, 11, rest the iron beams composing the roof. These are also H-shaped

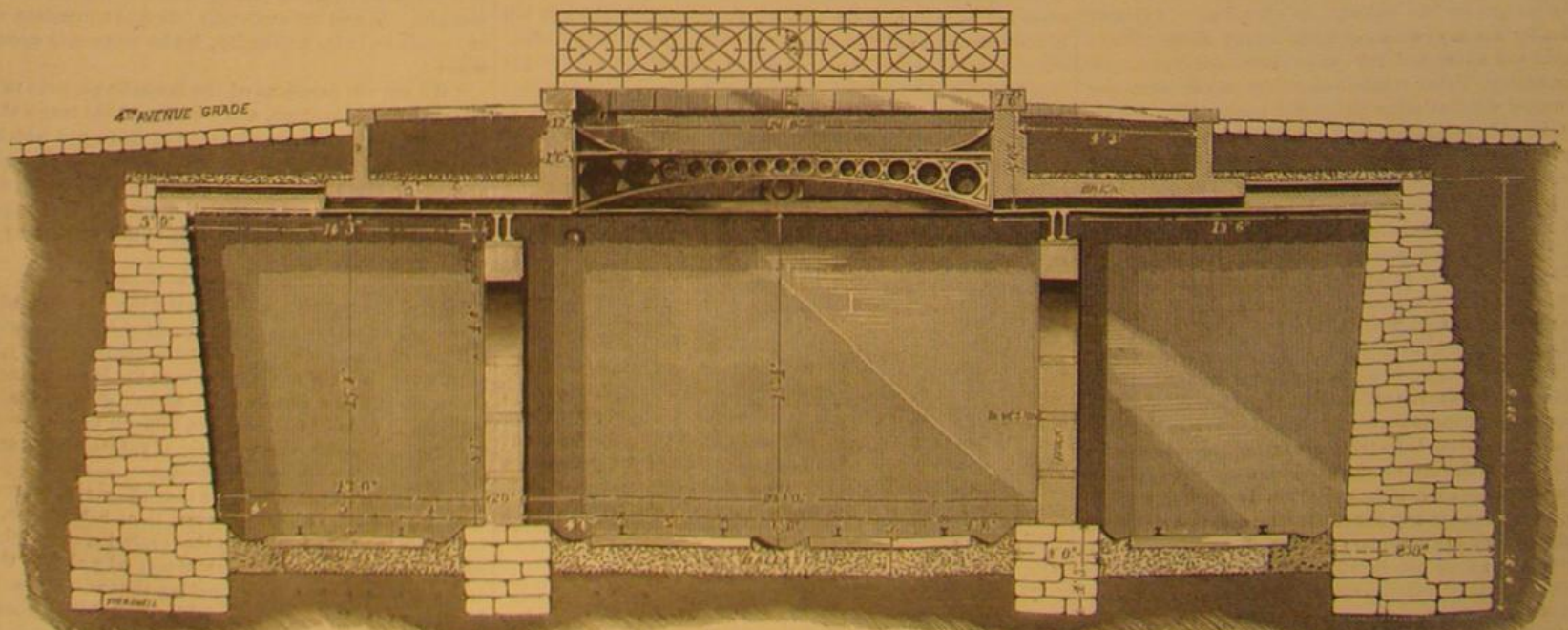


FIG. 7.—THE UNDERGROUND RAILWAY IN NEW YORK CITY.—CROSS SECTIONAL ELEVATION OF THE BEAM TUNNELS AND VENTILATORS, 59th TO 76th STREETS

but very much heavier and deeper than the girders on which they rest, being fifteen inches deep and weighing two hundred pounds to the linear yard, and varying in length from sixteen to twenty-seven feet. They are placed upon the walls, at right angles to the length of the tunnel, and three feet five inches apart from center to center, strapped and anchored, and tied together with one inch iron tie rods, cast iron thimbles being placed between the beams at each tie

on the outer wall and the other projecting over the inner brick wall into the central tunnel. See Fig. 7.

Around these openings are placed brick retaining walls, which rise to the level of the street and are then coped with a coping of first class pane-hammered granite coping, six teen inches by ten inches, which supports a light iron railing. The brick face of the opening is faced with cast iron and braced with cast iron beams placed about seventeen feet

American Iron.

It is proverbial, at least among the Americans themselves that they, of all nations, possess in its greatest plenitude the faculty of recuperation. From time to time the American world of business is distracted by financial typhoons; the vessel of state is laid on her beam ends; hotels, and even theaters, reduce their prices; and stern admonitions issue from press and pulpit that the period of piping and dancing

FOURTH AVE. GRADE

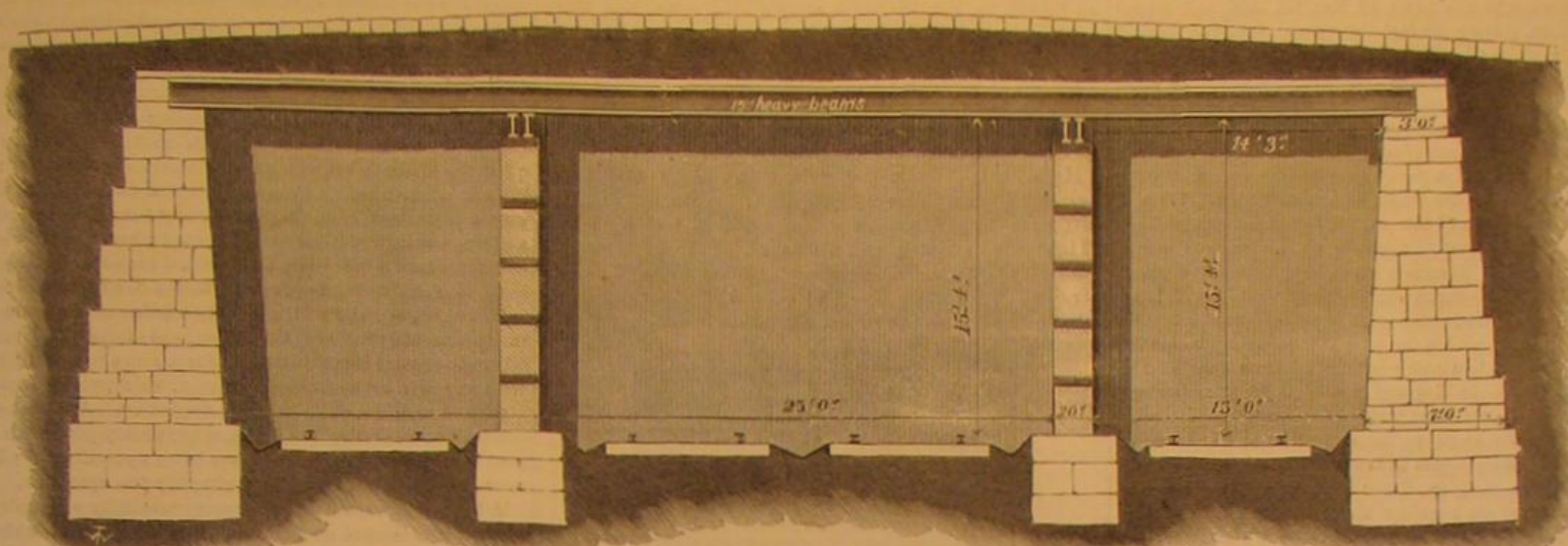


FIG. 8.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—SECTIONAL ELEVATION OF THE BEAM TUNNELS, BETWEEN THE VENTILATORS,—50TH TO 16TH STREETS.

rod and at the ends. This manner of tying the beam is illustrated in Fig. 11, which represents a cross section through two of the beams placed over the large central tunnel, as also the horizontal projection of a longitudinal section through the center, showing the thimble at the tie rods. The strapping consists of two iron bands or straps, one of which passes from the top flange of one beam under the bottom flange of the second, and to the top flange of the third; the other, from the bottom flange of the first beam to the top flange of the second, and thence to the bottom of the third, the straps being fastened at each flange.

Over the small side tunnels, whose span is but 14 feet 3 inches, the roof beams are placed singly; but over the central tunnel, which has a span of 25 feet, they are placed in pairs, that is to say, two beams are placed side by side so that their flanges touch, each pair being 3 feet 5 inches apart from center to center. See Fig. 9.

Between the beams are placed the turned brick arches, 8 inches thick. The whole is then covered, to a depth of 4 inches above the tops of the beams and arches, with concrete, composed of one part Ulster county hydraulic cement and two parts sand and gravel, or stone, broken so as to pass every way through a two inch ring; over this is placed a coating of three-ply roofing felt and cement, and then the earth and paving.

The main central tunnel is lighted and ventilated through openings, twenty feet wide and one hundred and fifty feet long, placed one in each block.

We mentioned that the roof beams varied in length from sixteen to twenty-five and twenty-seven feet. The reason for this variation will now be quite apparent. The sixteen feet beams are used to span the small or side tunnels, which have a width at top of 14 feet 3 inches; the twenty-seven feet beams span the large central tunnel, whose breadth at top is twenty five feet, while the twenty five feet beams are used where the openings occur in the large tunnel, one end resting

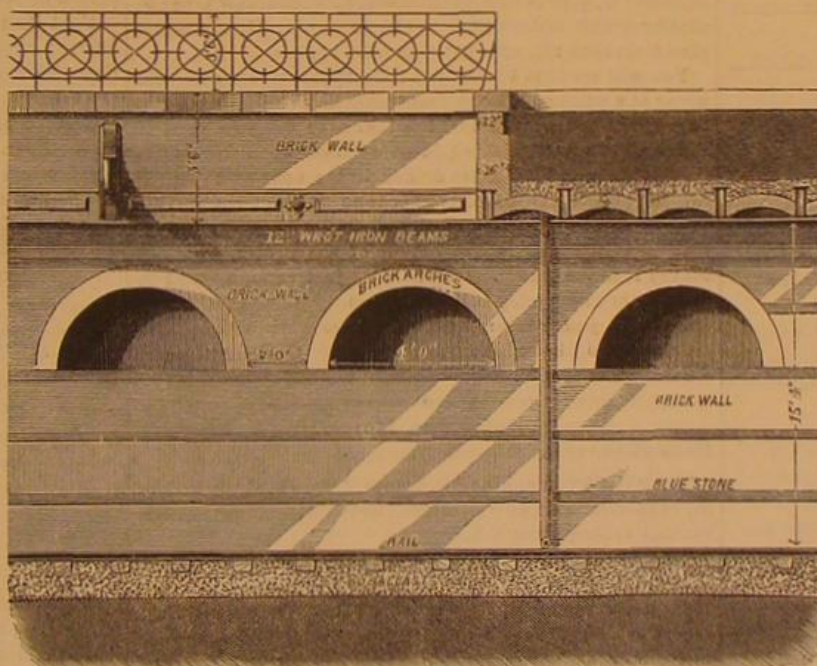


FIG. 9.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—LONGITUDINAL SECTIONAL ELEVATION OF THE BEAM TUNNELS,—50TH TO 16TH STREETS.

part of the wall for the entire length of the central opening, and are four by eight feet.

The Temperature of the Sun.

M. Violle considers that the emissive power of the sun at a given point on its surface will be the relation between the intensity of the radiation emitted at such point and the intensity of radiation which a body, having an emissive power equal to unity and carried to the temperature of the sun at the considered point would possess. So that he defines the true temperature of the sun as the temperature which a body of the same apparent diameter as the sun should possess in order that this body having an emissive power equal to the average of the solar surface, may emit, in the same period, the same quantity of heat as the sun. From experiments made at different altitudes, M. Violle determines the intensity of the solar radiation, as weakened by passage through the atmosphere, and finds, for the effective temperature of the sun, 2,832° Fah.

Investigations conducted with an actinometer by the dynamic method lead the investigator to conclude that steel, as it emerges from a Siemens Martin furnace, has a temperature of 2,732° Fah. If it be admitted that the average emissive power of the sun is sensibly equal to that of steel in a state of fusion, determined under like conditions, it appears that the mean true temperature of the solar surface is about 2,832° Fah.

THE Patent Office has granted a patent for a dummy, for dry goods merchants, to enable them to make a large show on a small stock. It consists of a block of wood, neatly done up in a cover of cloth, labeled and ribboned to represent, in exterior appearance, a full package of real goods.

Iron. The Americans have a splendid "forest primeval," but the blast furnace is a great devourer, and will thin the surrounding country in an alarmingly short space of time. Possibly improved railway communication will more than keep pace with the rapid destruction of timber, but the significant fact yet remains that, out of 630 furnaces in blast in 1873, 265 were supplied with charcoal. No charcoal smelting of iron can be long lived; and it is, therefore, clear that, unless increased railway communication be provided, a certain section of the iron industry of the United States will

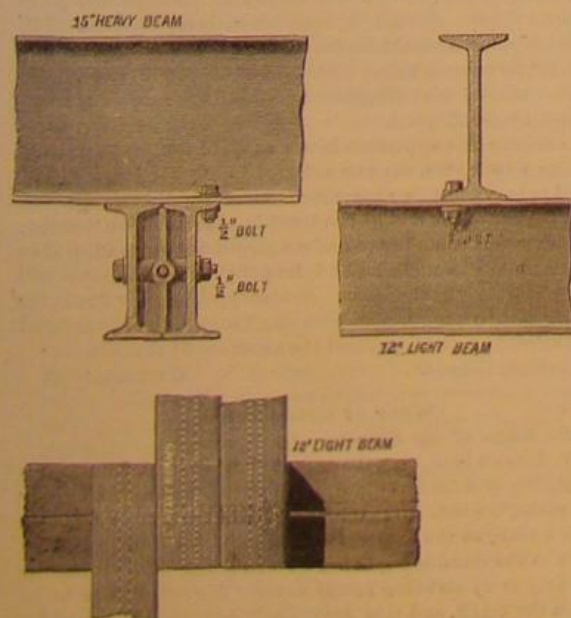


FIG. 10.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—JOINTS AND COUPLINGS OF THE IRON BEAMS.

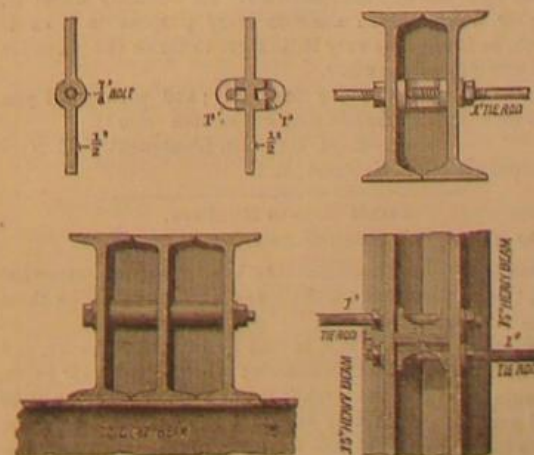


FIG. 11.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—JOINTS AND COUPLINGS OF THE IRON BEAMS.

be soon "played out." Vigorous efforts will undoubtedly be made to put other iron producing centers on a level with Pittsburgh, by improving the communication between coal and iron regions; but the truth will always remain constant, that, however rich iron ore may be, it will not pay to carry it too far.

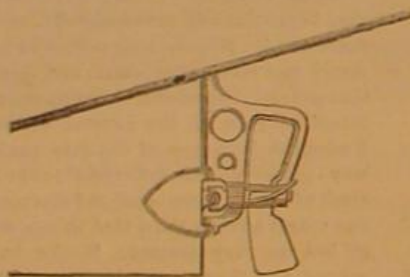
For a long while the American makers had a heavy uphill journey, as, although they were protected by an enormous tariff, and were supplied with a huge home demand, English makers of railway material swept the market. An unprecedented advance in the price of English coal, and consequently of iron, during the last three years, deprived English makers for a while of their advantage, and, despite dear labor, the American ironworks rose last year to a high pitch of prosperity. The delicate conditions of business in the United States failed, however, last autumn to withstand the tension of the financial world, and the American iron and steel trade suffered a paralysis which it communicated in no small degree to the trade of Great Britain. With a keen eye to the wants of the future, the American makers apparently foresaw that the wants of the railway world would be confined to Bessemer steel, and have made great efforts to compete—under the aegis of their duties—with English makers in the production of this important metal. So long as exaggerated prices for fuel and labor prevailed in England, a chance of success remained; but so soon as the period of inflation in England ceased, it at once became evident that steel rails were wanted for America. Barrow-in-Furness is likely to prove for some time a hard nut to crack for all her competitors in Bessemer steel, be the same English or Welsh, Belgian, French, or American. She has the precise kind of ore required under her feet, and in this particular possesses an undoubted advantage over American rivals. That a country may escape ridiculous smallness by being inconveniently large, is proved by the significant fact that Algerian and Bilbao ores cost at the furnace in America \$30 per ton, when they may be bought at Barrow or at Cardiff for \$8.25. Without "magnificent distances", the superb supplies of iron ore in "the States" would be speedily utilized; but until increased and cheaper railway communication has brought her coal and iron closer together, America will need all her unquestionable energy and ingenuity to compete with England in the world of iron.—*Iron.*

Correspondence.

Universal Joints in Screw Shafts.

To the Editor of the Scientific American:

I have lately noticed in your valuable paper a number of references to the use of Hooke's universal joint in a screw shaft, but I have seen nothing resembling an invention of my own in that direction, and I would like to call your attention to it. The engraving, I think, explains itself, and it



is designed to facilitate the handling of small boats, like launches intended for torpedo work.

The propeller and that portion of the shaft beyond the universal joint is hung in a composition frame, which takes the place of the ordinary rudder. A line passing through the axis of motion of the pintles and gudgeons would also pass through the center of the ball of the universal joint; and by means of the frame, the propeller is thrown to the right and left in steering. My invention has been applied to one of our torpedo launches, and has been in operation for several months. The speed of the boat is exactly the same as it was with the same propeller fitted in the ordinary way; while the rapidity with which she can turn to starboard or port is very much increased, the diameter of her circle being much decreased. The rudder framehead is fitted with an arc which gears into a rack on the side of a cylinder moving athwart the stern of the boat, so that she can be steered by steam or compressed air. An ordinary wheel is, however, fitted, which answers every purpose in a small launch, as it requires very little force to throw the propeller from one side to the other.

I have no patent on my invention; and perhaps, if you print my sketch, some one may get an idea from it.

F. M. BARBER, Lieutenant U. S. N.

Torpedo Station, Newport, R. I.

Small Steam Engines.

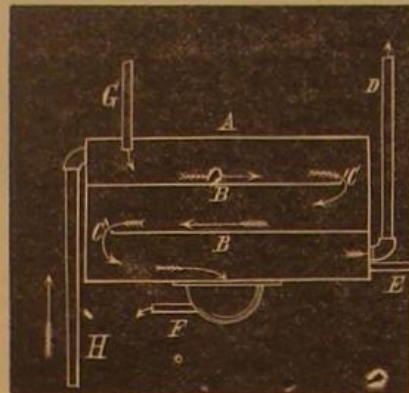
To the Editor of the Scientific American:

Several of your correspondents having written somewhat upon the performance of small engines, I would like them to see what I am doing.

My engine cylinder is 4 inches by 10 inches stroke, and runs at 120 revolutions per minute; it has a common D valve, and cuts off at $\frac{1}{2}$ of the stroke; it has a boiler pressure of 60 or 70 pounds. With this engine I run my machine shop, which has 52 feet of $1\frac{1}{2}$ inch shafting, running at 200 revolutions, driving two engine lathes of 8 and 6 feet bed respectively, one planer of 6 feet bed, one upright drill (medium

size), one small drilling lathe of 4 feet bed, one drop hammer (hammer weighs 300 pounds), one blower, one grinding machine for grinding rolls, etc., beside a grindstone and an emery wheel. These tools are in my own shop. I run a quarter-turn 4 inch belt into the next building, and drive 32 feet of $1\frac{1}{2}$ inches shafting, and one large iron blacksmith's or boiler maker's punch and shears combined, and one medium-sized upright drill. I also take another quarter-turn 4 inch belt from my shaft, and (by three countershafts and pulleys) reach the second story of the second building, and go thence up into the third story of the same, and there drive 54 feet of one inch shafting, and 30 sewing machines running upon heavy cotton goods. I also take from my main line in my shop a rope belt of $1\frac{1}{2}$ inches diameter, and drive (in the third store adjoining me on another side, 56 feet distance between shafts) some coffee-roasting and spice mills.

My boiler is of locomotive style, with a 26 inch shell, 6 feet long, with twenty-nine $2\frac{1}{2}$ inch flues; the fire box or grate surface is 23×28 , with a smoke stack 40 feet high and 10 inches in diameter, with a damper. I use no blower; I burn coke and bituminous screenings mixed (about 2 barrels per day). I evaporate about 20 gallons of water per hour, introducing it into the boiler, through a heater of my own construction, at about 206° F. ab.



A, heater of sheet iron; B B, two sheet iron pans; C C, points where the pans are turned up a little, and small holes drilled through; D, pipe where steam escapes; E, overflow pipe; F, pipe by which hot water is taken to pump; G, cold water pipe from tank; H, exhaust pipe from engine.

You will see that I introduce the exhaust steam and cold water at a point as near to each other as possible, and that both steam and water travel together over the two pans to their exit, the water falling down upon each pan successively, and through little holes drilled in the ends of the pans for that purpose, in order to expose as much of the surface of the water to the action of the steam as possible, until it reaches a little well in the bottom of the heater, whence I convey it to the pump. I admit only just enough water to this heater to keep my boiler supplied.

If any of your readers are doing more work with less engine, I would like to hear from them. O. B. FENNER.
San Francisco, Cal.

Cribbing in Horses.

To the Editor of the Scientific American:

The letter upon cribbing in horses, from D. Cook, Elmira O., is calculated to do a great deal of harm, without any advantage arising therefrom.

He says that the habit is caused by some foreign substance being pressed between the teeth, or by the front teeth growing too close together, thus causing pain. If this were the case, I ask him: Why a great many horses, during the act of cribbing, always apply the under jaw, instead of the teeth, to the manger? His treatment for the same, which no doubt he offers as an entirely new idea, has been known to horsemen for years, but is seldom practised by them.

Instead of crib-biting or wind-sucking being caused by pain in the teeth, it is due to a derangement of the stomach. Filling the incisor teeth apart, in the place of relieving pain, very often produces it; and therefore, whenever it is successful in preventing the animals from indulging in the habit—which is but seldom—it is on account of the soreness of the teeth occasioned by the operation.

To enable a horse to swallow wind, it is necessary for the muscles of the neck to contract, and the only object in applying the teeth or jaw to the post or manger is to afford a fulcrum for these muscles to act from. J. C. HIGGINS.
Millstone, N. J.

Forming and Tempering Taps.

To the Editor of the Scientific American:

I find that T. I. B.'s tap, a quarter inch in diameter, which has tapped "over two hundred thousand hot forged nuts," was made according to the instructions given by Mr. Rose in his valuable practical essays. It was forged to as near its finished size as possible, so that it would true up. It was passed through a hardened steel gage. It had three half round grooves, the only clearance being to ease off the tops of the threads. It was heated to a cherry red, "red without being hot enough to scale," then dipped endways, and the shank made the softest and tempered on a piece of iron, as given in "Practical Mechanism" for dies. All these operations are precisely those recommended by Mr. Rose; and it is curious that it broke from being applied to a hole that was too small, giving it, as Mr. Rose puts it, "more duty than it should be required to perform."

As a mechanic, I agree with T. I. B. as to his method of making and of sharpening a taper tap, and thank him for

giving to the world, through your columns, the method and result of his practice, which is truly remarkable.

East New York, L. I.

MACHINIST.

[The above is only one out of many scores of letters which we receive, constantly testifying to the value of the articles on "Practical Mechanism."—EDS.]

A New Friction Brake.

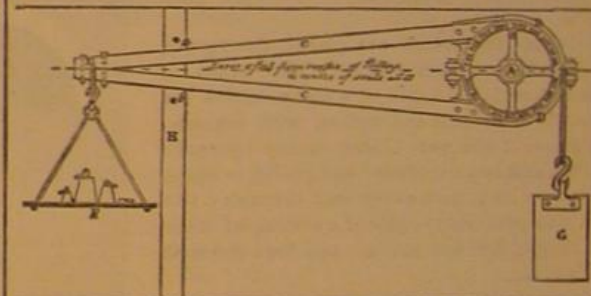
To the Editor of the Scientific American:

In your issue of October 31, 1874, is an illustration and description of a simple friction brake for testing the power of small engines. Having given some attention to the various kinds of dynamometers for such purposes, I submit for your inspection a modification of a brake somewhat similar. The difference between this brake and that referred to consists in the weights of my brake being suspended from a center line horizontally through the shaft. It does not require the piston in oil which forms a part of your brake; and instead of two wooden blocks, I use a metal ring in two pieces or sections, each piece being less than the half circle and lined with wood, leaving an opening between the pieces, and turned on a face plate to the exact diameter of the pulley. Each half ring is provided with a flange, to which the arms are bolted, and which meet in a point at a certain distance from the center of the pulley, and form the lever by which the power is measured. There is also a box partly filled with scraps to act as a counterbalance, which, with a common scale and weights, completes the apparatus. As a matter of convenience, in using the brake, a temporary post with two pins is used for securing the lever in an approximately horizontal position, which tends to simplify the operation.

A is the shaft, revolving at seventy revolutions per minute; B, a pulley fastened on the same, the diameter of which is immaterial, but should neither be very small nor very large; C C, two wooden arms which form the lever; D D, two pieces of a metal ring, each piece being less than the half circle; F, a scale whereon weights are placed in making a test; G, a box with scrap which counterbalances the lever C C, and scale, F, when hanging loosely on the pulley; H, a temporary post, with two pins, a and b, for securing the lever in nearly a horizontal position. The weight of the lever, with rings, scale, and counterbalance, is 300 pounds, when the said lever is perfectly level and loose on the pulley. The length of lever from center of shaft, A, to point, E, is 5 feet.

First find the friction caused by the lever and counterbalance when loose upon the pulley. The coefficient of friction with wood or cast iron, lubricated, is 0.21 ; $300 \times 0.21 = 63$ pounds.

Tighten up the brake until the speed of the shaft, A, falls a revolution below its usual speed; slack the brake until the speed comes close up to the full number of revolutions; place weights on the scale, F, adding thereto until the lever, C C, falls down to a perfectly horizontal position. This accomplished, take the number of pounds weight on the scale, F,



and multiply this by the circumference of the circle in feet of which the lever, C C, is the radius, measured on the horizontal line, and by the number of revolutions of the shaft, A, per minute; this will give the number of foot pounds (or the number of pounds raised one foot high in one minute), to which product add the friction of the lever as previously found, and divide the whole by the standard horse power, 33,000 lbs. raised one foot per minute, which will give the horse power transmitted by the shaft, A, which shaft may be either that of a small steam engine or a countershaft in a factory or mill.

Example: A lever is 5 feet long; this gives a circumference of a circle described from the center, A, through the point at E, 31.4 feet. Weight in scale when lever is level, 75.05 pounds; speed of shaft, 70 revolutions per minute; $31.4 \times 70 = 2,198$ feet per minute; $2,198 \times 75.05 = 164,959$, and $164,959 + 63 = 165,022$, and $165,022 \div 33,000 = 5$ horse power transmitted by the shaft, A.

I consider this apparatus better adapted for the purpose of testing power than the one referred to in your journal. The friction brake in this apparatus is more rigidly secured, and will not cause the end of the lever to vibrate when testing, so that it will come to the desired position more readily than that with the two blocks and long bolts, which latter will cause vibration of the lever. Secondly, the center line is the proper line to hang the weights on. Thirdly, the piston in oil will affect to a certain extent the accuracy of the test.

Toronto, Canada.

WILLIAM GILL

Wear of Grindstones.

To the Editor of the Scientific American:

W. Kapp's idea, on page 228 of your current volume, for arranging grindstone spindles to prevent the uneven wear of the stone, is good. But the difficulty is not wholly removed by his plan, as the greatest cause of uneven wear is attributable to the stone being softer on the lower side, caused by the drip or by standing in the water. A good idea is to remove the crank, and this may apply advantageously to his plan.

C. C. BLAKEMORE.

Washington C. H., Ohio.

THE NATIONAL ACADEMY OF SCIENCE.

The second session of this body (the first meeting was held, it will be remembered, at Washington, during the spring) met on November 3, at Philadelphia. The attendance has been large, and includes the names of many of the most distinguished scientists and scholars in the country. We give below brief abstracts of the papers read.

CAUSE OF SUDDEN COLD WEATHER.

Professor Elias Loomis has made careful studies of the weather maps of 1872-3, with a view to the discovery of laws governing the relation between the direction and velocity of the wind and barometric pressure. In the center of an area of low barometer, a strong upward movement has been observed, and it now appears certain that a downward movement prevails over areas of high barometer. The result of this downward flow must be a considerable fall of the thermometer. These considerations appear to prove that the extremely low temperatures which occur at irregular intervals in every month, and particularly in the winter months, are due mainly to the descent of cold air in the neighborhood, and that this descent of air results from the outward movement which generally takes place from the center of an area of high barometer. In summer, during a thunderstorm, the temperature often falls 10° in a few minutes, but observations show that there was no current of air from the north. These sudden gusts of cold must descend from the higher atmospheric regions.

In the discussion which followed the reading of this paper, Professor Joseph Henry suggested the possibility of currents from the north in the upper atmospheric regions bringing down the cold air, which is afterward precipitated on the earth's surface in the areas of high barometer where the outward motion of the wind is observed.

Professor Packard detailed some observations on the specific gravity of water in the Gulf of Maine, and stated that the bottom water is considerably denser than the surface. The average specific gravity of bottom water is slightly less than that of surface water; yet, from 50 to 800 fathoms, the specific gravity increases with the depth, from 1.0273 to 1.0277.

Professor Sterry Hunt delivered an extemporaneous address on the

DECAY OF CRYSTALLINE ROCK.

In Western Connecticut, the brown hematite iron ores of Salisbury and Kent are associated with what is locally called fuller's earth, but consists, according to Shepard, of nearly vertical strata of crystalline formation decayed in place.

From a comparison of the masses of iron ore thus found with the similar masses observed in the decayed crystalline rocks of the Blue Ridge, which were recognized as the results of the alteration of beds and lodes of iron pyrites, and in some cases of beds of spathic iron ore, found in these rocks where the decay has not reached them, professor Hunt argued that such had been the source of much of the hematite ore found along the great Appalachian Valley.

The iron oxide in these and similar decayed rocks had, by its solution, furnished the whole of the iron ore which, in various forms, is interstratified in our palaeozoic rocks at different horizons. From these decayed strata had also come the materials for all the clay rocks and sand rocks of various ages.

RELICS OF AN ANCIENT RACE.

Dr. F. V. Hayden mentioned his discoveries of ruined cities in the cañons leading to the Colorado river. He said that there once existed, in what are now the arid plains and savage gorges of Southeastern Colorado, a race so far civilized that they built large cities, constructing their houses of well hewn blocks of stone, with timber floors, well formed windows and doorways, and smoothly plastered walls, and that they possessed the art of making glazed pottery.

Professor Henry produced a eulogy upon

JOSEPH SAXTON,

the inventor of the magneto-electric machine, who died October 26, 1873. Mr. Saxton also invented the locomotive differential pulley; an apparatus for measuring the velocity of vessels; and a metal ruling machine, a contrivance for tracing lines on metal or glass at a minute distance from each other. Mr. Saxton returned to this city in 1837, and during his connection with the United States Mint constructed the large standard balances still used in the annual inspection of the assays and the verification of the standard weights for all the Government assay and coinage offices of the United States. Mr. Saxton's inventive powers were exercised rather for the pleasure their employment gave him than for any gain to himself. Others reaped the profit from many of his most valuable inventions. He rarely sought to bring into use his devices and discoveries. Among a great many valuable inventions, for which he never received proper credit or any pecuniary return, was that of metallic cartridges.

Professor Packard described the indications of the nervous system of the limulus (king crab) which he succeeded in discovering in a fine transverse section of an embryo in an early stage of development. He also mentioned a bright red gland in the crab, hitherto undescribed, which, he thinks, is renal in nature, and homologous with the green glands of normal crustacea.

MEASURING MINUTE CHANGES IN ATMOSPHERIC PRESSURE.

Professor Mayer described a machine accurately measuring the most minute variations in the pressure of the atmosphere—changes so slight as not to affect the barometer. A hollow metallic vessel, with unyielding walls containing air, has adapted to it an open glass tube. In this tube is a short liquid column. The glass tube is in a horizontal position. The vessel is surrounded with melting ice, which

keeps the air in the vessel at a constant temperature. In this condition the liquid in the tube remains stationary, if the pressure of the air outside the apparatus remains constant; but any increase of pressure in the atmosphere will cause the liquid in the horizontal glass tube to move toward the vessel. The contrary motion takes place when the atmospheric pressure diminishes. These motions of the liquid column are registered continuously by photography. A standard mercurial barometer is observed at stated times, so that the values of the motions of the liquid column can be determined. This apparatus, if placed at certain important stations of the United States Signal Service, would be of good use in studying the variations in atmospheric temperature in connection with the development and progress of storms.

Professor Mayer spoke afterward of the change in dimensions of solid and hollow iron cylinders on their magnetization, and described experiments made on solid and hollow cylinders of iron three feet in length and five or six inches in diameter. He found that solid cylinders elongate on being magnetized, but at the same time so contract in their transverse dimension that the volume of the cylinder remains constant. In the case of hollow cylinders, however, it was found that their interior capacity increased on their magnetization.

Professor Henry replied briefly to the criticisms upon our lighthouse service, which appeared in the recent report of Major Elliott, an abstract of which has appeared in these columns. He said that lard oil made a brighter light in large lamps than kerosene; and that as most lighthouse keepers were appalled by politicians, they were ignorant of their business, and could not be trusted with gas generating apparatus. There was often trouble in teaching them to manage the simple steam boilers used with fog whistles and sirens. An electrical light had been proposed instead of oil, but such light was deficient in the red ray. No light was strong enough to penetrate fog. A mile of cloud shut out the sun's rays, and we could not hope to get a light superior to the sun.

Professor Silliman described a method for the

REMOVAL OF AMMONIA FROM ILLUMINATING GAS,

and obtaining it in the form of a dry salt, adapted to the uses of agriculture. When nitric acid salt cake, a by-product of acid works and of small value, ground to powder, was placed in an apparatus similar to that used for lime purification, all the ammoniacal compounds were completely removed from the crude gas, while the salt was enriched by about 13 per cent of sulphate of ammonia, or 3½ per cent actual salt. It appeared on investigation that all the cyanogen compounds had been decomposed by the salts of iron in the nitric acid salt cake, derived from the action of the acid on the iron retorts, and excited a ferro- and ferri-cyanide of iron action in the mass, staining it distinctly.

The so-called commercial superphosphate of lime also effectually withdraws every trace of ammonia from gas. An acid salt of this sort is found in ammonia, which yields a soluble monobasic calcic phosphate of 6.76 per cent of phosphoric acid; when saturated with ammonia composed from gas, it yields 6.11 per cent of salts.

The ammonia may be completely withdrawn from coal gas in its crude state by acid salts, and presented in a dry and manageable form, without further labor or expense in solution, crystallization, or manufacture; and also it is easily deprived of the poisonous effects of cyanogen compounds by a proper use of salts of iron. Analytical chemists will be glad to know that, by using either sodic or potassic bisulphate in a U tube, it is quite easy to withdraw ammonia from a gaseous mixture containing ammoniacal compounds, and to obtain it in a condition to be weighed.

Professor W. B. Rogers, on

NEWPORT CONGLOMERATE,

said that there is nothing in the structure calling for further agency than the ordinary transporting and wearing actions under which such products have generally been accumulated.

Professor Rogers described a

SIMPLE METHOD OF GENERATING POSITIVE ELECTRICITY

wherever a steam boiler exists in the building.

He attached a pipe to an ordinary boiler used for heating purposes, and carried it through the window to the outer air. To the end of the pipe where the steam escaped he attached what are known as Faraday's nozzles—15 of them—with applewood apertures. In front of these nozzles he suspended, by a brass rod, a piece of brass foil, cut so as to present a bristle of points to the escaping steam. He had only to provide an insulating support for the rod, and carry a wire through a pane in the window to a long rod held by ribbon silk in the room where he desired to use the electricity, to have a strong positive current. A tube inserted in the steam pipe, with a valve opening inwardly, admitted air sufficient to produce a uniform condensation of the steam.

Professor Mayer's paper on the composite nature of electrical discharges, that of Professor Henry on the effect of wind on sound waves, and Dr. LeConte's address on the use of mineral poisons by farmers, we reserve for fuller consideration.

The meeting adjourned on November 5.

A NEW SOURCE OF COAL.—The English engineers sent by the Viceroy of Egypt to examine the carboniferous deposit of Dranesta have recently forwarded to England 300 tons of the fuel to be experimented upon. Dranesta is situated 108 miles south of the city of Salonica, in the midst of the mountains which extend to the southward of Mount Olympus.

Character of Electric Discharges.

A flash of the duration of $\frac{1}{100000}$ of a second is instantly recognized by the retina, but the effect on the eye lasts fully $\frac{1}{2}$ of a second. The duration of the flashes recently examined by Professor A. M. Mayer, of the Stevens Institute, varied from 0.124 to 0.0416 of a second. An idea of the length of this last mentioned interval may be obtained by recalling the fact that a rapid involuntary wink takes place in nearly the same time. That the Leyden jar discharge is multiple was discovered by Professor Henry, and this has been subsequently confirmed by Cazin, Tedderson, and Rood. Professor Mayer, however, has sought more definite results, and the object of his investigations has been a permanent record of the character of the discharge, of its duration, and of the intervals separating its constituent flashes and sparks. To this end he prepared disks of thin printing paper, blackened over burning camphor, and of a diameter of 5.8 inches. When one of these was revolved very rapidly, it became quite flat by centrifugal action, and in this position the discharge between points or balls perforated it, leaving the required record. By presenting momentarily to the rotating disk the delicate point attached to a vibrating tuning fork, the number of vibrations per second of the fork was determined to the last degree of precision by means of a break-circuit clock, which at each second sent a spark from an inductorium through the fork. The result was traces on the blackened disk; and by tracing the axis of the sinuous line with a needle point, and then drawing radii through symmetrical intersections of the axis on the line, the disk was divided off into known fractions of time. These marks were then rendered permanent, the disk centered on a dividing circle, and the indications read by a low power microscope, determining with accuracy intervals and durations to one 50,000th of a second.

The results thus far obtained we summarize below, and we understand that others have been reached which the investigator withholds until he has subjected them to more careful examination.

The first discharge was between large inductorium points, 0.39 inches apart, the striking distance of the coil being 17.7 inches. Thirty-three clear round holes were made in the disk by a portion of the discharge lasting $\frac{1}{1000}$ of a second. The average interval between the perforations at the beginning was $\frac{1}{1000}$ of a second; then followed a period of quiescence of $\frac{1}{1000}$ of a second, and then a shower of 30 minute sparks, lasting $\frac{1}{1000}$ of a second. The average interval separating these was $\frac{1}{1000}$ of a second. The second discharge was between platinum points, 0.39 inches apart, of a large inductorium, with a Leyden jar of square inches, connected with the terminals of the secondary coil. The discharge on its path around the disk dissipated 91 little circles of carbon, each perforated by from 1 to 4 holes. The discharge lasted 0.124 second, and the intervals were $\frac{1}{1000}$ of a second up to the tenth flash. For four fifths of the discharge they were separated by $\frac{1}{1000}$ of a second, and at the last by $\frac{1}{1000}$ of a second.

