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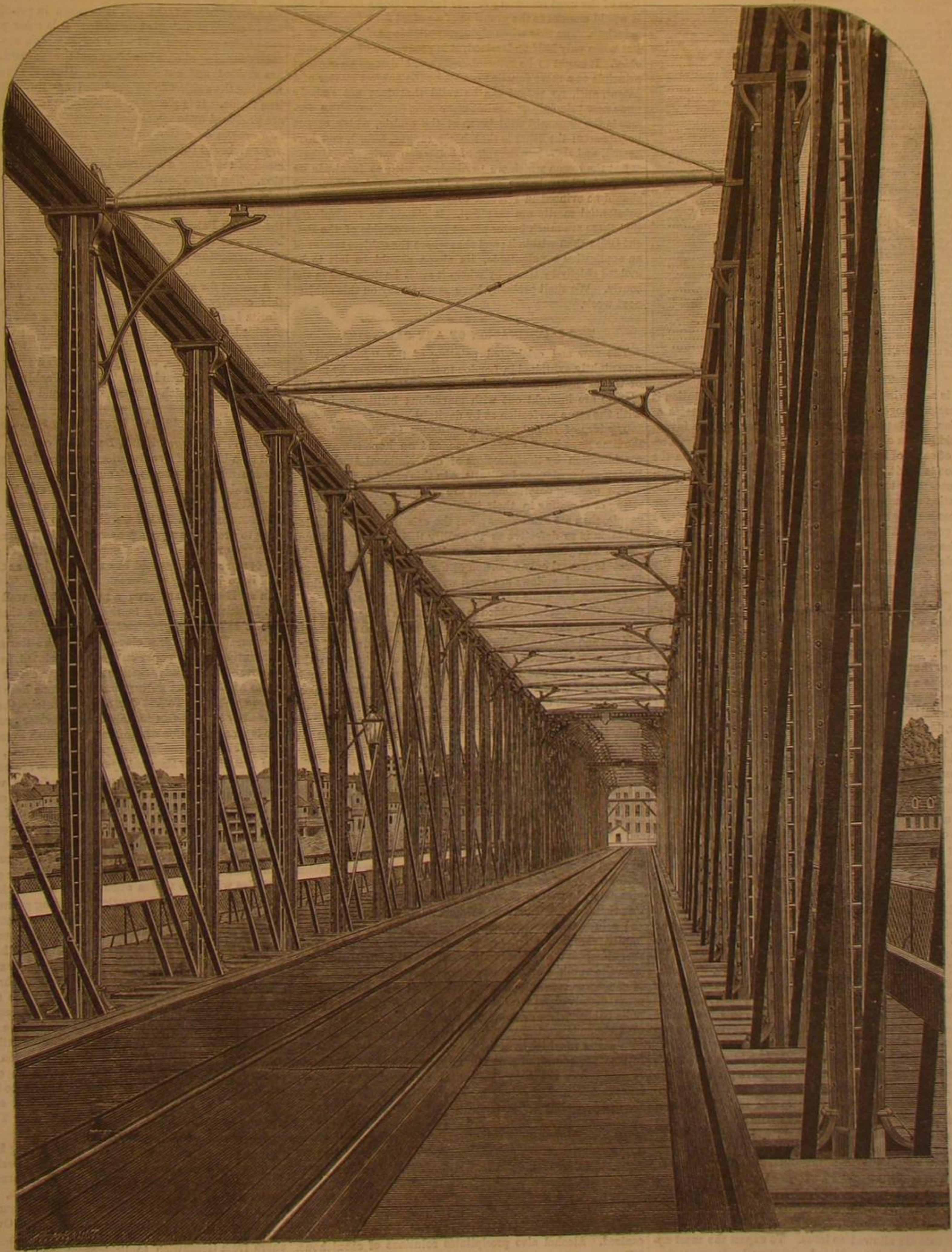
THE KEOKUK (IOWA) BRIDGE.

We give herewith an interior view of the fine wrought iron road and railway bridge which spans the Mississippi river at Keokuk, Iowa, the general appearance of which was illustrated on p. 323, vol. 30. The builders were the Keystone Bridge Company of Pittsburgh, Pa., and the designs of the superstructure were made by Mr. J. H. Linville, C. E. Beginning at the west or Keokuk end of the bridge, the spans are located as follows: Pivot span, total length of one truss, center to center of end posts, 376 feet 5 inches; opening under each arm, 160 feet, measured on the square; two spans, 253 feet 6 inches; eight spans varying in length from 148 feet $4\frac{3}{16}$ inches to 171 feet 6 inches; total length, backwall to backwall on bridge seats, 2,192 feet. It is a through bridge, built on a skew of 17° 15', with a distance between the two trusses of 21 feet 6 inches, and carries a single line of railway track and two tramways for local traffic, the track being placed in the center between the tramways. On each side of the bridge, outside of the trusses, are foot walks 5 feet wide, protected by light and substantial iron lattice railings. We extract our engraving from *Engineering*.



BRIDGE OVER THE MISSISSIPPI, AT KEOKUK, IOWA.

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VOLUME XXXI., No. 24. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, DECEMBER 12, 1874.

Contents.

(Illustrated articles are marked with an asterisk.)

THE PATENT OFFICE.

There is a growing conviction that this great institution is not conducted altogether in accordance with the purposes of its creation. Instead of being made to encourage the inventor and aid him in obtaining his patent, it seems—at least on the part of some of its employees—to be administered in the very opposite spirit. Doubts are resolved against the applicant, unnecessary technicalities are interposed to prevent the consideration of cases on their substantial merits; and where patents can no longer be denied, they are often emasculated by some prescribed phraseology, instead of leaving to the applicant the largest liberty, in this respect, which is not incompatible with the rights of other parties. And even the astonishing doctrine has been avowed—and more frequently acted on—that the decisions of the courts are not to control those of the Office, and that a patent may be denied by the latter while admitting that it would be sustained by the former.

This tendency—which is all the while increasing—must be checked, or the whole system is in imminent peril. Already has it become a matter of serious consideration whether the present practice of examinations should not be discontinued, and the functions of the Office limited to those of an advisory character, leaving to the applicant the ultimate right to his patent in his own language, subject to such conditions as will prevent him from practising successful frauds upon others. The present discontent cannot be greatly increased before some radical change in our system will be far from improbable.

These untoward results have been influenced mainly by the head of the Office. Commissioners have done more than any other individuals towards perverting the system from its legitimate purpose, so that, instead of being an instrumentality for promoting the progress of science and the useful arts, by securing to inventors the full enjoyment of their property, the Office is becoming a means of frittering away their rights to their smallest practicable dimensions, or for denying them altogether.

We do not intend to impeach in the slightest degree the integrity of any of the individuals above referred to, but merely to point out and account for some of the errors which we believe they have committed. Commissioner Fisher, who, more than any other individual, has contributed to this perversion of the great purpose of the Office, was placed at its head after an extensive practice before the courts in patent cases. His continuance in office was always regarded by him as a temporary means of securing a still more extensive practice in the future. Now the most profitable clients are the large companies, whose interests are adverse to the multiplication of patents, and who often feel annoyed at being obliged to pay royalties on the patented improvements which they desire to make use of. How natural that the attorney should sympathize with his clients and honestly imbibe their notions. How, almost inevitably, will he take a one-sided view of the whole matter, overlooking the rights and interests of the inventor and contemplating in exaggerated proportions the inconveniences felt by the great manufacturers on account of the multitude of patents that are allowed to issue. To expect the most upright mind to be wholly unbiased under such circumstances would be to look for something more than human. This is not the right training for a good Commissioner.

The tendency thus communicated from the head of the Office operated in a greater or less degree upon all his subordinates, and has influenced the course of decision ever since. General Leggett seems to have done nothing to correct these errors of administration. He followed, quite implicitly, in the footsteps of his predecessor, and perhaps also felt himself further swayed from a just perpendicular by similar influences. The present Commissioner has been in his seat for too short a time to enable us to judge whether any change of spirit may be expected to guide his course. Let him be fairly tried, and honestly judged by the result of that trial.

But an influence of a character different from that above stated often operates to produce a similar result. When an application is rejected, the case is disposed of and the object sought for is attained. Stimulated by the desire of thus ending the investigation, many minds grow more ingenious in tracing resemblances than in appreciating differences. At all events, they are apt to frame for themselves some technical rules, from which, as from official ruts, it is difficult to move them, however inappropriate to the case under consideration. One of the most common grounds for rejecting a claim is that it would amount to the granting of a patent for a function or a principle. The rule when rightly applied is perfectly correct; but when only half understood, it is productive of much mischief. It ought to be remembered that, although an abstract principle or a mere function cannot be the subject matter of a patent, still, no patent can be valid that does not embody some new principle or exhibit some new function. The former is the uncaught wild horse of the prairie, which cannot be property; the other is that horse caught, tamed, and harnessed, and therefore capable of being appropriated.

But the lesson which we particularly wish to inculcate on this and other similar subjects is that less fastidiousness should be evinced in relation to forms of expression, where substantial merits are manifest. It should be remembered that there are much better patent lawyers outside of the Patent Office than within it; and that where the subject matter of an application is patentable, its shape should be left to be molded chiefly by those by whom it must be defended in the courts. We shall probably have more to say on this subject next week.

THE ILLUMINATION OF ART GALLERIES.

The new and celebrated painting of the "Roll Call" is now nightly exhibited in London to large audiences, by means of the oxyhydrogen or lime light, and all the colors of the picture are brought out with marvelous brilliancy, in fact with the same perfection as by daylight.

The idea of illuminating art galleries in the evening by the lime light is an excellent one, and we hope it may have consideration by the directors of our National Academy of Design and analogous institutions in this country.

Few evening entertainments are in themselves more interesting or elevating in their influences, especially for young people, than art exhibitions; but the existing method of illumination is so defective as to nullify their principal attractions. The yellow color of the ordinary gas flame has the effect to reveal only a portion of the colors of the paintings. The reds and yellows are seen well enough; but the blues and greens, and their various tints, are sadly distorted, and the artistic effect lost. Added to these defects is the vitiated atmosphere of the gallery, caused by the production of carbonic acid gas and escape of unburned gas from the hundreds of jets. A feeling of lassitude comes over the visitor, interest in the pictures lessens, and relief is sought by escape from the gallery into the open air. The use of the lime light or the electric light would obviate all such difficulties, as they generate no deleterious gases. By the exercise of a little skill, we think that either of these methods of illumination might be adapted with advantage for art galleries.

SOLVENTS FOR RUBBER.