We understand that Professor Mayer is examining the discharges of the frictional and Holtz machines, as well as of the Leyden jar and inductorium, so that results of considerable scientific interest and importance may be expected.

Rubber Thermometers.

M. Kohlrausch, having several times noticed that glass flasks, closed by stoppers of hard rubber, burst, concluded that this substance must be very dilatible. This hypothesis was fully verified by experiment, for the expansion of this body was found to be about three times that of zinc. From his measures, the coefficient of dilatation for 1° between 16.7° and 25.3° = 0.0000770, and between 25.3° and 35.4° = 0.0000849. Thus, not only has hard rubber a very great coefficient of dilatation, but the latter increases very rapidly with the temperature.

This remarkable property can be applied to the construction of very delicate thermometers. Thus, with a small instrument, consisting of two strips of rubber and ivory, 8 inches long, glued together and fastened at one end, we obtain, at the other extremity, a considerable movement for a change of temperature of one degree. The coefficient of hard rubber is equal, at zero, to that of mercury; above, it is greater. We can, then, as a curiosity, construct a mercury thermometer with a reservoir of this substance, whose changes will be the opposite of those of a common thermometer, and which will fall with an increase of temperature.

The Pennsylvania Railway Company's Figures.

The Pennsylvania Railway Company owns about 16,000 eight-wheeled freight cars, valued at \$512 each; 1,800 four-wheeled freight cars, worth \$170 each; 521 passenger cars of all grades, worth \$3,550 each, and 879 locomotive engines, worth \$11,000 each. Total valuation of the rolling stock, twenty millions of dollars. The length of the company's tracks, or those controlled by the company, is 5,934 miles.

MUSCARINE is a new alkaloid obtained from poisonous mushrooms, and especially from the *agaricus muscarius*. Dr. Provost, of Geneva, has shown that, when muscarine is injected into the veins of an animal, the heart is arrested in its diastole. The action of this poison is so much the more remarkable, since in such a case the heart is not dead, nor even paralyzed, and its contractions can be aroused after several hours' silence.

ACCORDING to Képesy, the surgeon to the Austrian Polar Expedition, chocolate, as a beverage, proved most valuable of all; the preserved meat and vegetables in tins being also of the greatest service in sustaining the strength and spirits

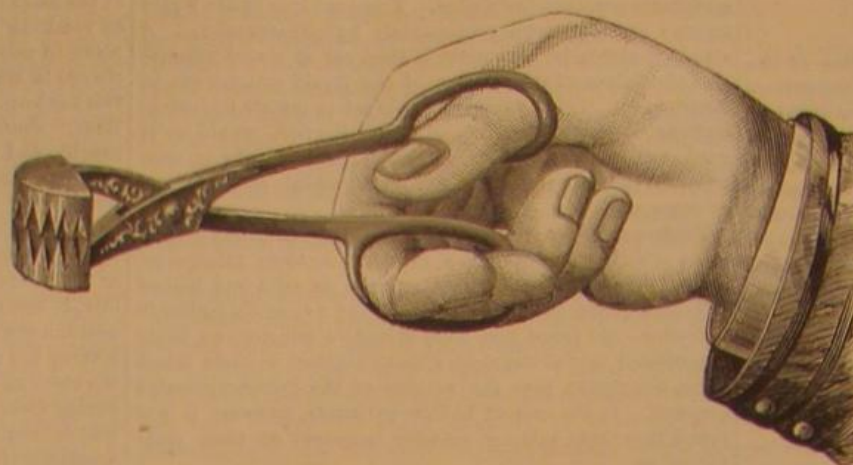
IMPROVED PINKING IRON.

This is an ingenious and handy substitute for the old fashioned pinking iron, or one under which the cloth is usually laid and the cutting done by pounding on the end of the tool with a hammer.

The present invention is nothing more than two cutting blades, of any desired form, attached to levers which are jointed like pincers and are operated like scissors. The upper blade does the cutting, and the lower one is made to correspond to it in shape, having its edge made, however, by beveling one side only. Both are so constructed that, when the jaws are closed, the edge of the upper blade sinks slightly below the surface of the lower tool and just back of the same, so that at each stroke the beveled parts of the blades bear against each other, and the cutting edge strikes against nothing but the fabric.

Of course the dies or blades are varied in form for different patterns, but it is considered cheaper to have an entirely separate instrument for every pattern instead of providing detachable blades.

Patented September 1, 1874. For further particulars regarding sale of State rights, etc., address the inventors, Mrs. Eliza P. Welch, Groton, Caledonia county, Vt.



WELCH'S PINKING IRON.

that cast iron at ordinary temperatures is both heavier and denser than molten iron; but that, as its temperature rises, the solid iron expands, and becomes lighter and finally floats on the molten iron. The latter fact shows simply that solid iron, when at a high temperature, approaching its melting point, is less dense and lighter than molten iron, which fact again implies that molten iron must undergo a rapid expansion in the moment of its solidification. The extent of this expansion is, however, less than that of the subsequent contraction in cooling, so that the cold iron is again denser than the molten iron.

The error of Mr. Mallet and of many preceding observers consists in this: Their observation, that the solid metal floats on the molten metal, refers to the former when heated, while their determinations of specific gravity of the solid metal are made with the metal, when cold. But my experiment, as above described, shows that this cold metal, which has the highest specific gravity, does not float, and the heated metal which does float has undoubtedly a smaller specific gravity. There is certainly nothing either incongruous or wonderful in all this, and nothing that would require or justify the assumption of a repellent force. None of Mr. Mallet's experiments prove anything against the temporary expansion of certain metals in the moment of solidification, and all the observations I made on this point in foundries verify it."

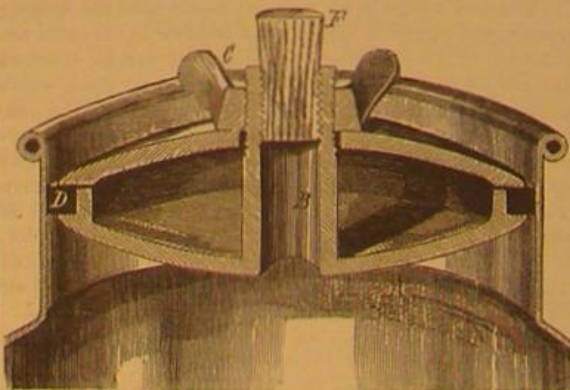
The Study of Chemistry.

We often hear it said, by way of excuse, that the study of chemistry is so dry, and the time required so great that the student must begin young or not at all. Now this is simply nonsense; there is no branch of Science so interesting, and none more easily acquired. Three or four hours a week for a few months would so open the eyes and interest the understanding of any ordinary mortal that, without laying any claim to the prophetic mantle, we may safely assert that he who will make the trial shall have provided for life a source of pleasure for himself, and a power to interest and instruct his fellow men.—*Western Photographic News.*

A NOVEL MILK CAN.

Mr. Marquis D. L. Gaines, of Boonton, N. J., has recently invented an ingenious packing for the caps of milk cans, and also a novel arrangement of plug for binding the milk in the receptacle to prevent its churning during transportation.

After the can is filled, the cap, A, made in two parts, as shown with the same slightly screwed together, is inserted in the neck of the vessel until the milk fills the plug hole, B. The thumbscrew, C, is then turned down, causing the upper plate of the cap to press upon a rubber ring, D (which fits in a rabbet of the lower plate), squeezing the same out-



ward against the inner surface of the can, making a rigid airtight joint. The plug, E, is subsequently screwed down into the milk, forcing it into every interstice of the can, and so preventing its shaking about during carriage. Patented February 24, 1874.

Two thousand millions of dollars (\$2,000,000,000), in round numbers, was the total existing debt of the United States on November 1, 1874, according to the report of the Secretary of the Treasury. The debt is being steadily reduced.

Air Pressure in Wind Instruments.

Dr. W. H. Stone, in a paper before the Physical Society of London, describes some experiments on the wind pressure in the human lungs during performance on wind instruments. About six feet of water or 13 lbs. pressure per square inch was the ordinary maximum when a small tube was inserted between the lips. When the lips were supported by a capped mouthpiece, as in brass instruments, a much greater pressure could be sustained, and lip muscles invariably gave way long before the expiratory power of the thoracic muscles was exhausted. The following pressures were sufficient to produce an average orchestral tone: The oboe requires an air pressure of from 5 to 10 ounces per square inch, the clarinet 8 to 14 ounces, bassoon 7 to 14 ounces, horn 2½ to 5 ounces, cornet 5 to 18 ounces, trumpet 7 to 18 ounces, euphonium 1½ to 23 ounces, bombardone 1½ to 20 ounces.

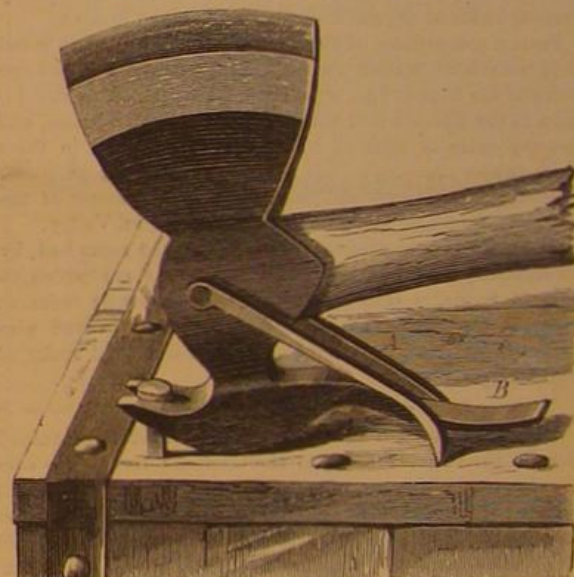
It will be noticed that the clarinet in this, as in some other respects, differs from its kindred instruments, and also that most of the pressures are small, not exceeding or indeed attaining the pressure of a fit of sneezing or of coughing. They are, therefore, very unlikely to injure the lungs, or to produce the emphysema erroneously attributed to them.

Vanilline.

At a recent meeting of the Paris Academy of Sciences, Dr. W. A. Hofmann announced that his two students, MM. Tiemann and Haarmann, who had obtained vanilline (the aromatic principle of the vanilla bean) from pine sap, propose to manufacture this substance on a large scale. The sap of a tree of medium height gives vanilline to the value of \$20, and the wood is not injured by the extraction of the sap. This will be the second vegetable product manufactured by purely chemical methods.

IMPROVED HATCHET.

We illustrate a new hatchet which is provided with a claw attachment, by the aid of which nails can be withdrawn from the wood in a perfectly straight condition. To perform this operation, the claw of the tool is placed near the head of the nail, while the handle is held perpendicularly.



On pressing down on the latter, two dogs, A, pivoted, as shown, to the hatchet, enter the wood surface and thereby force the claw under the head of the nail. By further pressure the handle becomes a lever with the fulcrum formed by the projecting piece, B, so that the claw is carried straight upward, thus pulling the nail in that direction.

Patented May 12, 1874. Mr. James A. Wisner, of East Saginaw, Mich., is the inventor.

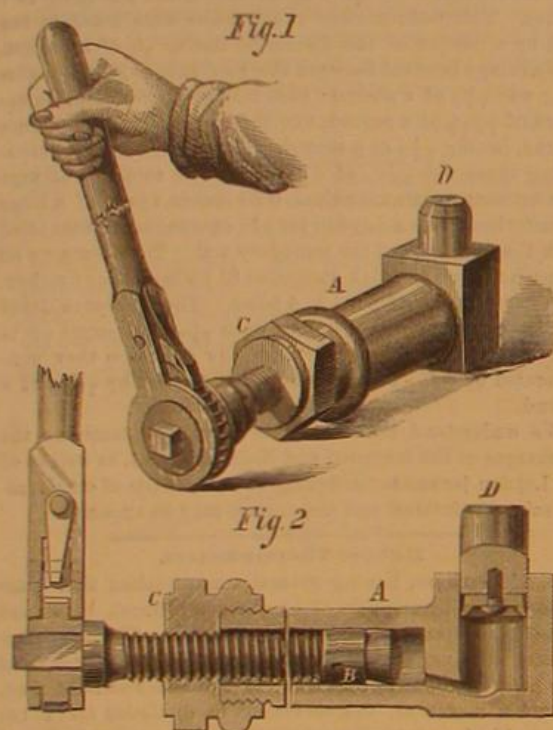
Watered Butter.

In the course of some investigations by Professors Angell and Hehner, England, out of analyses of fifteen samples of butter which were determined by them, twelve of the samples, which were undoubtedly good butter, contained 6 to 13 per cent of water; the astonishing quantity of 42.3 per cent was found in one sample from London, or an excess of about thirty-two per cent of water, for which Londoners pay from 32 to 48 cents per pound. Another butter from the same place had 24 per cent, these high ratios being due to the fact that the butter had been treated with milk. On the other hand, a sample purchased in Ventnor was found to contain under 4 per cent of water, and according to the authors it contained 50 per cent of foreign fat. The authors also found that genuine butter spread out on sheets of paper and exposed for a week to the air in the laboratory became, so far as the senses could judge, indistinguishable from tallow. With regard to the microscopic examination of butter, Messrs. Angell and Hehner think that Dr. Campbell Brown said too much when he declared that with polarized light it was the most reliable means of distinguishing pure butter from that containing other fats.

If the heat which a human being gives off in twenty-four hours could, consistently with life, be retained within the body, its temperature would, at the end of that time, have reached 185° Fah., a temperature above the point of coagulation of albumen, and high enough to cook the tissues.

BIDDLE'S HYDRAULIC JACK.

For forcing crossheads out of piston rods, bolts from engine frames and cylinders, crank pins out of locomotive driving wheels, and for performing similar work in which it is necessary to employ a tool of large power in a small space, the invention herewith illustrated will, it is claimed, prove excellently adapted. It is a novel form of hydraulic jack, consisting of a long tube, A, Fig. 2, in which works a piston, B. The latter is provided with suitable packing flanged



at the circumference, for expanding and closing tightly the more the pressure is increased, and is connected by a universal or similar joint to its screw bolt. The screw nut, C, is affixed at the end of the tube, A, and through it the bolt passes, terminating in a square end, to which the ratchet wrench is applied.

The liquid in tube, A, is forced by the advancing piston into the ram tube through a small connecting channel and against the lower end of ram, D, which is packed in the same way as the screw piston. The effect is to push the ram outward, and so to apply power to whatever may be in contact therewith. It will be seen from the exterior view, Fig. 1, that the device is quite compact, and it can be made of any size. It will doubtless prove a very useful implement for work in spaces too small for the employment of common tools.

Patented through the Scientific American Patent Agency, August 25, 1874; caveat also filed in Canada. For particulars regarding sale of rights and other information, address the inventor, Mr. Edward Biddle, Carlisle, Elko county, Nevada.

Solid Metal Floating on Melted Metal.

It has been alleged that a cast iron cannon ball will float on molten cast iron, and Mr. R. Mallet, in a paper before the Royal Society, on the fusion of metals, explained the fact that some metals, when solid, float on a melted bath of the same metal, by the assumption of a "repellent force." Before definitely adopting this rather mysterious explanation, Mr. Adolf Schmidt advises all who are yet in doubt in regard to this subject to make the following experiment:

"Have a solid ball of cast iron, of 1½ to 2 inches diameter, cast and filed off pretty smoothly. Have a ladle or vessel, of at least ½ cubic foot capacity, filled with molten cast iron. If then you lay the cold cast iron ball on the surface of the molten iron, you will find that the ball, in spite of the re-

THE LATE JOHN LAIRD.

One by one the founders of modern engineering science pass away. We chronicled the week before last (page 309 of our current volume) the death of Mr. John Laird, one of the originators and, for many years, the head of one of the largest iron shipbuilding works in the world, and a prominent figure in the industrial arts at a time when iron vessels were merely matters of theory; and we publish herewith an excellent likeness of this well known man. Birkenhead, the scene of the labors and prosperity of the Laird family, lies on the left bank of the estuary of the Mersey, immediately opposite Liverpool, and is renowned for its many important industries and its magnificent inclosed docks, cut out of the solid rock, which there forms a surface stratum of immense thickness. In 1841, William Laird, father of the lately deceased, commenced the shipbuilding and iron works, and lent his aid to establish many of the important steamship lines which have their headquarters in Liverpool and Birkenhead. In the year 1829, John Laird constructed an iron ship, which there is good reason to believe was the first ever built. She was a 60 ton vessel, built for inland navigation; and although many difficulties, owing to the novelty of the task, beset the builders, she was framed and plated very similarly to the largest and best ocean steamships of the present day. In 1834, Mr. Laird built a paddle steamship for the late G. B. Lamar, who recently died in this city; she was called the John Randolph, and the *Practical Magazine* asserts that she was the first iron vessel ever seen on American waters. She was shipped piecemeal from Liverpool, and set up on the Savannah River.

In the limits of a newspaper article, it is hardly possible to detail the development of the great industry of Birkenhead; suffice it to say that the firm of John Laird & Co. have, to this date, possessed one of the largest establishments for the special purpose ever organized. Between the years 1829 and 1873, they turned out 429 steamers, of 229,663 tons builders' measurement, driven by engines amounting to 39,790 horse power. Half these engines were manufactured by Messrs. Laird & Co., as well as engines to the amount of 25,143 horse power, fitted in vessels constructed by other builders.

Mr. John Laird's administration of these large operations is noticeable in many ways. He was, as early as the year 1839, and previously, urging the British Admiralty to build iron ships only; and his iron steamers of that date became renowned for speed and durability. He built a vessel of 446 tons burthen, which drew only two feet of water, and he obtained an advantage over many rivals by building, in three weeks, a gunboat for use in the Russian war. The splendid fast steamers plying between Holyhead and Dublin are his work; and, indeed, there is no quarter of the globe where his handiwork is not represented. The building of the notorious Alabama, for a Liverpool firm of merchants who were the financial agents of the South during our late war, and her depredations upon our commerce during the first few months of the rebellion (for which the English Government has already paid over fifteen million dollars for damages to our shipping), have given the Laird establishment great notoriety in this country. The Alabama was built after Mr. John Laird's retirement from business.

The works of this firm cover 20 acres of ground, and have held the chief position in Birkenhead since 1824. In 1831, the population numbered only 2,569; it is now over 70,000. Three thousand skilled artisans are employed by Laird & Co., and, to their credit may it be said, the firm have made many liberal arrangements for the moral and social wellbeing of their employees.

John Laird retired from business in 1861, when Birkenhead became a Parliamentary borough, and was elected member for the town, retaining the seat to the day of his death. Since his withdrawal, the works have been carried on by his three sons.

SEVERAL years since a spontaneous explosion took place in a rock quarry near Nicholasville, Ky. The *Lexington Gazette* says that recently these explosions have begun again, two very violent ones having occurred, rending the rock in all directions and throwing up a vast amount of debris. The people of the neighborhood are very much exercised in reference to these unaccountable proceedings. The explosions are described as so violent that, if one should occur under a house, it would hoist it and its contents like a veritable torpedo.

The Great Suspension Bridge between New York and Brooklyn.

The engineers of the Brooklyn Bridge have prepared plans and specifications of the massive iron saddles upon which the cables are to rest, and bids for their construction will soon be called for. The saddles, four in number, will each have for a foundation a solid plate of iron, 16 feet long, 8 feet wide, and 1½ inches thick. The plates are to be provided with two flanges, which will be imbedded in the solid masonry of the tower. But in order to provide for the contraction and expansion of the enormous mass of metal in the cables, forty-three iron rollers, 3½ inches in diameter, will be inserted in a groove between the saddles and the saddle plates. The saddles will then be enabled to move backward and forward, and accommodate themselves to the strain of the cables, which is liable to differ in intensity according to changes of the temperature. Each saddle will weigh about 25,000 lbs., and will contain at its apex a rounded groove 19½ inches wide,



THE LATE JOHN LAIRD.

through which the cable will find an exit. Each cable will be composed of more than 6,000 wires, and will sustain nearly 1,000 tons. The stay cables will bear a portion of the weight, and it is computed that the entire structure between the spans will weigh about 5,000 tons. It is predicted that the bridge will be completed in four years.

Car Brakes.

A series of experiments were recently made by the Baltimore and Ohio Railroad Company to test an improvement made by Mr. Loughridge in car brakes. The object was to determine in what time and distance a single car could be stopped at high speed in comparison with the old system where the hand brakes are used, which was determined by drawing the coupling pin and separating two cars from the train. The results were that, when the pin was pulled and the brakeman signaled to apply the brakes, the car with the new system was stopped when running at a speed of forty-eight miles an hour within a distance of 550 feet, and within 13½ seconds time, while with the other car it required 1,255 feet distance. Several stops were made, which showed great power and a remarkable uniformity of action in the new brake. Mr. Loughridge claims this as the shortest distance in which a car has ever been stopped with hand power, as some two hundred feet were required to fully apply the power with a brakeman, and that with this improvement the effectiveness of the air brake will be proportionately increased.

Medieval Superstition.

The increased longevity of later times is less owing to improved therapeutics than improved hygiene. Dr. Lyon Playfair says, in a late paper read at Glasgow: When the Egypt-

tian, Greek, and Roman civilizations expired, with their baths and divine maxims about ablutions and purifications, dirt reigned for a thousand years. Not a man or woman in Europe ever took a bath; hence the spotted plagues, the black deaths, the sweating sicknesses, the dancing manias, the mewing manias, and biting manias that ravaged the people, and cut off, in the middle ages, one fourth of the entire population. Religion came to the aid of dirt; the more filthy a saint was, the more saintly he was considered. Some of the hermits never changed their clothes, and only combed their hair once a year. St. Anthony never washed his feet, and St. Thomas à Becket's under garments acquired an additional sanctity from the vermin they contained. Nervous diseases, the result of superstition, were frequent, and often attributed to demons.

The Camacho Electro-Motor.

Several scientific men, at Havana, have been appointed to examine the electro-magnetic engine invented by J. S. Camacho, and to report on its advantages for industrial purposes in general, and especially as motive power. So says the *Revista de Telégrafos*. In the Camacho electro-magnet each limb is formed of four hollow concentric iron cylinders, the inner one half an inch in thickness, and the three remaining one quarter inch. The interior diameters of the tubes are, respectively, 2, 3, 4, and 5 inches. Each of them is surrounded with a coil of copper wire, covered with cotton, and is one eighth inch in section, forming, on the three inner tubes, two complete layers with 180 turns, and on the outer tube seven layers with 630 turns.

The copper wire on each tube is coiled in the same direction, passing at its ends across the armature of the magnet, and uniting them, therefore, in the natural order, so as to form a single conductor through which the current from the battery may travel, magnetizing each tube, and endowing them all with magnetism of an equal nature. The length of the limbs of the magnet is 8 inches, the weight 77 lbs., and that of the copper wire 47 lbs., with a total length of 2,600 feet.

Repeated experiments have shown that this magnet requires the current produced by seven bichromate of potassa elements, and its power of attraction at a distance of one twelfth of an inch is more than 1,250 lbs. An electro-magnet of the ordinary construction, of equal exterior diameter and placed in the same conditions, is only able to support 25 lbs., a weight 50 times smaller.

Repeated experiments of physicists, as eminent and well versed in electro-magnetism as De la Rive, have shown that the main difficulty which has opposed the industrial application of the electro-magnetic force has been that hitherto it has proved from 25 to 30 times dearer than that of steam. If, therefore, M. Camacho has succeeded in obtaining electro-magnets so

powerful, the following proposition cannot be pronounced too venturesome: "The new electro-magnets offer to industry a source of power much cheaper than animal labor, and capable of immediate application to urban railways. The same power is further destined, at no remote epoch, to replace advantageously that of steam."

The report is signed by D. Francisco Clerch, Professor of Physics and Chemistry at the College of Guanabacoa; D. En. de Araníave, Inspector General of Telegraphs for Cuba; D. Antonio de Molina, Engineer in Chief on the staff of the roads, canals, and harbors, and of public works; and D. Alberto de Castro, Civil Engineer.

Red Wall Paper Dangers.

To the dangers due to the arsenic entering into the pigment used in staining green wall paper, must now be added others produced by coralline dye employed in the coloring of red hangings. It appears that the poisonous symptoms (extending to acute eruptions of the body, when under garments thus dyed are worn, and to eye diseases in papered rooms) are owing not directly to the coralline, since recent experiments have proved the substance to be harmless, but to an arsenical mordant used to fix it. This last acts as a poison, both topically upon the skin, through contact with garments, and also by its dust and vapors, disengaged from the stuffs which it colors.

PROFESSOR SCHIMPER has discovered a fossil plant in protogine, a rock hitherto considered as of igneous origin and found in the form of erratic blocks in the sides of Mont B'anc. The plant is of aquatic nature, and hence the aqueous origin of the rock is rendered probable.

THE FAIR OF THE AMERICAN INSTITUTE.

The closing days of the Fair have been marked by still greater throngs of visitors. Indeed, we doubt whether any previous exhibition during late years has met with so large a share of popular appreciation, and certainly none has more richly deserved the same. As a consequence, we hear from exhibitors on all sides self-gratulatory remarks as to the benefits gained. One manufacturer informs us that he has received orders for forty-five of his engines; another traces a large increase in his sales to his representation at the Fair; a company in need of working capital have negotiations well advanced for the same, simply through presenting their products under working conditions; and so on through a number of instances, all tending to show the value of such exhibitions, when rendered really attractive to the public, as a means of bringing together the seller and the buyer.

To the careful student of the gradual growth and establishment of new national industries, there are many evidences of progress which cannot but be gratifying. Two instances occur to us: the fine porcelain and elaborate paper hangings, manufactured respectively by the Union Porcelain Works, of Greenpoint, and Messrs. Beck & Company, of this city. The porcelain will, in delicacy of make and tasteful ornamentation, compare favorably with the best produced abroad. The wall paper presents a series of embossed, gilded, and colored designs, equal in every respect to those of the finest imported. We notice also fine collections of bronzes and chandeliers, also a variety of philosophical, dental, and medical instruments, the workmanship of which it seems hardly possible to excel.

There is a slight difference between swill or sugarhouse refuse and clear, bright honey, and yet the bees contrive to find the latter in the former waste as readily as in the sweetest of buckwheat fields. A neat hive at the Fair contains the comb, insects and all, and the visitor can see for himself that the neglected sweets of New York produce a by no means inferior article.

The Blake stone crusher, a machine which literally chews stone into fragments with a rapidity exceeding that to be found in the geological investigations of a whole regiment of convicts, is in full operation. It has just gained another medal—this time at Cincinnati. Snow's water wheel governor is also exhibited in motion. This device (which we illustrated on page 183 of our current volume), when the water is drawn down to a given point, automatically closes the gate so as to allow the water to regain the lost head, and, when at the available point, of itself resumes its natural action. Hall's universal emery grinder is a tool which will recommend itself to mechanics, on the score of handiness, if of nothing else. It is an emery wheel, arranged at the extremity of a long arm and actuated by elastic belts. By means of counterpoises and suitable attachments of the arm, the wheel can be carried to any point within the radius of the latter, turned upside down, carried to the floor or high in the air, and, when let go, remains in convenient position to be readily grasped.

Messrs. Merrill & Sons' drop hammer has been in operation, forging small articles, the metal being heated in a small portable forge near by. Phillips' corn husker deserves mention as an excellent machine of its class. The stalks, with the ears adhering, are fed in at one end, meeting toothed rollers and other devices which tear off the ear, husk it, and deliver it clean, on an endless band, while the stalk, thoroughly crushed, is thrown out beneath.

Sillies' patent hydrostatic mercury pressure gage is a novelty on which we have heard much favorable comment. Its principle is simply the counterpoising, weighing, and indicating the steam pressure by means of a low mercury column. The construction is quite simple, and there are no springs, levers, or other complicated mechanism.

The Value of Fresh Air.

Dr. Le Bow, of Paris, in a recent work on hygiene, speaking of the hygiene respiration, observes that typhoid fever, anæmia, typhus, and dysentery are the diseases to which those who breathe an atmosphere insufficiently renewed are predisposed. If these individuals are wounded, they are rapidly decimated by purulent infection. Of all the facts that can be cited to show the danger to human life that results from inspiring air vitiated by the products of our own respiration, especially when debilitated by disease, none is more convincing than the mortality which occurs in our American hospitals, and which can only be termed frightful when compared with that of foreign hospitals, where the system, always adopted by us, of immense wards containing many patients, has been completely abandoned. In comparing the mortality of patients operated on during the wars of the Crimea and of the Secession, we see, from the statistics of Chénou and of Woodward, that, while the French army lost 73 per cent of all operations, the English army only lost 40 per cent, and the Federal only 34 per cent. In this case it might be objected that the English and American wounded were, as has elsewhere in this work been stated, well fed, while the French were very badly fed. Insufficient food will always increase the bad effects of imperfect aeration, and it is difficult, perhaps, to assign to each the exact part that it plays. But in the example which follows, this reason cannot be invoked, for the patients were well cared for in time of peace, and in the most renowned hospitals.

In some statistics in which M. Lefort compared those who had suffered from the same lesion, amputation of the thigh, he arrived at the following results, which he communicated in 1868 to the Society of Surgery:

In a hospital containing 100 patients, 25 per cent died; in one containing 200, 31 per cent died; in one containing

300, 37 per cent died; in one containing 400, 40 per cent died; in the hospitals of Paris, there die 74 per cent.

It thus appears that the most dangerous fields of battle are less murderous than for a wounded man to take refuge in one of the hospitals of Paris, and it may well be open to question whether any advantage they afford can counterbalance a sojourn in these dangerous establishments.—*Medical and Surgical Reporter.*

Co-operation.

We have recently had to call attention to several new phases of the coöperative movement, which has done so much in many countries to induce the industrial classes to economize their means and invest their savings in mills, mines, factories, and stores. One of the largest of such associations (which illustrates the principle admirably, though it can scarcely be considered as a workmen's movement) is the Civil Service Supply Association, of London, England. It was begun by a few government clerks, who united to purchase their own tea by the chest and calicoes by the piece.

In six months just ended, goods to the amount of nearly \$2,000,000 were purchased by the Association; these goods were retailed at a gross profit of about 10 per cent, showing a nett result of 2½ per cent on the whole, after payment of expenses. But the remarkable feature about this associated trading is that these large operations sprang from and were transacted on an original capital of \$10,890. The profit of 2½ per cent on \$2,000,000 is \$50,000, equivalent to more than 500 per cent on the original stock of the Association. It would be difficult to find a better illustration of the value of small profits, quick returns, and prompt payments than this.

Substitutes for Rubber Insulators.

Th. du Moncel examines the manner of rendering wood non-conductive—a question of some practical importance, since the only insulator free from brittleness hitherto known, suitable for the construction of electric insulators, is ebonite, a substance both costly and liable, in course of time, to an efflorescence of sulphur.

Ivory and guaiacum wood, which are both relatively good conductors, become nearly non-conductive if stove-dried and saturated with certain oily and resinous liquids, which close up the pores of the bodies in question, and prevent moisture from penetrating within. Other kinds of wood can be modified in the same manner.

Sawdust of hard wood, agglutinated with blood and submitted to a considerable pressure, so as to mold it into a solid tenacious body, like the hardened woods of M. Latry, is a good insulator for voltaic currents. After remaining six days in a damp cellar, it showed no galvanometric deviation.

Samples of wood baked and soaked in paraffin, and then exposed to moisture, were sensibly conductive.

Wood, stove-dried and soaked in different varnishes, proved also still capable of re-absorbing moisture, and, consequently, of becoming conductive. Compression diminishes the conductivity of wood for the time being.—*Chemical News.*

Albumen.

Albumen is an organic compound found both in animal and vegetable substances. Its properties are best studied in the white of an egg, which is a very pure form of albumen. It also abounds in the blood and chyle, and more or less in all the serous fluids in the animal body; it also exists in the sap of vegetables and in their seeds, and other edible parts. Albumen forms the starting point of animal tissues. The chief component elements of albumen are carbon, hydrogen, nitrogen, and oxygen, with small proportions of sulphur and phosphorus. It is believed to be a definite chemical compound, though the exact proportions and the rational formula have not been definitely ascertained. Carbon forms fifty-four per cent of it, nitrogen sixteen, and sulphur two. The disagreeable smell arising from the decomposition of eggs is from the generation of sulphuretted hydrogen.

Albumen is capable of existing in two states: in one of which it is soluble, in the other insoluble, in water. Insoluble in water, it is found in the egg, the juice of flesh, the serum of blood, and the juice of vegetables. Soluble albumen may be converted into the insoluble form in the following ways:

1. *By the application of heat.*—A moderately strong solution of albumen becomes opalescent and coagulates on being heated to about 150° Fah., but a temperature of 212° is required if the liquid is very dilute.

2. *By addition of strong acids.*—Nitric acid coagulates albumen perfectly, without the aid of heat. Acetic acid, however, acts differently, appearing to enter into combination with the albumen.

3. *By the action of metallic salts.*—Many of the salts of the metals coagulate albumen completely. Bichloride of mercury, acetate of lead, sulphate of copper, and nitrate of silver form insoluble compounds, and the egg is therefore used as an antidote to these poisons. The white precipitate formed on mixing albumen with nitrate of silver is a chemical compound of the animal matter with protoxide of silver, and has been termed albuminate of silver. Albumen also combines with lime and baryta. When chloride of barium is used with albumen, a white precipitate usually forms. By long keeping, albumen loses its alkaline reaction and becomes sour and more limpid than at first. Mucous threads like cobwebs form in it, which appear to be caused by oxidation.

Ammonia added to albumen is said to preserve it for a longer time, and a lump of camphor floated in the liquid has a good effect. Alcohol, ether, creosote, and tannic acid likewise cause the coagulation of albumen.—*Western Photographic News.*

Recent American and Foreign Patents.

Improved Heating Furnace.

Adolphus F. Bishop and John H. Aiken, Norwalk, Conn.—The boiler contains two air chambers near the ends of the cylinder, the faces of which are concentric rims. Said chambers are connected by air tubes extending all the way round, except in front, where the fire doors are. In a central space is placed a furnace, above which is a smoke chamber. The furnace, air and fire tubes, air and smoke chambers, are watertight, and the air and fire tubes are sufficiently apart to permit an easy circulation of the water between, around, and among them.

Improved Car Coupling.

Frank W. Rowe, Hardwick, Vt.—A frame is placed a little below and in the rear of the draw bar, and a bar is connected with it, so as to have a small longitudinal movement. The forward end of said bar receives a hinged block. The forward end of the block projects a little in advance of the drawbar, and has a flange, the upper edge of which has two notches formed in it to receive the link, so that the link may be raised into a horizontal position by raising the forward end of the block. To a lever is attached an arm which projects forward into such a position that, when the free end is moved forward, the said arm may pass in beneath the hinged block, and raise its forward end to raise the link into a horizontal position. With the lever and frame is connected a spring, which, when the lever is released, forces the said lever back, withdrawing the arm and allowing the flanged block to drop away from the link and the drawbar.

Improved Animal Clipping Machine.

Warren S. Burgess, Norristown, Pa., assignor to himself and Charles P. Bickings, same place.—The cutter is attached to the end of a vibrating lever, and vibrates on the cutter plate. An air engine gives the vibrating motion to the lever. The machine is connected with the pump or compressed air reservoir by a flexible tube, so that it may be conveniently moved over the animal. By means of a fly wheel, the cutter is given a steady and regular motion, and the machine is guided with great ease and accuracy.

Improved Crosscut Sawing Machine.

Jefferson Thompson, Mexico, Ind.—The saw is supported on guides or ways as it is moved back and forth by a pitman, clasps serving as slides on the ways. A cord attached to the forward end of the ways extends upward, and passes between pulleys in a stand, consisting of the two inclined posts. From this stand the cord extends through a plate, which is adjustably attached to a back post, and thence to an adjustable arm. The arm is adjusted on a circular plate, so as to arrest the downward movement of the saw at any desired point by means of a pin through the plate. The saw is also lifted up and supported by the cord when it is not in operation.

Improved Manufacture of Glass.

Hugh Percival, Bishop Wearmouth, Eng.—This invention consists in the adaptation of covered pots or coverings to be used in connection with ordinary tanks, and also in the adaptation of ordinary tanks to be worked in connection with covered pots or coverings. Said pots or coverings are constructed with an opening at or near the bottom for the inflow of refined glass, as well as an opening at the upper part, where the glass is gathered and worked into merchantable articles. Two or more tanks are also connected together, and with the tank containing the pots, by conduits below the surface of the glass.

Improved Cotton Planter.

Oliver H. Trout, Honey Grove, Texas.—The opening plow is attached to the lower end of a standard inserted and pivoted in a slot in the rear end of the tongue. The draft strain upon the standard is sustained by a brace bar which is curved and passes through a slot in the tongue, and has a number of holes formed through its upper part to receive a pin which rests upon the tongue. The lower end of a forked lever receives the upper part of the brace bar, and can be operated by the driver from his seat to raise the opening plow from the ground in passing.

Improved Cotton Tie.

Alexander A. Szabo, Houston, Texas.—This invention consists in a block for holding the ends of bale wire, it having an open cross slot on each side leading to an inner aperture, as well as a cramping groove running longitudinally from the latter to the end of block. This enables the baling to be effected very rapidly, while the tie is reliable under all contingencies.

Improved Grain Separator.

Hermann Kurth, Milwaukee, Wis.—This invention relates to certain improvements in machines for cleaning grain of cockle, garlic, and other impurities. It consists in the combination of a perforated revolving cylinder with an internal oppositely rotating reel, and the relative adjustment of the two, through friction wheels. Also in the combination, with the reel, of an internal and external spiral conveyor, and furthermore in the combination, with the perforated revolving cylinder, of an endless apron passing over adjustable rollers.

Improved Reel or Carriers' Aprons of Threshing Machines.

George C. Dodge, Millburn, Ill.—This invention consists of a reel with a hand crank arranged at the rear of a threshing machine, so that the carrier can be readily rolled upon the shaft, so as to save the labor and time lost in taking it off and packing it when the machine is to be moved from place to place, or when it is necessary to put it under shelter from rain and snow.

Improved Washing Machine.

George D. Berdan, Saddle River, N. J.—This invention consists in the application of circular guards to the lower head of a vertical revolving rubber having fluted rollers, which act on the clothes placed between them and the corrugated sides of the tub. The guards are of galvanized wire, and keep the clothes away from the pivot of the head, forcing them out against the sides of the tub.

Improved Ironing Table.

Francis Harvey, Renovo, Pa.—A bracket is attached to the wall for supporting a knuckle which has a pivot passing through a plate, and secured by a pin which allows it to revolve a quarter of a turn, and arrests its further movement by stops. The table is connected to the knuckle by a vertical pivot projecting from its under side. The leg is pivoted at the outer end of the table, so as to be folded up and secured by a button. The plate turns on its pivot to swing the table to or from the wall when folding up or down, and the knuckle turns in said plate, for shifting the table to a horizontal or vertical plane.

Improved Grubbing Machine.

George E. Rayner, Clay, Iowa.—Power is applied to this device by attaching a horse to the outer end of a beam, which end is supported by a wheel. The mechanism at the other extremity is adjusted and operates as follows: The machine is raised from the ground, and a loop is dropped over the stump. A ring is then placed upon the stump, and a wedge is driven into the top of the said stump, which spreads it sufficiently to fasten the ring. The ring prevents the loop from slipping off the stump, and at the same time serves as a band to prevent the wedge from spreading the lower part of the stump, so as to tighten said loop. The knife is then forced into the ground five or six inches, more or less, and the horse is driven around the stump, the knife cutting off the side roots that may be in its path. At each round the knife is forced deeper into the ground until all the side roots have been cut off. A hook between the knife and staple or loop is then dropped to the ground, and is held down with the foot until it catches upon a root, when a few rounds will twist off the top root, and allow the stump to be raised from the ground.

Improved Ice Creeper.

George F. Lemon, New York City.—The upper and lower plates are cut of soft rubber, corresponding to the shape of the shank or hollow of the shoe, the upper plate being made tapering toward the front part for fitting the curve of the shank, and producing a nearly horizontal position of the studded plate, which projects slightly with the points of its studs below the level of the base of the heel. Both plates are riveted to a lateral strap which is interposed between them, and applied by a buckle at the ends to the foot.

Improved Key Fastener.

Alfred W. Sperry, Wallingford, Conn.—This invention consists of a pointed shaft or arbor with a hooked-shaped part keyed thereto. A slot and pointed cam slides thereon for being opened and attached to the key by a pivoted lever acting on a projecting pin or stud of the cam. The slot and cam slides in the circumferential groove of the shaft, and resists by its steady position thereon, any attempts at pushing the shaft inward from the outside.

Improved Grain Binder.

William Lenz and Robert Wittke, Glenwood, Iowa.—This grain binder is operated by following the reaper, taking up the grain left at suitable intervals by the same. The attendant is seated on the front frame of the binder, operating with his foot the lever mechanism for throwing the spider frames in and out of gear. He places the serrated clasp with one hand into the grooved jaws of the lock, places with the other hand the end of the binding cord from the outside below the lock and up the inside over the clasp, winds it around one jaw and secures then the end to the band spring at the rear of the lock. The turning motion of the lines unwinds a sufficient length of the cord from the spool to extend from the guide rod along the circumference of the lines over the supporting springs of the same, till the turning of the lines is nearly completed. The cord has then loosely encircled the gathered grain on the lines. The toothed segments of the spider frames gear at this point with the spool shaft, and produce the re-winding of the cord on the spool, and the stretching of the same, to such a degree that the supporting line springs give way and allow the formation of the loop around the grain. The cord is then tightened until the strain throws the spool shaft out of gear by means of the tension springs. The lever of the lock mechanism is engaged almost simultaneously with the rear extending spring of the front frame, so as to clamp the clasp into the cord ends and cut the cord by the shears. The sheaf is then dropped and taken up by the gatherer.

Improved Folding Seat and Table.

William Tetley, Pans, Ill.—This invention consists of folding seats and tables, contrived to fold into recesses into the floor of a building flush with the surface. The object is to provide public and other halls, market and other buildings, with seats and tables that can be more readily disposed of when it is desired to clear the floor of them.

Improved Earth Auger.

Don Juan Arnold, Brownville, Neb.—The improvements consist in the construction of devices for guiding the bit into proper position when lowered on the shaft, and in the provision of a socket arm on the sweep which connects with the windlass gearing and causes the bit to be raised when a certain predetermined depth has been reached, and in improved means for coupling the shaft sections. There is a square lower end on the lower section of the shaft, and on a square lower end on the bit sleeve, for connecting the bit to the shaft in such a way that the said bit may be operated by turning the said shaft.

Improved Opera Chair.

Bernhard H. Koechling, New York City.—By suitable construction, when the seats are turned up, the seats and backs become vertical and parallel with each other, so as to take up the least possible space, and the seats are thrown back by angle irons, so as to considerably widen the passage in front of the chairs, giving more room for a person to stand while another is passing.

Improved Steam and Water Heater.

Edward B. Light, Westfield, Mass.—The sections of the boiler, each of which consists of a hollow hub and hollow ring, are connected with each other by radial tubes. Any desired number of the sections may be used. Upon the outer sides of the hollow rings of the sections are formed a number of hollow radial arms, which are flattened toward their outer ends to furnish a large amount of radiating surface. These are provided with a horizontal diaphragm or partition, extending from their inner ends nearly to their outer ends, so that, as the steam rises and enters said arms above the diaphragm, it may force the air out beneath them.

Improved Post Driver.

Ira M. Hardy, Oshkosh, Wis.—The upright guides are attached to the hind bolster, and the bolster is provided with an adjusting brace and connected at the top to uprights, so that they can shift laterally to the wagon. The uprights have a cranked pinion gearing with a toothed portion of the brace, by which to shift them along it for righting them when the truck stands on uneven ground. The uprights are shifted forward and backward by an extensible brace, made of two parts, which slide along each other. One is toothed, to be worked by a pinion on the other, turned by a hand crank. The rope for hoisting the hammer passes under a guide pulley at the hind axle and along to the front of the wagon, where a horse will be hitched to it for hoisting the hammer.

Improved Car Coupling.

Jacob Shasber, Reading, Pa.—As the cars are run together, and as a lower loop or clevis slides up on a hook, it will raise the upper loop into an erect position, so that it will be caught by an outwardly projecting hook pivoted to the front of the car, so as to be entirely out of the way.

Improved Machine for Transmitting Power.

Albert Reed, Oroville, Cal.—This invention consists of suitable weighted, swinging, and regulating levers, which produce, when set to work, a uniform degree of motive power. By setting the operating handle in motion, the various parts are consecutively brought into active operation, until the final reciprocation of a single lever is obtained.

Improved Combined Scrubber and Mop.

George Pirrung, Ravenswood, Ill.—This invention consists of a mopping contrivance attached to a handle. There is a water-receiving box and a piece of thick flexible rubber, so contrived that, by placing the edge of the rubber on the floor and pulling quickly along, it will spring back from the water box, forming an opening into the same, through which it will force the water which it gathers from the floor at its front, and then, being quickly lifted from the floor, it will instantly spring up to the box and close it, and confine the water to be removed and poured out.

Improved Wagon Body.

Frank Clemens, La Fayette, Ind.—Strap hooks, attached to the side boards, hook into the eyes of an eyebolt attached to the ends of cross bars. The ends of the two middle cross bars connect with short bars, which serve as a platform to the wagon bed, and to which braces are bolted near one end. The braces rest against the side boards, and are secured in place by hand screws. Other arrangements are provided, so that, by removing a rod from either end of either end board, the end board can be swung out upon the rod as a hinge, and, by removing several rods and hand screws, the whole bed can be taken apart.

Improved Car Coupling.

Alexander Neel, Richmond, Ohio.—The drawhead of one car is provided with a pin, which is connected by an extension rod with the top of the car. A band spring of the car is bent forward and locks into a notch of the pin when the same is raised, the pin being readily released from the spring catch on the sliding back of the drawhead. The drawhead of the adjoining car has the common coupling pin, but is provided with a lever rod, which swings on a perforated bracket bar, and supports, by a bottom guide loop, the coupling link in horizontal position for coupling. The top end of the lever rod is retained in position for holding the link by a catch piece. When the link is thus held horizontally, and the coupling pin of the other drawhead raised, the approach of the cars produces the entering of the link, and, by the contact of the lever rod with the drawhead, the dropping of the same and its swinging back over the other drawhead toward the car. The link enters then the drawhead until the concussion of the draw heads releases the raised pin and causes the dropping of the same.

Improved Fare Register.

Emanuel P. Loveman and Herman H. Loveman, Atlanta, Ga.—This invention relates to fare-register boxes, which not only register, on an inside dial plate, the number of fares taken by a car conductor, but simultaneously strike an alarm that notifies each passenger that a record of his particular fare has been made. The invention consists in novel means whereby the conductor can make his register and strike the alarm in a more rapid and convenient manner than heretofore.

Improved Centering Device.

William D. Black, Lewisburg, Pa.—This invention relates to certain improvements in centering tools. It consists in a flanged annular ring, to the under side of which is pivoted the ends of several gripping arms. Inside said ring is a centrally perforated disk, which is attached to the gripping arms by links. This said disk is extended above the outer ring in the form of a boss or hub, in which is contained a pointed punch, usually held up by a spiral spring and provided with a knob. Attached also to the hub is a radially moving lever. When said lever is moved, the gripping arms beneath clutch the shaft to be centered, and a blow upon the knob of the punch taps the same in the center by causing the punch to descend through the hub and the hole in the disk.

Improved Fire Shovel and Tongs.

Harvey Maranville, Akron, Ohio.—One arm of the tongs has a shovel end, and the other terminates in a plate. The rear extremities are pivoted to a short bar. Arrangements are provided by which the shovel arm may be thrown in advance of the other, while the latter is closely held thereto, making the implement into a shovel; or both arms may be brought down evenly, so converting it into a tongs.

Improved Circular Saw Guide.

Calvin H. Husted and Charles H. McPherson, Southwater, Col. Ter.—The guide consists of two arms and a guide plate, which latter is made to slide transversely on an adjusting plate. A supporting roller, for the purpose of supporting the overhanging portion of the log, having its upper surface on a level with the lower surface of the log, is connected with the adjusting plate, and, by means of a slotted flange in which it revolves, is made adjustable as to height, and may be entirely detached from the adjusting plate and saw guide. This saw guide may be adjusted to the saw with safety when the saw is running as well as when it is at rest.

Improved Fermenting Vat.

John C. G. Hüpfel, New York City.—The object of this invention is to provide for brewers' ice houses an improved fermenting vat, in which the beer may be exposed in large quantities to fermentation, and kept at the requisite temperature, without the use of ice floats. The device consists of an open vat with vertical cooling tubes, attached securely to the bottom for the free circulation of the air, or the application of ice by means of a detachable bottom at the lower opening of the cooling tubes.

Improved Hat Ironing Machine.

Antoine Giroux, Louis Drovon, and Claude Sturel, Newark, N. J.—The block for ironing the brim is arranged in a large hole in the center of the table with its lower end resting on a vertically adjustable stand, so that it can be taken out after the brim has been ironed on the upper side and reversed, to iron the under side, the crown being placed in the hole in the table. The stand for the block is adjustable, high or low, to adapt it to crowns of different heights.

Improved Process of Concentrating Copper Pyrites.

François A. H. La Rue, Quebec, Canada.—This is a process for eliminating impurities from and preparing copper pyrites for convenient transportation, by partially reducing the previously roasted and carbonized ore with heat until it becomes magnetic, and then passing the product through an electro-magnetic machine, whereby the copper and iron ore are separated from the earthy or other matter.

Improved Wagon Tongue Support.

Joseph Oehler, La Fayette, Ind.—The pole is provided with rear extending side pieces, by which a fork-shaped end is produced. A center piece is interposed between the front part of the hounds, and projects, by a tongue extension, into the forked pole end and is pivoted therein. The center piece is further strengthened by a longitudinal bar, extending back to the under side of the front axle and fastened thereto.

Improved Check Row Attachment for Planters.

Lyander L. Haworth, London, Ohio.—A cross board is secured to the frame of the planter, and to the end parts are pivoted two pulleys, around which passes a cord which is stretched across the field. The ends are secured to the ground, and it is provided with knots at the required distance apart of the hills. To the ends of a shaft are attached arms which receive the cord, so that the same can slide through freely, but not the knots. As each knot strikes the slotted arm, it turns the said arm to the rearward until it can slip through the outer part of said slot. The arm is then again carried forward by a weighted arm also attached to the end of the shaft. To the shaft are besides attached guard arms, which prevent the cord from getting out of the slot as the knots slip through. Suitable connection is provided from this shaft to the dropping slide and valve.

Improved Electric Railway Signal.

Paul Tesse, Henry Lartigue, and Pierre D. Prud'homme, Paris, France.—This invention is a semaphoric mast, to the top of which are pivoted two large arms fulcrumed so as to hang vertically, said arms being attached to the cranks of two similar electrical apparatus below by a traction rod. Just below these two large arms are two small ones, fulcrumed to said mast so as to hang horizontally, and connected, each by traction rods, with separate electrical apparatus similar to the first mentioned. The whole line consists of a series of these masts provided with arms and electrical apparatus, said arms being disposed vertically along the mast when not in use, and the electrical apparatus of the large arms of one station being connected by wires with the electrical apparatus of the small arms of the second station, etc. The large arms are locked or presented horizontally to the gaze of the engineer, mechanically by moving a crank of the electrical apparatus. Said motion, also, by means of a commutator, brings into play a battery, which, by communicating with the electric apparatus of the small arms of second station, allows them to fall horizontally. The mechanical effect of said fall, through a commutator and battery of second station, sends a current back to first station, which acknowledges, upon a bell and an annunciator at first station, the receipt of the original signal sent from said first station. By means of this arrangement the large arms of a mast at the first station serve as a signal to an approaching train, and the elevation of them notifies the agent at second station, through the electrical apparatus, battery, wires, and small arms of mast at second station, of the passage of the train past the first station. After the train has reached the second station, the agent there allows the small arms of his station to fall, which mechanical action, through a commutator and battery of the second station, allows the large arm of the first station to fall. Said fall, through the commutator and battery of first station, sends another current to second station, which acknowledges, by a bell and annunciator, the receipt of original signal, and announces the fact that the large arm of first station has fallen. This combined electrical and mechanical apparatus is situated in between the two tracks, one large arm and one small one on same side of the mast being used for the trains passing up, and the other large arm and small arm on the opposite side for the trains passing down.

Improved Washing Machine.

Daniel Kunkel, Oregon, Mo.—This is an improvement on the washing machine for which letters patent were granted to same inventor October 20, 1865. By suitable construction, as a disk is turned in one direction, a pin will rest against said disk and hold another pin projecting downward vertically, to take hold of the clothes and sweep them through the suds. As the direction of the disk is changed, rollers partially revolve, the projecting pins resting against the disk, and the others projecting to take hold of the clothes in another place and sweep them in another direction through the suds. Mechanism is provided which keeps the clothes away from the center of the tub, so as to be in proper position to be moved through the suds by the pins.

Improved Seed Separator.

William E. Lee, Swan River, Minn.—This is a machine for separating cockle from wheat, comprising a sheet metal cylinder perforated with holes just large enough to receive the cockle, but too small for the wheat, with a skin belt as wide as the length of the cylinder surrounding it. This causes the perforations to retain the cockle, carry it up, and throw it on a descending shaking trough, hanging in the cylinder above the wheat, to chute the cockle out at one end. Above the cylinder, where it is not covered by the belt, a revolving brush is arranged to brush back on the chute any grain that may stick on the perforations. The chute has a brush at one edge to brush down the wheat and leave the cockle in the hole.

Improved Shingle Block Mapper and Bolter.

John F. Bassett and James Nichols, Limestone, N. Y.—This invention consists of a sector-shaped table, pivoted to and moving by friction rollers on a truck of the usual construction. The table is provided with raised concentric rings for turning readily the block to be cut thereon, and also with a slot and segmentally cut-off side part corresponding with a saw recess of the truck. A stop pin at the bottom of the pivoted table and a spring latch define, in connection with a check block and stop pin on the floor, the position of the table toward the saw. A pivoted arm with center pin swings in a standard of the table, and is applied to the block or a center dog fastened to the same. A pivoted hand lever with adjustable dog swings on the center pin of the arm, and serves to adjust the block for sapping and bolting.

Improved Electric Car Detaching Device.

William W. Carson, High Bridge, N. Y.—This invention consists of a pivoted lever frame, which is applied above the rail between the wheels of each car truck, and placed in electrical circuit by means of spring contacts with a powder charge and detaching mechanism of the drawhead. The closing of the circuit, whether by the action of the lever frame on the spring contacts when the car is thrown off the track, or by direct action from the car, ignites the powder charge, separates thereby the drawhead and detaches the car.

Improved Power Hammer.

Alfred L. S. Chenot, Paris, France.—This invention consists in a percussion cylinder bearing upon its lower end a hammer block and hammer, and moving smoothly in an incasing cylinder, which acts as a guide, and prevents any lateral motion of the percussion cylinder resulting from the strokes of the same. Inside the said percussion cylinder is a piston rod bearing upon each end a piston which moves freely in the cylinder and is between the two pistons and permanently attached to the cylinder, a diaphragm, which, with the two pistons, divides the cylinder into three air compartments. When the piston rod is elevated by the connecting mechanism, a vacuum is formed in the upper and lower compartments, a compressed plenum in the middle compartment, and the cylinder raised by the elasticity of the air. When the connecting mechanism drives the piston rod down, the force of the steam, gravity, and the elasticity of the air combine to give a heavy, quick, and elastic blow.

Improved Spring Saddle Seat.

John L. Sommerville, Maysville, Ky.—Between the sides of the tree and beneath the pommel, are spiral springs inclined in short tubes. A joint in the leather covering of the tree separates the seat from the pommel, and is faced up with elastic cord. Strong leather supports attached to the rear portion of the saddle tree extend forward to near the joint, the forward ends of which are attached together and to the leather covering of the seat. Wire rods are connected with the spiral springs at one end and with the leather covering of the seat at the other end, so that, when the seat is depressed by the weight of the person, the pressure will act upon the springs and render the seat elastic.

Improved Car Coupling.

Michael J. Roach, Middle Granville, N. Y., assignor to himself and R. L. Williams, same place.—The drawhead has an additional detachable face plate fastened to flanges, and cushioned off by packing. The approaching drawhead strikes against the face plate and carries a slide back until its pinhole is vertically below the pinhole of the drawhead, releasing thereby a pin from the slide and dropping it to couple with the link of the ordinary shape. An inclined movable plate is arranged in side grooves of the drawhead below the slide plate, to protect the spring of the sliding plate from injury.

Improved Valve Coupling for Hose Branches.

James R. Biggs, Utica, N. Y.—This is an improved valve coupling for hose branches, by which two or more streams of water may be thrown on the fire from the same main hose, and thereby the extinguishing of the same facilitated. The hose branches are opened and closed by a sectional spring valve sliding on a guide tongue of the valve stem, turning in suitable bearings.

Improved Reservoir.

Bennet Cohen, Jersey City, N. J.—This is a reservoir which may be attached to the water pipes in the upper stories of buildings, so that, should the water be cut off from below, there may be a sufficient supply retained above for temporary purposes. The upper part is made semicircular, and its lower portion tapers down to its junction with the water pipe. The back is perfectly flat, so that it may be secured to the wall. In the pipe near each reservoir is a check valve, so that the upward pressure of the water in the pipes will cause the water to run continuously up through the pipes and reservoirs. Each reservoir is provided with a ventilator, which will close automatically by means of a float valve when the reservoir is filled. A faucet taps the water pipe between the check valve and lowest part of the reservoir, so that it may be able to carry off all the waste contained in the latter.

Improved Watchman's Time Detector.

Anton Meyer, Stuttgart, Germany, assignor to Theodore Hahn, of same place.—In this device the printed dial hitherto in use may be dispensed with and plain paper disks substituted, on which the marks of the stations and the time are quickly printed by suitable spring devices without the direct action of the keys on the marking parts and a bridge piece. There is a rotating steel dial, which has the hour and minute subdivisions engraved in raised figures thereon, and is set in motion by a suitable clock train. The numbers of the stations are arranged sideways thereof, and marked on a plain paper disk, rotating with the steel dial, by means of strong band springs with steel marking plates. The last are actuated by the keys at the stations, so that one spring strikes on the steel disk at each station for indicating the time, while the springs for marking the stations strike their corresponding numbers consecutively in the customary manner.

Improved Wood Planing Machine.

John H. Russell, Milwaukee, Wis.—This is an improved system of springs for attachment to planer and sticker tables, to enable rake heads with tapering or arched backs and other different shaped pieces of wood to be planed upon three or four sides at a time, and which will hold the wood to be planed firmly in place while being operated upon.

Improved Rotary Steam Engine.

William Haab, New York City.—The shaft is attached to a piston plate enclosed between the two parts of a cylinder, to which the piston is secured. The abutment is given a horizontal reciprocating motion by the exhaust steam, and is fixed to one leg of a gate. On the other leg is a piston, which works in a small straight cylinder, which cylinder is connected with the main cylinder. The abutment plays back and forth in a chamber. A supplementary exhaust tube is connected with the cylinder, and is for the purpose of exhausting any steam that may remain between the piston and the abutment after the piston has passed the exhaust cylinder. A spiral spring on this tube throws the abutment and the small piston back, the former into the cylinder and the latter to the cylinder, at each revolution of the main piston. The steam is admitted through the tube, in which is a rotating steam valve, which is alternately closed and opened by tappets on the shaft striking an arm attached to the valve stem.

Improved Liquid Compound for Burnishing Leather Goods.
James Clausen, New York City.—This compound is prepared of ground nutgalls and extract of logwood boiled in water, Castile soap, and glycerin. A few drops of the liquid are mixed with the common ink used for burnishing and finishing leather goods, the ink becoming thereby of superior blacking quality.

Improved Molding Machine.

Otto Meyer, Kansas City, Mo.—This invention consists of a barre saw mounted on rollers, which are in adjustable supports adapted for shifting readily to suit saws of different sizes for sawing different curves. There is an adjustable work-holding table for presenting the work to the saw, by which it is designed to saw moldings to shape with less waste of time than attends the present mode of sticking moldings. The idea is to saw out whole strips in making grooves, and in cutting out corners and the like that may be used for window stops, beads, and the like, which are now cut into shavings.

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E. A. C. will find a rule for proportioning cone pulleys on p. 180, vol. 26—H. G. R. will find particulars of the reward offered for a car coupler on p. 161, vol. 29—G. K. Jr. should consult a physician.—J. F. can galvanize cast iron by the process described on p. 39, vol. 24.—M. M. will find directions for gilding mirror frames on p. 75, vol. 28.—J. F. F. and others will find S. Hughes' book on "Gas Works and the Manufacture of Coal Gas" useful.—W. W. D. should consult p. 215, vol. 30, for directions for extracting essential oils.—P. H. can case-harden iron by the process described on p. 281, vol. 27.—J. M. W. and J. G. should refer to p. 140, vol. 31, for a description of the "horse hair" snake.—T. U. S. will find full directions for bronzing brass on p. 331, vol. 29.—E. P. M. and S. G. A. will find directions for bronzing brass on p. 321, vol. 26. A balloon (gutta percha) varnish is described on p. 279, vol. 30.—M. A. C. will find a recipe for bronze lacquer on p. 231, vol. 19, and verde bronze on brass on p. 233, vol. 31.—C. L. D. should refer to p. 212, vol. 26, for a method of tinning cast iron.—F. G. S. will find a good recipe for calcimine (sometimes spelt kalsomine) on p. 351, vol. 24.—J. B. will find a recipe for a cement for leather on p. 138, vol. 25.—O. M. L. can waterproof cotton cloth by the process described on p. 30, vol. 30, and prevent mildew by the recipe on p. 138, vol. 27.—H. R. J. and C. G. J.'s rules for finding the radius of a circle, chord and arc being given, are correct, but neither is the solution that R. O. B. asked for.—J. S. E. will find full directions for proportioning gears on p. 187, vol. 29.—C. E. H. will find a description of a petrifying process, applicable to dead bodies, on p. 24, vol. 29.—G. A. S. should refer to p. 265, vol. 31, for a method of preserving flowers. For directions for crystallizing them, see p. 283, vol. 31.

(1) A. H. D. says: A friend of mine has recently purchased a 10 horse engine and boiler, in which the feed water of the boiler is heated by live steam taken from the dome on the boiler. The manufacturer recommends him, for economy's sake, to heat the feed water by the exhaust. Please give your opinion. A. It is more economical and usual to heat the feed water with the exhaust steam.

(2) T. D. says: 1. Given a piece of watch spring steel, 11 feet long, tightly drawn and securely fastened at both ends, at 110° Fahr. what will be the contraction at 90°? Will the spring return to its original length at 110°, provided the fastenings have meanwhile been undisturbed? A. It seems to us that the spring would break if cooled under the given conditions. 2. Will steel wire deteriorate from constant contact with rubber, pure or vulcanized? What remedy, if any, can be used to prevent such deterioration? A. We think not; but in any event, a coat of varnish will act as a protection.

(3) G. asks: 1. Has there ever been a locomotive constructed with only one cylinder? A. We do not know of any. 2. Could a locomotive be worked with only one cylinder, and would there be anything objectionable in such construction? A. A locomotive can be worked with one cylinder, as is evident from the fact that it is done occasionally, in case of accident. The principal objection to a single cylinder engine is the difficulty of starting and reversing.

(4) J. S. McK. says: I live in longitude 20° 30' W. from Washington, and in latitude 33° 30' N. What is the proper variation of the magnetic needle at this point? Is there a general rule by which I can find the variation of the needle at any point, knowing the latitude and longitude? On what degree of longitude is the variation 0°? A. The variation must be found by observation. It is not constant at any one place, so that the agonic lines, or lines of no variation, are continually changing their position.

(5) J. C. W. says: In Pennsylvania and elsewhere, we use large quantities of soft coal for steam purposes, costing from \$1.50 to \$3 per ton. We can get slack or fine coal for about \$2.50 per ton. We have tried several times to use slack, and as many times have failed to make it work satisfactorily. We have come to the conclusion that we do not know how to construct our furnaces and manage our fires, and we would be pleased to have your views on the question. A. Such coal requires a strong draft, and grate bars with small interstices. Steam is sometimes admitted beneath the ash pit. There are several patented devices for burning coal dust and slack that are well spoken of.

(6) G. H. G. & S. M. C. say: 1. We wish to conduct steam from boiler to engine, distance 350 feet. What would be the loss per cent of fuel by the condensation of steam in traveling that distance, and what sized pipe would be required to supply a 30 horse power engine under the above circumstances, provided the pipe be well packed? A. The loss would be inappreciable if the pipe was well covered and trapped. Use a pipe 3 inches in diameter. 2. What would be the cost of an air pump sufficiently large to furnish 30 horse power? A. Four thousand dollars. 3. Would additional distance require additional pumps? A. No, for a reasonable increase of distance. 4. Should a stationary engine have a slide valve set with lead or lap, and how much of either? Should it be set so that the instant it passes the center the port will open? A. The steam port should commence to open just before the end of stroke. There is no general rule for the best amount of lap. 5. With what would you brace the bell of a steam whistle made of thin sheet copper? A. It is not probable that you can repair it successfully.

(7) W. S. H. says: I wish to make a model of a steamboat 248 feet long, 37 feet wide, 13 feet deep, and 72 feet wide over all. Would a model, 5 feet 2 inches long, 9 1/4 inches wide, 3 1/4 inches deep, and 18 inches wide over all, be in the right proportion? A. The proportions are correct.

(8) J. B. says: Please give me a formula for making best sewing machine oil. A. Sewing oil will probably answer this purpose better than any manufactured compound.

Having Brazil wax in powder, I wished to form it into tablets, and applied heat, but failed to accomplish the desired object. What will cause the particles to adhere? A. We think that the proper degree of heat would accomplish the desired result.

(9) C. M. A. says: I propose to ventilate my house by means of wooden tubes, starting from near the floor, passing inside partitions, and discharging at the roof. The house is warmed by a furnace. I am told by a builder that the draft in these tubes will be as likely to bedown as up, and that the only proper way is to have the tubes terminate in a chimney. I can see that he may be correct so long as the temperature inside the house and outside is equal, as in summer; but would not a very slight addition of heat to the air of a room cause a current to pass up the ventilator? A. Yes. You are correct; experience proves that your tubes will work very well.

(10) E. asks: My driving pulley is 6 feet in diameter, and driven pulley is 9 inches in diameter. My belt is of India rubber, 1/4 inch thick and 14 inches wide; it travels 3,043 feet per minute, and is 41 feet long. How much horse power am I using? A. You do not send enough data. The distance between the centers of the pulleys and the tension of the belt should be given. Probably the most satisfactory mode of settling the question would be to make a test, if the matter is of any importance.

(11) E. H. asks: 1. What should be the strength of a nickel solution? Do the salts merely require to be dissolved in water, or is cyanide required? A. If the salt you speak of is (as is highly probable) the double sulphate of ammonia and nickel, 100 parts of water at 63° Fahr. will dissolve 5 parts of the salt. 2. How is the mottled or crystalline appearance given to galvanized iron, particularly that used for making ice water coolers? A. By the action of dilute nitric acid. 3. What is the latest and best work on electro-metal-lurgy? A. Roscley's "Galvanoplastic Manipulation." 4. Is there any way of coating cast iron goods, such as door knobs, hollow and made of malleable iron, so as to prevent them from rusting? Plating with copper and nickel did not do in all cases, as the iron is porous, and electro-plating will not fill up all the small holes. A. Try Japan varnish.

(12) B. H. asks: What is the metal used, and what is the process of making galvanized sheet and other iron? A. The iron, after being cleaned and washed with muriate of zinc, is dipped into a bath of zinc with a little mercury, or zincalane. A little potassium or sodium is sometimes added to the amalgam.

(13) H. K. asks: If the normal temperature of air is 63° Fahr., and it is compressed to 50 lbs. pressure to the square inch, what will be its temperature? A. Nearly 350°, if there be no loss of heat by radiation or conduction.

(14) R. T. asks: Will a thin steel spring, such as is employed on harness, lose its temper in the process of tinning? A. No.

(15) O. K. asks: What will be the working horse power of a boiler whose dimensions are 24 feet diameter, 9 feet length, with 32 two inch tubes, and of an engine of 5 inches bore by 10 inches stroke, with 60 lbs. pressure per square inch? A. About 6 or 7 horse power.

(16) J. T. says: 1. I have a double chimney, each chimney of which is 4 by 20 inches, and 45 feet high. Sometimes I use one of them for a ventilator, and the smoke will go up the chimney and down the other into my room; at other times the draft is down both chimneys. What is the difficulty? A. The arrangement is bad. The ventilating flue would be better on the other side of the room. 2. Where is the proper place to put registers for ventilating a room, at the top or bottom in the side wall? A. At the bottom, with some exceptions. 3. Does one chimney or ventilator interfere with the other in the same room? A. Yes, more or less.

(17) J. S. asks: Is the idea that powerful engines may be driven by compressed air in place of steam practical? A. The change would not be economical.

(18) A. V. asks: Has the low pressure pound of steam more volume and power than the high pressure? A. If the pressure is only 30 lbs., it must act upon 4 times as much area of piston as steam of 60 lbs. pressure, to produce the same effect, other things being equal.

(19) C. M. Q. and others.—The most important magneto-electric machines have been fully described, in many cases with appropriate illustrations, in these columns.

(20) W. H. asks: When, in painting walls, two or more coats dry spotted, is it caused by the unequal troweling in plastering, leaving some parts more porous than others, thus producing an unequal absorption of color? A. It is most probably caused by a greater amount of plaster having been incorporated with the lime in some places than in others. 2. What is the best preparation for coating the walls prior to painting to obtain an even gloss? A. It is usual to repeat the coats of paint until the pores are well filled and an even gloss is obtained. Sometimes as many as five coats are necessary. The first and last application should be the paint. 3. In calcimining walls that are very porous (or, as some call them, lime burnt) the color is so quickly taken up as to prevent the being put on evenly, and dries shaded or clouded. A. A fine size will not stop the suction. What will? A. In calcimining, the walls should be first thoroughly washed; when dry, a coat of glue sizing may be put on; if the latter is of the proper consistency, the calcimining will finish of an even tint.

(21) J. F. asks: What is a simple way to line shafting? A. By running a fine line through the boxes, so adjusting them, and then putting up the shafting.

Are there any slide valve engines that can be reversed? A. Yes.

I have a sycamore with two glasses. The large glass is flat; would it not be better to grind it to a convex? A. Yes, if it is properly done. We do not think, however, that the glass is flat.

(22) J. D. W. says, in reference to A. Z.'s difficulty with his blower: My blower would not blow when it was finished. Your answer to A. Z. was "that he had probably made the fans so that they only kept the air in the case in motion instead of forcing it out." How should a blower be made so as to force out the air instead of simply giving it motion? A. It is a good plan to arrange the fans in the case so that their air is slightly compressed after reception, and allowed to expand on reaching the discharge openings.

(23) S. asks: If it be true that a candle fired out of a shot gun will go through a board, what would happen if the candle was still and the board sent against it with exactly the same force as is required to shoot the candle through the board? A. By parity of reasoning, the board should go through the candle, if the "wicked" part of the candle were not strong enough to resist it.

Which way would a compass point if it were placed exactly over the north pole? A. If freely suspended, it would, no doubt, point to the north pole.

(24) F. S. Jr. says: 1. How long is a German mile? A. German short mile, 5,280 yards; German long mile, 10,120 yards; German geographical mile, 3,100 yards; German sea mile, 2,025 yards. 2. How long is a German foot? A. Prussian and Danish foot is 1.05732 English feet; Austrian foot is 1.03728 English feet; German foot 0.971 English feet.

(25) I. P. McD. asks: 1. Which has the more resistance to electricity, a relay or a sounder, and why? A. Commonly speaking, the relay, because of the greater number of convolutions of wire in its coils. In some main line sounders, the resistance is equal to that of the ordinary relay. 2. Will electricity separate in any degree, or travel in two different directions? A. Yes. 3. Is not electricity attracted to some extent by the north pole, and will it not take a northerly direction in preference to a southerly one? A. No. 4. Is water a conductor or non-conductor? A. Water is a conductor of electricity, although a poor one. 5. Will it form a good ground wire when not connected directly with the ground or earth? A. No. 6. Have the pores in any substance anything to do with its power of conducting electricity? A. Conductivity has been shown to vary with the density of metal conductors. 7. Do you think telegraphing a good business to follow? A. Yes.

(26) R. O. S. asks: How much nitrate of silver could I get by dissolving a silver dollar in nitric acid? A. The nitrate of silver will weigh a little more than half as much again as the coin. 2. Would it be sufficiently pure for photographic purposes after being fused and re-crystallized? A. You would probably have trouble. 3. In what sort of a vessel would the fusing have to be done? A. Fuse it in a silver dish. Your coin is probably made of an alloy of gold. The inscription signifies John V. King of Petalig, (untranslatable abbreviation). "In hoc signo vinces" means "by this sign" (the cross) "thou shalt conquer."

(27) N. A. W. says: My housekeeper went in the dark for some sugar, and came running back, saying that a witch, a wizard, or the devil was in the sugar barrel. "I considered myself equal to all three, and boldly went for them. The frightened housekeeper told me to stir the sugar; I did so, and to my astonishment it produced a white light resembling the light from electricity. Will you give an explanation?" A. It is well known that, when two pieces of sugar are rubbed together in the dark, a sort of electrical phosphorescence may be observed, due probably to the friction of the particles. Attention has been called to it in our columns.

(28) G. C. W. asks: How do astronomers calculate the distances of the sun and stars? A. The sun's distance is calculated in various ways, as by observing the time it takes for light to travel from the sun to the earth, by noting, from proper points on the earth's surface, the time occupied in the transit of Venus, etc. The distance of the stars is estimated from parallax.

1. What are meteors composed of? A. Principally of iron, nickel, hydrogen, and certain minerals. 2. What gives them velocity? A. Their orbital movement. 3. Which has the strongest attraction, an electro-magnet with one half inch core, containing fifty feet of copper wire weighing one half pound, or one of the same size containing one hundred feet of copper wire weighing one half pound? A. The latter. 2. What weight will an electro-magnet, containing 50 feet of copper wire, No. 22, with one half inch core, with one cell of Bunsen's battery, hold up? A. We can give you no general rule for determining magnetic energy in this manner.

What is the origin and chemical analysis of the aerolites? A. They are supposed to be of planetary origin. For analysis, see answers to meteor, above.

What is the rule to find the convexity of a circle, such as the earth, reckoned from a level? A. See p. 132 vol. 30.

What is the length of the steamship Great Eastern? What is the size of her engine cylinders, and how many tons of coal did she consume in 24 hours? A. Length 692 feet; cylinders of paddle wheel engines 74 inches diameter by 14 feet stroke; cylinders of screw engines 84 inches diameter by 4 feet stroke; coal consumed per ton in her voyage to New York in 1860, 26 1/2 tons. She indicated on this journey 7,352 horse power, by both sets of engines.

(35) W. O. says: My engine appeared to blow through when running light, or with little or no work on. The valves and piston work smoothly, and appear to be steam-tight. The question arises: What is the cause of this blowing through? The indicator diagrams exhibit an unusual amount of back pressure or compression; and although I did not have an opportunity of taking a diagram when running light, it is reasonable to suppose that the compression is the same as when in full work. The compression, which begins at half stroke, is equal to the initial pressure of steam at the end of stroke, the steam being cut off sharply. The forward pressure gradually runs down until, during the latter half of stroke, there is a point where the back pressure overbalances the forward pressure (namely, the pressure above the main valve, or between piston and cut-off valve), which forces the main valve up and allows the steam to escape during the latter half of stroke, the engine being carried over by the momentum of the fly wheel. It is necessary to state that the steam is regulated by a variable cut-off governor, which relieves the main valve of undue pressure. Am I correct? A. Your explanation seems plausible according to the diagrams, but we do not get a very clear idea of the arrangement of the valves. If the valve lifts on account of too much cushion, change it. The first thing to determine, however, is whether or not the valves are tight; as it is only when this matter is settled that the engineer can properly begin to theorize about the indicator diagram.

(36) R. M. says: I have been round Cape Horn and the Cape of Good Hope several times, and I have been round the globe twice in a sailing ship, but it is slow travel. I propose to make my next voyage around the globe in 24 hours. By going up in the air high enough to clear the current that follows the globe round, remaining there 12 hours, I will let the earth do the travelling; then I will descend, land the mails in China, take in the United States mail, ascend for 12 hours more, then come down and land the China mail in New York. I believe this can be done and will be done yet. A. We do not understand what you mean by the current of air that goes round with the earth, unless it is the atmosphere; in which case, we do not think that you will get out of it.

(37) I. L. T. says: I read that, after a house was struck by lightning, a tin cup had a tendency to adhere to the kettle spout, and finally the spout would suspend the whole weight of the tin cup. Upon further investigation, it was found that any nail in the house would suspend a common drawing needle. Can you explain it? A. If the statement is reliable, the fact that every particle of iron about the premises was found to be temporarily polarized is a fine illustration of the power of the induced currents liable to be generated on the instant of the passage of the discharge.

(38) W. M. W. asks: How can I prepare heavy cotton cloth to prevent the evaporation of alcohol? I want to cover over open barrels, and would like some preparation that will be pliable. A. Melt paraffin with 5 percent of linseed oil, and run into cakes for use. When needed, melt, and spread the mixture over the cloth with a brush.

(39) F. W. D. says: I attempted to make the phosphorized oil light (described in a back number of the SCIENTIFIC AMERICAN) by placing a piece of phosphorus of the size of a hazel nut in a four ounce phial, filling one third full of boiling hot olive oil, but it and would not operate. Was the phial too large? What kind of phosphorus should I use? A. Use a larger proportion of phosphorus. The phosphorus should be that known as clear. The red variety will not answer the purpose.

(40) H. C. W. says: In the SCIENTIFIC AMERICAN of October 21 you state that a gallon of water will produce a gallon of steam if confined in the same space. I think you have made a mistake, as I do not think that it would produce steam at all, but would remain water. A. Have you any authority for your opinion? 2. Please give me a rule for finding the size of the pulley in the head of the lathe, to fit a fly wheel, so that the belt will be tight on each of them? A. See p. 96, vol. 22.

(41) P. H. asks: Is there any method of hardening steel so that it will drill a file or hardened steel? A. Heat the steel to cherry red and quench it in mercury.