For the information of correspondents, several of whom have made enquiries on the above subject, we give the following:

The proper solvents for caoutchouc are ether (free from alcohol), chloroform, bisulphide of carbon, coal naphtha, and rectified oil of turpentine. By long boiling in water, rubber softens, swells, and becomes more soluble in its peculiar menstrua; but when exposed to the air, it speedily resumes its pristine consistence and volume. Industrially, the etherial solution of caoutchouc is useless, because it contains hardly more than a trace of that substance. Oil of turpentine dissolves caoutchouc only when the oil is very pure and with the application of heat; the ordinary oil of turpentine of commerce causes india rubber to swell rather than to become dissolved. In order to prevent the viscosity of the india rubber when evaporated from its solution, one part of caoutchouc is worked up with two parts of turpentine into a thin paste, to which is added ½ part of a hot concentrated solution of sulphuret of potassium in water; the yellow liquid formed leaves the caoutchouc perfectly elastic and without any viscosity. The solutions of caoutchouc in coal tar naphtha and benzoline are most suited to unite pieces of caoutchouc, but the odor of the solvents is perceptible for a long time. As chloroform is too expensive for common use, sulphide of carbon is the most usual, and also the best, solvent for caoutchouc. This solution, owing to the volatility of the menstruum, soon dries, leaving the latter in its natural state. When alcohol is mixed with sulphide of carbon, the latter does not any longer dissolve the caoutchouc, but simply softens it and renders it capable of being more readily vulcanized. Alcohol also precipitates solutions of caoutchouc. When caoutchouc is treated with hot naphtha distilled from native petroleum or coal tar, it swells to thirty times its former bulk; and if then triturated with a pestle and pressed through a sieve, it affords a homogeneous varnish, the same that is used in preparing the patent waterproof cloth of Mack intosh. Caoutchouc dissolves in the fixed oils, such as linseed oil, but the varnish has not the property of becoming concrete on exposure to the air. Caoutchouc melts at a heat of about 256° or 260°; after it has been melted, it does not solidify on cooling, but forms a sticky mass which does not become solid even when exposed to the air for months. Owing to this property, it furnishes a valuable material for the lubrication of stopcocks and joints intended to remain airtight and yet be movable.

POLYCHROME PRINTING.

"A remarkable innovation upon the ordinary process of color printing has just been introduced to public notice at the International Exhibition, London, by Messrs J. M. Johnson & Sons, printers, etc. The new process is perfectly distinct, in every respect, from any of this class by which it has been preceded. Although embodying some very striking features, it is in itself a very simple matter. So simple is it, in fact, that the first idea which suggests itself is: Why was it never thought of before? Briefly, it consists in printing any number of colors at a single impression; it is color printing without blocks or stones, and with colors which are not ink, the colors forming at once the block and the pigment. The colors are molded and cut into blocks, when the various pieces forming the subject to be produced are fitted together in an iron frame. It is placed on a printing press, and impressions are produced upon moistened paper. The advantages of the new system over that ordinarily practised are very marked; any number of colors can be printed at a single impression, instead of requiring a separate block or stone for each impression. The prints become perfectly dry in a few minutes," etc.

The foregoing is from a recent editorial article in *Engineering*. If our esteemed cotemporary will send 3d. over to the British Patent Office and procure a copy of Robert Reyburn's patent 14,078, April 20, 1852, it will find an answer to its interrogatory. This supposed new discovery is more than twenty years old.

A patent for substantially the same idea was applied for in this country by E. B. Larcher, but rejected, in 1868. But Moritz Laemmel was more successful, for on July 4, 1871, he obtained an American patent for the thing; which grant is chiefly of value as illustrating the little worth of our so-called official examinations, to carry on which an army of five hundred men and women is maintained at Washington, at an enormous expense, which is assessed upon and paid by inventors.

AMERICAN OYSTER CULTURE.

A short time ago, Frank Buckland counted forty oyster spat on a bunch of five American oysters, in a lot sent to the London market by some of our exporters. Such apparent disregard for the future alarmed him, and he straightway warned us, in *Land and Water*, that we were squandering our resources, and that if we did not do something immediately to protect our young oysters against rapacious oyster catchers, or to increase the supply by artificial propagation, our oyster grounds would be exhausted, just as those of England have been.

In an Englishman, even a naturalist so well informed as Mr. Buckland generally is, the assumption that oyster culture is something practically unknown in this country may be excusable; but for a clever writer like the author of the pleasantly written paper on oysters, printed in the current number of the *Popular Science Monthly*, to assert that nothing in the way of oyster culture has been done here is altogether unpardonable. To set forth so minutely the antiquated methods of Europe as models for our oyster growers to imitate is an aggravation of the fault for which even a residence on the Jersey coast offers but partial mitigation. It is fortunate that our New England oyster growers are not vindictive, else they might overwhelm our erring friend with remorse by sending him a few hundred "extras" as a sample of what are covering hundreds of thousands of acres of the bed of Long Island Sound, all natives raised from the spawn by a system of culture developed on the spot. To a writer accustomed to be accurate, however, it may be sufficiently humiliating to learn that of late years the finer grades of the varieties which he writes about with such enthusiasm have been transports from Connecticut breeding grounds, the fruit of a culture which he declares to be non-existent.

The French experiments in this line have been public undertakings, officially reported on: with us they have been the work of unpretending oystermen, whose aim was oysters, not fame; and having accomplished their object, they have gone about their business, quite unconscious of the service they were rendering the country. The consequence is that, though the business has developed to enormous dimensions, those not directly engaged in the work know little or nothing about it; and even those who have taken upon themselves the task of writing up the oyster trade of the country have missed its most important feature, by going to the markets instead of the oyster grounds for information, or by assuming that methods which prevail south of New York are also those of the East.