(42) R. R. asks: 1. What is the best way to mend an overshoe that is all rubber? How can I mend one that is rubber and cloth? How can I mend a leather shoe without sewing a patch on, using cement prepared for the purpose? A. A solution of pure gum rubber in naphtha will answer these purposes. 2. Can the gum of an old overshoe be dissolved in any way to make it useful as a cement? A. Owing to the large amount of sulphur in such rubber, we do not think it would pay you to try the experiment.

I once saw a fire lighter of the shape and size of an egg, with a wire fastened in it, to be dipped in coal oil to kindle fires; can you tell me how to make it? A. Ordinary potter's clay is mixed with sulphur or other inflammable substance, molded into the desired form, and thoroughly burned. It will then be found to be exceedingly porous and will then absorb, by capillary attraction, a large quantity of oil.

Is there any kind of preparation that will make any kind of goods waterproof without injuring the goods? How is it prepared and used? A. Ten pounds of alum and a similar quantity of acetate of lead are dissolved in sufficient warm water, and the mixture allowed to stand till the precipitate of sulphate of lead has settled down. The clear solution, acetate of alumina, is poured off, and mixed with water in which dissolved litharge is stirred up. The articles to be made waterproof are steeped in this mixture for twelve hours, after which they are dried and subjected to pressure. This process will render the cloth both watertight and moth proof.

(43) J. V. R. asks: What is carbolate of iodine composed of? A. This is not a chemical compound, known as such to chemists.

(44) J. H. M. says: 1. In looking over the back numbers of the SCIENTIFIC AMERICAN, I find a question by W. B. N. about the rack and pinion and eccentric set works for sawing lumber. There appears to me the greatest difference imaginable between the systems. In the first place, the rack and pinion block has a uniform motion throughout the whole of its movement; the first and last 1-12 of an inch is made at precisely the same speed as any of the intermediate parts of an inch, provided there is a uniform speed of the lever. Therefore, in order to set correctly and not throw a small log too far away from the knee, you are compelled to stop the lever very gradually, and at an exact point. If not, your lumber will be too thick or too thin, which is not the case with the eccentric head blocks. While the lever is being moved at a uniform speed, the motion imparted to the knee by the double

eccentrics is an accelerated and a retarded motion, until the knee actually stops while the lever is still in motion, so that it is not necessary that the lever should be moved to any fixed point in order to make even lumber. With the eccentric block you have only to go through with a certain manipulation to get certain and accurate thicknesses. The manipulation need not be accurate, but the lever may vary two inches in one movement as compared with another. Another advantage is that, while the lever is moving either backwards or forwards, the knee always moves ahead. Therefore you can set as quick as you can with the rack and pinion, for you have only to go through with the same process. A. There are various devices for operating the rack and pinion set works, also for operating the eccentric set works. By a sudden or quick jerk on the lever, either device is liable to throw a light log too far away from the knee unless it is fastened to it. There are several effective devices for accomplishing the latter. The only liability, then, is to the extent of slack which may exist in the working parts. 2. In our mill, we have a cog wheel and pinion to drive 5 gangs and 2 large circular saws. This gear is driven by two 18x40 inch cylinders. The cog wheel is 10 feet diameter with 7 arms, depth of rim 5 inches, width of rim 16 inches, size of mortice for cogs 15x12 inches, diameter of hub for shaft 16 inches, length of hub 12 inches. The cogs of said wheel are made of maple, well fitted and driven hard and fastened with dovetailed keys. The rim of this wheel has been broken; and in order to mend it we took two wrought iron rings, 14 inches square, and put them on hot, to shrink the rim together. Would there be contraction enough to the shaft wheel to prevent outtaking out the shaft? A. A shrieking of the bands on the blank cog wheel would undoubtedly diminish the size of the center hole, proportionately to the extent of pressure and size of wheel, causing it to grip the shaft.

(45) M. M. asks: In what months do the winds blow the strongest, and what are the prevalent directions? A. In February and March. From S. W., W. by S., and N. W.

(46) B. says: Some zinc castings are to be exposed to the weather; but as they are of an ornamental character, I want to wash them with some chemical that will oxidize them to some extent and give them a better color. I have tried ammonia, but find that the rain will run down on the castings in a milky stream, giving them a streaked appearance. Can you tell me what will oxidize the castings with a color that will stand exposure, or, in other words, what will hasten natural oxidation? A. Your best plan would probably be to try a series of experiments on the subject, by using the various acids beginning with nitric, and making them of various degrees of strength and different temperatures until the object in view is accomplished.

(47) R. C. asks: Is there any instrument to test the sourness of vinegar, so as to tell when it is fit for market? Is there any instrument to test the sweetness of cider, to tell if it will turn into vinegar quickly? A. The means employed require more apparatus and care than could be employed by one who is not a chemist.

(48) C. F. O. says: I have some very nice books which have been handled by careless persons. How can I clean off the finger marks and dirty spots? A. We do not know of any other method than the use of rubber.

(49) C. H. asks: What will clean hammered granite after it becomes dark or dingy? A. Try careful washing with a moderately strong acid.

(50) W. D. asks: How can I color paraffin yellow, red, blue, black, etc., so that it will retain the coloring when in a melted state? A. Except with black, we believe this has not yet been accomplished. By continued experiment you might possibly discover the true method.

(51) Z. C. B. asks: Is there a composition with which the insides of vinegar tanks, made of spruce lumber, can be painted to make them tight, which the vinegar will not affect? A. Pitch is used for this purpose.

(52) C. H. M. asks: Why are the brilliant jewels, that so much resemble diamonds, called paste? A. The ingredients (white sand, pearlash, niter, arsenic, manganese, etc.) are first made into a paste with red lead, which, after the mass has been fused, imparts to the glass beautiful prismatic colors.

Upon what does the magnetic tension of a helix depend, upon the number of turns of the wire, or upon the volume of electricity flowing through it? Which would induce the more magnetism, a helix of small wire composed of 400 spirals with 3 cups to excite it, or a larger wire of 200 spirals and 6 equally strong cups to produce the current? A. It depends upon the number of farads per second, and the compactness of the helix, for the inductive influence is inversely as the square of the distance from the core. As to electricity and crystallization see p. 187, vol. 31.

(53) G. H. H. asks: 1. Is there any test besides experience by which we may know that a room on the ground floor should not be used as a sleeping apartment, on account of dampness? A. The hygrometer is used for this purpose. 2. In ventilating a room, should the flue open near to the ceiling or near to the floor? A. Near the floor in many instances, but no general rule can be given. 3. Is the lightest air necessarily the purest air? A. No.

(54) O. B. says: From philosophical works, I find that gold as a conductor of heat is set down at 1,000, silver 975, tin 308, firebrick 11. Earthenware is composed of a substance that ranks it as a conductor with firebrick. From the above figures then, it appears that silver is more than 88 times a better conductor than firebrick or earthenware; yet Professor Tyndall in his work on "Heat as a Mode of Motion," in speaking of the comparative radiation of a silver teapot and an earthenware one, both being filled with boiling water, says: "The silver produces but little effect, while the radiation from the earthenware is as copious as to drive the needle to 50°." Why is it, too, that in practice tin is always preferred for hot air pipes to flues that are smoothly plastered? Of course, some advantage would be derived from the superior smoothness of the tin; the ascending air currents would not encounter so much friction, but this advantage would not compensate for the difference in the conducting capacity of the two substances, tin being more than 27 times a better conductor than the plaster. Please explain. A. Good radiators are good absorbers of heat, that is, the surfaces which can easily communicate motion to the ether are equally capable of accepting it from the ether. On the contrary, a bad radiator, such as a metallic surface, is a bad absorber, and therefore a good reflector. Hence, the thin metallic film upon a surface powerfully protects it from the action of radiant heat.

(55) L. O. asks: What is a test for lard oil? A. The operation of determining the quality of the oil is one of considerable difficulty, and cannot be advantageously employed by one who is unacquainted with chemical operations.

(56) M. A. asks: Why do the leaves of one tree turn yellow and fall, while the rest are still bright and green? A. It is probably due to some accident that has befallen the tree, which has caused the premature change in the color of its foliage.

(57) W. A. C. asks: How can I make a good burnishing ink for the heels of boots and shoes? A. Take soft water 1 gallon, extract of logwood 1 oz.; boil them until the extract is dissolved, then remove from the fire and add copperas 2 oz., bichromate of potassa and gum arabic, each ½ oz., all to be pulverized. This makes a cheap and good color for shoe or harness edge; but for cobbling and for new work, upon which you do not wish to use the hot bit, but finish with heel ball you will find that if, as you pour this out into the bottle to use, you put a tablespoonful of lampblack to each pint of it, it will make a blacker and nicer finish. It makes a good color for cheap work, but for fine work, nothing will supersede the following: Alcohol 1 pint, extract of logwood and tincture of iron each 1 oz., nut galls, pulverized, 1 oz., sweet oil ½ oz. mix.

Will insects preserved in a solution of arsenic have any injurious effects if kept in a sleeping room? A. We think not. Arsenic is not a volatile poison.

Where can I obtain a Nautical Almanac? A. Of any dealer in nautical instruments.

Can you furnish book numbers of your paper? A. Generally. Send us a list of what you require.

How can I make a cheap telescope? A. See p. 186, vol. 30.

(58) M. K. asks: Do you recommend coal tar as the best preservative for the bottom of red cyprus fence posts in the ground? A. Tar dipping is very good; solutions of chloride of zinc and of corrosive sublimate are also extensively used for this purpose. Another good method is that of slightly charring the ends of the posts, as charcoal is very unchangeable, resisting perfectly the action of both air and moisture. Timber and grains of wheat and rye, converted into charcoal 1,500 years ago, at Herculaneum, remain as entire as if they had been charred but yesterday.

(59) G. says: I have a glass 55 inches long with 2½ inch objective. It is a ship glass, with a power of only fifty times. You state that a glass with that sized objective may be made to magnify a hundred and fifty if it is to be used for an astronomical glass, which I often want to do. Can I have a stronger eyepiece, that I can use for such purposes? A. Yes.

What metal in common use would answer for a faucet for vinegar, and would not be affected by it? A. Block tin might be used, but faucets of wood are by far the best for this purpose.

What is the best touse on a boat to prevent its water-soaking? A. Try coal tar.

(60) S. J. L. says: I learn that Professor Bischoff, of Glasgow, filters water for drinking purposes through spongy iron and powdered limestone. The iron is procured in a powdery, spongy state by the reduction of an ore without fusion after the extraction of sulphur and copper by heat. Can you give me such information as will enable me to do this? A. Iron may be obtained in a finely divided state as the hydrated sesquioxide, by using nitric acid as the solvent and precipitating it with ammonia, decanting the supernatant liquid, and washing the precipitate several times with water.

(61) W. H. F. asks: What is best for filling such woods as walnut, butternut, oak, etc., previous to varnishing, and how is it applied? A. Boiled linseed oil and carbonate of lead is used for this purpose.

Can toy balloons be made by blowing the rubber into bubbles? A. No.

Wood expands with water, but a cord which is of woody fiber shrinks. How is this? A. Wood does not expand longitudinally, but transversely. This swelling, as in the case of the cord, causes it to twist very tightly, which accounts for the longitudinal contraction.

How can I gild or bronze the inside of a cocoa-nut shell that I have made into a bowl? A. First apply two or three coatings of boiled linseed oil and carbonate of lead. When quite dry, lay on a thin coat of gold size. This is prepared by grinding together some red oxide of lead with the thickest drying oil that can be procured, mixed, previous to using, with a little oil of turpentine, till it is brought to a proper consistence. When the size has sufficiently dried, the gold leaf is applied upon the point of a fine brush, and gently pressed down with a ball of soft cotton. The dextrous application of a camel's hair brush sweeps away the loose particles of the gold leaf without disturbing the rest.

(62) I. G. C. asks: I am making a hollow glass prism for liquids. Bisulphide of carbon smells too badly to suit me. I am informed that oil of castor has a still higher dispersive power. Is this true? A. Yes. 2. What cement or varnish can I use, that is not permeable to or soluble in that liquid? A. Take a quantity of common shellac, dissolve in alcohol, expel the solvent by evaporation, and melt. Apply hot.

(63) G. asks: 1. Does the nickel plating process without the use of a battery, devised by Professor Stolba, give as substantial a covering as the one with a battery? A. It gives a fine covering, which is quite durable. 2. Does the Stolba process deposit any of the zinc used in the solution? A. No.

How are chloride of nickel and sulphate of nickel made? A. Chloride of nickel is formed by dissolving the oxide in hydrochloric acid. Its solution on evaporation yields green hydrated crystals. Sulphate of nickel is obtained by dissolving metallic nickel, or its oxide or carbonate, in sulphuric acid. It crystallizes in green, rhombic prisms, which require 3 parts of cold water for solution.

(64) J. P. asks: How can iron stains be eradicated without damage to the fabric? A. Wet the spot with lemon juice, sprinkle with salt, and lay in the sun to dry. Repeat the application until the stains are removed.

(65) J. T. V. asks: Can you inform me of a process for making sensitive paper? A. See p. 314, vol. 30.

What chemical is used for preparing the automatic telegraph receiving paper? A. If a current be made to pass through papers soaked in iodide of potassium, iodine will be separated at the positive wire, and a brown stain will be produced. It is more convenient to employ a mixture of equal parts of saturated solutions of ferrocyanide of potassium and titrate of ammonia, diluted with an equal volume of water, one part of each solution to two parts of water. Any kind of fine, white, unglazed paper will answer the purpose.

(66) Q. asks: How is the crystallized or frosted appearance on galvanized sheet and cast iron produced? A. Immerse for a short time in dilute nitric acid.

(67) E. E. P. asks: What is the best sizing to apply to outside brickwork before painting? A. Try boiled linseed oil and carbonate of lead.

(68) J. D. asks: Is there any liquid substance as subject to capillary attraction as water, and not so easily evaporated? A. We know of no such liquid.

What would be the result if an irresistible came in contact with an immovable? A. The supposition is absurd, for there can be neither except as mere metaphysical conceptions.

(69) M. B. asks: 1. Where should a tree one hundred feet high break, in order that the part broken off may reach from the top of the stump to a point on the ground fifty feet from the root of the tree? A. At 37 feet 6 inches from the ground. 2. Will you please give me a rule by which all such examples can be worked? A. See Euclid, Book I, Prop. 47. "The square of the hypotenuse of a right-angled triangle is equal to the squares of the sides which contain the right angle."

(70) A. G. Jr. writes to correct statements made in our answer to A. F. O. on p. 135, current volume, in regard to the Leclanché battery, which were founded on misconceptions of its real action. In the Leclanché, the conditions of ordinary batteries are not changed. In this, as in all other forms of battery where it is used, zinc is the electro-positive element, or one acted upon. The electro-motive force of a Grove being 100, this is 75, and Daniell's 50; or 3 cells of this battery are equal to 4 of the Daniells. It cannot be driven to do more than a limited amount of work (running down in a very short time if kept on closed circuit), and therefore continues its usefulness for a very long time.

(71) H. C. W. says, in reply to W. F. S., who asked as to the action of oil on rubber: Some time ago I put some kerosene oil in a bottle, closed it with a rubber stopper, and laid it down on its side, so that the oil came in contact with the rubber. In a day or two, I found the oil had swelled the rubber to about twice its original size, and forced it out of the bottle, spilling the oil. On drying the stopper, it took its original size and shape.

(72) H. P. says, on producing musical tones from thin goblets: I hear that it is now very difficult to find glasses which will produce a clear musical note. Fine glass of old manufacture is lead glass, and has a beautifully brilliant appearance; and when struck, it gives a very clear note. If the edge is thin, it is very easily thrown into musical vibration. But very little of this glass is now made; a year ago there were but two manufacturers of it in this country, and one of those gave it up during the past year. The manufacture of lime glass has been so very much improved within a few years that it is taking the place of the more expensive lead glass, and it is sometimes difficult, even for an expert, to tell by the eye which is which; but when the glasses are struck, there is longer any doubt. The lead glass gives a pure clear tone, in comparison with which the sound from the lime glass is weak and harsh; and no amount of rubbing will bring a note from the edge of the lime glass.

(73) J. H. G. says, in reply to H. H. M., who asks: "What will harden coal tar so that the heat of the sun will not cause it to run or melt?" I have an old fashioned steep shingle roof that I had covered with English roofing felt; then I had coal tar applied (about five feet square at a time) and then I sprinkled clean coarse bar sand on the tar. So far it has made a good, cheap roofing, which does not run. The roof is quite a steep one, and the tar was applied last August.

(74) J. K. says, in answer to C. M. C.'s question as to thumping in an engine: I think the center of piston and the center of crank pin are not in a straight line, and that the crosshead is too loose.

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

G. F. F.—It is an impure quartzose rock, colored by sesquioxide of iron.—A mineral sample without name or address contained galena.—E.—It is a quartz pebble, with a seam coated with oxide of iron.—L. E. F. L.—Both specimens are chiefly microscopic crystals of magnetite, together with crystallized fragments of zinc and quartz.

P. B. asks: How can I get rid of rats, other-wise than by poison or traps?—M. A. H. & B. asks: 1. Will an 18 inch currstone mill grind corn into good meal? The mill is an under runner, hung stiff on the spindle, with a dress quite deep at the eye but shallow at the skirt; speed from 80 to 600 revolutions per minute. Some old millers say that such small stones have to be set so close that the meal will heat, and the speed is so high that the grain will be thrown out before the grinding has been completed. They also declare that such a mill will take more power than an upper runner of 48 inches diameter. Is this so? 2. We have 8 horse water power; how much corn ought this to grind per hour?—B. G. B. asks: Of what material is the reed of the euphonium whistle, sometimes called the prairie whistle, made?—W. W. B. asks: What is the mode of operation for synchronizing the hair or balance spring of a watch?—A. F. W. asks: How shall I make a good article of candy, of various flavors?—T. S. M. & Co. ask: How is manganese converted into manganate?—J. McD. asks: What is the best method of drying corn and corn meal on a small scale, so that the meal may be shipped without danger of heating? Is it better to dry the corn or to dry the meal?—W. H. R. asks: How can I make maricatic salts of nickel?

COMMUNICATIONS RECEIVED.

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

On a Sliding Face Plate. By E. B. W.

On a Siphon Ram. By B. F.

On the Sun and the Earth. By W. L.

On Copper in Mineral Springs. By J. N. P.

On Scientific Truths. By A. M.

On the Squares of Numbers. By E. B. W.

On Lacing Belts. By C. McC.

Also enquiries and answers from the following:

K. L.—I. D. I. S.—C. W. C.—C. S. B.—G. W. B.—E. L.—J. S. J.—H. I. M.—J. K. P.—W. C. E. S.—L. S. H.—J. C. K.

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 a machine for making matches be obtained? Who sells a basket sifter? Who makes combined butter printers and scales? Whose are the best books on mechanical drawing? Who sells dies for cutting envelopes? Who makes a machine for dressing millstones? Where can a lathe for turning butter lades be bought? Who sells battery carbons? Where can a paper bag machine be bought? Whose is the best hammer hay press? Where can a computing machine be obtained? Who sells egg testers? Who makes pocket alarm watches? Where can information about the uses and selling prices of mica be found? Who sells flint glass for lenses? Whose is the best steam plow? What is the price of a terrestrial globe, 2 feet in diameter? How can the sugar-refining business be learned? Who sells corn mill apparatus, to do the best work with the least power?" 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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Windmill, Sholes & Kelly.....	156,316
Windmill, E. and D. C. Stover (r).....	6,101
Window blind, etc., A. A. Jaques.....	156,300
Wooden handles, making, T. Piper.....	156,378
Wrench, B. G. Martin.....	156,365
Wrench, W. R. Moore.....	156,370

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

31,229.—FINGER GUARD.—M. L. Ballard.....	Jan. 13.
31,252.—IRON BALE TIE.—J. J. McComb.....	Jan. 15.
31,284.—FINGER GUARD.—M. L. Ballard.....	Jan. 13.
31,315.—GRINDING CARD TEETH.—C. Hardy.....	Jan. 20.
31,578.—PAPER FOLDER.—W. H. Miliken et al.....	Feb. 19.

EXTENSIONS GRANTED.

30,536.—FINISHING GAS FITTINGS.—J. W. Lyon.

DISCLAIMER.

30,536.—FINISHING GAS FITTINGS.—J. W. Lyon.

DESIGNS PATENTED.

7,506.—ENVELOPE HACK.—M. Bennett Jr., Hartford, Ct.....	
7,507.—VASE.—J. R. King, St. Paul, Minn.....	
7,508.—SPOON HANDLE.—C. Osborne, N. Attleboro', Mass.....	
7,509 and 7,510.—OILCLOTH.—C. T. Meyer et al., Bergen, N. J.....	
7,511.—OILCLOTH.—J. Meyer, Lansingburgh, N. Y.....	
7,512.—SIDEBOARDS.—L. E. Steilman, Cincinnati, O.....	
7,513.—BOTTLE.—J. H. Williams, Broadalbin, N. Y.....	

TRADE MARKS REGISTERED.

2,037.—BINDER.—J. R. Barrett & Co., Chicago, Ill.....	
2,038.—CIGARS, ETC.—Batchelor Bros., Philadelphia, Pa.....	
2,039.—MEDICINE.—E. Edmundson, Jr., Pittsburgh, Pa.....	
2,040.—NAILS, ETC.—Wallace & Sons, New York city.....	
2,041 and 2,042.—TAN CORDIALS.—H. R. Wishart, Phila., Pa.....	
2,043.—CARBON BLACK.—The C. B. Co., New York city.....	
2,044.—PUBLICATIONS.—J. Gruber, Hagerstown, Md.....	
2,045.—MEDICINES.—J. C. Street & Co., New York city.....	

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, OCTOBER 29 TO NOVEMBER 7, 1874.

3,999.—N. Stephens, Brooklyn, Kings county, N. Y., U. S.....	
Improvement in cement lined pipes, called "Stephens' Improved Cement Lined Pipes." Oct. 29, 1874.	
4,000.—M. S. Schario, Village of Sunderland, Ontario county, Ont. Improvement in spring bed bottoms, called "Schario's Improved Spring Bed Bottom." Oct. 29, 1874.	
4,001.—I. Fréchet and Louis Coré, St. Hyacinthe City, P. Q. Une machine à faire les cambrures de boîtes et solières, called "Le Tailleur de Cambrures de Fréchet." (Boot and Shoe Crimping Machine." Oct. 29, 1874.	
4,002.—J. O. Brown, Forestville, Chatsauqua county, N. Y., U. S., assignee of O. M. Sweet, same place. Improvement in step ladders, called "Brown & Sweet's Improved Step Ladder." Nov. 2, 1874.	
4,003.—M. J. Althouse, Wauwaton, Fond du Lac county, Wis., U. S., assignee of G. Raymond, same place. Improvements on wind wheels, called "Althouse & Raymond's Wind Wheel." Nov. 2, 1874.	
4,004.—D. Morse, Chicago, Cook county, Ill., U. S. Improvements in churn dashers, called "Morse's Improved Churn Dasher." Nov. 2, 1874.	
4,005.—J. Head, Andover, Alleghany county, N. Y., U. S. Improvements on a machine for scouring leather, called "J. Head's Leather-Scouring Machine." Nov. 2, 1874.	
4,006.—A. F. Cooper, Cambridge, Middlesex county, Mass., U. S. Improvement on medicated pads or belts for the cure of rheumatism and other kindred complaints, called "Dr. Cooper's Medicated Pad or Belt." Nov. 2, 1874.	
4,007.—N. B. Dolson, Gatham, Kent county, Ont. Improvements on car couplings, called "Dolson's Automatic Car Coupling." Nov. 2, 1874.	
4,008.—O. P. Flynt, Boston, Suffolk county, Mass., U. S. Improvements on ladies' garments, called "Flynt's Dust and Weather Protector." Nov. 2, 1874.	
4,009.—L. D. Adams, Buffalo, Erie county, N. Y., U. S. Improvements in car couplings, called "Adams' Car Coupling." Nov. 2, 1874.	
4,010.—H. Servis, Rochester, Monroe county, N. Y., U. S. assignee of C. M. Coolidge, same place. Improvements on a process for producing caricature photographs, called "Coolidge's Process for Producing Caricature Photographic Pictures." Nov. 2, 1874.	
4,011.—A. Goth and C. A. Wollé, Bethlehem, Northampton county, Pa., U. S. Improvement on machines for coating paper with oil colors, called "Goth & Wollé's Machine for Coating Paper with Oil Colors." Oct. 7, 1874.	
4,012.—J. Authors and W. F. Munro, Toronto, Canada. Useful form for the head or the slot in the head of screw nails, called "Author's Improved Screw." Nov. 7, 1874.	
4,013.—A. D. Cable, Montreal, Can., and O. B. Howard, Portland, Cumberland county, Me., U. S. Improvement on racks and safes, called "Cable & Howard's Rack and Safe." Nov. 7, 1874.	
4,014.—F. S. Barnjum, Montreal, P. Q. Improvements on pantaloons stretchers, called "Barnjum's Patent Pantaloons Stretcher." Nov. 7, 1874.	
4,015.—C. A. Hussey, New York city, U. S. Improvements on railroad axle boxes, called "Hussey's Railroad Axle Box." Nov. 7, 1874.	
4,016.—G. Woods, Cambridgeport, Middlesex county, Mass., U. S. Improvements in processes for drying lumber, called "Wood's Process for Drying Lumber, etc." Nov. 7, 1874.	
4,017.—K. McKenzie, Hamilton City, U. S. Improvements on cooking stoves, called "McKenzie's Revolving Oven Cook Stove." Nov. 7, 1874.	
4,018.—L. B. Sullon, Minneapolis, Hennepin county, Minn., U. S. Improvements on safety car shoes, called "Sullon's Safety Car Shoe." Nov. 7, 1875.	
4,019.—K. McKenzie, Hamilton city, Ont. Improvements on sheet pattern cutting blocks, called "McKenzie's Sheet Pattern Cutter." Nov. 7, 1874.	
4,020.—C. Rommel, Elizabeth, Union county, N. J., U. S. Improvements on polychromatic printing machines, called "Rommel's Universal Polychromatic Printing Machine." Nov. 7, 1874.	
4,021.—J. Ney, Jr., Ellice Township, Perth county, Ont., and A. Eby, Downie Township, Perth county, Ont.	

Machine for the catching and collecting of the Colorado potato bug, called "The Colorado Bug Catcher." Nov. 7, 1874.

4,022.—T. E. Roberts, Ionia, Ionia county, Mich., U. S. Improvement on spark arresters and consumers, called "Roberts' Spark Arresters." Nov. 7, 1874.

4,023.—J. Tomlinson, Goderich, Huron county, Mich., U. S. Improvements in barrels, called "Tomlinson's Improved Barrel." Nov. 7, 1874.

4,024.—G. L. Anders, Boston, Mass., U. S. Improvements on printing telegraphs, called "Anders' Improved Printing Telegraph Instrument." Nov. 7, 1874.

4,025.—K. C. Tozer, Newcastle, Northumberland county, New Brunswick. Improvements on freezing and refrigerating apparatus, called "Tozer's Freezer and Refrigerator." Nov. 7, 1874.

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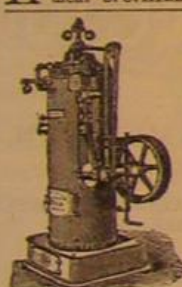
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BRIDGE ON THE MONT CENIS RAILWAY.

Although the opening of the Mont Cenis tunnel has effected a great saving of time, not only between France and Italy, but between England and India—the direct route from Calais to Brindisi, the Italian port of embarkation for the East, via the Suez Canal, being now used for passengers and mails—travelers in search of the picturesque probably prefer to travel over the mountain, using Mr. Fell's railway, and obtaining views of the grand scenery of the Alps from the highest of those peaks which has as yet been crossed by an artificial road. Of the nature and difficulties of the work, and of the glimpses of rock and precipice afforded by the many ravines it crosses, our illustration (selected from *Engineering*) will give an excellent idea. It is a view of the bridge at Comba Scura in the Piedmontese Alps, which crosses a gorge, at a height of 395 feet from the ground. The span is 185 feet between the abutments; the width is 14 feet 9 inches, and the depth 18 feet. Over 200 tons of iron were used in the construction, and the work showed a deflection of $\frac{3}{4}$ of an inch, under a strain estimated at 4 tons per square inch. This bridge, and others similar to it, were designed by the Italian Government engineers, and constructed by Fleet and Newey, of West Bromwich, England.

Honors to an Inventor.

In France, Frederic Sauvage is considered to have the largest share of merit in practically applying steam power to the screw propeller, which he did in 1832. The town of Boulogne-sur-Mer, where Frederic Sauvage was born on the 20th of September, 1786, has lately gone to considerable expense in awarding him posthumous honors, which culminated in the uncovering of a monument to his memory. At 10 o'clock the government, municipal, naval, and military authorities, deputations from various cities, headed by M. le Baron de Latouche, Sous-Préfet, and M. Huget, Maire, started in procession from the Hôtel de Ville for the cemetery to which the remains of Frederic Sauvage were removed from Paris and interred with public honors on the 20th of September, 1872. The monument over his grave is a square pediment in three portions, made of gray marble of the same kind as the Napoleon Column is built, and obtained from the Marquise quarries. It rises to the height of 14 feet, and on the top a bronze heroic sized bust of Frederic Sauvage is placed.

On either side of the monument is an inscription setting forth the date of his birth, death—19th July, 1857—the translation of his remains, and a list of his inventions. On the front are the two words "Frederic Sauvage," and a bronze bas-relief showing a vessel with a screw propeller, a pantograph—*procédé Collas*—a physionotype, a horizontal mill for sawing marble, and a *soufflet hydraulique* for raising water, all of which were either invented or perfected by F. Sauvage, who, in addition, invented the *conformateur*, an instrument for measuring the head, the *physionomètre*, and a automatic boat.

The bronze bust and bas-relief were modeled by Mr. John Hopkins, and were cast by Messrs. Thiebaud et Fils, of Paris.

Frederic Sauvage's life was similar to those of many other inventors, in that he spent his days and fortune in perfecting inventions which brought him no profit. Having lost his own money, he borrowed from others, and, being unable to repay, was thrown into a debtor's prison, which he afterwards exchanged for a madhouse, where he died on the 19th

American trade mark. In all, 1,841 objects, weighing a total of 11 pounds and 10 ounces. The person was crazy, and his mania, whenever unwatched, consisted in swallowing any small object. It is remarkable, however, that the functions of digestion could continue with this immense mass in the stomach.

Educated Birds.

The *Baltimore American* gives the following account of a troupe of trained Java sparrows and paroquets, now exhibiting in the streets of that city:

"When a suitable place is found, a circular table is opened and the birds are all turned loose upon it; they manifest no fear at the crowd, and do not offer to escape. The performance consists of ringing bells, trundling small wheelbarrows, slack wire walking, firing off pistols, dancing, swinging each other in small swings, an excellent imitation of a trapeze performance, and a number of other equally interesting tricks. The most wonderful part of the performance, however, is done by a paroquet. This bird walks to the center of the table, and, after bowing to the crowd, seats himself in a small chair near a bell. To the clapper of the bell there is attached a small cord, and any one in the crowd is allowed to ask the bird to strike any number of times upon the bell. If asked to strike ten times, he leaves the chair, seizes the bell rope and pulls it ten times, after which he bows and returns to his seat. This was repeated a great many times, and with one exception the bird made no mistake. The bird will strike twenty seven times, but after that he refuses; and his owner states that he has worked nearly a year to get this bird to strike up to thirty, but it appears that his memory gives out at that point, and it is unable to count further. A collection is, of course, taken up after each exhibition."

Roman Remains.

An important discovery has been made at Highwood, near the village of Ashill, in Norfolk, England, consisting of a vast collection of Roman remains in an oak lined well, 60 feet deep. The Norfolk and Norwich Archaeological Society recently visited the spot, when the well, under the superin-

tendence of Mr. Barton, was emptied of its contents by a number of workmen. The well contains a great variety of articles, the most abundant being urns, of which about 100 have been obtained; more than fifty of these are perfect, and many of most beautiful form and ornamentation. There is considerable doubt as to the purpose which these wells were intended to serve; there are other two at Ashill, and others have been found elsewhere.

Vigorate.

The account of trials of this newly discovered explosive, at Stockholm, states that a charge of about eight ounces, made up in five cartridges and deposited in an excavation, raised a block of stone of 163 cubic feet. It would have taken over fourteen ounces of dynamite to have produced the same effect.



COMBA SCURA BRIDGE, ON THE MONT CENIS RAILWAY.

of July, 1857. The monument was designed by M. de Bayser.—*London Times*.

A Human Ostrich.

The curious cases which we recently mentioned of persons, one of whom swallowed a fork and another a thermometer, are completely overshadowed by that of an individual who recently died in an asylum in Prestwich, Eng. A medical contemporary, in its account of the *post mortem* examination, gives the following catalogue of the contents of the man's stomach: 1,639 shoe pegs, 6 nails four inches in length, 19 nails of three inches, 8 of two inches, 58 of one inch; 39 metal eyelets, 5 copper screws, 9 copper buttons, 20 scraps of buckles, 1 pin, 14 bits of glass, 20 pebbles, 3 pieces of twine, a fragment of leather three inches long, a piece of lead four inches long, and a bodkin bearing an

Scientific American.

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SUCTION.

As our readers may have observed, a number of inquiries have recently been made in regard to the action of pumps and siphons: whether the water delivered by these machines was sucked up by the action of the mechanism, or forced up by the pressure of the atmosphere. To these questions we have answered: that there is, properly speaking, no such principle as suction, meaning thereby that water would not rise in a void space unless some pressure was applied to force it up. Until it was demonstrated by Torricelli that the atmosphere had weight or pressure, it was popularly believed that a liquid would rush into an empty space, because "Nature abhorred a vacuum." We judge, from the tenor of many of the letters sent to us, that this belief is not, as yet, wholly dissipated; and some elementary works on natural philosophy treat the subject in such an obscure manner as to confirm their readers in this opinion. It may be added, also, that one of the earliest accomplishments acquired by the infant is that of sucking, although we venture to assert that the exact nature of this process is not generally understood. It may be useful and interesting, then, to examine the action of the common pump, and compare it with that of the human mouth when engaged in sucking liquid through a tube. The common pump, in its simplest form, consists of a cylinder containing a tightly fitting piston, a pipe connected to the bottom of this cylinder extending into the water; at the bottom of the cylinder is a valve which opens when pressed from beneath, and there is a similar valve in the piston. Now suppose the piston to be at the top of the cylinder, which, together with the pipe, is filled with air. As the piston is forced down, it compresses the air in the cylinder, so that the valve in the piston opens and allows the air to escape. When the piston is pulled up, there is a void space beneath it in the cylinder, so that the pressure of the air on the water outside of the pipe forces it up some way in the pipe, opens the valve in the bottom of the cylinder, and forces some of the air from the pipe into the cylinder. After a few strokes, the water will be forced into the cylinder, and then, as the piston descends, the water will rise through the valve in the piston, and be carried out

on the upward stroke. If the pump cylinder is placed at a greater distance above the surface of the water than the height of a column of water equal in pressure to the atmosphere, no water will be forced into the cylinder—showing, as Galileo ironically asserted to the advocates of the suction theory, that, if Nature does abhor a vacuum, its abhorrence only extends to a height of 34 feet. Again, if the water be placed in a tight vessel from which all the air is exhausted, and the pipe from the pump extends into the water with an airtight joint, the pump will cease to draw water, no matter how perfect the suction may be. A similar experiment conducted with the human suction apparatus, the mouth, will give a like result, proving that something more than the removal of the air is necessary in elevating water. To show that the suction of the mouth is similar to the action of the common pump, suppose a short tube to be held between the lips, the other end being immersed in water. The first operation is similar to the downward motion of the pump piston, the tongue being moved forward or upward against the palate, commencing at the root and filling the mouth. Next, as in the case of the ascending piston, the tongue is drawn back or bent down, creating a void, into which the water is forced by the pressure of the air, this pressure depressing the cheeks at the same time. The tip of the tongue is then applied to the teeth, to prevent the return of the water, and this action corresponds to the closing of the valve in the bottom of the pump cylinder. Finally, the tongue is pressed against the palate, commencing at the tip, forcing the water back; and the mouth being relieved of the water, the former operations are repeated.

This is only one illustration of the many that could be given to show that natural operations are conducted on truly scientific principles, so that the investigations of scientific men for the discovery of natural laws are among the most important and practical of the labors of the human race.

The action of the siphon may properly be considered in this connection. It appears to be the belief of many of our correspondents that the column of water in the long leg of the siphon, being heavier than the short column, pulls it along, and that the pressure of the atmosphere cannot render any resistance, since, if anything, it is a little greater at the lower end of the siphon, and so would rather tend to force the water back. A simple experiment, that can readily be made, is to place the short end of the siphon in an exhausted receiver, filling the tube with water, when it will be found that the liquid is discharged into the receiver, instead of flowing out at the other end; so that by this means the action of the siphon can be reversed, water being drawn through the long leg and delivered at the short one. The correspondents above referred to seem to think that the water in a siphon is something like a rope over a pulley, the part on one side being longer than that on the other, so that the weight of one part overbalances the other and draws it down. The trouble with this conception is that the water is an exceedingly weak rope; and if the heavy part starts to draw the other along, the rope will break in two, unless it is forced from behind. In reality, then, the action of a siphon is something like that of a rope over a pulley, the strength of the rope being about fifteen pounds per square inch. Thus, as long as the distance from the highest point of the siphon is no greater than the height to which the pressure of the air will raise the water, this pressure keeps the rope of water together, and the flow goes on continuously. But if this height is exceeded, the air can no longer force the water up, and the rope breaks, leaving in the upper part of the siphon that vacuum which Nature was said to abhor. It would appear, therefore, that the heavy column in the long leg of the siphon only draws or sucks along that in the short leg when there is something to push, that does all the work until the water is transferred to the long leg; and the sucking force gives out simultaneously with the failure of the pushing force to elevate the water to the highest point of the siphon.

OPERATIONS OF THE PATENT OFFICE.

We publish on another page an abstract from the annual report of General Leggett, now Ex-Commissioner of Patents, showing the operations of the Patent Office for the year ending September 30, 1874.

The Ex-Commissioner dwells with commendable pride upon the increased proportion of patents granted, and the diminished proportion of rejected cases—a result due, he suggests, to the publication, in a popular, accessible form, of weekly abstracts of all new patents, together with the full specifications thereof. We have, on several occasions, expressed the opinion that the more widely the publication of the patents was extended, the greater would be the increase in the number of patents granted, and the less the necessity of maintaining so large a standing army of officials as we have now at the Patent Office.

We are glad to perceive that the Ex-Commissioner has at last reached the same view. He has heretofore been an advocate for the increase in the number of examiners; but his present conclusion is that, by extending the printing, the present large force of examiners may be diminished.

Since the presentation of this report, the Hon. J. M. Thacher has assumed the duties of Commissioner of Patents, and the public will look with interest for the development of the line of policy that is to characterize his administration. He has on former occasions given expression to views which would lead us to suppose that, under his rule, the Patent Office would surely be conducted in the interest of inventors. But there are some indications of a contrary policy. For example: In some of the classes, he permits inventors to be harassed by long delays; while in respect to

that large class of applications known as compositions, especially medicines, he is daily sending out, under his official signature, decisions like the following: "This application is finally rejected on the ground that physicians' prescriptions are not patentable."