Ever since the country was first settled, Long Island Sound has been noted for producing oysters of superior size and quality. They are of the northern species, characterized by great breadth and thickness, firm white meats, and delicate flavor, qualities which the southern oyster cannot rival even when transplanted into the same waters. Owing to the streams which freshen the water along the Connecticut shore from Greenwich to Bridgeport, and to a less degree farther east, where the influence of the open sea is more strongly felt, the oysters along this coast attain a quicker and finer development than elsewhere, the culminating point being in the swift channels among the rocky islands off Norwalk—the home of the original "Saddle rocks," the "Sounds," and other standard varieties: all the same oyster though differing, in size, shape, color, and flavor, with the position and character of their bed and the accidents of their development.

Twenty years ago, the oyster business of this region was carried on precisely as described in the *Popular Science Monthly*; that is to say, artificial propagation was unknown, and, when the native grounds were exhausted, the supply was kept up by restocking them with "seed," or small oysters brought from the Chesapeake Bay or the Hudson river. Among the oystermen of Norwalk at that time were the Hoyt Brothers, young men who brought to the business more than the usual allowance of brains. Not satisfied with merely handling oysters, they sought to understand them, studying them in the water and out of it with a persevering directness that would have delighted the heart of Agassiz. Observing that native spat would sometimes settle upon seed brought from abroad, they set to work to discover the conditions of such fixing of the spawn, rightly arguing that, the secret once penetrated, they might save themselves the trouble and cost of going elsewhere for seed, besides securing a better breed of oysters.

Had they known anything of European experiments in oyster culture, they might have got on faster at first: they might also have been led astray and discouraged, as others have been, by fruitless imitations of foreign methods. The climatic and other conditions here are so unlike those of France or Italy that entirely different methods of oyster culture are required. On the whole, therefore, it was fortunate that the Hoyts had to begin at the bottom and learn everything by personal observation and experiment. It was fortunate, too, that with Yankee common sense they pitched upon the master key to the problem at first, and sought to discover the natural conditions of oyster propagation on their own grounds. One year the Sound's bed will be literally covered with oyster spat; the next, it may be, though the oysters spawn as abundantly, scarcely a young oyster will be found. Again there will be a year, like 1873, when there will be no spawn. Their problem, it will be seen, was no easy one to solve.

After much study of oysters and oyster grounds, and many trials with different materials for fixing the spawn, our experimenters learned at last that the securing of a crop of seed depends upon two essential conditions: first that the parent oysters spawn; second, that, at the time of spawning, the floating spat must have presented to them something clean to which to attach themselves; it may be stone, shell, glass, iron, wood, leather, anything, in short, provided it is perfectly clean. The first great point in artificial oyster propagation is therefore to know just when to have the stools on the ground. The time of spawning varies with the season, the position of the bed, and the depth of water over it, so that it requires close watching, with frequent dissections, to determine the precise moment when the spawn begins to run. If the stool is presented too late, the spawn is lost and the stool worse than wasted; if too soon, it is equally thrown away, since it becomes covered with white slime in a few days, and then the spat cannot strike. Sometimes a heavy storm at spawning time comes to the aid of the oyster farmer, and adds immensely to the productiveness of natural beds: it churns up the gravel and shells on the bottom, scours them clean, beats the slime off the rocks, and brightens things generally for the reception of the coming spat. Last summer the spawn was abundant; the natural conditions for its lodgment were unusually favorable; and if the starfish and other enemies of the oyster do not destroy the crop, it will be an unusually productive one. But we are getting ahead of our history.

Having come to the conclusion that clean stools at spawning time were the one thing needed to fix the native spawn, the Hoyt brothers gathered up some thousands of bushels of weather-worn shells and scattered them over their grounds. Naturally they were laughed at by "practical" oystermen, who had been in the business for years and knew "all about it"; while other men threatened them with all sorts of penalties for filling up the channels and otherwise interfering with the natural order of things. Their venture, however, proved eminently successful; the clean shells were quickly covered with spat, and sixteen years ago they reaped their first crop of artificially propagated oysters.

There is nothing that commands respect like success. Seeing the result, those who had scoffed at the method were eager enough to try it. A new impetus was given to the oyster business. Exhausted oyster grounds were restocked, and miles of hitherto unproductive ground were brought under cultivation. From Greenwich to Westport there is not a break in the oyster beds, the great bulk of them owing their existence to artificial propagation.

The stools chiefly prized are shells and screened gravel, ranging in size from a hickory nut to a hen's egg. The fragile amber-colored shells which abound throughout the Sound—the oystermen call them "gingles"—make excellent stools: so do scallop shells, boat loads of which are brought from the Rhode Island shore for this purpose. Large stools are less desirable, since the oysters crowd and pinch each other on them, and the bunches are harder to separate when the time for transplanting arrives. Still in many cases it is necessary to scatter comparatively large shells and stone, among the finer shoals, their action being apparently to create little rests or eddies in the water flowing over the bottoms, thus enabling the spawn to strike.

In the costly tile and cone devices for taking spat, employed by the French systems, which have, by the way, superseded the methods described in the *Popular Science Monthly*, the fixing of a few hundred thousand spat is accounted something wonderful; and much to the amusement of our oyster growers, American newspapers have copied French reports, wonderment and all, when within an hour's ride of their publication offices are breeding grounds of many acres, sown with spat in countless millions. Our oystermen number such small things only by the bushel. Over large areas, this year's seed is so plentiful that an ordinary "drag", holding a bushel or more, will be filled by drawing it loosely over a strip of bottom a yard wide and a rod long. A bit of shell as big as one's finger nail will carry perhaps half a dozen spat, and as many as sixty or eighty may be counted on a single valve of an oyster shell.

The diminutive breeding grounds which the French make so much of—creeks and puddles, we have heard them called by men accustomed to the larger spaces under cultivation here—compare with those of Long Island about as a kitchen garden with a Californian wheat farm. The difficulty along the Connecticut shore is not in propagating the oyster—that is easy enough now—but in maintaining the crop until it is mature. It is only by the most persistent warfare against star fish and other oyster enemies that uniform success is possible.

In another article, we propose to describe more minutely the processes of oyster culture and the effects of it, also the obstacles which our oyster breeders have to contend with.

THE COAL AND IRON PRODUCTS OF THE WORLD.

M. Gruner's report on the coal and iron industries of the world, which has lately appeared in France, is a document evincing laborious research, and one which, to the student of political economy and to the statistician, cannot but be of the highest practical utility. The author was a member of the International Jury at the Vienna Exposition, and it has been his object to compare the conditions of the two great industries as existing in 1873 with their state at the time of the French Exposition in 1867. While we cannot follow the details of the long report, there are, nevertheless, many general results and conclusions which will prove both instructive and interesting.

M. Gruner estimates the entire fuel production of the world at 250,000,000 tuns, and he calls attention to the fact that the value of the mineral combustible annually consumed largely exceeds that of the ores mined. In England, in 1871, the total coal yield was valued (in round numbers, which for convenience' sake we shall use throughout this article) at $92,000,000, while that of all the other mineral products, including refractory clays, marine salt, phosphorites, etc., did not exceed $62,000,000. In Germany and France the same excess in favor of coal also appears. Throughout the entire world during 1872, the author places the value, of all the minerals but fuel, mined at $320,000,000: of the fuel at $620,000,000, or nearly double.

Referring to the English coal production, the author states that, for the forty years from 1831 to 1871, the ratio of increase has been as from 1 to 6. The present rate of production per workman is about 299 tuns per annum in England, 220 in Prussia, 159 in France, and 157 in Belgium. It is believed that these figures will never exceed 300 tuns in England, and 160 in France and Belgium; so that, estimating by the present English yearly increase in fuel mined, in the year 1910 fully 2,000,000 men will be actively engaged in the industry. This is hardly possible, since the above number of working men support a population five times greater; and for this aggregate to be maintained by a single industry, there must be a corresponding increase in all the other branches of English labor. Hence, from the nature of things, a maximum of coal production must be eventually reached. Regarding the final exhaustion of the English mines, the author places their duration at 750 years.

The aggregate production of 250,000,000 tuns in 1872 is made up by the various countries in the world contributing as follows: Great Britain, 123,000,000; United States, 40,000,000; Germany, 40,000,000; France, 15,900,000; Belgium, 15,600,000; Austria and Hungary, 10,000,000; Spain, 1,000,000; Russia, 800,000; and English colonies, China, Chili, and Japan, 3,700,000. It is believed that within thirty years the American coal production will exceed that of England; but the indefinite increase of the yield, it is thought, will be prevented by the absence of a corresponding increase in the demand, in the same manner as in Great Britain.

After thus dealing with coal, the subject of iron is discussed, and the value of its ores stated to exceed that of all those of other minerals save gold. At a minimum, the annual value is placed at $70,000,000, or $2 per tun on the aggregate extraction of 1872. From the 35,000,000 tuns then mined, 14,000,000 were made into cast iron, 8,500,000 into rolled or forged iron, and 1,000,000 into homogeneous iron and steel. On comparing these figures with those given for 1865, the iron production is shown to have become still more rapidly developed than that of coal. In seven years the coal yield increased from 9 to 12·5, while that of iron increased from 9 to 14. The steel manufacture has tripled in the same period.

THE Pittsburgh *Commercial* explains the origin of a very foolish, sensational story as to the possibility of Pittsburgh being destroyed, wholly or in part, by the caving-in of the soil from the action of subterranean fires. It is merely a deserted coal pit, which has been smoldering for 30 years past, without damage or danger.

THE death is announced of the General Marquis de Laplace, son of the great astronomer, at the age of eighty-five. He began his military career under the first French Empire.

TO OUR PRESENT AND FUTURE SUBSCRIBERS.

We call the attention of our subscribers, and the public generally, to the new prospectus of the SCIENTIFIC AMERICAN, for the year 1875, published on another page of this issue.

In about ten days, each one of our mail subscribers will receive a handsome subscription list, printed in colors, a catalogue of publications issued from this office, and a chromo pocket calendar for 1875. The publishers of the SCIENTIFIC AMERICAN will esteem it a personal favor if every present subscriber will take the trouble to circulate the subscription list when he receives it, and ask some of his friends to join him in taking the paper for the coming year.

Notwithstanding that the SCIENTIFIC AMERICAN has a much larger circulation than any paper of its kind ever attained, and the fact that each year its sale increases several thousands over that of the previous year, we believe that it merits a still larger patronage; and we shall not be satisfied until its weekly issue reaches one hundred thousand copies.