The author of such stuff is evidently a quack in patent law, whatever may be his pretensions in medicine. Such decisions are not only absurd, but they are in direct violation of the law and the previous practice of the Patent Office. The 24th section of the patent law expressly provides that any person who has invented any new and useful composition of matter, or any new and useful improvement thereon, may obtain a patent therefor. Medical compositions or prescriptions rank among the most important of discoveries. Hundreds of such patents have heretofore been granted, and have resulted in the production of many new and valuable medical remedies, by which life has been saved and health promoted.

With a few exceptions, such as above indicated, we believe that the examiners of the Patent Office are animated by a desire to serve the country according to the best lights they have. But we fear they are not sufficiently awake to the real purpose and intent of the patent laws, which is to encourage and assist the inventor. There is a tendency to looseness, inefficiency, and injustice on the part of the Patent Office in its decisions. This is strikingly shown by the astounding fact that some 7,500 applications for patents were last year condemned to the category of the rejected. The conclusion is irresistible that, if the claims of these applicants had been properly considered, if the Patent Office officials had in every instance, as in duty bound, extended the encouraging word and the helping hand to these inventors, the number of rejections would have been far less. We earnestly hope that the new Commissioner will bestir himself and try to promote the needed reforms.

WHAT IS STEEL?

At the time of the Vienna Exposition, this question was brought up and resulted in numerous discussions among the metallurgists assembled at the Austrian capital. Professor Jordan, of the Central School, and M. Greiner, Superintendent of the Seara Steel Works, proposed that the proper definition of steel was "all malleable siderurgical products obtained in a melted state," and to reserve the name wrought iron (*fer*) for such malleable products as were not submitted to fusion. According to this, however, natural steel, puddled or forged, and cemented steel would be no longer steel, in spite of the properties which distinguish these from soft iron. In a word, steel, whether melted or not, is a product which places itself, from all points of view, between cast iron and wrought iron. The various ferrous products encountered in the arts form a continuous series from the softest and purest iron up to the most impure cast metal; or rather, there are two continuous but diverging series, both commencing at pure soft iron. The one ends at black or dark gray pig, including untempered or unannealed steel; the other, terminating at white cast iron, more or less manganiferous, includes tempered steel.

M. Gruner, in his recent report of the progress of the coal and iron industries, as developed at the late Vienna Exposition, after advancing the views last given, arrives at the conclusion that we should understand, by the term steel, all iron (whether melted or not, more or less pure) which is susceptible of tempering, but which is malleable, hot or cold, so long as it has not been submitted to sudden cooling. Soft iron, whether melted or not, is metal malleable, hot or cold, but not susceptible of tempering.

As puddled, as well as refined and cemented steel, is distinguished from melted, Bessemer, and Martin steel, etc., so also should soft iron be divided into puddled and homogeneous iron. This last may be especially subdivided into the homogeneous metals of Bessemer, Martin, Siemens, etc. It should not be forgotten, however, that, though the types are well characterized, there is a gradual passage from one to the other. Thus homogeneous iron passes in an insensible manner to cast steel, as soft iron, simply refined, passes to hard steel iron, then to properly called natural steel, which itself terminates in wild steel (*wild stahl*) for wire draw-benches, before attaining the true white cast iron.

RUSTING OF RAILWAY RAILS.

At the recent session of the American Association for the Advancement of Science, Professor Haldeman read a paper on this subject, showing that railway rails when in use oxidized but very little, but when not in use were subject to rapid oxidation. In fact, disuse for one day, for example, Sunday, resulted in a visible increase of rust of the track rails. This, in the opinion of the author, would indicate that, in chemical combination, vibrations may interfere with the molecular arrangement of the elements. In the discussion which followed, Professor Vander Weyde took the same view, and thought that molecular relations tended to prevent rust. But other speakers combated this view, and it was suggested that possibly the oil employed upon the locomotives might be more or less spread in a thin film over the rails in use, and thus prevent their oxidation.

Professor Robert Mallet, of London, has had his attention called to this discussion, and in a recent note to *The Engineer* states that some thirty years ago he was requested to examine and report upon the same matter on behalf of the British Association for the Advancement of Science, a grant of money being allowed for the purpose. He made a variety of experiments and examinations, all of which were duly reported. He found, in brief, that one of the reasons, why rails when used corrode less than the same rails when not

used, is because the vibration of the used rails tends to shake off the rust formed, so as to prevent its prolonged contact with the metallic iron from accelerating the corrosion of the latter.

THE MECHANIC OF THE FUTURE.

An esteemed correspondent desires us to call attention to the difficulty in finding mechanics able to fill situations where special knowledge is required, and to the hindrances thrown in the way of capable men by trade rules and customs, prescribed and enforced in the interest of the worthless and incompetent.

This country is almost overstocked with professional men; and whenever education and ability are united in a young man, he is almost sure to quit the practical part of his trade, and become a consulting engineer and an expert, living by fees instead of by wages, and selling his knowledge and not his skill. Thus, men of brains are taken out of the really working class; and many manufacturers look in vain, in the rank and file of their establishments, for men capable of being master mechanics. The question as to where our leaders and foremen are to come from is deserving of our best consideration; for there are many influences at work which are retarding the progress of the American working man. Boys and young men should especially bear in mind the value of acquiring a thorough knowledge of all branches of the trade by which they intend to earn their bread, so as to become capable leaders and instructors of others, less gifted and fortunate than themselves. The gentleman above referred to recently needed a first class machinist to superintend a certain branch of business, the specialties of which would require a few months of attentive study and practice. It is difficult to believe that the rules of a trade society, ostensibly organized for the protection of the rights of working men, prevented a skilled artisan from leaving an inferior position to be a superintendent; but it is nevertheless a fact. He stated that the union to which he belonged would not allow him to work for an hour at less than a certain rate, even though his temporary reduction should certainly lead him to permanent employment of great responsibility and credit, and consequently large remuneration. The employer, naturally averse to having his liberal offer thus treated, at once declined to promote the man on any terms whatever, as no one who would thus debar himself from getting on in the world was fit to be put over others, who would naturally follow his example and imitate his ideas.

So many qualifications are wanted in a manager and superintendent of a machine business that fitness for the post is rare, and the ambition to fill it creditably ought to stimulate our workmen to study and improvement.

CHARACTERISTICS OF A BUSINESS KING.

During his career as a great contractor, the late Thomas Brassey was engaged in the construction of railways in England, France, Spain, Italy, Belgium, Saxony, Bohemia, Austria, Hungary, Moldavia, Syria, Persia, India, Australia, Canada, and South America, aggregating something like six thousand and five hundred miles, besides water works, drainage schemes, docks, bridges, and other important undertakings. In the execution of these great works, he had, at various times, twenty-seven different partners; four hundred million dollars of other people's money passed through his hands; and at times the army of workmen to which his contracts gave employment numbered as many as eighty thousand men.

Such a record, to say the least, entitles Mr. Brassey to a high place among the great captains of industry to which the age of railway construction has given birth and occupation; and as one of the pioneers of a new order of men, his character is peculiarly worthy of study, more especially as he represents a type of man which the world is likely to have more and more need of with the spread of the industrial civilization which distinguishes our modern times.

Abundant materials for the study of Mr. Brassey's qualifications for an industrial leader are furnished in the volume on his "Life and Labors," prepared by Sir Arthur Helps; and though it is never safe to assume that all the characteristics of a successful man were essential or helpful to his career, and therefore worthy of imitation by those who would aspire to similar success, we may nevertheless easily detect those which were strikingly helpful; while the doubtful ones, even those most widely at variance with the popular ideal, may possibly have been factors worthy of recognition.

Before entering upon any analysis of Mr. Brassey's character, it is proper to notice, first, an important condition of his success in the great business of his life, a condition without which every other qualification would have been wasted. His business training was such as to give him a practical knowledge of nearly every kind of labor necessary to be understood for the accomplishment of great works of construction. This we put before any personal characteristic, since no man, however well fitted by Nature for the rank of master, can command to good purpose without a minute personal knowledge of the work to be done, a fact which ambitious youngsters are very apt to overlook. Mr. Brassey was fortunate in not being sent to school until he was twelve years old. At sixteen, he was apprenticed to a surveyor and real estate agent,—something different, by the way, from what the term implies with us—who subsequently took him into partnership. His first work of consequence was in connection with the laying-out of the once celebrated Holyhead road, of which all England was very proud. At the death of his instructor, Mr. Brassey became sole agent and representative of the owner of a large estate, in the care of which he had brickyards and limekilns to superintend. Later he

had the management of a quarry, from which stone was taken for a viaduct on the Liverpool and Manchester Railway, the first for passenger traffic ever constructed. It was in connection with this quarry that Mr. Brassey made the acquaintance of George Stephenson, under whose advice he made his first (unsuccessful) tender for a railway contract. His next attempt was to better purpose; and at the age of twenty-nine, Mr. Brassey entered upon his life work as a railway contractor. His first undertakings received his personal supervision to their minutest details, thus laying the foundation for the higher and more valuable art for which he became celebrated in after years, the art of dealing with details in masses.

Thus Mr. Brassey was prepared by education for dealing with the great problems of railway construction. Let us consider briefly the personal qualities which he brought to the work. In the first place, he had the energy needful for great accomplishment. Said one who worked under him for many years: "If he'd been a parson, he'd have been a bishop; if a prize fighter, he would have had the belt." The physical basis was sound and enduring, and his activity untiring. With great capacity for hard work, he keenly enjoyed working hard, not so much for the profit it would bring as for the pleasure of doing. He could not bear to have work drag, nor to leave anything which he undertook undone or half done. Even when the pushing forward of work, arrested by accident or otherwise, involved the taking upon himself responsibility for expense which belonged elsewhere, he did not hesitate to go forward.

A striking illustration of this spirit occurred in connection with the Paris and Rouen Railway, his first great foreign contract. In the carrying out of this work, he was restricted in his choice of certain materials to French products; and in consequence of inferior lime for mortar, a rapidly built viaduct—a huge brick construction, a hundred feet high and a third of a mile long, costing \$250,000—fell down in utter ruin. It was suggested that, on representing the facts of the case to the directors of the company, some alleviation of his loss might be obtained. His reply was: "No: I have contracted to make and maintain the road, and nothing shall prevent Thomas Brassey from being as good as his word." Without stopping to discuss the question of responsibility in the matter, new materials were secured, and the work was reconstructed with a rapidity that was accounted marvelous. It is a satisfaction to record that the company voluntarily assumed the cost of the new structure.

With all his anxiety to have work done rapidly and well, Mr. Brassey never wasted his energy in worry. Having given his best efforts to ensure success, he was content to await the result and abide by it with perfect equanimity. This, as Sir Arthur justly remarks, is a great felicity of temperament. It gives a man of much work the staying quality known as "bottom" in a racer, and enables him to meet inevitable reverses without being crushed or disconcerted. It is the basis of the two-o'clock-of-the-morning courage, which the first Napoleon used to rejoice in, a quality which Mr. Brassey had to an eminent degree. If called up suddenly in the middle of the night, upon some urgent peril or difficulty, he met the alarm with perfect coolness; sat down to consider and calculate what was the best mode of obviating the danger; and before break of day, when he had to proceed to the scene of action, he was ready with his plan. Like master, like man. His example could not but be felt by his assistants, who took courage at his stability of mind, and gave their fullest confidence to a leader who always seemed ready for any emergency. In addition to this imperturbable presence of mind, Mr. Brassey evidently possessed singularly quick and comprehensive powers to take in the essential conditions of a problem at a glance, uncommon power of rapid calculation, and great ability for organization—qualities which not only inspired his staff with confidence in times of difficulty or danger, but enabled him to administer complicated affairs with a royal ease and facility.

It was in dealings with his agents, however, that his most striking characteristics were displayed. In the course of his career, he carried into execution nearly two hundred contracts, many of them involving hundreds of miles of railway. The works for which he made unsuccessful tenders amounted to upwards of seven hundred million dollars. It is obvious that no man could examine the details of works of such variety and magnitude. He must necessarily trust largely to his agents; and it was in the choice of these, and his subsequent treatment of them, that Mr. Brassey's business sagacity came into full play. He chose his agents with great care and with consummate judgment. After that, he placed implicit trust in them; and though capable of exercising the most minute supervision and criticism, he never judged by details, but looked to results. His system of keeping accounts was what most men would consider loose, and his agents were entrusted with vast sums of money to be expended almost at their discretion; yet his financial secretary and confidential adviser upon all monetary matters testified that not one of his representatives was ever known to deceive or rob him. When asked if this was to be taken as a proof of the general honesty of mankind, Mr. Tapp replied: "Not exactly that. I think it rather more shows that he placed so much confidence in those whom he employed, and put them, as it were, so much upon their honor, that they would not deceive him; and that people, who might not have acted uprightly with other masters, did so with him because they felt responsible to him, and also a certain amount of pride in being confided in by him to such an extent that they really carried on the business as if it were their own." His biographer adds his personal belief that the system of trust which Mr. Brassey adopted uniformly, in respect to all those who worked under him, was

such as would be generally successful if carried out with that perfect faith and completeness which he always manifested in these transactions—a belief which might be considered Utopian had it not such a substantial backing in Mr. Brassey's large experience.

In another connection, Sir Arthur observes that where most men fail in governing is in not entrusting enough to those who have to act under them. Most men intend well, and try to do their best as agents and subordinates; and he is the great man who succeeds, with the least change of agents and subordinates, in making the most of the ability which he has to direct and supervise. Besides, men must act according to their characters; and he who is prone to confide largely in others will mostly gain an advantage in the general result of this confidence, which will far more than counteract any evil arising from that part of the confidence which is misplaced.

That a man whose ruling passion was the execution of great works in a way which should win him renown for faithfulness, punctuality, and completeness in the execution of his undertakings should succeed, as Mr. Brassey did, by such a mode of dealing, with those on whose faithfulness and integrity his reputation depended, is cogent evidence that his plan of action was not far from correct. Not only did Mr. Brassey trust his subordinates, but they trusted him as implicitly. In the earlier part of his career, when each contract had his personal supervision, he allotted to each nominal sub-contractor his portion of the work, and fixed the price for it. Says one of them: "They did not ask him any questions. He said: 'There is a piece of work for you. Will you go into it? You will have so much for it.' And then they accepted it, and went to work." Their invariable willingness to take the work at his valuation was accounted for by the conviction, which each of them had, that if any mistake had been made, to their injury, Mr. Brassey always stood ready to make good the loss. In case a job turned out more difficult than had been anticipated, no appeal would be made; the work would go on according to contract until Mr. Brassey made his customary tour of inspection, when he never failed to recognize the contractor's position, and voluntarily set it right. When his undertakings became too extensive to be thus minutely inspected, the same policy was carried out through resident agents. To many this course may seem very unbusiness-like, but the result uniformly proved the wisdom of it. By treating his agents generously, he secured generous service in return, and was able to withdraw his attention more and more from matters of detail. He never wasted his time in doing work that an agent or sub-contractor could do just as well. As to mere money grubbing, one of his principal agents testifies that he had not any of that in his composition, but he knew the value of money as well as any one, and how far a pound would go; nevertheless he had no greediness to acquire wealth, and he was always ready to give away a portion of his profits to anyone who was instrumental in making them, and that to a remarkable extent.

For illustrations of Mr. Brassey's hatred of contention, his uniform courtesy, his large-hearted unselfishness, his frank appreciation of merit of all kinds in others, and other qualities which pertain to the man rather than the contractor, we have no space. At the busiest period of his life, he would travel hundreds of miles to be at the bedside of a sick or dying friend or associate, to give what aid or consolation he could: a spirit which his staff rewarded as it deserved. The regard and affection which Mr. Brassey won from all those who served under him were most strikingly manifested during his last fatal illness. Men of all classes, humble navvies as well as trusted agents, came from great distances solely for the chance of seeing once more the old master they loved so well.

At a time when there seems to be a growing belief that a masterly man must be a stern disciplinarian, rough rather than gentle, brusque rather than courteous, exacting, watchful, a believer in the vile theory that every man must (in business) be treated as a rascal until he proves himself something better, it is singularly pleasing to review an exceedingly successful career, throughout the whole of which the opposite qualities are conspicuous. At a time, too, when financial treachery and eye service are supposed to be predominant, when the most minute and exacting checks upon the free conduct of agents fall to prevent "irregularities," it gives one fresh confidence in the general honesty of human nature to see the spirit of trustfulness made the basis of a great business, and to see it justified by service honorable to the highest degree.

That Special Edition.

The issue of a Special Edition of ONE HUNDRED THOUSAND copies of the SCIENTIFIC AMERICAN will come off soon after the first of December.

The names of parties to whom this large number of papers will be sent have been selected with care, and the publishers guarantee the issue to be fully 100,000, and it will probably reach 150,000 copies. The probability of this excess over the one hundred thousand is predicated on last year's experience. We then guaranteed 60,000, but actually printed and mailed 120,000 copies.

The papers will be mailed in separate wrappers, and the postage prepaid to every post office in the United States, Canada, and the adjoining Provinces.

The space allotted for illustrating new machinery and inventions is nearly all taken; but a few more good engravings, of first class inventions, may find place in the editorial pages, if immediate application is made. There is also a very little more space left for advertisers. See page 365 of this paper for particulars.

Aniline Colors.

The following on the subject of aniline colors, from the pen of Mr. P. Kuntz, of Paris, may be useful as a concise *résumé*: The first colors employed were the violets; it was only in 1859 that aniline red was discovered, and by whom first is not clear. Aniline red, rosaniline, or fuchsin is now usually prepared by the mixture of aniline with arsenical acid and water, or aniline and arsenical acid found in commerce in the state of sirup, and which contains sufficient water for the purpose. Pure rosaniline has scarcely any color. According to the opinion of Hoffmann, generally accepted, the coloring matters produced by the various reagents from aniline are all salts of one and the same basis, the rosaniline. The colors of the salts of rosaniline are not permanent, they will neither withstand ley, soap, nor the effect of light; but their base serves in the preparation of other coloring matters which are of great interest. The resinous residue of the preparation of fuchsin, treated with different solvents, gives the chrysaniline, violaniline, mauvaniline, etc. The color recently introduced into commerce under the name of cerise, and the tint of which, less scarlet than that of fuchsin, approaches rather to poppy color, is also obtained from the residue of fuchsin. By treating fuchsin by means of various agents, and in various methods, the most varied tints of red are obtained. One of the colors most employed in the dyeing of silk, saffranine, the magnificent color of which approaches scarlet, is obtained by a method the details of which are but little known. The blue colors derived from aniline are produced by numerous methods, the great part of which remain laboratory curiosities. The number of processes which have entered into actual practice are relatively very few. The most advantageous are those first indicated by M. Girard and M. Laire, in which the salts of rosaniline are heated with aniline. It is believed that the production of these blues is based on the introduction of phenol into the composition of rosaniline. They are classed under the generic appellation of Lyons blue. Different phases of the manufacture yield different products, some of which are insoluble in water, and are called *bleu direct*, *bleu purifié*, or *bleu lumière*, the last being entirely exempt from any tinge of violet; the others, which are soluble in water, constitute the industrial coloring matters.

The *bleu de Paris* is obtained by the action of the bichloride of tin on the aniline of commerce. Other blues have been successively added to the list, some discovered accidentally, others by scientific experiments.

The violets likewise are the results of the action of various agents. They seem to be produced by the mixture of blue and red in very different proportions; in many of the processes, it is very difficult to obtain the precise tint required. According to the intensity of the preponderating tint, the violet is too blue or too red. The violet of Hoffmann, dahlia, is obtained by the mixture of rosaniline or of a salt of rosaniline with the iodide of ethyl and concentrated alcohol in different proportions. The violet of Paris results from the mixture of methylated spirit, chloride of ammonia, and aniline, by the method of MM. Poirier and Chappart. Perkin's violet, which was the starting point in an industrial sense, is prepared by bringing bichromate of potash into contact with sulphate of aniline, and treating the precipitate with wood spirit, which absorbs the coloring matter. The spirit is then evaporated and the residuum mixed with water with the addition of soda, which precipitates the coloring matter.

The most important green pigments derived from tar are those of Usebe and Hoffmann. The former was discovered accidentally, by a workman named Cherpin, who, not being able to fix aldehyde blue in a tissue, applied to a photographer, who recommended him to try hyposulphite of soda, the result was the production of a magnificent green color. Aniline browns are but little employed. Aniline yellows are numerous; most of them, however, have an orange or brown tint. Aniline black may be said to be almost exclusively for cotton.

The employment of these colors is very simple. Silk, whether in hanks or woven, is dyed by simple immersion, and wool in the same manner. The same colors also serve for printing on silk and woolen fabrics. For cotton, the colors must first be mixed with albumen and then submitted to the action of steam; or they are printed on cloth prepared with tannin, which forms with the pigments insoluble products. Aniline is not the only substance derived from tar which yields coloring matter. Naphthaline, which distills at 428° Fahr., yields among others the yellow of Marine, one of the most brilliant and purest yellows known, which dyes woolen and silk without mordant, from light citron to gold of the purest tint with true yellow reflections, differing from the greenish yellow shade of picric acid, another substance derived from tar. Naphthaline red is superior to the aniline reds, and possesses greater solidity; but it can only be employed for light tints, as it loses its brilliancy in the darker shades. These two are the only colors which naphthaline supplies at present to industry; the others have not sufficient purity, brilliancy, or freshness, and are too much affected by light and atmospheric influences; their price is also at present, too high.

Anthracene, which distills (at a temperature above 360°) with the last products of tar, has, on the contrary, a brilliant future, since the important discovery of its transformation into alizarine. Anthracene is still too dear to come into dangerous competition with madder; but its production and the apparatus used are being reduced to greater simplicity. It is a carburet of hydrogen. Artificial alizarine is prepared by means of bromine and potash. According to the calculations of M. Kopp, in order to replace completely the aliza-

rine of madder and purpurine by artificial alizarine, 704 tons of the latter would be required in the dry state, which is equal to 7,044 tons of the raw color. It would require 2,720 tons of the raw artificial alizarine to replace the true alizarine only; this quantity represents about 720 tons of anthracene.

THE DOCKS AT PORTSMOUTH, ENGLAND.

The well known town of Portsmouth, in Eng and, is not only a thriving business place and a commercial port of considerable extent, but it is the chief station of the British navy, and has, on this account, been so strongly fortified that it is deemed by many high authorities to be absolutely impregnable. The fortifications are bastioned ramparts faced with masonry, and inclose the whole town, to which entrance is permitted by four carriage ways; and outworks, in the form of trenches, are arranged to protect the inner line of walls. The harbor is only 220 yards wide at the entrance, but broadens to a width of about six miles; and on the waters of this naturally secure bay, the whole British navy can safely find anchorage.

The dockyards of this immense naval station, large as they are, are not sufficient for the accommodation of the ships under repair, and some very important additions are now being made. We publish herewith a view of the works now under construction, from which a good idea of their nature and magnitude may be formed. The immense blocks in the foreground show how concrete is coming into use not only in ordinary work, but in situations where strength and permanency are points to which expense is not to be compared. The large repairing and refitting basin, from which numerous dry docks of great size branch off, is nearly ready for the inlet of the waters, on which ride the ships whose masts are seen in the distance, towering above the buildings.

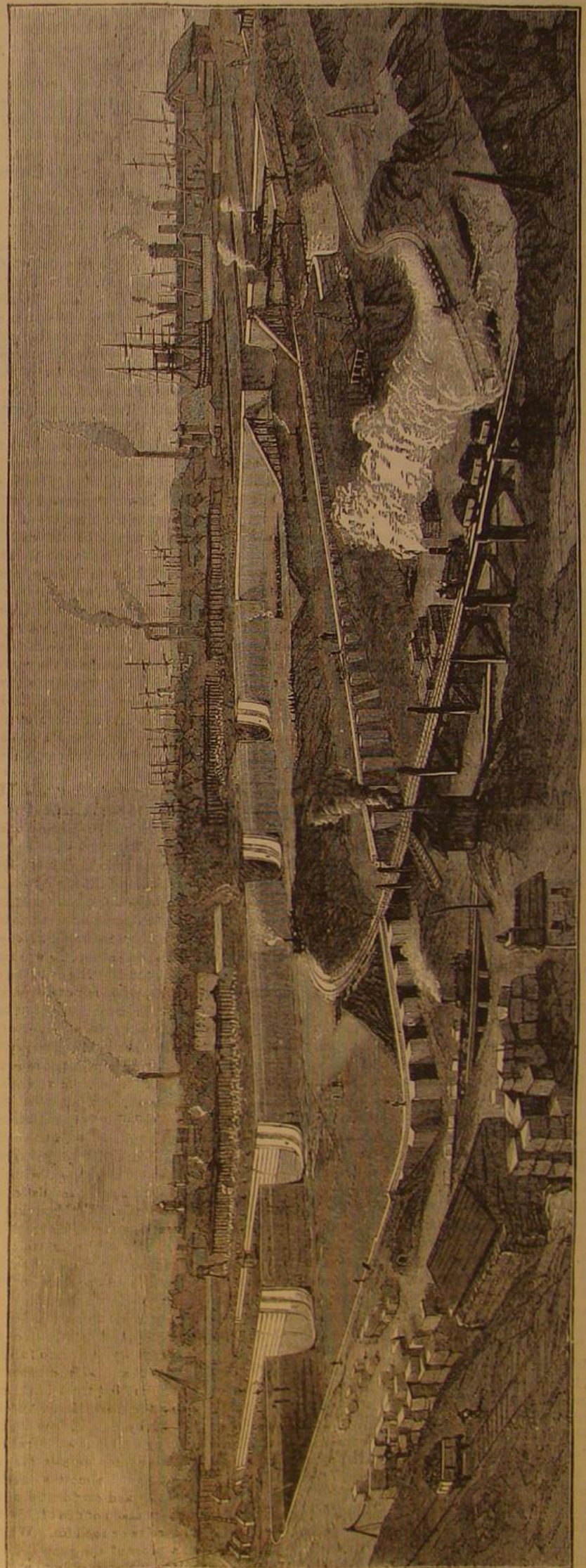
Cutting and Storing Grafts.

There is no better time to cut grafts, says the *London Garden*, than at the commencement of winter. In cutting and packing them away, there are some precautions to be observed. In the first place, let them be amply and distinctly labeled, as it is very annoying to find the names gone at the moment of using them. For this purpose they should be tied up in bunches, not over two or three inches in diameter, with three bands around each bunch—at the ends and middle. The names may be written on a strip of pine board or lath, half an inch wide, a tenth of an inch thick, and nearly as long as the scions. This, if tied up with the bunch, will keep the same secure. For convenience in quickly determining the name, there should be another strip of lath, sharp at one end, and with the name distinctly written on the other, thrust into the bundle with the name projecting from it. If these bunches or bundles are now placed on end in a box, with plenty of damp moss between them and over the top, they will keep in a cellar in good condition, and any sort may be selected, and withdrawn without disturbing the rest, by reading the projecting label. We have never found sand, earth, sawdust, or any other packing substance so convenient, clean, and easily removed

as moss, for packing grafts. It is needful, however, to keep an occasional eye to them, to see that the proper degree of moisture is maintained—which should be just enough to keep them from shriveling, and no more.

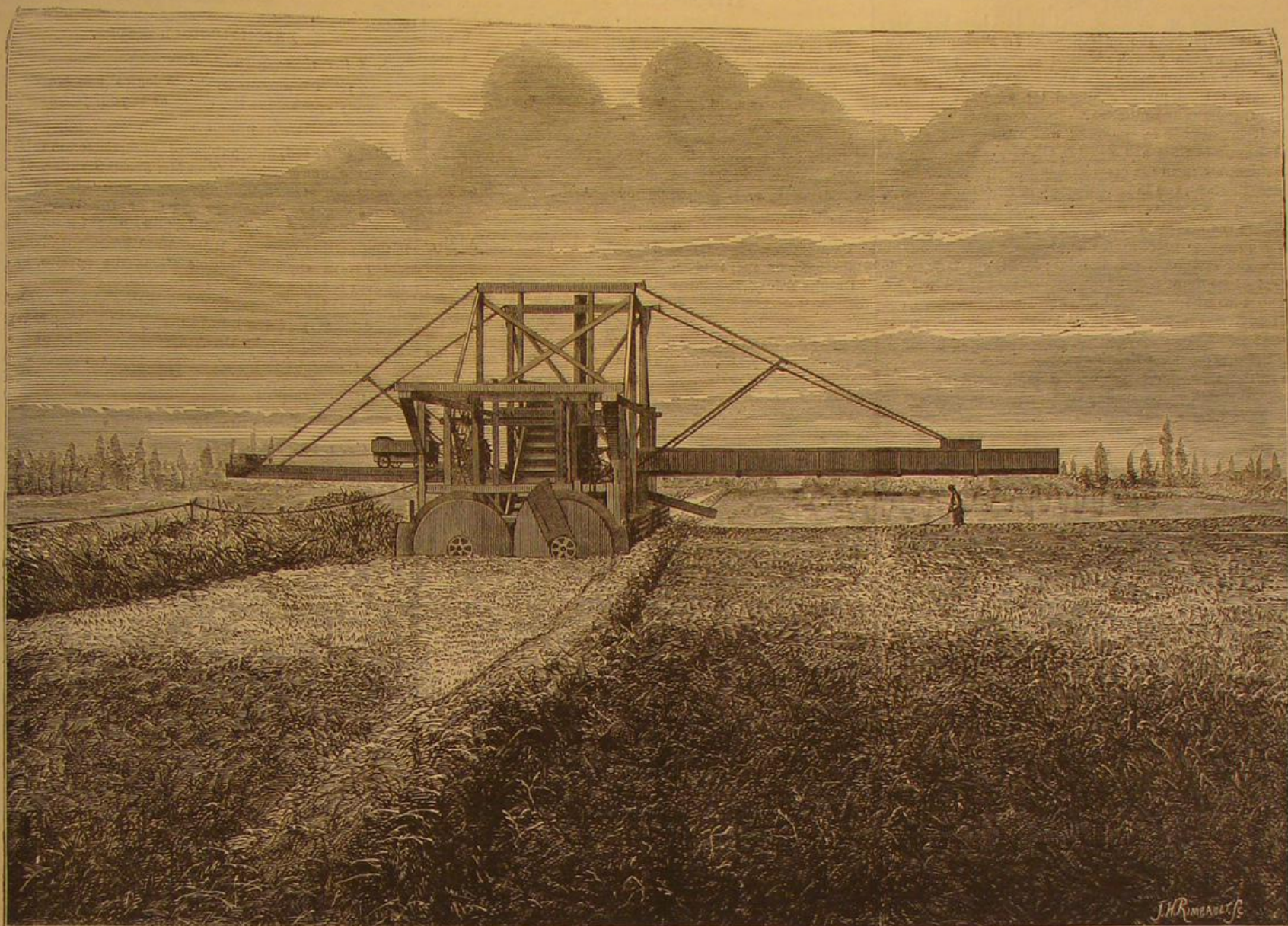
Live Fish Trade.

Arrangements have been made for placing on board one of the steamers, running between Liverpool and New York



THE DOCKYARDS AT PORTSMOUTH, ENGLAND.—THE NEW REPAIRING BASIN AND DRY DOCKS.

one of the American aquarium cars, a newly invented contrivance for transporting live fish, which has succeeded very well in long overland journeys, and by means of which it is hoped to effect a useful interchange of living fish of various kinds between England and America. There are many American fish which might with benefit be introduced into England, and we at the same time might transport to the other side of the Atlantic some varieties of fish which are not found there.—*Nature*.



PEAT FUEL MANUFACTURE IN CANADA.—CUTTING AND PULPING APPARATUS. (See page 356.)



PEAT FUEL MANUFACTURE IN CANADA.—DRYING AND STACKING. (See page 356.)

PEAT FUEL.

The difficulties in utilizing peat as fuel have been very widely discussed, but the operations at La Pigeonnière, Canada, have, by ten years' practical operation, proved the practicability of converting the substance into a clean and cheap fuel, the supply of material for which is, in many localities, practically unlimited.

The Irish peat, the formation of which is due to the moist atmosphere, when cut and dried in the air, is ready for use in furnaces, etc.; and the considerable formations in Somersetshire, England, and in the valley of the Somme, in France, are utilized in a similar manner. In Canada and this country, where the atmosphere is drier, a supply of surface water is required to produce the substance. It is fibrous in texture, and somewhat red in color; in drying, it loses 40 per cent of its bulk and about 90 per cent of its weight. Thus 10 tons of the material must be dug out to obtain one ton of fuel; and its economical working is, therefore, a point of great importance. When dry, its heating capacity is about three fifths that of coal.

To render its combustion practicable, it must be pulped and disintegrated before drying, otherwise it is too loose in condition to form a good fuel. The pulping operation destroys a certain hygroscopic character that the dried raw peat assumes, and causes it to resist moisture and to be indestructible by frost.

Mr. James Hodges, C. E., is the engineer of the La Pigeonnière operations, and the process is described as follows: A center level line is traced out, and for ten feet on each side of it the surface is cleared of vegetation, the debris being piled up on each side to form two banks 20 feet apart. This arrangement is the preliminary work for a canal, and at one end of it a kind of dock is formed, for launching the apparatus shown in our first engraving. It being ascertained that the peat bog contains sufficient water to flow in behind the machine and fill the excavation, the cutting vessel is started. It consists of a boat of 80 feet length, 16 feet beam, and 5 feet depth, with two screws, of 11 feet diameter, in front, fitted with cutting blades and driven by an engine in the stern of the vessel. The blades cut their way through the bog; and as the water flows in as fast as the peat is taken out, the vessel moves forward, generally at the rate of about 15 feet per hour. Two men are required to clear the peat from pieces of wood, roots of trees, etc. When cut, the peat is lifted by an elevator and discharged into a hopper, and thence passes into a pulping apparatus, and flows off by a distributing trough. The two men occasionally add water to keep the pulp of a proper consistence, but no other hand labor is required. The distributing trough lies at right angles to the length of the boat, and may be lengthened to deposit the material at the required spot. The peat is left on the ground to dry, to the depth of about 9 inches; and when consolidated, it is ready for cutting into blocks. This is done with curved knives, placed 6 inches apart and mounted on a frame, and worked by two men. In a fortnight of favorable weather, the blocks are ready for stacking, which a gang of a man and three boys can perform at the rate of 4,000 blocks a day. They required to be turned and restacked to insure thorough dryness. Our second illustration shows this process.

Mr. Hodges states that, in 10 hours, from 300 to 400 tons of peat can be excavated by this machine. This will yield about 50 tons of dried fuel, and will leave a canal 150 feet long, 19 feet wide, and 5½ feet deep, in the peat bed. For this quantity, an average of 38 men for the day of 10 hours will be required. Fuel thus made has been burned in the locomotives of the Grand Trunk of Canada Railway, with a saving, it is said, of 45 per cent of the expense of coal, and a rather larger economy over that of wood.

The engravings were originally published in *Engineering*.

Wave Motion.

Mr. Deverell, of England, has devised an apparatus by which the movement of a ship at sea is registered. From the results of a recent voyage, Mr. Deverell deduced the following: The duration of the voyage was 2,026 hours. During that time the ship made 1,764,088 beam oscillations or rolls, and 1,041,137 fore-and-aft oscillations or pitches. The average number of oscillations in both directions per minute was 14. The aggregate arc of pendulum registering beam movements was over 15,000,000 degrees, while that of the fore-and-aft movements was nearly 5,000,000 degrees. Mr. Deverell also considered that he had definitely established from these observations the following propositions: 1. That between ocean limits, the swell of the ocean is unceasing. 2. That the motion of an independent body within a ship on the ocean is unceasing. Here then was represented an immense amount of conservable energy, and the question remained: Could a practicable method be found for conserving it for use on board ship? Mr. Deverell believed that it could, and to a sufficient extent to be useful in auxiliary propulsion. He expects to be in a position in a few months to detail his method of putting his propositions into practice.

The Bicycle.

A remarkable instance of what can be done with the bicycle was recently exemplified in England. A match had been made between Mr. Stanton and Keen, the champion rider, to run 100 miles, the former to receive a start of half an hour. Stanton's machine had a driving wheel of 58 inches in diameter, that of Keen's being 4 inches less. Keen accomplished 50 miles in the extraordinary time of 3 hours 14 minutes 18 seconds, but was compelled to retire in the 91st mile, leaving Stanton to finish the 100 miles alone, which he did in 1 minute 5½ seconds less than 8 hours—an average of over 13 miles an hour, inclusive of a few short stoppages for refreshments, etc.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students.

Positions of Planets for December, 1874.

Mercury.

Mercury should be looked for in the morning. On the 1st of December, it rises at 5h. 23m. A.M., and sets at 3h. 32m. P.M. At this time it is well situated. On the 31st, it is not as easily seen, as it rises at 6h. 59m. A.M., and sets at 3h. 51m. P.M.

Venus.

Venus rises on the 1st of December at 8h. 17m. A.M., and sets at 5h. 3m. P.M.

On the 8th of December, Venus makes a transit across the sun's disk, affording an opportunity to astronomers to determine, by the best methods now known, the distance of the sun from the earth. To observe this phenomenon, expeditions have been sent to northern and southern stations by the United States, Great Britain, Russia, and other countries.

The transits of Venus which have been observed occurred in 1639, 1761, and 1769. The next after this of 1874 will be in 1882, and will be visible in this country. The transit of 1769 was observed in this country, and a curious pamphlet describing it was published at that time in Providence, R. I. The writer says: "The transit of 1761 was observed at St. John's, in Newfoundland, by John Winthrop, at the expense of the Massachusetts colony."

"To observe the transit of Venus in 1769, several observers were sent into the South Seas by the Royal Society in London; the Empress of Russia sent several companies into those parts of her empire where the visible duration was of the greatest length, and the King of France did likewise send observers into foreign parts."

On Dec. 31st, Venus rises at 4h. 59m. A.M., and sets at 2h. 49m. P.M.

Mars.

Mars is not well situated for observers. It rises at 2h. 46m. A.M., and sets at 2h. 4m. P.M. on the 1st of December. On the 31st, it rises at 2h. 20m. A.M., and sets at 0h. 50m. P.M.

Jupiter.

Jupiter is also unfavorably situated for observations, rising on the 1st at 3h. 18m. in the morning, and setting at 2h. 20m. P.M. On the 31st, Jupiter rises at 1h. 43m. A.M., and sets at 0h. 33m. P.M.

Saturn.

Saturn is not as well situated as it has been through the summer. It comes to the meridian before dusk, and sets on the 1st at 8h. 57m. in the evening. On the 31st, it rises at 9h. 28m. A.M., and sets at 7h. 14m. P.M., so that it is scarcely possible to get a good view.

Uranus.

Uranus can sometimes be seen with the eye; and as it rises on the evening of the 1st, among the small stars of *Cancer*, at 9h. 24m., it could perhaps be seen at midnight. It rises on the 31st at 7h. 23m. P.M., and passes the meridian at about 2h. 30m. in the morning, at which time it has an altitude, in this latitude, of nearly 59°.

Neptune.

Neptune rises at 2h. 32m. P.M. on the 1st, and sets at 3h. 38m. the next morning. On the 31st, Neptune rises at 34m. after noon, and sets at 1b. 39m. the next morning.

Sun Spots.

The record is from Oct. 20 to Nov. 14, inclusive. The photograph of the 20th shows the three large spots of the 19th, with another of good size, very near the center, which was not seen on the 19th. The 21st was not clear; and on the 22d, this spot had disappeared, together with the most westerly of the other three. On the 23d, the two remaining spots were seen, the more westerly having perceptibly decreased in size, and on the 24th it had disappeared without reaching the edge. From the 26th to the 29th inclusive, the spots were few and very minute, the faculae being very marked on the 27th. On the 30th, a large spot appeared on the eastern edge of the sun's disk, which proved to be the precursor of a fine group. Photographic pictures of Oct. 31st and Nov. 2d show two large, well defined spots. Owing to clouds and fog, no pictures were taken from Nov. 2d to Nov. 10th; but the group was watched with a small telescope, and the two large spots were seen to divide into several smaller ones, the picture of Nov. 10th showing a group of six small spots within the western limb. On the 11th, the group was near the edge of the disk, and on the 12th it had disappeared, and the sun's axial motion had brought a small spot into view within the eastern limb. On the 14th, three groups of very small spots were seen within the eastern limb, and nearly in a line with the sun's equator.

In describing a recent balloon ascent to the French Academy, M. Tissandier mentions having entered a bank of gray clouds at a height of only 485 feet, this being lower than in any previous ascent. At one time, curiously, while the ground was completely hid from the voyagers, they ascertained, from the voices they heard, that they were distinctly seen from the ground. The clouds were transparent from below upwards, opaque from above downwards. M. de Fonvielle took spectroscopic observations of the sun at various heights, from 4,850 to 3,250 feet. The blue was observed to invade the space occupied by the indigo and violet rays, while the red was much the same as on the ground. On nearing the upper surface of the clouds again, the violet and indigo resumed their former extent.

Correspondence.

ENTOMOLOGICAL NOTES.

To the Editor of the Scientific American:

I send you a few notes on entomological paragraphs which have lately appeared in the columns of your journal.

BEECH BLIGHT.

Under this head, you published several communications last spring, one of which, from Mr. Jacob Stauffer, of Lancaster, Pa., contained the following words: "It would seem that this blight is not so very new after all. Westwood figures the larva of the *psylla betula*." * * "I would simply add that neither from Mr. Riley, Mr. Walsh, nor Mr. Harris could I learn anything further about the species, or if it were ever before noticed."

The insect is not the *psylla* referred to, and does not belong to the flea lice (*psyllada*), but to the plant lice (*aphida*). It was briefly described by Dr. Asa Fitch, in 1851, under the name of *eriosoma imbricator*, though it in reality belongs to the genus *pemphigus*. I have referred to it in the *American Entomologist*, vol. I, p. 58.

VESICATORY POTATO BUGS.

The Colorado potato beetle possesses no vesicatory properties; but the so-called old-fashioned potato beetles, belonging to the very same family as the Spanish fly (*cantharis vesicatoria*) all possess it in a high degree, and the fact was known and made use of not only nineteen years ago, but half a century ago. Kirby and Spence, in their invaluable "Introduction to Entomology," speak of these insects being used in place of the green European species, and Harris and most subsequent authors who treat of the *lytta* refer to the fact. Some years ago I caused large quantities of the striped blister beetle (*lytta vittata*) to be collected and properly dried, and from them Mallinckrodt Brothers, of this city, made an excellent cerate, which has been used with satisfaction by our local physicians. I would also state to Mr. E. S. Wicklin that these blister beetles have not become great strangers. *Lytta vittata* may be got in almost any year, by the cartload in this latitude, and they often ruin a potato field in a few days; while *cinerea*, *marginata*, and *atrata* frequently swarm on particular plants. The European *vesicatoria* abounds most on ash trees, and is collected principally from these trees, and with far more labor than is required to collect the *vittata* in this country. But such is the force of habit and the difficulty of diverting the course that trade has once taken, that our pharmacutists still send to Southern Europe for their cantharides. But I presume they make as much profit on the one as they would on the other, and there is no particular inducement for them to encourage home industry.

THE PHYLLOXERA PREMIUM.

An item in one of your late numbers makes mention of the fact that one of your correspondents has discovered that the liberal use of cow dung is a sure cure for the phylloxera on vines, and—whether jokingly or not, I cannot pretend to say—calls upon the French Government to remit the amount of the reward, in case the proposed remedy prove effectual. It is a pity that your correspondent is so modest as to keep back his name, and a still greater pity, for him, that cow manure and cow urine were among the earliest supposed remedies thoroughly tried in France. The fact that he will not be able to prove priority of suggestion is all the more to be deplored, for the reward for a remedy has been increased from sixty thousand to three hundred thousand dollars. Cow manure is an excellent invigorator of the vine, and its use, as that of all other invigorators, is beneficial in counterworking the effects of phylloxera, but it is no sure remedy for the disease.

CHARLES V. RILEY.

St. Louis, Mo.

What Temperature Kills?

To the Editor of the Scientific American:

I notice in your issue of November 7, 1874, an editorial article entitled: "What Temperature Kills?" In the third paragraph you say that "not one seed germinated after exposure to boiling water." I wish to state that the seed of the common locust tree will not only stand the temperature of boiling water, but will always fail to grow unless boiled for 8 to 10 minutes.

My father planted about 15,000 seeds of the common locust on four acres of land, and only about 50 seeds germinated. We now boil them for 10 minutes, or place them in cold water and allow it to come to a boil, and remove them three minutes afterwards. These seeds will grow finely after a large brush pile has been burned over them.

These are facts, occurring every year, to my personal knowledge.

HIRAM VAN METER.

Macomb, Ill.

The Crystallization of Carbon.

To the Editor of the Scientific American:

I would like to add my testimony to what you have already published to the world on the crystallization of carbon, especially as at last we seem to be on the high road to success.

Twenty years ago, while conducting experiments for another purpose, I was accidentally led to the conclusion that the diamond is a crystal of slow growth, from carbon, first reduced either to a liquid or gaseous state. I inferred this, partly, from the growth of large crystals of other substances, whose full size was not attained in less than from five to eight years time. This theory is less complex than that of Mr. Thiele, of Rochester, and it consists in confining carbonic acid gas in a large strong receiver, and in submitting it to a moderate heat and great pressure for a considerable

length of time. The oxygen would probably be first thrown down to form ozone; other constituents and spurious carbon would follow, forming a mass at the bottom, upon which the crystallization of pure carbon would take place in due time.

I would suggest the construction of several large and stout glass vessels for the purpose, so that different combinations of chemicals may be submitted to trial, and the result noted from day to day.

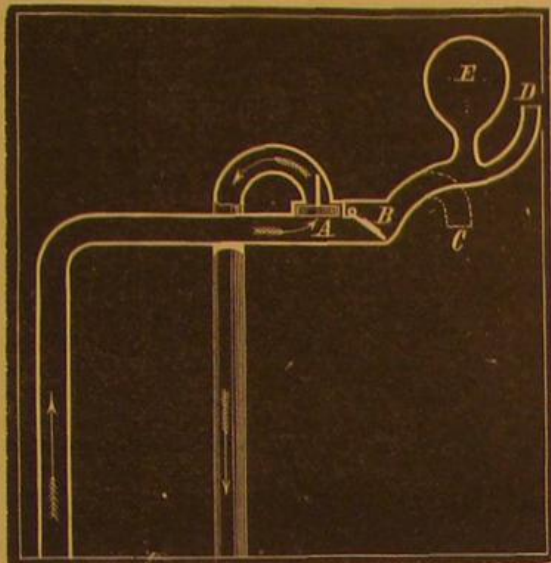
CHARLES THOMPSON.

St. Albans, Vt.

A Siphon Water Ram.

To the Editor of the Scientific American:

I wish to call attention to an improved siphon hydraulic ram, which, I believe, will elevate water to the height of thirty feet with considerable less fall than the ordinary ram requires for that elevation.



The engraving herewith given will explain its operation, the arrows indicating the course of the water through the siphon. A is the check valve, and B the outlet valve. Water may be discharged at C, or be carried up by the tube, D, in which case the air chamber, E, will be required.

Gilman, Ill.

B. FRESE.

A Flying Machine.

To the Editor of the Scientific American:

Cannot we arouse a little more spirit and inquiry regarding the subject of a practical flying machine, and keep the ball rolling until the aim is accomplished? What think you of this contrivance? (See accompanying illustration.) As here represented, the fireless steam engine is assumed to be used, but the object is rather to show a good arrangement for other parts, aside from the motor.

The horizontal driving shaft passes through the frame of the car, and is made to revolve by means of its crankle, worked by rods from the oscillating cylinders below. At each end of this shaft are beveled gears which actuate the vertical wing shafts, and so rotate the spiral fans.

The arms which support the wing spindles are disconnected at the center of the car (under the canopy) and so arranged upon the car frame that, by means of handles, they are easily and quickly made to revolve, partially and independently above the shaft, so that the gearing may always be in action. The object is to incline the wing shafts, for the purposes of propelling the machine forward or backward, or of turning it around when desired.

By this mode of gearing, the two fan wings always revolve in contrary directions to each other, and each has the same number of revolutions. They are also of the same form and size. When both wing shafts are vertical, the car moves upward; when both are slightly inclined in one and the same direction, the car will not only rise, but also move forward; and a contrary inclination of both wings stops the forward motion. A certain velocity of the wings, when the shafts are vertical or nearly so, as before said, causes the car to rise; a less velocity balances it in the air, neither rising nor falling, and still less allows it to descend gently.

The form of the car can be varied to suit the fancy, and it can be made to carry two or more persons. The legs are supposed to be hinged to the body, and to have stout india rubber straps attached across them, to act like springs, breaking the jar when the machine alights. Should the wings cease to revolve, they will act, with the canopy of the car, as parachutes to break the fall. Indeed, a regular parachute can be made to rise and open above the canopy, and flaps may be placed on the sides of the car, if desired.

The most effective inclination or angle for the blades appears to be about 33° from a horizontal line. The wings need not be very large. When intended to carry the machine and only one man, ten feet diameter for each wing appears to be quite sufficient.

We must not mistake the buoyant power of still air for its capabilities under the quick stroke of a wing. This effect of rapid motion in the wing is well illustrated in birds: A wild duck of quick motion flies with only one square inch of wing to each ounce of its weight; a turkey with only three fourths, robins with four, tame pigeons with three and three quarters, bats twenty, and butterflies from twenty to fifty; and we find generally that large and heavy birds have much less wing space, proportionally, than the smaller ones.

In this machine every desired evolution appears to be provided for. Now what motor shall we use? The whole machine, with all its appliances, can probably be made within a weight of 150 lbs., and at a cost less than that of a good horse.

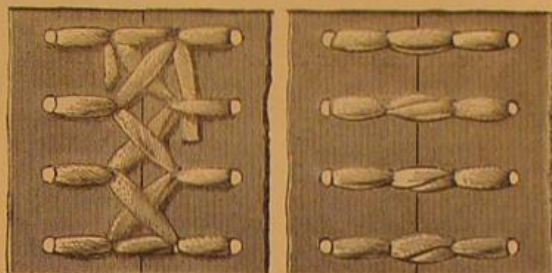
New York city.

W. D. G.

Lacing Belts.

To the Editor of the Scientific American:

Permit me, through your valuable columns, to give your readers my experience in lacing a belt: Place the ends of the belt together, punch holes as for lacing in the usual way; then punch another row of holes directly behind them, from one to one and a half inches away, and not as large as the ones nearest to the end. Cut a lacing eight times as long as the belt is wide, or the lace may be spliced as soon as one is used up. Commence lacing from the inside of the belt; put the lace through the holes nearest the end and in opposite ends of the belt, beginning at one edge, and draw the lace through, until the ends of the belt are drawn together and the lace is of equal length on the outside of the belt. Pass the ends across, put them down in the contrary way from what they were before, and bring them up through the same holes that you put them through first; then you



have the laces on the outside of the belt. Put the ends of each lace down through the holes directly behind them; but do not draw them down snug until after you put it up through the same hole as before from that side, and draw it all tight. Now we have one set of holes finished, and the lace is on the outside of the belt. Cross the ends, and pass down the first row of holes, and repeat as at first, and the lacing will be exactly similar, with the exception that there will be but two thicknesses of lacing in the place of three, as at the first; for it is most essential to have the edges of the belt laced firmly, lest your belt should run crooked over

around the zinc, and glycerin and nitric acid around the carbon. I therefore call this latter battery the nitro-glycerin battery. In this battery I use carbon taken from the bottom of a gas retort, cut into convenient slabs, which I find to be better than artificial carbon. I tried cast iron in this battery, but the result was that the iron oxidized very rapidly and covered the zinc. I found also that it is not necessary in using glycerin to amalgamate the zinc.

I thus caused the most powerful batteries to be constant.

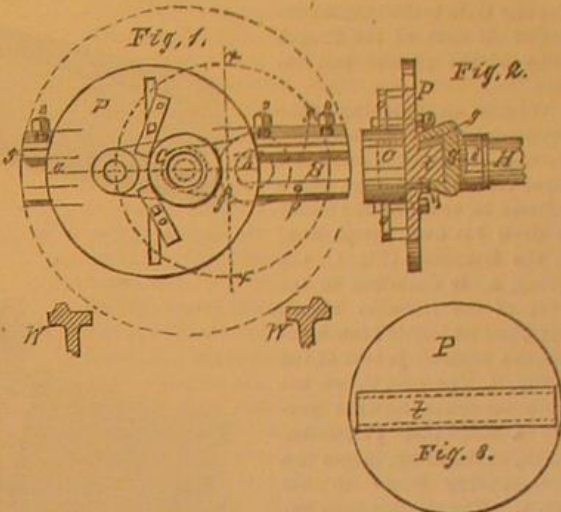
Milwaukee, Wis.

L. BURSTALL.

A Sliding Face Plate.

To the Editor of the Scientific American:

Mr. Rose's recent article on boring the crank calls to mind a sliding faceplate, of which I send a sketch. Fig. 1 is a front view; Fig. 2, a side and sectional view; Fig. 3, back of faceplate, showing dovetail bar, *t*. *S* is a slide, as long as will swing over the ways, *W*, hollowed by a dovetailed



longitudinal groove, and provided with a hub, *d*, at the middle, which screws on the spindle, *H*. *P* is a faceplate with a bar, *t*, extending nearly across the back, fitted to the slide, *S*, along which it may be moved. *g* is a bar held against *t*, by screws, *s*, at any desired pressure. *C* is a crank, strapped to the faceplate, and the latter is moved to a position for boring the main hub; the dotted lines (Fig. 1) show the position for boring the smaller hub. Both hubs are bored and faced at a single chucking; and if the workman is careful not to spring the piece in clamping, the work will be positively in line. It is of no consequence whether the faceplate is crowning or dishing, or whether the slide is square with the spindle; the work will be true. By using a dowel pin, at *y*, and alternately at *p*, cranks may be bored to have exactly the same throw. Eccentrics can be accurately bored and turned at a single chucking.

Its general use will be readily understood by mechanics. All holes bored will be on the line, *ab*, and work must be bedded accordingly.

E. B. WHITMORE.

Rochester, N. Y.

Curious Apples.

To the Editor of the Scientific American:

The curious apple described in your issue of November 21 is simply the effect of abnormal growth, one portion of the fruit developing and ripening sooner than the other. The sweet and sour portions show the contrast between ripe and unripe fruit. By keeping a specimen a sufficient time, this fact will appear. The suture between the parts is also produced by one part having an earlier and larger development.

Splitting a bud could not produce the effect. Even if it could be made to grow, it would only produce on each side a limb bearing fruit according to its kind. Trees of the greening apple are sometimes subject to this unnatural growth of the fruit, and the contrast between the ripe and unripe parts is of course strongly marked.

FLETCHER WILLIAMS.

Newark, N. Y.

Drawing as an Educator.

In referring to the usefulness of the art of drawing, in education, the *Illustrated London News* says: "The school board have taken an important and, we think, very wise step by resolving to introduce the elementary teaching of drawing into the schools. The teaching of drawing confers, as it were, a new sense; it develops perceptions which reading and other branches of education can never reach. To say nothing of the increased pleasure it affords through life, so long as the power of sight endures, it trains precisely those faculties which are most regarded in nearly all mechanical occupations, and it forms, therefore, the basis of most technical education. There are few mechanics who would not be benefited in their work by a knowledge of drawing; while here and there the proposed teaching may stimulate genius that might otherwise remain dormant. The system of teaching adopted in the German *kindergarten* has been recommended and the suggestion deserves consideration."

PROPOSED FLYING MACHINE.



the pulleys. This way of lacing I have learned from fifteen years' experience, and I freely give it to your readers, for I have received far more valuable information from correspondents of your paper, which I would not be without for anything.

CLARENCE MCCOY.

Antioch, Cal.

[Our readers will not fail to see that there is a great advantage in having the lacing on the side next the pulley running lengthwise of the belt, as this method gives less friction on the pulley.—EDS.]

New Galvanic Batteries.

To the Editor of the Scientific American:

In addition to the facts in my communication, published on page 277 of your current volume, I wish now to inform you that I have succeeded in making Daniell's and Bunsen's batteries constant and inodorous, by using glycerin instead of water. Thus, in Daniell's battery I put glycerin with sulphuric acid in the copper, and glycerin with sal ammoniac or sulphuric acid in the zinc.

In Bunsen's battery, I use glycerin and sulphuric acid

THE NEW FRENCH ARMY GUN.

Through the courtesy of a Paris correspondent, we have lately obtained tracings of the official drawings of the new gun, which a board of officers, under the presidency of Marshal Canrobert, adopted, on the 13th of August last, as the weapon with which the army is to be provided. Out of the various designs submitted to the examiners, it appears that but two were favorably regarded. One known as the Beaumont, the invention of a Hollander, found support from four of the eight members of the board, while the remaining half advocated the Gras gun, a French invention. The casting vote of the president, probably influenced somewhat by a patriotic feeling, decided the question in favor of the Frenchman, and so the weapon of which Captain Gras is the reputed inventor is that of the French army of the present and future.

We give an engraving of the Beaumont gun, and also illustrations of the Gras arm, prepared from the tracings above referred to, to enable the reader to draw his own comparison. In the Beaumont (Fig. 1), the spring, A, is contained in the lever of the movable breech piece, and its longer branch exercises a pressure in rear of the needle, B. The dog, C, has, beneath its lower forward portion a helicoidal projection, which, at the firing, lodges in a corresponding recess in the bolt, B. The rotation thus impressed upon the latter causes a pressure against each other of the spiral surfaces, and, consequently, the recoil of the dog and needle, sufficient to bend the spring. All the movable portion is then drawn to the rear, so as to expose the end of the spent cartridge, in order to remove the same, and to introduce a new one. This done, the movable part is brought forward until the stop on the bottom of the dog takes against the trigger catch, at D. The breech lever, which has hitherto been in a horizontal position, is then turned upward, closing the mechanism, when the parts are as shown in our illustration, and the weapon is ready to fire.

From this arm the Gras gun, represented in Figs. 2 and 3 (section in the latter), will be found to present much material difference. Fig. 2 shows the position of parts as the cartridge is being extracted, and Fig. 3 the mechanism just before it is closed together for firing. A A is the movable breech piece operated by the lever, B. C is the dog, at the end of which is a button, to which the rod, D, of the firing pin, E, is attached. F is the coiled spring, which throws the pin forward. For loading the gun, the parts are drawn back as shown in Fig. 2. The cartridge is inserted, and the bolt, A, by the lever, B, is drawn forward. While this is being done, a stop, G, enters a cam groove, H, in the side of the bolt, A, so that the latter is forced to turn as it is brought forward. In Fig. 3, it will be noticed that the notch on the dog, C, is almost in contact with the spring stop, I, governed by the trigger. By pulling on the latter, this stop is withdrawn, and the needle is thrown forward by its spring, stri-

king and exploding the cartridge. At J is the extractor, the part containing which, though drawn back, does not turn with the movable breech, so that the spring hook always grasps the rim of the cartridge case from above. With this gun, it is stated that 45 shots can be fired in three minutes, effective at a range of 5,120 to 5,440 feet.

Fig. 1



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A Wooden Railroad in Michigan.

The tram road of Van Eitten, Kaiser, & Co., manufacturers of rough and dressed pine, lumber and lath, at Pincanning, Bay county, Mich., is 11 miles long, and is thus described by the firm: "There are, first, logs laid crosswise, about five or six feet apart. The logs are from 12 to 16 feet in length. Then gales are cut in the logs and flattened timber laid in these gales; this prevents the road from spreading. Our rails are of hard maple. Before spiking the rails down we put ties across the stringers, notching the stringer enough to let the tie down even with the top of it, and spike the tie fast before the rail is laid on. The ties are of 3 inch hem-

Fig. 2

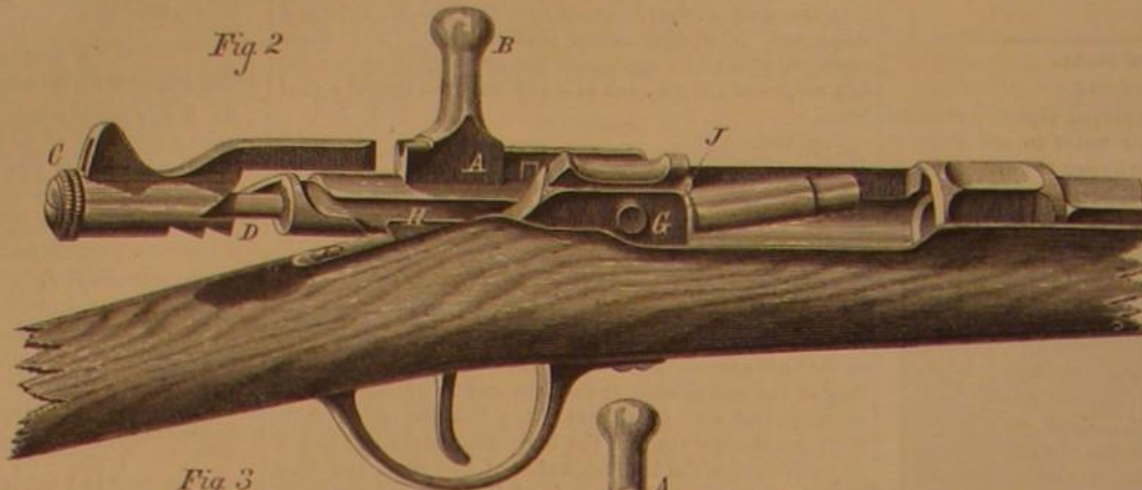
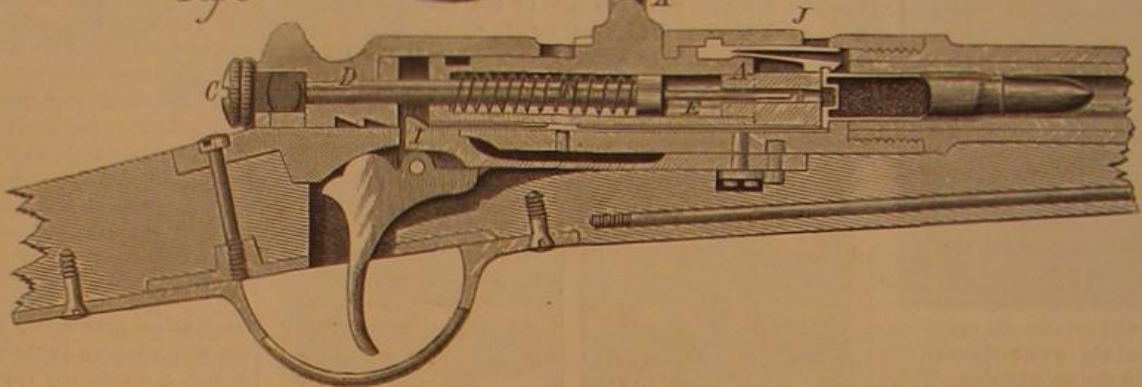


Fig. 3



THE NEW FRENCH ARMY GUN.

lock plank, from 6 to 12 inches wide; this prevents the stringer from rolling. We would recommend any one who wishes to build a road on the above system to build it as straight as possible. We have some curves in our road, and we have been obliged to dispense with wooden rails on the curves, and lay down iron. We operate our road with locomotive power. Cost of building, without rolling stock, is about \$2,000 per mile. The stringers are made from elm,

oak, pine, and ash, and are flattened on two sides to 10 inches in thickness."

A BRIDLE AND A BLINDER FOR UNRULY HORSES.

A novel arrangement of horses' head gear has been patented, June 30, 1874, by Mr. R. W. Sanborn, of Rochester, N. Y., by which, it is claimed, the most unruly animal can be constantly kept under control. The device consists of a kind of bridle, as represented in our engraving (Fig.

Fig. 1



Fig. 2



1), the ends passing over the horse's nose, thence through the bit rings, then through two apertures in a sliding piece, and finally through guide loops on the head stall, the extremities being made fast to the reins. The effect of this is, when a strain is brought upon it, to draw the animal's head

up, and, at the same time, to compress the upper jaw between the strap going over the nose and the bit. The amount of power which it is desired to use is regulated by tightening or loosening the bridle in its connection with the reins so that either a constant strain may be maintained, or the pressure on the jaw applied only when the reins are strongly pulled upon.

By means of the sliding piece just above the nose, the parts of the bridle may be brought together at any desired distance above the ends of the bit. By thus changing the adjustment of the bridle, its action on the animal may be varied as desired.

The second invention, which is represented in Fig. 2, is designed to prevent horses turned out to pasture from jumping fences and so running away. It consists of a strap which buckles around the horse's head just below the eyes, to the front part of which the blinder, in shape concave upon the arc of a circle, is secured. This is further supported by the short strap shown leading to the edge of the blinder from the top of the animal's head.

As will be readily understood, this blinder is not for travel. While it admits plenty of light and air to the horse's eyes, it, however, stops the animal's view, both in front and at the sides, so that, as he approaches a fence, he is able to see neither the bars nor the ground beyond, and consequently does not attempt the leap. The device is easily detachable, and may be used in connection with an ordinary halter or bridle. It was patented through the Scientific American Patent Agency, June 23, 1874, by Mr. John W. Kennedy, of Central Village, Windham county, Conn.

SMITH'S IMPROVED REIN HOLDER.

This invention is intended to prevent the fastening of the reins to the bridle in a twisted condition, also to keep the former from falling under the horse's feet when unattached to the bit, or from dropping under the tongue of the vehicle.

The device is represented in our illustration secured to the harness, and also separately in Fig. 2. It consists of a simple metal casing, having one pivoted roller, A, and another, not pivoted, but forced in close contact with the first by means of a spring, B. The rein is passed through between the rollers, and thus supported.

Fig. 1

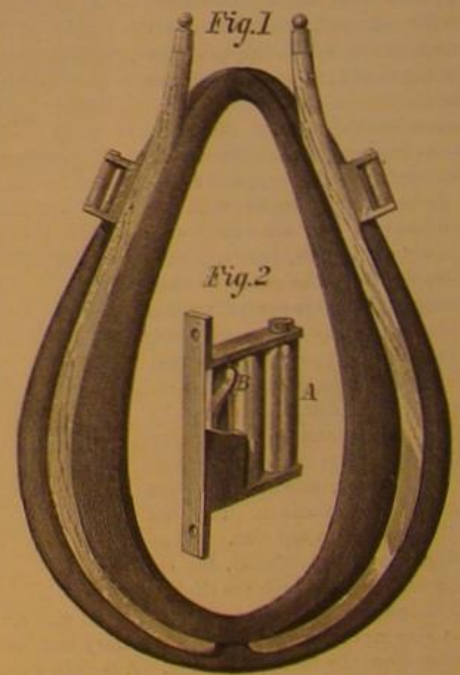
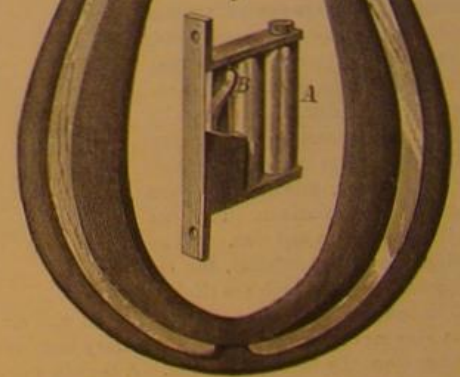


Fig. 2



On work harness, the rein holder may be made pendent to conform to the position of the reins. On light harness it may take the place of the terret, and thus, it is claimed, be of greater service than a rein holder secured to the carriage, since it keeps the reins up in front of the animal so that he cannot get his fore feet over them. At the same time the reins, when thrown over the dashboard, are less liable to get under the horse's feet and tail. The inventor points out that, in similar devices which keep the reins taut, the horse is apt to put his tail over, and so, pulling on the lines, to cause himself to back, thus breaking the hitching strap, a difficulty evidently obviated by the present invention.

The entire right is for sale; or, if not sold within six months, proposals for manufacturing on royalty are invited. Patented August 25, 1874, by Mr. A. K. Smith, of Nebraska, Pickaway county, Ohio, who may be addressed for further information.

THE INDOOR GARDEN AND THE SHRUBBERY.

The numerous lovers of flowers are now turning their attention indoors; and the conservatory and the window sill again receive the chief share of consideration. We introduce to notice an exquisite flowering plant, easily cultivated in a hothouse. It is called the lemon-scented gardenia, and is especially suited for bouquets, and for any purpose for which choice cut flowers are in demand. It is readily propagated by means of cuttings inserted in a genial bottom heat, and young plants, if liberally treated, seldom fail to flower the first year. A rich peaty soil suits it admirably; and during the growing season, it requires copious supplies of moisture, both at the roots and in the atmosphere. Apart from its attraction as a decorative stove or warm greenhouse plant, its flowers are extremely useful for buttonholes, as they can easily be mounted on thin wires, either singly or in clusters. Like other gardenias, this species is very liable to be infested with insects, which must be carefully looked after. Its pearly sweet-scented flowers, which are produced in winter, form a good substitute for orange blossom, and on that account alone it deserves attention. It is a native of Southern Africa.

The flowering bulbs which decorate our mantel-pieces are being much inquired for. Among the best for indoor growth are narcissus (such as the paper-white and *soleil d'or*), hyacinths, snowdrops, crocuses, and tulips. All these may be potted in a light compost, and the two first mentioned grown well in glasses of water. A more effective method of displaying their beauties is the use of a perforated vase, as shown in our engraving. It is pierced with holes, opposite each of which a flower bulb is placed; and the intervening spaces are filled with compost. Some use moist sphagnum (moss) in place of soil; and if the bulbs are well ripened, it answers nearly equally well. A hyacinth bulb, planted at the top, finishes off the arrangement in a pleasing and artistic manner.

Hyacinth and narcissus bulbs may also be placed in common hyacinth glasses, filled nearly full of tepid water. Care should be taken to prevent the base of the bulbs touching the water below; and if a space of about half an inch is left between, the roots, attracted by the moisture, soon protrude from the base of the bulb, and find their way down inside the glass. If this point is not duly attended to, it often results in the bulbs rotting away at the base, and this is especially the case if they are unripened or loose in texture. Few early flowering plants give greater satisfaction to the amateur than these, as they are so easily grown, and flower so quickly after being potted.

In addition to those mentioned above, flowering bulbs of both the belladonna and Guernsey lilies, if carefully potted in any light rich soil, will flower in a week or two, and will keep the window gay until hyacinths and narcissus develop their delicate, wax-like, richly perfumed flowers.

Leaving the greenhouse and parlor, we come to a very hardy shrub, recently brought from Japan, and exhibited in Paris; it is the *rhodotypos kerrioides*, and is shown in our third illustration. The flowers are pure white, and are abundantly produced, the plant being about three feet high. It is easily propagated by cuttings, and by separation of the suckers. In favorable seasons, it begins to flower about the middle of April, and continues to bloom throughout the

month of May. We know of no subject, says the English *Garden*, from which we select the illustrations, more worthy of a place in the flower garden or choice shrubbery.

The Java Agricultural and Industrial Exhibition. There will shortly be no corner of the world which the industrial exhibition idea has not reached. The Dutch colony of Java announces her second "Exhibition of the Works of Certain Industries of all Nations," to be opened at Djocja-

karta, in April, 1875. The colonies of Holland in the great eastern archipelago are very extensive, and contain a population of 30,000,000. The demand for machinery, especially agricultural implements, is large, and the natural productions of the islands are very numerous and valuable. The agriculture of Java is excellent, showing much of the care in tillage and irrigation which distinguishes the Dutch people in their own country.

The managers of the Exhibition especially wish to introduce to the people of these islands: Labor saving tools, implements, and machinery of every description and for every purpose, for use and appliance in industrial, agricultural, or domestic pursuits; as well as articles for general use, either



THE LEMON-SCENTED GARDENIA, AND BLOOM (natural size).

for wear or food, adapted to the requirements of a people of thrifty and frugal habits, "containing among them numerous native and European planters and dignitaries, people of distinction and of cultivated and refined tastes."

It is worth knowing that books, engines, machinery of all kinds, and metals (raw and manufactured) are admitted to these islands free of duty; while textile manufactures, leather, clocks, domestic wares, and provisions pay a duty of only 6 per cent *ad valorem*.

Mr. L. W. Morris, of 50 Broadway, New York city, is the agent for the United States, and will be happy to give detailed information.

The Glass or Enamelled Photograph.

The glass upon which the enameling is to be done must be scrupulously clean. Plate glass, free from scratches, is the best, although good photograph glass will do if not scratched. Blisters in the glass hurt nothing. After it is thoroughly clean, sprinkle over it, by means of a five cent pepper box, powdered talc (or French chalk), and with a tuft of cotton rub in a circular motion (carefully going over the whole surface) until no trace of the chalk is perceptible. Do not rub heavily. The chalk gives a surface to the glass that assists in the lifting the enamelled print from it. Now flow the plate with collodion made as follows, namely, ether, 4½ ounces, alcohol 3½ ounces, cotton to thicken (say from 5 to 7 grains to the ounce of solution), and 24 drops (or minims) of castor oil. When this flow is dry, apply the prints face down, after immersing them in a gelatin solution made as follows: Coxe's gelatin 1 ounce, water 8 ounces, glycerin 50 drops. Add the gelatin and glycerin to the water, and let it stand over night, when it will be ready for use after filtering, which can be done by warming sufficiently to make the solution limpid. Allow the prints to remain in this solution about five minutes before laying them on the collodionized glass, and then pass a gum roller lightly over them to press them tightly to the glass, and also to remove the surplus gelatin. After the prints are nearly dry they are ready for the mounts. For this purpose, light Bristol board is best. Use the gelatin solution for mounting, and mount on the glass as the prints lay. The whole thing must be perfectly dry before an attempt is made to remove them from the glass. When they are dry, run a knife blade around the edge to start them up; and if thoroughly dry and the work properly done, they will come off all right. "I forgot to say, in the proper place, that it is a good idea to lay upon the back, after the mounts have been applied, a weight of some

kind, say a heavy piece of glass, which should remain there for an hour at least. This assists in securing a complete contact to the print. At the end of an hour remove the weight and leave the print, back up, until perfectly dry all through. Sometimes they start off without help, which shows perfect success. Remember that careful manipulation is the only surety for success. A little experience will enable any one to perform this operation well."—*Philadelphia Photographer*.

Carrots.

In Belgium and other continental countries, the carrot has been grown as a field crop for a longer time, and to a much greater extent, than in Britain. In the year 1785, the attention of the Society for the Encouragement of Arts, etc., was directed to this branch of husbandry, and, in consequence, an account of the culture of carrots and the uses to which they may be applied was published by Robert Billig, a farmer in Norfolk, who states that he obtained, from twenty and a half acres, five hundred and ten loads of this root, which he found equal in use and effect to a thousand loads of turnips, or three hundred loads of hay. Some of them measured two feet in length, and from twelve to fourteen inches round. Horses are remarkably fond of carrots, and when mixed with oats they form very good food for them. The efficacy of these roots in preserving and restoring the wind of horses had, it is said, been partially known in Suffolk, where carrots were administered as a secret specific for the complaint long previously to their being commonly applied as food for that animal. Carrots are equally beneficial as nourishment for cows, sheep, and swine. It was stated some years since that at Purlington, in Yorkshire, the stock of a farm, consisting of twenty working horses, four bullocks, and six milch cows, were fed from the end of September to the beginning of May on the carrots produced from three acres of land. The animals, during the whole of that period, lived on these roots, with the addition of only a very small quantity of hay.

Carrots contain a large amount of water, 86 parts in 100 lbs. Their most distinguished dietetical substance is sugar, of which they possess nearly 6½ per cent. Starch is also found in small quantities, with a small portion of albumen. The ancients used the seed both of the wild and cultivated carrot as an internal medicine against the bite of serpents; they also gave it to animals that had been stung by them.

Dr. James says that carrots strengthen and fatten the body, and are very proper food for consumptive persons. The root of the garden carrot is much used as a poultice for cancers, on account of its antiseptic qualities. In some parts of Europe a spirit is distilled from this vegetable. The abundance of sugar contained in the roots is readily converted into alcohol. About 160 lbs. of the crushed roots are required to yield one gallon of spirit. Sugar has been obtained from them; but notwithstanding the large amount existing in them, the manufacture has not been found profitable. In Germany, a substitute for coffee has been made of the roots chopped up into small pieces and partially carbonized by roasting. A dye similar to wood has been obtained from them.

Parkinson, botanist to James I., tells us that ladies of his



RHODOTYPUS KERRIOIDES.

time used to decorate their hats or heads with the leaves of the wild carrot, which in the autumn are exceedingly beautiful. This, says Phillips, would rather show the simplicity of our ancestors than their want of taste; as we have seen ladies' dresses trimmed with the curled leaves of the garden parsley, which were not more admired for their novelty than for the elegance they displayed.

If in winter a section be cut from the end of the thick part of the root, and this be placed in a shallow vessel con-



PERFORATED VASE FOR FLOWERING BULBS.

month of May. We know of no subject, says the English *Garden*, from which we select the illustrations, more worthy of a place in the flower garden or choice shrubbery.

The Java Agricultural and Industrial Exhibition.

There will shortly be no corner of the world which the industrial exhibition idea has not reached. The Dutch colony of Java announces her second "Exhibition of the Works of Certain Industries of all Nations," to be opened at Djocja-

taining water, young and delicate leaves are developed, forming a radiated tuft, the graceful and verdant appearance of which makes it a pleasing ornament to a room in that season when any semblance of vegetation is a welcome relief to the eye. Flowers may be cut out of large carrots that closely resemble ranunculuses, without the least aid of coloring.—*Hempden G. Glasspole, in Science Gossip.*

PATENT OFFICE YEARLY REPORT.

The Annual Report of the late Commissioner of Patents, General M. D. Leggett, was recently submitted to the Secretary of the Interior, and we here give an abstract.

The following table shows the receipts, expenditures, and business of the Office during the year from October 1, 1873, to September 30, 1874:

MONEYS RECEIVED.	
Amounts received for applications for patents, extensions, caveats, disclaimers, appeals, and trade marks.....	\$645,480
For caveats.....	47,923
For recording assignments.....	18,152
For subscriptions to <i>Official Gazette</i>	8,913
For registration of labels (since August, 1874).....	642
Total.....	\$721,110
MONEYS EXPENDED.	
Amount paid for salaries.....	\$484,694
Amount paid for photographing back issues.....	36,223
Amount paid for photographing current issues.....	46,313
Amount paid for illustrations for <i>Gazette</i>	35,292
Amount paid for contingent expenses.....	83,082
Amount paid for tracings.....	8,668
Total.....	\$694,072
Excess of receipts over expenditures.....	27,038

STATEMENT OF THE BUSINESS OF THE OFFICE.	
Number of applications for patents from Oct. 1, 1873 to Sept. 30, 1874.....	21,077
Number of patents issued, including reissues and designs.....	13,545
Applications for extensions of patents.....	229
Patents extended.....	308
Caveats filed.....	3,129
Patents expired.....	5,287
Patents allowed but not issued for want of the final fee.....	2,680
Applications for registration of trade marks.....	589
Trade marks registered.....	524
Application for registration of labels.....	107
Labels registered (since August, 1874).....	50

The number of applications and of patents granted is a slight increase upon those of the preceding year.