Next week we shall print both our Special Edition and the regular issue, amounting to ONE HUNDRED AND FIFTY THOUSAND COPIES, and we shall commence the new volume by printing fifty thousand every week, relying upon our old friends and subscribers to furnish new names, enough, with the renewal of their own subscriptions, to enable us to exceed that number soon after the commencement of the year.

The public attention is called to the inducements for new subscribers, published in the prospectus already alluded to.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE CHEMICAL EFFECT OF THE PHYLLOXERA ON GRAPE VINES.

To those who may be experimenting in search of a remedy for the phylloxera, so as to gain the $60,000 reward offered by the French government, the following table, showing the chemical effect of the insect upon the vine, will be of interest, and perhaps may lead to a more intelligent investigation

	Healthy vines, per cent.	Attacked vines per cent.
Bark of fresh roots: Cane sugar.........	2	0
Glucose.............	0	1
Fresh roots without bark: Albumen.....	2	0·6
Oxalic acid...	17·80	4·04
Roots dried at 212° Fah.: Pectic acid....	6·20	1·96
Tannin.........	9·60	7·68
Radicles dried at 212° Fah: Carbonate of potash	1·48	0·428
Total ash.............	6·42	12·85
Leaves dried at 212°, collected in June: Carbonate of potash	1·35	0·72
Total ash...........	8·80	2·95
" collected in September: Carbonate of potash ...	0·72	0·39
Total ash...........	13·25	13·00
Branches dried at 212°: Carbonate of potash	1·90	0·26
Total ash..........	3·45	3·49

RECENT EXPERIMENTS ON EXPLOSIVES.

In experimenting upon dynamite, not long ago, M. M. Roux and Sarrau found two kinds of explosions. The simplest, or, as it is termed, of the second order, is caused by the ordinary inflammation of the substance; the explosion of the first order, or detonation, is produced by the percussion of a powerful priming such as fulminate of mercury. These two explosions are such that the same quantity of the substance, deflagrating in the same capacity, causes therein very different pressures. Later investigations prove that this remarkable quality of dynamite belongs also to the majority of explosives. Nitro-glycerin, pyroxylin, picric acid, and the picrates of potash, baryta, strontium, and lead, detonate by fulminate of mercury. Ignited with an Abel capsule (or when this does not suffice, with a small quantity of powder), an explosion of the second order is produced.

Gunpowder, either in grains or in a dust, does not detonate with fulminate of mercury; but by using nitro-glycerin as an auxiliary detonator, itself being excited by the fulminate, an explosion of the first order is obtained in the powder, very different from the ordinary explosion. This takes place under all the conditions in which gunpowder is commonly employed.

ZINC A PREVENTIVE OF BOILER INCRUSTATION.

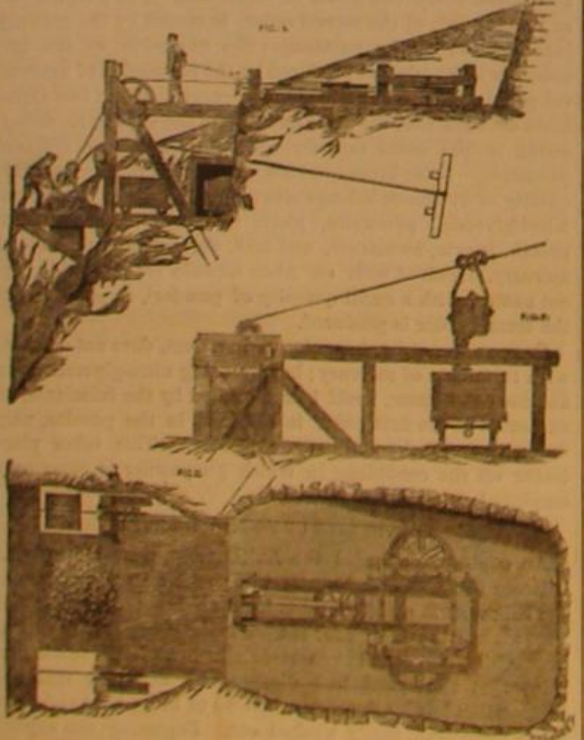
An engineer on board the *St. Laurent*, a steamer plying between this port and France, after making some repairs in the boilers, left accidentally therein an ingot of zinc. Some time after, in searching for the bar in the generator, in which, meanwhile, steam had been maintained, he found to his surprise that the metal had disappeared, and also that the incrustation left by the water, instead of being hard and firm, was a mere mud, easily washed out. Repeating the experiment over another voyage, the same result was reached. M. Lesueur, of Angers, France, after examining into this circumstance, thinks that the zinc forms a voltaic couple with the iron of the boiler, zinc being the negative pole and the iron the positive. It then happens, as in all batteries, that the zinc is consumed; while the iron is protected both from oxidation and dissolution.

WE are informed that the Attorney General has considered the question, whether the subscribers to the Patent Office Tea Party Testimonial are liable to the penalty prescribed in the Act of Congress in such cases. It is further stated that, for reasons of State, the decision is withheld from the public. Can any one inform us whether there has really been any official action in the matter?

WIRE TRAMWAYS.

The use of wire rope ways for transporting minerals, etc., especially in hilly countries, is becoming very general, and a company is now constructing them in many parts of the world, an improved design by its engineer, Mr. W. T. H. Carrington, being usually adopted. We give herewith a view of the line erected in Norway, in the iron mines at Aalsund. Many such mines have been for a long time worked only to a very small extent, or even left unworked, owing to their being placed at such inaccessible spots as to preclude the possibility of economically transporting the ore to a port of shipment. Frequent examples of such are found on the coast of Norway, situated high up among the mountains, which tower above the numerous fiords which indent its seaboard. The only approach to these mines consists of a rugged and zigzag road, quite unfit for the carriage of any large quantity of mineral, and, owing to the extreme steepness of the mountain side, often leading a circuit of many miles to reach a spot which is less than half a mile distant in a straight line. To accommodate such cases an arrangement of wire rope incline has been designed and successfully worked, as shown in the engravings, the details being represented in the second illustration. It consists of two steel ropes of about 40 tuns breaking strain, fixed at the mines and stretching direct to the small pier at the foot of the mountain, spanning a distance of 750 yards without support. On it are run two cages with small grooved wheels, in which are placed about 12 cwt. of iron ore, the fixed ropes being kept in tension by means of weight boxes at the bottom. The loaded cage is made to draw up the light one by means of a light steel rope, which passes round suitable brake sheaves at the mine, and by which the speed of the descending load is governed. On arriving at the bottom, the cage is discharged into a large truck ready to receive the ore, which, when full, is, in its turn, discharged into the ship to be loaded. The light cage has, meantime, arrived at the top, and, being filled, is allowed to descend, and to draw the emptied cage up. The incline is an angle of 45 degrees, and the speed at which the cages are run is about 15 to 20 miles per hour. By this means about 100 tuns per ten hours are transported at a very low cost, the only expense being the men required to work it, namely, about three at the top and two at the bottom.

WIRE TRAMWAY AT THE IRON MINES, AALSUND, NORWAY.



The Detection of Suet Butter.

We have had occasion repeatedly to allude to the various imitations of butter, mainly compounded of suet, which have found their way into our markets, sometimes under fanciful names which indicate their composition, and in some cases marked as and purporting to be the genuine article. Owing to the determined opposition of the butter and cheese trade of this city, but little, we believe, is here consumed; but it is credibly stated that quantities are shipped to the South and to other sections of the country, where a less careful supervision is exercised over the quality of the staple or the condition of the markets. We also learn that, of late, various disagreeable compounds, known in England as "French" and "Australian" butter, have been imported into this country by British dealers desirous of avoiding penalties under the adulteration acts of their own nation; so that altogether it would appear that there is sufficient of the artificial material in the United States to render the following method for its detection valuable to merchants or consumers who desire to avoid investments in it.

Mr. John Horsley, F. C. S., furnishes to the *Chemical News* a record of the results of recent experiments, which were directed toward the detection of meat fats mixed with butter, and therefore the process indicated will prove useful both to those suspecting such adulteration in genuine butter, as well as to others who are not sufficiently expert to distinguish the artificial from the inferior qualities of the real article.

Fresh butter is permanently soluble in methylated ether of specific gravity 0·730 at the temperature of 65° Fah. With the view of determining whether any other substance contained in the butter could be precipitated from it, Mr. Horsley first placed 25 grains of the fresh material in a test tube with 1 dram of methylated ether, in which ready solution took place. Thirty drops of methylated alcohol, 63° over proof, were added, and the whole agituted, but nothing was precipitated. The experimenter then mixed 10 grains of fresh butter with 15 grains of mutton fat, and added the liquids as before, when, in less than half an hour, the fat was precipitated, the heat of the room being 68° Fah. Lard, beef, mutton, and tallow fats, properly melted together in proportions of 60 grains of butter and 40 of fat and stirred until cold, can each, by a similar operation, be precipitated in a few minutes. As much as 30 per cent of the fat first used has thus been recovered. This is a simple and direct way of dealing with such adulterations, and is superior to the process of estimating the butyric acid. It should be observed, however, that crystallization of butter out of the ethereal solution at a lower temperature than 65° must not be mistaken for the fats precipitated by the alcohol alluded to, since the butter, besides being so much lighter, occupies the upper layer, and is different in character and easily remelted by the application of the warm hand for a minute or so.

The One Rail System.

A contract has been taken by Messrs. Whittaker & Woodward to build a railroad on Crew's prismoidal one track system, from the depot in Austin, Tex., to some quarries near that city. It is built by the contractors at their own risk, as an experiment, and, if successful, is to be paid for at the rate of $4,000 per mile.

We have heretofore illustrated this novel style of railway. We have no doubt as to the success of the above example. The Crew plan is one of the cheapest and best plans for railways that has been devised.

A Large Trip Hammer.

The largest trip hammer in the United States has recently been completed at Nashua, N. H., at an expense of $75,000. The weight of iron used in it is about two hundred tuns. The ram weighs twelve tuns, its striking force is about one hundred tuns, and four large boilers are brought into use to furnish steam to run the six hundred horse power engine required to successfully operate it. The immense crane, with which the iron that is manipulated is hoisted into position, is the largest in the country, and is rigged with modern mechanism, so nicely that two men can easily hoist fifty tuns dead weight.

The above devices are pigmies in comparison with some of those used in England and on the Continent. For example, the new hammer at Woolwich, Eng., made by Nasmyth, Wilson & Co., weighs forty tuns, and its blow under steam is equivalent to a fall of that weight from a hight of 80 feet. The actual force of the blow has not yet been determined. The total weight of the machine is 665 tuns, and its cost $250,000.