The prompt publication of abstracts of patents issued has improved the character of such applications, thereby warranting the issue of patents for a larger proportion than could otherwise be granted. Before the establishment of the Patent Office *Gazette*, it was from two and a half to three years after the issue of a patent before the public had any means of knowing of its contents. Consequently there would be in existence from twenty-five to thirty thousand patents, the substance of which was sealed to all except their owners; hence applications were constantly being made to patent devices which had been previously patented by others.

REPRODUCTION OF DRAWINGS OF OLD PATENTS.

The importance of printing the older existing patents is illustrated and explained.

No one thing in the Office is needed more than a thorough digest, published in convenient form, of each one of the 145 classes of inventions, as represented in the Patent Office. The number of applications on file in the Office is nearly 300,000. To look back over these applications and the devices represented by them, in considering new applications, is a work the vastness of which need not be further explained to be fully understood. The digest referred to should, in a classified form, briefly describe each one of these, in such a manner that they would become sufficient in the examination of cases, without constantly resorting to the files. If correct and thorough digests of this character, from the organization of the Office down to the present time, were in the hands of the examiners, inventors, and attorneys practicing before the Office, the labors of the examining corps would be 25 per cent less than at present, and would bear a considerable reduction, unless the number of applicants largely increased. In many of these classes a sufficient number of volumes could be sold to reimburse the government for the entire expense of their publication. Such digests would, therefore, be an economical investment, saving money to the Treasury, and securing far greater accuracy in examining applications and the granting of patents. "To this matter, therefore, I would earnestly request the Secretary to give special thought and attention. A special appropriation would be needed for the purpose."

MORE ROOM NEEDED.

Additional room is required for the use of the Patent Office. It is utterly impossible to properly transact the work of the Office in the narrow quarters granted to it. Eight additional rooms are needed immediately. The report pays a just tribute to the character of the persons employed in the Patent Office, and regrets that the salaries paid are not sufficiently large to retain the best men in the service, who are constantly leaving it for more lucrative employment.

THE new American built steamer Tokio has made a successful first voyage, from New York to Aspinwall. Time, seven days and fifteen hours, being an average of eleven knots an hour, on thirty-nine tons of coal per day, with fifty pounds of steam and six boilers. There was no occasion to stop the engine during the entire trip of two thousand miles.

Odors.

Among mineral substances, few solids, but quite a number of liquid and gases, are endowed with more or less powerful scents, in most cases not very pleasant ones, and usually characteristic. Those odors belong to simple substances, such as chlorine, bromine, and iodine; to acids, as hydrochloric and hydrocyanic acid; to carburets of hydrogen, as those of petroleum; to alkaline substances, ammonia, for instance, etc. The odors observable among minerals may almost all be referred either to hydrocarbonic or hydrosulphuric gases, or to various solid and liquid acids produced by the decomposition of fats, or to peculiar principles secreted by glands, such as musk, ambergris, civet, and the like.

The odor of plants is due to principles very unequally distributed throughout their different organs; some solid, as resins and balsams, others which are liquid, and known by the name of essences or essential oils. In most cases the essence is concentrated in the flower, as occurs with the rose and the violet. In other plants, as in bent grass and Florence iris, only the root is fragrant. In cedar and sandal wood, it is the wood that is so; in mint and patchouli, the leaves; in the Tonquin bean, the seed; in cinnamon, it is the bark which is the seat of the odorous principle. Some plants have several quite distinct fragrances. Thus the orange has three: that of the leaves and fruit, which gives the essence known by the name of *petit grain*; that of the flowers, which furnishes neroli; and again the rind of the fruit, from which essence of Portugal is extracted.

What, now, is the chemical nature of the odorous principles in plants? The chemistry of today reduces almost all of them to three categories of well ascertained substances: hydrocarbons, aldehydes, and ethers. We will endeavor to give a clear account of the constitution of these three kinds of substances, and to mark their place in the register of Science. The hydrocarbons are simple combinations of carbon and hydrogen, as, for instance, the petroleum oils. They represent the simple compounds of organic chemistry. As to aldehydes and ethers, their composition is rather more complex; besides carbon and hydrogen, they contain oxygen. Every one knows what chemists mean by an alcohol; it is a definite combination of hydrogen, carbon, and oxygen, neither acid nor alkaline, which may be regarded as the result of the union of a hydrocarbon with the elements of water. Common alcohol, or spirits of wine, is the type of the most important series of alcohols, that of the monoatomic alcohols. Chemists represent it by the formula C^2H^6O , to indicate that a molecule of it arises from the union of two atoms of carbon with six atoms of hydrogen and one of oxygen. Independently of the alcohols, which are of great number and varying complexity, organic chemistry recognizes another class of bodies, of which vinegar is the type, and which receive the name of organic acids, to mark their resemblance to mineral acids, such as oil of vitriol or aquafortis. Now, every alcohol, on losing a certain amount of hydrogen, gives rise to a new body, which is called an aldehyde; and every alcohol, on combining with an acid, produces what is called an ether. These rapid details allow us to understand precisely the chemical character of the essences or essential oils which plants elaborate within their delicate tissues. Except a small number among them which contain sulphur, as the essences of the family of crucifers, they all present the same qualitative composition—carbon and hydrogen, with or without oxygen. Between one and another of them merely the proportion of these three composing elements varies, by regular gradations, but so as always to correspond either to a hydrocarbon, or to an aldehyde, or to an ether. In this case, as in almost the whole of organic chemistry, everything is in the quantity of the composing elements. The quality is of so little importance to Nature that, while following always the same laws and constantly using the same materials, she can, by merely changing the ponderable relations of the latter, produce, by myriads of various combinations, myriads of substances which have no resemblance to each other. The strange powers of the elements and the mysterious forces concealed in matter make themselves known to us in a still more remarkable phenomenon, to which the name of *isomery* is given. Two bodies, thoroughly unlike as regards their properties, may present absolutely the same chemical composition with respect to quality and quantity of elements. "But in what do they differ?" it may be asked. They differ in the arrangement of their molecules. Coal and the diamond are identical in substance. Common phosphorus and amorphous phosphorus are one and the same in substance. Now, the odorous principles of plants offer some exceedingly curious cases of isomery. Thus the essence of turpentine, the essence of lemon, that of bergamot, of neroli, of juniper, of savin, of lavender, of cubeb, of pepper, and of gillyflower are isomeric bodies, that is, they all have the same chemical composition. Subjected to analysis, all these products yield identical substances in identical proportions, that is, for each molecule of essence, ten atoms of carbon and sixteen atoms of oxygen, as denoted by their common formula, $C^{10}O^{16}$. We see how these facts as to isomery prove that the qualities of bodies depend far more on the arrangement and the inner movements of their minute particles, never to be reached by our search, than on the nature of their matter itself; and they show, too, how far we still are from having penetrated to the first conditions of the action and forces of substances.

But chemistry has not stopped short with ascertaining the inmost composition of these substances; it has succeeded in reproducing quite a number of them artificially; and the compounds thus manufactured, wholly from elements, in laboratories, are absolutely identical with the products extracted from plants. The speculations of theory on the arrangements of atoms, sometimes condemned as useless, do

not merely aid in giving us a clearer comprehension of natural laws, which is something of itself, but they do more, as real instances prove: they often give us the key to brilliant and valuable inventions. An Italian chemist, who was then employed in Paris, Piria, in 1838, was the first who imitated by art a natural aromatic principle. By means of reactions suggested by theory, he prepared a salicylic aldehyde, which turned out to be the essence of meadowsweet, so delicate and subtle in its odor. A few years later, in 1843, Cahours discovered methyl-salicylic ether, and showed that it is identical with the essence of wintergreen. A year after, Wertheim composed essence of mustard, while believing himself to be making only allyl-sulphocyanic ether. These discoveries produced a sensation. Nowadays the chemist possesses the means of creating many other natural essences. Common camphor, essence of bitter almonds, that of cummin and of cinnamon, which are aldehydes, as we have seen, may be prepared without camphor leaves or almonds, without cummin or cinnamon. Besides these ethers and aldehydes, whose identity with essences of vegetable origin has been proved, there exist, among the new bodies known to chemistry, a certain number of products formed by the union of common alcohol or amyl alcohol with different acids, that is to say, of ethers, which have aromatic odors more or less resembling those of some fruits, but as to which it cannot yet be affirmed that the odors are due to the same principles in both cases. However this may be, perfumers and confectioners, more industrious and wide-awake than chemists, have immediately made good use of many of these properties.

Artificial aromatic oils made their first appearance at the World's Fair of London in 1851. There was there exhibited a pear oil, diffusing a pleasant smell like that of a jargonel, and employed to give an aroma to *bonbons*. This product is nothing else than a solution of amylacetic ether in alcohol. Apple oil was exhibited beside the pear oil, having the fragrance of the best rennets, and produced by dissolving amyl-valeric ether in alcohol. The commonest essence was that of pineapple, which is nothing else than ordinary butyric ether. There was observed, too, an essence of cognac, or grape oil, used to impart to poor brandies the highly prized aroma of cognac. The product which was then, and still is, the most important article of manufacture, is the essence of mirbane, which very closely resembles in its odor that of bitter almonds, and which commerce very often substitutes for the latter. Essence of mirbane is nothing else than nitrobenzene, which results from the action of nitric acid on benzene. Benzene, in turn, is met with among the products of distillation of tar, which also yield the substances used in preparing those beautiful colors called aniline.—*F. Papillon, in Revue Scientifique.*

SCIENTIFIC AND PRACTICAL INFORMATION.

OCCCLUSION OF GASES BY IRON WIRE.

In drawing certain numbers of iron wire, it often becomes necessary, in order to continue the use of the drawing bench, to anneal the iron. This is done in a hermetically closed receptacle, so as to avoid, as much as possible, the oxidation of the metal. In spite of this precaution, however, the latter becomes covered with an ochraceous film, which it is necessary to remove by an acidulated bath. It frequently happens, however, that, subsequent to this process, the metal becomes so brittle as to render its further drawing impossible. M. Seroz, engineer of the *Société des Forges de La Franche Comté*, has examined into this phenomenon, and finds that the iron becomes charged with a condensed gas. On breaking the wire under water in a test tube, inflammable bubbles were generated, which detonated in the air. The exact nature of the gas has not yet been decided, nor that of its direct action upon the metal; but it is believed to be either hydrogen or carbonic oxide.

THE EUCALYPTUS GLOBULUS.

In addition to its remarkable properties as preventer of miasmatic fevers, Dr. Behr, of San Francisco, Cal., states that he has been recently informed by an Australian correspondent that the wood of this tree made most excellent shingles, by reason of its non-inflammable characteristics. It was a common joke in Australia to hand new comers an ember, from the fireplace, of this wood, by which to light their pipes. It would go out as soon as drawn from the fire. Made into shingles, it furnishes a first rate fireproof material for buildings.

THE ORIGIN OF GUANO.

Dr. Habel, who has devoted several years to the exploration of guano islands and the microscopic study of the fertilizer, has recently arrived at the conclusion that the material is not the defecation of sea birds, as ordinarily supposed. He has obtained an insoluble residue after chemical treatment, composed of fossil sponge and marine plants and animalcules. He thinks, therefore, that guano results from the accumulation of fossil remains, of which the organic matter has been transformed into a nitrogenized substance, while the mineral portion has remained intact.

COOKING OATMEAL.—W. says: One reason why oatmeal is not more generally used as food is that, in the way in which it is usually cooked, it requires constant stirring, which takes a good deal of time and attention. If, after the porridge is mixed, that is, as soon as the oatmeal is stirred into the boiling water, the cover is put on and the tin saucepan containing it placed in another pot of boiling water on the stove, and the water let boil, good oatmeal porridge will be made, without the least danger of its being scorched.

A Dog on the Witness Stand.

The Richmond, Va., *Enquirer* states that a Mr. Spears was recently before the police court in that city, charged with keeping a vicious dog, and the animal was ordered to be killed. Subsequently, however, the execution of the sentence was suspended, as the evidence upon which he was convicted was *ex parte*, and a new trial granted. When the case came up again, a large number of persons testified as to the good character of the dog, and the whole matter resolved itself into the fact that he had scared the gentleman, who complained of his attacking him, by rough play. Nevertheless, to make assurance doubly sure, at the request of his master, the dog was put upon the stand to testify in his own case. On being asked if he would bite any one, he uttered a peculiar noise and shook his head. He was then asked if he would bite if his master set him on, and replied in the affirmative by nodding his head and barking. When asked if he would bite the Court, he replied in the negative. Several other questions were asked him, and his answers and actions exhibited the greatest intelligence. It is needless to say that he was honorably acquitted.

Resharpening Files.

Well worn files are first carefully cleaned with hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts of sulphuric acid and 1,000 parts of water. The negative is formed of a copper spiral, surrounding the files but not touching them; the coil terminates in a wire which rises toward the surface. This arrangement is the result of practical experience. When the files have been in the bath ten minutes, they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced in the bath for the same period as before. Sometimes two operations are necessary, but seldom more. The files, thus treated, are to all appearances like new ones, and are said to be good for 60 hours' work. M. Werdermann employs twelve medium Bunsen elements for his batteries.

New Lighthouses.

A Baltimore firm, under contract with the government, have in course of construction two lighthouses, one of which is destined for Hunting Island, and the other for Morris Island, South Carolina. The one for Hunting Island is entirely of cast iron, and is one hundred and thirty-six feet high and twenty-seven feet in diameter. The one for Morris Island will be one hundred and fifty feet high; the lantern brackets, the gallery, and the lantern are of cast iron, the tower being of brick. The roofs of both the lighthouses are of copper, and each is to be supplied with a spiral stairway.

E. A. says (in commenting on the following statement in our recent articles on "Dentistry": "The teeth may possibly be removed by patiently sawing and cutting the vulcanite away from the pins"): "Teeth can be easily and quickly removed by holding them in a spirit lamp until the vulcanite is softened a little around the pins, and the teeth pushed off, using a cloth to protect the hand; but they will come off entirely clean and in much less time than they can be filed, to say nothing of the cost of the teeth."

Recent American and Foreign Patents.**Improved Car Coupling.**

Richard Hopkins, Frostburg, Md.—The coupling is pivoted loosely to the lateral front piece of a frame, which is pivoted by arms to staples of the drawhead. The arms of a rod frame swing along the sides of the drawhead, and carry a bottom piece, which extends across the under side of the drawhead, and defines the extent of motion in raising the pin for uncoupling, and also weights the same, to cause the dropping of the coupling pin after the uncoupling mechanism is released. The rod frame is hung to hook-shaped levers, which are pivoted to the car frame, and connected by elbow-shaped extensions to the forward projecting lever. The device is operated at the top of the car by a lateral crank rod and lever connection, with a crank shaft and wheel supported in a top frame.

Improved Adjustable Bed.

Albert F. Supplee, Nelsonville, O.—This is a mattress-supporting frame divided in the middle longitudinally; also divided in three sections transversely, and hinged together, and supported by springs upon two middle supports and two end supports. The whole is so arranged on springs and provided with adjusting levers that either end or side of the bed may be raised and supported higher than the opposite side or end.

Improved Box and Bale Hook.

John W. Knight, Galveston, Texas.—This invention consists of a guard or shield of leather or equivalent material, combined with the handle and shank of the hook used for turning or otherwise handling bales and boxes, to prevent the hands from rubbing or pressing against the bale or box, and thus becoming injured. The guard is so applied to the hook that (when lifting the box or bale, the hand is pressed toward the said box or bale) it will be interposed to protect the hand from the rough surface, as well as from any accidentally projecting corners, nails, or crews.

Improved Book-Supporting Attachment for Tables.

William H. Patterson and Ole Swensen, Cresco, Iowa.—A spindle holds the book holder directly in front of the writer. The book holder is adjustable along the bracket by a slotted foot and a binding screw. A lamp holder is held so as to throw the light of the lamp on the book on the holder to be copied from, as well as the one on the table to be written in. A couple of weighted arms are jointed to the book holder, hanging down in front of it, so that the weights will rest on the book and keep it open. The bracket can be shifted around the stand in case it may be wanted to do so, and it can be taken off and put on readily for convenience in adjusting the parts. An inkstand holder is also provided.

Operating Steam Engines by Compressed Air.

Jacob B. Van Dyne, Louisville, Ky.—This invention relates to a new method of charging steam boilers with a compressed medium of air or gas for instantaneous use, and is more particularly applicable to the boilers of steam fire engines. It consists in admitting a high pressure of air or gas into the boiler above the water when required, and operating the engine by the compressed medium while steam is being generated, the compressed medium furnishing a motive power which is instantaneously available, and which, owing to the expansion of the air or gas by the heat, is sufficiently continuous to run the engine until reinforced by the steam, without any permission.

Improved Bale Tie.

Henry B. Jones, Burton, Texas.—The key consists of a head, a short shank, and a radially projecting bit, having sharp corners to clutch the fibers of the bale. The key is inserted in keyhole slots in the ends of the hoop.

Improved Grain Binder.

James McNeal, Chauncey, Ill.—This invention consists of a pair of gripping arms, in combination with a sewing machine needle and shuttle and looping hooks, so contrived that they grip the gavel, compress it, and pass it across the needle hole into a bight of the twine, and hold it while the twine is being tied by the sewing machine devices.

Improved Bed Lounge.

Ferdinand Braun, New York city.—This sofa bed is readily thrown into open or folded position for use as bed or sofa or lounge, all the parts being firmly and securely connected. A hinged section has a longitudinal sideboard hinged thereto and a fastening rod pivoted to the board, with a hinged top piece for retaining the same rigidly in open inclined position.

Improved Horse Hay Rake.

Bolon H. Bushnell, Fairport, N. Y.—Collars placed upon an axle are secured adjustably in place by set screws which pass in through projections. Upon the other side of the collars are formed projections to receive the ends of the rake teeth which are held by set screws which pass in through the side of the said projections, and press against the said teeth. By suitable mechanism the draft strain may be made to hold the rake teeth down to the ground with more or less force, as circumstances may require; and other apparatus is provided which, as the rake teeth are raised to discharge the collected hay, prevents the hay from being raised by and with the rake teeth, and causes the hay to be promptly dropped, thus preventing the teeth from becoming clogged and the hay from being scattered.

Improved Wheel for Vehicles.

George Cornwall, Plainfield, N. J.—The rim of sheet metal has a groove in the face of half a circle; also sockets upon the inner periphery for the reception of the spokes. The last screw deep into the hub, so as to enter the socket, and then screw out again sufficiently to screw them in the rim. The tyre of the wheel is made of round vulcanized rubber, nicely fitting in the groove.

Improved Dust Cap for Watch Regulators.

Wenzel H. B. Schmidt, Napa, Cal.—This is a dust cap arranged to cover and shield the hair spring and regulator hand, and the more delicate portions of the watch movement. It is a metallic frame, enclosing a transparent plate, and is tightly fitted down on the plate and over the bridge, and fastened by square-headed screws. These screws have each an eccentric washer under the head, which, when the cap is fastened, are turned by means of a watch key on the narrow flange of the cap frame, which securely holds the cap in place.

Improved Chemical Fire Extinguisher.

Jacob B. Van Dyne, Louisville, Ky.—This invention relates to certain improvements in chemical fire extinguishers, and consists in the combination of two invertible fire extinguishers, supported upon wheels, and connected with a common discharge pipe by intermediate flexible pipes provided with detachable caps. It consists further in the combination of a swiveled screw rod, a frame, and a nut for the purpose of forming a stopper for the acid vessel, and also in the combination of a detachably locked acid vessel with an acid vessel holder, permanently attached to the shell of the extinguisher.

Improved Plow.

August Ibringer, Calvert, Texas.—This invention relates to means whereby the beam of a plow may be elevated or depressed at the front end, according to the depth to which it is intended that the plow shall run, and held securely at several points of adjustment.

Improved Bureau or Dressing Case Bedstead.

Mark Crosby, Boston, Mass.—The object of this invention is to provide a bedstead in combination with a bureau or dressing case, so constructed and arranged as to fold in the latter when not in use, and be disposed in a small compass and out of sight. It consists in the combination of a bureau having bottom and rear recesses, with a bedstead having a hinged head section, the said head section sliding in ways into the bottom recess, and the other portion folding in a vertical position in the rear recess. The lower portion of the bureau is also provided with a hinged leaf, which, when the bedstead is drawn out, adds to its length.

Improved Nozzle.

James H. McConnell, New York city.—The nozzle is swiveled to the bulb of a shut-off cock. A plug is inserted through a hole in the side of the bulb, which hole is closed by a screw cap, so formed that its outer surface may be continuous with the surface of the bulb. Upon the inner end of the nozzle is formed a segment, which gears with a segment upon the top of the plug. By this construction, by turning the nozzle in one direction, the plug will be turned to allow the water to flow through the said nozzle; and by turning the nozzle in the other direction, the water will be shut off.

Improved Table.

Louis Postawka, Cambridgeport, Mass.—The head pieces, which are long enough to extend across the table and serve for two legs, are connected by a tenon, fitting in a socket, and are attached to the frame by bolts which pass up to sockets in the upper side of the frame. The posts are mounted on foot pieces which receive the two legs of each end, which, together with the head pieces, form side frames, and the two frames are connected by a stretcher, screwing into them by right and left threads. Mr. Postawka is the patentee of an ingenious and useful improvement in piano stools whereby the seat is raised and lowered by turning a knob at the side, in place of rotating the seat.

Improved Sash Fastener.

Thomas L. Shaw, Laurinburg, assignor to himself and Hugh G. Fladger, Lileville, N. C.—This invention consists of a pivoted sector-shaped latch piece, which is guided in ribbed inclosing plates, and acted upon by a strong spring bolt for forcing curved V-shaped arms, with tapering ends, into notches of the window casing or sash frame, for retaining the sash in any position, and locking the same. Particulars regarding this invention may be obtained by addressing H. G. Fladger, Lileville, N. C.

Improved Pianoforte Attachment.

John W. Brackett, Boston, Mass.—This is an improved organ pedal attachment to pianos, which affords the organist and pupil all the advantages of the organ for practice, enabling them to gain the technique of both the piano and organ at the same time. A set of organ pedal trackers' levers, and stickers is combined with the keys of a piano, and stops and their levers are also provided, in connection with the trackers of the device. The value of this invention consists primarily in the facility afforded to students of obtaining practice in the use of the feet in pedalling, and thus acquiring an indispensable qualification for playing the organ when the latter instrument is not accessible.

Improved Faucet for Oil Cans.

Edwin A. Jackson, New York city.—This faucet is arranged entirely within a bell-shaped base part, with faucet barrel and spout, which is soldered to the can. The plug is provided with a hinged and recessed finger piece, to be thrown up for the purpose of turning the plug, and locked in downward position over a spring of the spout for closing securely the faucet.

Improved Slide Valve for Steam Engines.

Henry Bolthoff, Central City, Col. Ter., assignor to himself and James Clark, same place.—This slide valve is composed of two parts, connected with two eccentrics on the main shaft. The eccentrics are so arranged on the shaft that the parts are simultaneously moved in opposite directions. The valve is so set as to about half open the main port, more or less, as the case may require, when the crank is on the center. The upper part is moved in an opposite direction, consequently the full opening is made in less than the usual time required by the ordinary valve. The upper part has on the inside of each port an adjustable jaw, for the purpose of increasing and decreasing the size of the ports for cutting off steam at any point of the stroke that may be desirable.

Improved Quilting Attachment for Sewing Machines.

William H. Nell, Blandinsville, Ill.—This invention includes apparatus for adjusting the legs toward and from each other, to vary the height of the quilt to adjust it to the machine, and to set the benches so that the frame will descend a little to facilitate the feeding. The quilt is attached to rollers, held against turning by a friction band, lever brake, and holding pawl; and one roller has a ratchet, ratchet lever, and pawl for turning it to draw the quilt from one to the other as the work progresses. The quilt is stretched in the direction of the seams by books, cords, and a lever, the cords passing over suitable guides, to be operated alike by the lever to stretch evenly at both ends, and the lever being provided with a catch button, to hold it when pulled back to stretch the quilt.

Improved Battenning.

John Loppacker, New York city.—The boards are connected by the cleat pieces, and their edges are grooved. Grooves and rabbets of the cleat piece receive tenons of the boards, and a cleat, which overlaps the latter is held tightly thereto. The lower side of the cleat piece is flush with the lower sides of the boards. By this mode, the boards and cleat pieces are securely locked together, and the possibility of leakage is avoided.

Improved Bottle Stopper.

Joel B. Miller, Rondout, N. Y., assignor to himself and August Yost, same place.—This stopper is located inside the bottle, and has a bale or handle hinged to the top. It is provided with an enlarged upper end, designed to prevent the stopper from falling to the bottom of the bottle, and also to serve as a handle to facilitate the drawing of the device into the neck.

NEW BOOKS AND PUBLICATIONS.

CHEMICAL AND GEOLOGICAL ESSAYS. By Thomas Sterry Hunt, LL.D., F.R.S., etc., etc. Boston, Mass.: James R. Osgood & Co.

Dr. Sterry Hunt has for many years been a highly valued contributor to our current scientific literature, both on account of his learning and attainments and his uniformly graceful and pleasing style. In collating these papers, published originally in magazines or read before scientific associations, he has given us a book of permanent value to the history of contemporary science; and in it he enunciates many original views and theories, some of which have been justified by actual discovery by himself and other investigators. The paper on "The Theory of Chemical Changes" deserves especial commendation as a model of popular scientific exposition.

THE COMMON FROG. By St. George Mivart, F.R.S., etc. Lecturer on Comparative Anatomy at St. Mary's Hospital, London, Author of "The Genesis of Species," "Elementary Anatomy," etc. Price \$1. New York: Macmillan & Co.

From the days of Galvani and Volta, the batrachian has always been a martyr to Science; and on this ground, as well as for its remarkable metamorphosis from a fish to an amphibious animal, it deserves the closest study. Mr. Mivart discusses thoroughly and well the whole of the delicate organization which makes the frog so useful for physiological experiments, as well as the number and variety of its relations to other classes of animated nature.

THE BLOWPIPE: a Guide to its Use in the Determination of Salts and Minerals. Compiled from Various Sources by George W. Plympton, C.E., A.M., Professor of Physical Science in the Polytechnic Institute, Brooklyn, N.Y. Price \$1.50. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

Professor Plympton's earlier work on blowpipe analysis has long been recognized as a standard authority; and the volume just received is equally valuable as a text book, while its modern date and comprehensive arrangement make it the manual, *par excellence*, of analysis by the dry method. It is well illustrated, and will be read and consulted by practical scientists as well as by pupils and students.

THE USE OF THE STEAM ENGINE INDICATOR, or Practical Science for Practical Men. By Edward Lyman, C.E., M.A.I.M.E., etc. Price \$1, postage paid. Published by the Author, New Haven, Conn.

The use of the indicator is becoming daily more general, and there is need for precise and detailed description of its theory and mechanism which we find excellently given in the treatise before us. Some useful and original tables of pressures at various points of stroke, under steam cut off at different proportions of piston travel, are given, as well as cards showing the merits and faults of engines of all varieties, as displayed by the unerring indicator.

A PRACTICAL AND CRITICAL GRAMMAR OF THE ENGLISH LANGUAGE. By Noble Butler. Price \$1. Louisville, Ky.: John P. Morton & Co.

We have to give the highest commendation to this new edition of a standard work, which epitomizes the very numerous and complex rules of formation of four parts of speech in a clear and forcible manner. It is accurate and precise in all its definitions; and the examples are selected with great judgment. A better grammar cannot be put into the hands of the young; while its judicious elucidation of many disputed points will give it interest to students of all ages.

EATING FOR STRENGTH: a Book comprising the Science of Eating, Receipts for Wholesome Cookery and Drinks, and Answers to Questions. By M. L. Holbrook, M.D., Editor of "The Herald of Health," etc. New York city: Wood & Holbrook, 13 & 15 Laight street.

This book is a collection of much useful information on the important subject of diet, and contains many practical directions for the preparation of wholesome food.

ILLUSTRATED GUIDE TO THE CINCINNATI EXPOSITION, and Catalogue of the Fine Arts Department. By Daniel J. Kenny. Price 25 cents. Cincinnati Gazette Company.

This book is excellently arranged, and contains much useful and instructive information, besides the matters promised in its title.

A PRACTICAL THEORY OF VOUSOIR ARCHES. By William Cain, C.E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This useful handbook is No. 12 of Van Nostrand's "Science Series."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From October 17 to October 28, 1874, inclusive.

AXLE BOX.—C. A. Hussey, New York city.
BOX NAILING MACHINE.—J. H. Foster et al., Chicago, Ill.
CAN COUPLER.—J. D. Mills, Alexandria, Va.
CUTTING SCREW THREADS.—N. W. Frost, Cohoes, N. Y.
CUTTING TEXTILE FABRICS.—W. F. Johnson et al., New York city.
DYEING LUMBER.—G. A. Woods, Cambridgeport, Mass.
ENGINE DRAFT, ETC.—W. O. Cooke, New York city, et al.
IGNITION FUSE.—W. A. Leonard, Boston, Mass.
LADY'S GARMENT.—O. F. Flynt, Boston, Mass.
MARINE GOVERNOR.—E. T. Jenkins, Williamsburgh, N. Y.
PAPER BAG MACHINE.—G. S. Lewis, Springfield, Mass., et al.
POTATO DIGGER.—L. A. Aspinwall (of Albany, N. Y.), London, England.
POTATO PLANTER.—L. A. Aspinwall (of Albany, N. Y.), London, England.
PUMPING APPARATUS.—J. E. P. Hunt, Baltimore, Md.
ROTARY ENGINE.—A. J. Works et al., New York city.
UMBRELLA, ETC.—R. S. Spencer, New York city.
WASHING MACHINERY.—L. A. Aspinwall (of Albany, N. Y.), London, E. g.
WEAVER'S SPOOLS.—H. H. Bryant, Boston, Mass., et al.
WEFT STOP.—S. B. Capen, Boston, Mass.

Business and Personal.

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

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Treatise on the Steam Engine Indicator. Price \$1. Address E. Lyman, C. E., New Haven, Conn.

8 horse power, properly applied, will grind 100 bushels of wheat per hour. Jno. Ross, Williamsburgh, N. Y.

Barrel Machinery wanted by H. Schaperkotter, cor. 18th & Montgomery Sts., St. Louis, Mo.

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Engines and Boilers a Specialty—1st class; new patterns; late patents; reduced prices. Plain and Cut-off Horizontal and Vertical Engines; Hoisting Engines; the celebrated Ames' Portable Engines; Boilers of all kinds; Climax Turbine; and the best Saw Mill in the market. Large stock always on hand. Hampson, Whitehill & Co., 38 Cortlandt St., New York. Works at Newburgh, N. Y.

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Models and light metal work. H. B. Morris, Ithaca, N. Y.

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The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$5. F. C. Beach & Co., 383 Broadway, New York, Makers. Send for free illustrated Catalogue.

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For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

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B. H. can answer his query as to the size of pipe to convey water a long distance by referring to p. 45, vol. 29—A. Y. McD will find the directions on p. 59, vol. 24, for galvanizing iron pipes sufficiently explicit.

E. F. G. will find directions for making rancid butter sweet on p. 119, vol. 30—G. A. B. will find a recipe for birdlime on p. 347, vol. 28—T. D. B. will find recipes for fumigating powders on p. 96, vol. 31—L. G. D. will find ample instructions for building an ice house on p. 231, vol. 30—E. E. P. can polish stones by the process described on p. 138, vol. 30. A recipe for cement for aquaria is given on p. 214, vol. 30—G. W. H. and G. P. will find answers to their questions as to section and siphons on the editorial pages of this issue—C. J. C. should consult a physician—F. J. B. can bronze iron pipes by following the directions on p. 167, vol. 30—B. M. & Co. will find a recipe for preserving harness on p. 264, vol. 30.

(1) W. J. R. asks: Is there a flexible pipe made that will stand the heat and pressure of steam, say from 50 to 125 lbs.? I want it to be limber, so that a little power will bend it to any angle when the pressure is on. A. Yes. It is not very flexible; but by giving it sufficient length, it can readily be turned in any desired direction.

(2) J. F. K. asks: What is it that eats away the ends of the enclosed glass tube of a water gauge? The tube was packed with rubber, and had been in about one year, under a steam pressure of 50 lbs. A. The tube presents the appearance of having been cut by sand or grit.

(3) J. E. B. asks: I am running a blast engine at a furnace. Four cylindrical boilers, 60 feet long by 30 inches in diameter, in batteries of two boilers each, furnish the steam. There is a steam dome on each set, the domes being connected by the main steam pipe that goes to the engine. One of the batteries became charged with electricity. I opened a brass drip cock that was in the pipe upon the boilers, and left it open until I got the steam turned on. When I went to shut it, I felt a prickling sensation in my fingers, and opened it again. When I placed my finger within 1/4 of an inch of the cock, I could feel it very plainly. Can you explain it? A. It probably occurred from the friction of the water, contained in the steam, against the sides of the orifice.

(4) J. B. S. says: Our safety valve is 4 1/2 inches diameter; it weighs 5 lbs., lever weighs 5 lbs., and the weight is 75 lbs.; the distance from valve stem to fulcrum is 11 1/2 times the distance from valve stem to fulcrum. At what pressure should it blow off? A. If it works freely, it should blow off at about 67 pounds.

2. The engine is double, the cylinders being 12 1/2 inches, with a spur wheel (on crank shaft) of 3 feet diameter, geared to a wheel of 8 feet diameter. How many revolutions to the minute should this engine run without injury, working at 75 lbs. steam to the square inch? A. From 60 to 70. 3. We have two boilers set side by side, with 3 inch feed pipe, with check valve at the mud drum of each. Our steam connections are 4 inches in diameter, with a large valve in each boiler for disconnection. We have an equalizer of 4 inch pipe for water connection, with a stop valve in center. We never have any trouble with more pressure in one boiler than the other from unequal firing,

when we try the water gauges in one boiler, we are sure as to where it is in the other. We feed with either cold or warm, or nearly boiling water. I think if all boilers were raised in this way there would not be so many terrible explosions. A. This is a very good arrangement, and we are much obliged to you for the description. As to strength of boilers, see 193, vol. 29.

(5) G. H. A. asks: Will Babbitt metal make a good piston, if melted and run in a brass cylinder? A. Not very. Your other questions have been repeatedly answered in these columns.

(6) J. B. H. asks: How is the fine wire, of which a mile weighs only a grain, drawn? A. It is enclosed in a mass of other material, and the two are drawn together into wire, after which the casing is dissolved by a chemical preparation.

(7) H. A. T. says: I have an engine 12 1/2 x 36 inches stroke. I run it without a balance wheel. It has a direct connection of valve stem to eccentric. What lead should it have, and at what point should the cut-off be? A. Give the valve 1/4 of an inch lead, when cold. The point of cut-off will generally be regulated by the pressure of steam and the work to be done.

My railroad has a curve in it, about 10 feet in 100, 100 feet long, and then there is 100 feet of straight line. What is the best mode of running on the track so as to get the car round the curve? A. The tracks of street railroads have many such curves, and special appliances are used, which you can obtain from a manufacturer.

(8) C. J. B. asks: What is the process of gumming the parts of a newspaper together, to make it into book form? A. It is done by a machine which folds the paper and at the same time applies paste at the back of the leaves.

(9) E. T. C. says: I wish to put up a lathe for turning hard wood, such as oak and ash, of from 3 to 12 inches in diameter. I am thinking of having two pulleys on the mandrel. Of what diameter, and how broad on the face should they be? A. You can make one pulley 6 inches, and the other 4 inches in diameter. The face of each should be 2 inches. 2. What width of rubber belt should I use? A. Two inches. 3. How many revolutions per minute should the work make? A. From 500 to 800 revolutions per minute. 4. Would pulleys built up of pieces of wood, so as to present the end of the graft to the belt, give good results? A. The pulleys will do better if turned from solid pieces of wood, or lagged and turned off after being built up.

5. How large should a steel or iron mandrel be? A. Diameter of mandrel should be 1/4 inch. 6. What horse power would it take on 9 inch work? A. From 1/2 to 3/4 of a horse power.

(10) H. P. asks: What would be the probable bursting pressure of a cylindrical boiler 28 inches in diameter, of plates 1/4 inch thick, with a single row of rivets? A. See p. 153, vol. 29.

Does sharpening cotton gin saws aid in the cleaning of the seed, or does it only increase the speed of the gin? A. Speed is the more important item. The saws do not require to be very sharp.

(11) F. R. M. asks: Will you please give directions and formulae for designing a good turbine water wheel of the vortex or central discharge kind? A. There have been volumes written on this subject. You will find fully treated in Rankine's, Fairbairn's, and Weisbach's works. It is entirely too comprehensive for our columns. Moreover, if the best proportions were definitely fixed, there would be no more competition between water wheel manufacturers.

(12) D. asks: Can a band of steel, 1/4 inch broad and of sufficient thickness to sustain a strain of 150 lbs., be used as a belt on pulleys 4 inches in diameter? A. A piece of the best saw steel, about 1-16 of an inch thick, might answer, but it would be liable to break.

(13) D. M. says: I want to build a small furnace for melting iron. Of what size should it be to work properly? Would a furnace of 12 inches inside diameter and 36 inches high be large enough to make good sound castings? A. The above dimensions will probably give good results. 2. I have read that melting iron on a small scale is never successful. What is the trouble? A. Very small masses of iron are apt to oxidize quickly, which causes the difficulty. 3. What sized fan blower, with 4 fans, running about 2,500 revolutions per minute, would be required for the above mentioned furnace? A. A blower 9 inches in diameter will do, if properly constructed.

(14) E. D. P. asks: How can I tin gray iron? A. Clean the pieces thoroughly, cover them with a solution of sal ammoniac, and dip them into melted tin.

(15) J. W. S. asks: 1. How many strokes does the sickle or knife make to one revolution of the ground wheels of an ordinary mowing machine? The one which I am planning makes 128 strokes to one revolution of the ground wheels, and works the gear wheels by a screw. A. The speed of the knives is proportioned, in a good mowing machine, to the speed with which the machine advances. 2. Is the machine that makes the most strokes of the knife generally the best? A. Not necessarily.

(16) J. L. G. asks: 1. A saw mill is drawn by a portable engine of 25 horse power. The dues in the boiler leak badly on some days, and on others they will not leak at all. Sometimes the water will stand in the ash pit in a considerable quantity. Is such a boiler safe? A. We would like to have further particulars in regard to this case, such as kind of feed water used, and whether the tubes leak by fits and starts, or after blowing down or cleaning the boiler. 2. How often can the flues in a boiler be upset with safety? A. The tubes can be upset as long as there is enough material left, and sometimes a ferrule can be forced into the end with advantage. 3. The boiler is calculated to carry 100 lbs. steam: is it dangerous to run with 50 or 60 lbs. of steam on? A. If you have a good pump, and are careful, the boiler is not particularly dangerous on account of the leaky tubes, nor would it be unsafe to run the engine as suggested.

(17) W. asks: Why is it that, if you take two musket balls (both alike) and two similar charges of powder, and load them into two guns, one rifled and the other a smooth bore, the ball from the rifled barrel is thrown with so much more force and precision than the ball from the other? A. The greater precision of the ball from the rifle is due to the rotary motion which is imparted to it, and its greater force is probably due to the decrease of windage, and the greater pressure exerted by the exploding powder upon it.

(18) M. B. asks: How can I dye wood black? A. Boil 1/2 lb. chip logwood in 2 quarts water, add 1 oz. pearlash, and apply hot with a brush. Then take 1/2 lb. logwood, boil in 2 quarts water, and add 1/2 oz. verdigris and 1/2 oz. copperas; strain, and put in 1/2 lb. rusty steel filings, and with this go over the work a second time,

(19) C. E. E. P. asks: How are carbon plates made for galvanic batteries? A. The carbons for Hunsen's battery are made as follows: The fine dust of coke and caking coal is put into a close iron mold of the shape required for the carbon, and exposed to the heat of a furnace. When taken out, the burned mass is porous and unfit for use; but by repeatedly soaking it in thick sirup, or gas tar, and reheating it, it at length acquires the necessary solidity and conducting power. The carbon that forms on the roof of gas retorts is harder and better than the carbon thus made, but it is difficult to work, and the supply of it is limited.

(20) A. B. C. asks: Can more than one wire be supplied from an intermediate battery, all the wires being through wires? For instance, two or more wires work from New York to Philadelphia, with a main battery at Trenton; can both or more wires be supplied without dividing the battery? A. They cannot. An intermediate battery constitutes a portion of the main circuit, and connecting in another wire would have the same effect as crossing the wires.

(21) S. W. says: A few days ago, on examining one of our fire alarm boxes, I found jumps, or solid crystals, of sulphate of copper adhering to the kerite insulation of the wire inside the box. The box is some four or five squares from the office. I am positive the crystals were not on the wire when it was put in the box. The question is: How came the sulphate there? A. It was probably placed there at some subsequent time by some one having access to the box, for the purpose, perhaps, of exciting your curiosity.

(22) J. O. C. and others.—Belts will move towards that part of the pulley where the radius is the greatest.

(23) J. E. H. asks: How can I silver plate a watch case or other articles? A. Place the articles in a bath consisting of two grains of cyanide of silver and two grains of cyanide of potassium in every two hundred grains of water. Connect the zinc poles of a battery of three or four cells to the article to be plated and the copper pole to a piece of silver, which is also plunged into the bath. The passage of the current decomposes the salt, deposits silver on the object, and causes the dissolution of an equal quantity of metal from the silver electrode. The time required for the operation depends on the thickness of coating required.

(24) J. F. A. asks: How many feet of silk covered wire, and of what size, is required for the secondary coil of an induction apparatus capable of producing an inch spark? What is the length of the primary coil? Will the ordinary soft iron of commerce do for the core? A. An induction coil of that capacity would require about 40,000 feet of silk-covered copper wire of 0.0055 inch diameter, or No. 36 Birmingham gauge, for the secondary coil. The primary coil consists of two layers of copper wire of 0.1 of an inch diameter or No. 12 Birmingham gauge. Ordinary soft iron of commerce will answer very well for the core, but Norway iron is the best for this purpose.

(25) F. C. B. asks: How is an induction coil arranged so that the drawing out of the core increases the strength? How is a coil arranged so that a tube enclosing the coil regulates the current, drawing it out increasing, and pushing it in decreasing, its strength? A. There is no arrangement whereby the withdrawal of the core can increase the inductive effect of a coil. A primary coil when enclosed in a brass tube loses its inductive effect upon the secondary coil, because the induction currents circulate within the tube instead of passing into the secondary coil. By drawing the tube out, and leaving the primary coil within the secondary, the currents circulate in the latter and thus the inductive effect is increased in proportion as the tube is removed.

(26) C. D. C. asks: What are the characteristics of the Leclanché battery? Is it as it is now as the Grove? A. The Leclanché element consists of a zinc rod in a solution of ordinary commercial ammoniac; the negative pole is a prism of carbon, tightly packed into a porous vessel with a mixture of peroxide of manganese and carbon, in the form of a coarse powder. The zinc unites with chlorine, forming chloride of zinc while ammonia is set free at the negative electrode. Its electromotive force is 1.45 volts, while that of a Grove is 1.9 volts. There is no waste of material when the Leclanché battery is not in action; and if the evaporation of the liquid is prevented, it may be allowed to remain untouched for months without losing power. It is, therefore, admirably adapted for working telegraph wires where the open circuit is used, and where the telegraph is not in constant use, as well as for electric bells.

(27) L. V. R. asks: How can ivory be made decolor, or be reduced to the consistency of putty, so that it could be worked into any desired form? A. Soak it in a solution of pure phosphoric acid, and it will become flexible. Exposure to the atmosphere will harden it, but it may be made again pliable by immersion in hot water.

(28) R. N. asks: Does the 11 seconds of lunar acceleration, per century, mean a total acceleration of 11 seconds in that period, or that the lunar month is now 11 seconds shorter than it was a century ago? A. The total secular acceleration of the moon's mean motion amounts to between ten and eleven seconds per century. See Herschel's "Outlines of Astronomy," pp. 417-419. Lunar perturbations are almost numberless, and are compensated. The retarding influence of the ether of space must be immeasurably small.

(29) C. S. O. says: I have some photographs, the faces of which are somewhat marred; they look as if they had been piled together before the varnish had dried, and then pulled apart. How am I to make them appear all right? They are perfectly new. A. For restoring the surface to photographs, etc., if the scratches do not go through the albumen, wax them. Formula: Dissolve 1 oz. white wax in 2 oz. turpentine by a hot water bath. Add a few drops of oil of lavender which facilitates the solution of the wax, and neutralizes the odor of the turpentine. This has the consistency of butter. On an imperial sized photograph, take a lump the size of a pea, and, with cotton flannel, rub it over the print. Burnish with a clean piece of flannel. This gives a high polish.

(30) N. S. asks: What is put inside casks to prevent alcohol from soaking into the heads and staves? A. Dissolve in a water bath 1 lb. leather scraps and 1 oz. oxalic acid in 2 lbs. water, and distill gradually with 3 lbs. warm water. Apply this solution to the inside of the barrel, where (by evaporation) it will as

some brown color and become insoluble in alcohol. It will close all the pores of the wood, and will not crack or scale off.

(31) J. J. asks: What are good recipes for composition brass, and for bell metal? A. A good composition brass is made of copper 7 lbs., zinc 3 lbs., tin 2 lbs. Another: Copper 1 lb., zinc 12 lbs., tin 8 lbs. Metal for bell and other bells: Copper 30 lbs., lead 5 lbs., tin 1 lb., antimony 8 lbs. Bell metal for small bells: Copper 3 lbs., tin 1 lb. For large bells: Copper 100 lbs., tin from 20 to 25 lbs.

(32) N. F. C. says: I have a 2½ inch achromatic telescope, of 44 inches focus; and with the Huygenian eyepiece I get a power of 80. How high a power will it stand, and how must I construct the eyepiece? A. It will bear 125. Then $44 \div 125 = 0.352$ = equivalent focus $\div 2 = 0.704$ = focus of field lens; and $0.704 \div 0.235 = 3$ = focus of eye lens, showing $0.704 - 0.235 = 0.469$ = distance apart. 2. How close will it bring, apparently, the moon to the earth? A. Moon's distance in miles, 240,000 $\div 125 = 1,920$ miles.

(33) B. F. H.—Get Webb's "Celestial Objects," third edition. It contains an account of all objects likely to interest the amateur astronomer.

(34) T. M., of Roorkee, British India, and others.—The SCIENTIFIC AMERICAN, bound, will cost you \$3 per volume. Volumes 26, 27, 28, are not on sale at present. Science Record, three volumes, \$6.50 to gether.

(35) W. P., of Dublin, Ireland, and others.—"Captain Simpson's" Report on the Naval Ordnance of Europe" is to be issued by the Navy Department, Washington, D. C.

(36) C. Roggenkamp, Appingedam, Holland.—Subscription to SCIENTIFIC AMERICAN, prepaid postage, \$5.08 per annum.

(37) J. T. B. says: 1. In your issue of October 31, you say that it is not safe to cement directly on the wall of an excavation. My father has built hundred of cement cisterns, cementing directly on the earthen wall, and I have not known one of this kind of cistern of his make to fail for want of strength. Put on three good trowel coats (the last one containing a little larger proportion of cement), and a brush coat for hard finish, made by mixing cement in water to the consistency of thick cream, and add a pint of fine salt for a large pailful of the finish. Wherever the soil is stable enough to hold its place as the cement is laid on, the brick wall is in no sense needed. It is only money wasted. Of course all cisterns should be protected from frost. A. There are some soils sufficiently hard and permanent to admit of the treatment described by our correspondent, and no doubt such is the nature of the ground in the section of which he writes; but such construction is not safe in all soils, and it is liable to be damaged by surface water in any soil. In most sections of country, cisterns so constructed would be attended with a great deal of risk. It is not merely the looseness and friability of the soil that we have to contend against, but the pressure of the surface water as well, which, when confined by an understratum of clay, is sometimes very considerable, and forms the main difficulty in the construction of dry cellars. This pressure tends to wash away the earth behind the cement, and when this weakens to break it. Unless H. M. has had the matter proved in his immediate neighborhood, therefore, it will be with him in the nature of an experiment.

1. Suppose I have a pump whose bore is 2½ inches and stroke 4 inches, and (connected with the pump by a two way stopcock) two pipes, one with an inch and the other ½ inch bore, the pipes both leading to the same cistern: How much more water will be supplied to the pump at each stroke by the former than by the latter? A. If the pump is worked with a slow motion, its cylinder will be filled at every stroke, the same by the small pipe as by the large one, the difference being in the greater velocity of the water and consequently greater friction in the small pipe than in the large one; and for this reason, with the small pipe, greater power would be required to work the pump. But the quantity of water drawn at each stroke will be the same in each case. 2. What kind of pipe is best to bring water in, from a well at a distance, the water to be pumped up? A. Iron pipe coated with coal tar would stand well. 3. Which will last the longest ordinarily, underground iron or lead pipe? A. In some soils, lead pipe is the best, but others soon destroy it.

(38) S. R. M. asks: What is the effect, on the complexion, of gum benzoin dissolved in alcohol? A. Gum benzoin contains about 80 per cent resin and from 15 to 20 per cent benzoic acid. As it is insoluble in alcohol, the solution would be a varnish, and would have no more effect than any other varnish, though there is a slight chance of the benzoic acid being irritant to the skin.

(39) A. L. C. asks: 1. How many rings has the planet Saturn? A. Saturn has three principal rings or streams of satellites; the innermost is the gaseous or opaque ring. Five of the eight satellites have been seen in a four inch achromatic. 2. Do they all revolve around the planet in the same time? How does the time of their revolution compare with the rotation of the planet on its axis? A. Saturn rotates in about 10 hours; the rings revolve more slowly. 3. Does the rotation of the planet on its axis appear to be in the least affected by the attractive force of the rings? A. No. 4. If I understand the principle of the whirlpool, it is that the speed of the water is increased as it nears the center; am I right? If a ball constructed of some floating material be dropped into the whirlpool near the outer edge, where a slow projectile motion would be imparted to it, would it at the same time take a slow rotary motion? A. Fasten a bullet to a thread and let it revolve around a stick. As the pendulum shortens, the bullet moves faster. 5. As the ball comes nearer to the center of the vortex, would its rotary motion be increased at a corresponding rate to its projectile motion? A. No.

(40) B. S. says: I have two lenses, one of which has a focal distance of 5½ inches, and a diameter of 1½ inches; the other is 1 inch in diameter with a focal distance of 12 inches. Putting them together in the form of a telescope, the objective being the small glass, 12 inches being the distance, an object at a distance of 3 or 4 miles is plainly seen. How can I combine them so as to see plainly at a good distance, being near-sighted? A. Place your lenses 17½ inches apart.

What is the process of photography from the clean paper to the development of the picture? A. See Carey Lea's "Manual," or Dr. Vogel's "Handbook of Photography."

(41) G. M. H. asks: 1. Can the achromatic lens of an ordinary photographic camera be used as an objective for an astronomical telescope, to any advantage? A. We find by experiment that view tubes and

portrait combinations may be used as telescopes, taking out the stops, with a focusing glass or pocket microscope as an eyepiece. 2. What power of eyepiece would be most desirable for a lens of 1¼ inch diameter and 6 inch focus? A. The power should be below, about 80, and the glasses well centered, or collimated.

(42) A. L. C. says: 1. As the eclipse of the moon was passing off, on Sunday morning, October 25, the northwestern edge was first made luminous, being nearly opposite the point of contact. How do you explain that phenomenon? A. Because the moon passed through the earth's shadow very near its edge. 2. Is there any difference, by actual measurement, between the equatorial and polar diameters of the moon? A. A stereograph of the moon shows a bulge or projection toward the earth. The invisible side is supposed to be thirty miles lower than the visible one. 3. Can the polar axis of the moon be other than perpendicular to the plane of its orbit? A. The moon's axis is inclined to the ecliptic 1° 30' 10". Its orbit is inclined 5° 9' 47". 4. What is the average diameter of the satellites of our solar system? A. They range from Titan, sixth satellite of Saturn, which is over half the diameter of the earth, and Jupiter's satellites, respectively 2,340, 2,192, 3,579, and 2,062 miles, to the minute spheres forming the rings of Saturn, and the meteorites, which are the debris of comets. 5. How do you find the parallax of the sun? A. By measuring the displacement of Venus on the sun's disk, with the distance in latitude between two observers as a base line. 6. If I were standing on the equator, I should see the pole star in the horizon; but if I am in latitude 42°, do I see more than 42° below the pole? A. No. Why does the pole star appear so much nearer to the zenith than the horizon, to one thus situated? A. The pole star is about a degree and a half from the pole.

Why does more fruit fall during the night than during the day time? A. If the fact is as stated, it is because the deposit of dew makes fruit heavier at night.

(43) J. D. L. asks: 1. What is the best work on grinding and polishing lenses, one that contains all or nearly all the modern practice of opticians? A. We should be glad to hear of such a work, modernized. As any person can make an achromatic by following directions, with patience, intelligence, and "warranted" glass, the lesser opticians at times conceal their improvements. Our spectral information on achromatics has been collected by an amateur, and will not be found elsewhere. Among the leading opticians, Steinheil and G. & S. Merz determine whether a lens has the requisite curvature by placing a lens of correct and opposite curvature above it, and illuminating through a piece of tissue paper. If the parallel rainbow diffraction bands, crossing the lenses, are straight, then the surfaces are alike; if the bands are curved, they are unlike. Clark uses a home made wooden spherometer, and works to the two hundredth part of an inch, whereas the continental opticians follow Fraunhofer, and endeavor to have their work correct to the thousandth of an inch (see Precht's "Diotropik"), and to dispense with local correction, which is necessary after all. Steinheil cuts a prism in two by hand with a steel wire, sawing arm-d with diamond dust, instead of a lap. The force for his little hypocycloid polishing machine is supplied by the left arm of the workman turning a horizontal fly wheel. Clark uses a steam engine for rough grinding, and a vertical iron wheel fed with sand and water instead of the traditional lead grinder. In subsequent operations, he puts the iron grinder on the stump of a tree, and walks round it, moving the lens to and fro by its handle. He does pitch polishing by hand, with rouge and a wooden disk, the surface cut into one inch squares and diagonals, retouching with the forefinger dipped in rouge. If zones of different focus have formed in polishing, Fitz and others use the machine for local correction, nearly as figured by Draper. Foreign opticians fasten a lens with uniform drops of pitch half an inch apart, while ours use it solid. 2. What is the best method of bending a plate of glass in a true spherical concave? A. It is better to grind out and polish the cavity. A plate of glass will curve slightly without buckling when sufficiently softened by heat, and take the shape of an iron mold beneath it.

(44) N. Y. asks: 1. What quantity of water converted into steam is used in computing the horse power of boilers? A. There is no fixed standard. 2. What is the horse power of a locomotive firebox boiler, with a grate 42x44 inches, and a cylindrical part 4 feet in diameter, with 45 three inch tubes 12 feet long, and dome 24x24 inches? A. There is no rule that applies to this question. 3. What would be a fair evaporation per pound of coal in such a boiler? A. From 7 to 8 pounds.

(45) D. D. asks: If a boiler and a tank are placed 50 yards apart, and connected by a 1 inch pipe, would the pressure be the same in both? A. Yes. Does brass expand as iron does, when heated to the same degree? A. No.

When the boiler of the fireless locomotive is filled, do they force any steam in with the water? A. Yes.

(46) W. H. says: I am about to build a current wheel to be used in the Niagara river, where the current runs about 5 miles per hour past my wharf, depth of water being from 12 to 15 feet. The wheel is on the principle of a windmill or propeller wheel, and is to be wholly submerged. I wish to utilize the power to the extent at least of 12 to 15 horse power. What size of wheel and number of fans would you advise? How many square feet should there be on each fan? A. Your plan is somewhat novel, and you will have to make experiments in order to determine the best proportions.

(47) M. H. asks: What is the most approved method of putting locomotive cylinders in line with the main shafts? A. It would require too much space to make the method plain, and you will get a much clearer idea by personally inspecting the work. What are the best works on mechanical drawing, and on the link and slide valve? A. Professor Warren's works on drawing are very thorough; and Auchincloss' "On Link and Valve Motions" is the standard authority.

(48) W. B. says: 1. I am building a small boat engine; it is vertical, 3½ inches stroke x 3½ inches bore, to run 300 revolutions per minute, and to use steam for the whole of the stroke, of 125 lbs. pressure. My boat is a common row boat, clinker built, 18 feet long by 4 feet 4 inches beam. Of what size should my boiler be to supply the requisite amount of steam? A. Make a boiler 2 feet in diameter and 3 feet high. 2. Of what size should my screw wheel be? A. From 20 to 21 inches in diameter. 3. The boat draws about 6 inches, will it be weighted down enough to immerse the wheel when the machinery and 6 persons are in it? Its full depth is 21 inches. A. You can readily determine whether your boat will come down enough by placing weights in it. 4. Of what size should the pump be? A. Large enough to throw twice the quantity of water required.

(49) J. A. B. says: 1. I am building a boat, 21 feet long by 8 feet beam, and 3 feet deep. I am putting in a boiler 8 feet long by 21 inches diameter, and an engine 5 inches bore by 12 inches stroke, to drive a screw wheel, geared with a 3 feet, a 2 feet, or a 1 foot wheel. By which should I get the most speed? A. A few experiments will be your best guide in gearing the propeller wheel. 2. How many miles an hour will it make? A. The boat will probably go from 5 to 6 miles an hour. 3. What size should the propeller be? A. Make the wheel as large as convenient.

(50) H. H. says: I purpose building an oil tank, ten feet square and four feet deep, of two inch plank, as a plain wooden tank would leak. I think of lining it with ordinary galvanized sheet iron, with soldered joints. Is there anything objectionable in this plan? A. No. It will answer very well.

(51) G. L. L. asks: How can I make and arrange a kerosene lamp for the purpose of heating a small boiler? A. Your best plan will be to buy one. There are a variety of such lamps in the market, many of which give satisfactory results. What is white metal? A. Parts by weight, tin 82, lead 18, antimony 5, zinc 1, copper 4.

(52) N. O. V. asks: In what manner can two steam governors be tested to ascertain which is the best? A. Belt them from the same shaft, and see which will lift the most weight under variations of speed, and also which is the most sensitive, when running at a high velocity, to a slight change of speed.

(53) D. C. H. says: I am running a horizontal steam engine 12½ inches cylinder, with the valve face against the side of the cylinder; the slide valve consequently rides on its lower side. The valve annoys me very much by a constant clicking noise, by being forced away from the face and then back again. Why is this? Should not the pressure in the steam chest keep it up to its place? The valve has nearly 1-16 inch lead, which gives about ¼ inch lead to the exhaust. Could the feed water heater cause a back pressure sufficient to force the valve from its face? How can I make it work quietly? A. It is quite likely that the exhaust closes too soon, so as to cushion above the steam pressure.

(54) G. C. H. asks: Does melting and re-melting lead make the pure metal any lighter? A. Some of it will be probably vaporized. What is the philosophical reason that a circular saw cuts better at a certain speed than it does if run faster? A. We do not know that this is a fact.

(55) H. B. asks: What should be the exact dimensions of the different parts of a small steam engine, the cylinders of which measure 2½x1½ inches? What sized boiler, with what number of tubes, should be employed to furnish steam to two cylinders of the above dimensions? A. You will find the most of these dimensions in back numbers.

Is there any solder for soldering brass, of the same color? A. Yes. Take copper 32 parts by weight, zinc 29 parts, tin 1 part.

What work on the steam engine would you advise an amateur to read? A. Bourne's "Catechism of the Steam Engine" is one of the best.

Would a combination of pulleys and bands serve to reduce the speed of a foot lathe as well as a back-gear head? A. It would answer, but not as well as gearing.

Would the above described engine be large enough to run a lathe swinging eight inches? A. Yes.

(56) J. C. P. asks: If a perfectly tight vessel, of 4 gallons capacity, contains 1 gallon of water, and is of sufficient strength to resist any amount of pressure by heat applied to the same, would any portion of the water evaporate? A. It would all be converted into steam, if sufficient heat were applied.

(57) F. O. asks: How can I make fruit trees bear well? Last season the plum and pear trees were full of blossoms; but they bore little fruit. The apple trees were loaded, but the apples fell to the ground with worms in them. A. You must remove all the worms, and coat the trunks and roots with a preparation which you can obtain from a seedsmen.

(58) H. M. asks: How many inches high inside must I make a box to contain one barrel, if the inside measure of the box is 6x16 inches? A. Divide the number 1256.64 by the cross section of the inside of the box in inches. The quotient will be the height of the box in inches.

(59) G. S. S. asks: When a pair of scissors cut paper or any material, which blade does the cutting, the upper or lower, supposing that both blades are closing together? A. Both blades exert a shearing force, in such a case. If one blade be kept still, the other will do the shearing.

(60) W. J. S. says, as to the difference between a perspective view and a photograph: A photograph taken with a non-distorting (architectural) lens is absolutely identical with a correct perspective drawing taken from the point at which the lens is placed. Any one may prove this by placing the eye at the point where the lens was, and tracing the view on a piece of glass interposed between the eye and the view. If the distance between the eye and the plate is the same as the focal length of the lens, the two will absolutely coincide. A. We have never seen a non-distorting lens, and doubt if it can be made.

(61) G. F. T. asks: How can I tin the inside of a copper boiler? A. Clean it thoroughly, and then put it into melted tin to which sal ammoniac has been added. Move the boiler about, so that the melted metal will cover every part.

(62) J. H. P. asks: 1. Do oxygen, nitrogen, and carbonic acid, when heated, expand similarly, according to their volumes? A. The greatest expansion is between 32° and 212° Fah.: 1 volume of hydrogen, at 32° becomes 1.36613 at 212°, and one volume of carbon dioxide at 32° becomes 1.37099 at 212°. Such slight differences are observed in nearly all gases; but practically speaking, all gases expand 1-73 part of their volume for every 1° Fah. of increase of temperature. 2. Is moisture contained between the particles of gases? A. No.

What accounts for the colors of the African and Caucasian races respectively? A. The deep color of the African is due to a pigment in the cells of the epidermis. The pigment and epidermis of a negro were analyzed by Scherer, with the following results:

Pigment.	Epidermis.
Carbon.....	58.57
Hydrogen.....	5.91
Nitrogen.....	18.78
Oxygen.....	21.98
	99.96
	100.00

This would prove the color to be due to an excess of carbon.

Is there a substitute for tobacco that can be manufactured into cigars? A. We know of none.

How is bronzing on steel done? A. The usual method is that of coating the metal with good size varnish and then dusting over it the metallic bronze powder. When dry, it is again varnished over. As to the mastodon's tooth, write to the Academy of Natural Sciences Philadelphia, Pa.

(63) W. W. H. asks: 1. What degree of heat is required to kill trichinae in cooking? A. 212°. 2. Will boiling kill them sooner than frying? A. Yes.

(64) O. A. F. asks: 1. Can you give me a recipe for a good hair oil? A. Castor oil, 6½ pints, alcohol 1½ pints, oil of citronella ¼ oz., lavender ¼ oz. Shake well before each application. 2. What solution will do to wash the head with, and not injure the hair? A. See answer to J. L. on this page.

(65) J. L. asks: What is the best thing for washing the head with, which will make a lather and not injure the hair? A. Take aqua ammonia 3 ozs., salts of tartar ¼ oz., alcohol ¼ oz., and soft water 2½ pints; perfume with bergamot. In applying, rub the head until the lather goes down, then wash out.

(66) W. S. B. asks: What preparation can I use on my hair to keep it soft and make it retain its color, and at the same time keep the scalp clean? A. If your hair is losing its color, hair oil will not make it retain its hue. See answer to J. L. on this page.

How can I clean this buckskin gloves? A. Try benzine.

(67) W. V. G. asks: How can I destroy graybacks in clothes that cannot be washed? A. Sprinkle your clothes with chloroform, and pack them in a chest excluding the air. Two days under the influence of chloroform should exterminate them.

(68) S. R. asks: 1. Will sumac grow best in rich or poor ground? A. Put in a dry hill, though it will grow well in any common soil. 2. How far apart should it be planted? A. Four feet would be plenty; if it be a small kind, three feet would be sufficient. 3. After planting, should the ground be cultivated? A. That is a matter of experiment. It grows as well on poor as on rich soil, and we should say very little cultivation is necessary. 4. How is the curing done? Should I spread it on the ground like hay? A. With the best varieties, the plant is usually cut while in a soft state and carefully dried till the leaves can be pounded when it is thrashed with daisies, the stems and coarse twigs raked out, and the leaves packed in barrels sold.

(69) J. B. says: Every few months I suffer severely from an attack of the cramp in the stomach. I have frequently tried as a remedy brandy, whiskey, morphine, etc., but have secured relief only on the application of a strong mustard plaster. Will you explain the nature and cause of these long cramping spells, and how the mustard plaster effects a cure? A. The cramp of which you speak may arise from a variety of causes, chiefly, however, from the accumulation of gases in the canal. The distention paralyzes the proper muscles to such an extent as to prevent its expulsion. The plaster seems to set up a nervous reflex excitability, probably through the medium of the sympathetic system, and a proper tone is restored. This is however, entirely inferential.

(70) O. asks: How does gelatin clarify coffee? The action of gelatin in clarifying coffee is due to its combination with the tannic acid which is a large constituent of the berry. In boiling the gelatin in coffee, it forms a precipitate of tannate of gelatin, which acts precisely like albumen in collecting all sedimentary matter, but a much longer time is required for the precipitate to settle. The bulky precipitate of the egg separates at once when the solution reaches the boiling point.

(71) C. S. H. says: Passing a house recently, the owner remarked that he had a house, and invited me to see it. Entering, I found myself in a hall or entry about six feet square, with a door on each side. Opposite the front door was a blank white wall. Placing me in the left hand front corner of the hall, he directed me to look at the blank wall above spoken of. I saw nothing but darkness at first; but in about a minute and a half a faint tinge of a ochre color showed through the darkness. This increased in clearness and distinctness until, in about four minutes, a perfect picture of the house on the opposite side of the street stood outlined upon the wall; the color, the windows, the folds of the curtains, the fences, and the foliage of the trees, were distinct and beautiful, in a picture about two feet square. A little examination showed that the picture was transmitted through the keyhole of the front door; but by what process it is magnified and so vividly produced is a mystery to me, as to all others who have seen it. It is only three days since it was first discovered by accident. Can you explain it? A. When luminous rays, which pass into a darkened chamber through a small aperture, are received upon a smooth white surface, they form images of external objects. These images are inverted; their shape is always that of the external objects, and is independent of the shape of the aperture. In the camera obscura, the brightness and precision of the images are increased by means of lenses. The principle is the same in both cases.

(72) E. W. F. asks: How are the sheets used in manifold writing prepared? A. Take soft printing paper, and smear with any clean grease mixed with plumbago or lampblack. Leave for 12 hours in a dry place. This is for black paper. Other finely ground pigments may be used to produce the desired color.

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

W. D. S.—The fragments are part of a fulgurite or lightning tube. For full information, see pp. 3, 274, vol. 31.—O. P.—Your specimen contains carbon, but burns with such difficulty that it is doubtful (as far as we could judge from such small specimens) whether it could be used for coal.

L. K. of Königsberg, Austria, asks: How can I make carbolic soap?—T. M., of Roorkee, British India, asks: What is the greatest length of railway that has ever been built in one day of 12 hours, in the United States?—S. asks: How is the ordinary rim or flange cartridge charged? Is it possible to recharge the copper shells without expensive apparatus?—G. F. S. asks: How can I recolor coral when the original color has been drawn by heat?—E. A. D. asks: What is the composition used on the back of postage stamps?—F. J. H. asks: Can any one tell me of a means of calculating the distance between two points on the surface of a globe, angle and length of the two radii (which, of course, are in the same plane) being given?—A. F. asks: How can I clean plain lace, which has grown yellow with age?

COMMUNICATIONS RECEIVED.

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

- On Aerial Navigation. By G. W. M.
On Grinding Plane Irons. By A. C.
On Some New Dyes. By A. D.
On Gongs. By C. L.
On Feathering Arrowheads. By R. K. Y.
On the Divining Rod. By W. C.
On Swinging Saloons. By W. S. T.
On the Phylloxera. By M. L. R.

Also enquiries and answers from the following:

S. F. B.—H. E. C.—A. A. F.—L. F. W.—N. A. H.—J. C.—J. W. D.—W. D. D.—A. G.—C. H. S.

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: "Who makes a pulverizer, suitable for powdering dry manure? Whose is the best process for drying lumber by exhaust steam?" 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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Vehicle wheel, L. Warner.....	156,450
Vehicle wheel, J. V. Woolsey.....	156,499
Vinegar, making, D. Wimpfheimer.....	156,617
Violin brake rest, H. W. White.....	156,618
Wagon chais, C. M. Lemingwell.....	156,433
Washing machine, R. Little.....	156,462
Watch key, F. E. Allen.....	156,471
Watch, stop, C. E. Jacot.....	156,571
Water closet valve, J. E. Boyle.....	156,497
Whiffletree center, H. K. Porter.....	156,487
Windlass, W. H. Harfield.....	156,461
Wringer roll, T. J. Dickerson.....	156,518

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

- 31,324.—LOOMS.—W. Meekland. January 20.
31,337.—REVERBERATORY FURNACE.—J. Reese. Jan. 20.
31,546.—POLISHING IRON.—B. Lauth. February 10.

EXTENSIONS GRANTED.

- 30,594.—DOOR LATCH.—T. Slaght.

DESIGNS PATENTED.

- 7,314.—STOVE.—W. P. Abendroth, Port Chester, N. Y.
7,315.—PICTURE HOLDERS.—J. Barnes et al., Gilman, Ill.
7,316 to 7,319.—CARPETS.—R. R. Campbell, Lowell, Mass.
7,320.—STOVE.—G. Comstock, Keokuk, Iowa.
7,321 to 7,325.—EMBROIDERY.—E. Crisand, New Haven, Ct.
7,324 to 7,326.—MEDALS.—T. W. Derousse, Philadelphia, Pa.
7,327 to 7,329.—MEDALS.—T. R. Hartell et al., Phila., Pa.
7,330.—ORGAN CASE.—S. Hayward, Boston, Mass.
7,331.—JACKETS.—M. Landsberger, Philadelphia, Pa.
7,332.—BOTTLE.—G. Mackay, Rochester, N. Y.
7,333 to 7,335.—ORGAN CASES.—W. W. Neider, Wilkesbarre, Pa.
7,336.—BOTTLES.—C. C. Woodworth, Rochester, N. Y.
7,337.—COMPASS CARDS.—D. Baker, Boston, Mass.
7,338.—BRACKETS.—W. H. Britton, Milford, Mass., et al.
7,339 to 7,341.—CARPETS.—J. M. Christie, Kidderminster, England.
7,342 to 7,343.—ORGAN CASES.—S. Hayward, Boston, Mass.
7,344 to 7,346.—OIL CLOTH.—C. T. Meyer et al., Bergen, N. J.
7,347.—CHILD'S CARRIAGE.—J. Sues, Louisville, Ky.

TRADE MARKS REGISTERED.

- 2,045.—LUBRICATING OILS.—Am. L. O. Co., Cleveland, O.
2,047 & 2,048.—NURSING BOTTLES.—M. S. Burr & Co., Boston, Mass.
2,049 & 2,050.—FLOWS.—E. E. Lummas & Co., Boston, Ms.
2,051.—FRUIT JELLIES.—Sherwood et al., New York city.
2,052.—WASHING EXTRACT.—A. Döring, New York city.
2,053.—GROCERIES.—A. Goddard, New York city.
2,054.—PILLS.—S. D. Howe, New York city.
2,055 & 2,056.—TOBACCO.—Marburg Bro's, Baltimore, Md.
2,057.—ORGANS.—R. Nichols, Philadelphia, Pa.
2,058.—NIGHT SHIRTS.—Perego's Sons, New York city.
2,059.—TOWELING.—Stark Mills, Manchester, N. H.

SCHEDULE OF PATENT FEES.

- On each caveat.....\$10
On each Trade Mark.....\$25
On filing each application for a Patent (17 years).....\$15
On issuing each original Patent.....\$20
On appeal to Examiners-in-Chief.....\$10
On appeal to Commissioner of Patents.....\$20
On application for Reissue.....\$30
On application for Extension of Patent.....\$50
On granting the Extension.....\$50
On filing a Disclaimer.....\$10
On an application for Design (3 1/2 years).....\$10
On application for Design (7 years).....\$15
On application for Design (14 years).....\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
NOVEMBER 7 to 14, 1874.

- 4,026.—L. A. Desaulles and Wm. Murphy, Montreal, Can. Améliorations aux oeillets servant au passage des lacets pour fermer les chaussures, dits "Oeillets pour Lacer les Chaussures." (Improvements on Eye-lets for Boots.) Nov. 7, 1874.
4,027.—W. Shaver, Kemptville, Ont. Improvement on attachments for sewing machines, called "Shaver's Attachment for Sewing Machines for Laces, Braids, etc., with Hem." Nov. 7, 1874.
4,028.—A. D. McKenzie and O. G. Hughes, Toronto, Can. Improvements in dumping wagons, called "McKenzie's Improved Dump Wagon." Nov. 7, 1874.
4,029.—G. D. Thornhill, Xenia, Greene county, O., U. S. Assignee of W. Coulter, Albany city, U. S. Improvements on car couplings, called "Coulter's Car Coupling." Nov. 7, 1874.
4,030.—J. Bardsley, Akron, Summit county, O., U. S. Improvement in spark arresters, called "Bardsley's Spark Arrester." Nov. 7, 1874.
4,031.—J. Gregory, Wingham, Huron county, Ont. Useful middlings purifier, called "Gregory's Improved Middlings Purifier." Nov. 7, 1874.
4,032.—J. S. Robinson, Canandaigua, Ontario county, N. Y., U. S. Improvement on the method or process for hardening and toughening the surfaces of cast iron, called "Robinson's Improved Process for Chilling, Carbonizing, and Toughening the Surfaces of Cast Iron Moldboards for Plows and other Castings." Nov. 7, 1874.
4,033.—F. Snowball and J. C. Nichol, Montreal, Canada. Composition for artificial marble or stone. Nov. 7, 1874.
4,034.—J. B. Armstrong, Guelph, Wellington county, Ont. Improvements in furnaces for heating steel in tempering, called "Armstrong's Improved Tempering Furnace." Nov. 7, 1874.
4,035.—J. Absterdam, New York city, U. S. Improvements on process for the manufacture of illuminating

gas, called "Absterdam's Process for the Manufacture of Illuminating Gas." Nov. 7, 1874.

4,036.—J. Bird, Nantucket, New Haven county, Conn., U. S. Improvements on self-binding pulley blocks called "Bird's Eccentric Pulley Block." Nov. 7, 1874.
4,037.—J. Judson and W. A. Cogswell, Rochester, Monroe county, N. Y., U. S. Improvement on steam governors, called "The Judson Steam Governor." Nov. 7, 1874.

4,038.—J. B. Orr, Glasgow, Scotland. Improvements on obtaining a white pigment, and in the process employed therefor, called "Orr's White Enamel Paint." Nov. 7, 1874.

4,039.—M. Chase, Jr., and C. H. Muir, St. John's, New Brunswick. Improvements on shingle machines, called "Chase & Muir's shingle Machine." Nov. 11, 1874.

4,040.—M. Callan, Innerkip, Oxford county, Ont. Improvements in lime kilns, called "The Dominion Champlain Lime Kiln." Nov. 14, 1874.

4,041.—D. W. Long, Parkersburg, Wood county, Va., U. S. Improvements on hinges, called "Long's Surety Hinge." Nov. 14, 1874.

4,042.—S. Wilmarth, Malden, Middlesex county, Mass., U. S. Improvements on water engines or motors, called "Wilmarth's Water Engine or Motor." Nov. 14, 1874.

4,043.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Improvements on a machine for moving logs called "Rodgers' Log Mover." Nov. 14, 1874.

4,044.—J. W. Upson, Tallmadge, Summit county, O., U. S. Improvements on an apparatus for screening and loading coal, called "James W. Upson's Apparatus for Screening and Loading Coal." Nov. 14, 1874.

4,045.—W. Golding, New Orleans, Orleans county, La., U. S. Improvement on steam generators, called "Golding Steam Generator." Nov. 14, 1874.

4,046.—T. L., I., C. B., and J. M. Hubbard, Port Huron, St. Clair county, Mich., U. S. Improvements on ship's winches, called "Hubbard's Ship Winch." Nov. 14, 1874.

4,047.—M. A. Cushing, Aurora, Kane county, Ill., U. S. Impro

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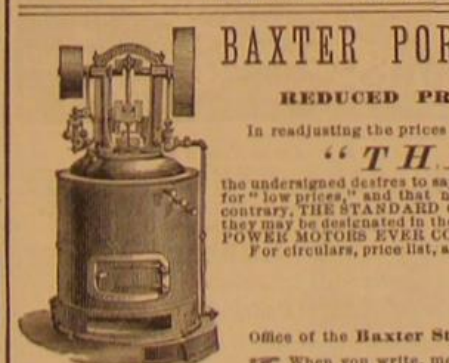
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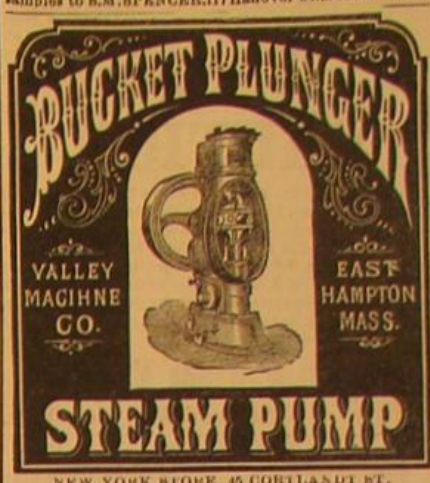
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