Coppering of Iron Rollers for Calico Printing.

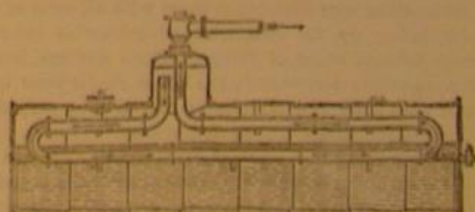
Th. Schlumberger cleanses the iron cylinders with a concentrated alkaline ley, washes well in water, and goes over the whole surface with the file. The surface is then very bright, and is not to be touched with the finger or soiled with the breath. It is then plunged in an alkaline bath composed of: Sulphate of copper, 1 part, dissolved in water, 12 parts; cyanide of potassium, 3 parts; carbonate of soda, 4 parts, sulphate of soda, 2 parts, dissolved in water, 16 parts. Or: Ammonia, 3 parts, acetate of copper, 2 parts, dissolved in water, 10 parts; cyanide of potassium, 3 parts, carbonate of soda, 4 parts, sulphate of soda, 2 parts, dissolved in water, 10 parts. The cylinder is allowed to remain twenty-four hours in one of these baths, subject to the action of a battery of four or six pairs, till the surface is coated with a slender but adherent layer of copper. It is washed and cleansed with pumice stone. If in this operation the iron should be laid bare in any part, the cylinder must be anew submitted to the alkaline bath. As soon as the coating of copper is uniform, it is washed in acidulated water and immersed in an acid bath of sulphate of copper. This bath is composed of solution of copper at 20° B., to which $\frac{1}{300}$ of its volume of sulphuric acid is added to facilitate the solution of some metallic copper, which is also immersed in the bath for the purpose of maintaining the solution in a uniform state of concentration. Here the cylinder is left till the layer of copper has attained the desired thickness, a galvanic current being kept up by a battery of four pairs. If the temperature is between 60° and 65°, three to four weeks are required to produce a deposit of one thirty-third of an inch in thickness. The cylinder is turned one quarter round daily to change the portion of its surface which faces the sheet of copper used as a positive electrode.

A Good Suggestion.

A writer in the London *Builder* suggests that thick glass might be easily and cheaply cemented to the walls of hospitals, etc. It would be non-absorbent, imperishable, easily cleaned, readily repaired if damaged by accident, and, unlike paper and paint, would always be as good as at first. Glass can be cut or bent to conform to any required shape. If desired, the plates may colored any cheerful tint. The non-absorbent quality is the most important for hospitals and prisons, and, we should think, is worthy the consideration of architects.

A DEVICE FOR PREVENTING PRIMING.

The difficulty of securing the dryness of steam, as it leaves the boiler, has lately engaged much attention, and many devices for the purpose have been invented. We give herewith a sectional view of one of the latest, which is the idea of Mr. Robert Johnson, of Haughton Place, Bradford, England, and which has already been successfully applied by him to a



number of boilers. The arrangement—to which Mr. Johnson gives the name of anti-primer—consists simply of a pipe extending from the dome down into the barrel of the boiler, the whole length of which it traverses below the water line, then returning again to the dome, where it joins the stop valve through which the steam is drawn off. As seen from the engraving, the steam on its way from the boiler has to traverse the pipe, and during its course any water which may be mixed with it is evaporated by the heat communicated from the surrounding steam and water through which the pipe passes. The arrangement can be easily fitted to existing boilers, and we hear, says *Engineering*, that it has given very good results.

THE *jaborandi* is the name of a Brazilian plant, which, it is said, has lately been found to be the most powerful known sudorific. It is stated that the medicine therefrom is effective against even *rabies*.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER IV.

Continued from page 339.

For the many interesting details connected with this great work, that have been already published by us, with engravings, the reader is referred to the SCIENTIFIC AMERICAN of November 14, 1874, page 307, where the series begins. In our last paper on the subject, page 338, we printed engravings and descriptions of the novel iron beam tunnels. We now come to the masonry tunnels, which start at the end of the beam tunnel, 24 feet 9 inches south of the south side of 67th street, and extend thence 1,150 feet, to a point 29 feet 2 inches north of the north side of 71st street. By reference to the profile of the road, published in our impression of November 14, 1874, it will be seen that, at 66th street, the grade of the avenue commences to ascend a pretty high ridge, thus increasing the headway so much that the difference of railway and avenue grade is 25 feet at 67th street, 33 feet at 69th street, and 23 feet at 71st street. The hight of the main central tunnel is 21 feet in the clear from railroad grade to the crown of the arch, which thus, at 67th street, gives the ventilating shaft a depth of 4 feet, and at 71st street, a depth of 2 feet.

Like the beam tunnels, the brick tunnels consist of three parallel tunnels, a large central one and on either side a small single track tunnel, having no connection with the central tunnel save by an occasional manhole and the ventilators to be hereafter described. The roofs of the tunnels are semicircular brick arches, resting on four stone abutments. The two outer abutments, which form a continuation of the outer rubble walls of the beam tunnel, are founded 3 feet below railroad grade, and are 6 feet in thickness up to grade, where an offset 6 inches back and front occurs, giving a thickness of 5 feet, as shown in Fig. 12. From this point the wall rises 8 feet and 6 inches to the springing line of the arch, vertical in the inner face but battered on the back ⅝ of an inch to the foot, which gives the wall a thickness at the springing line of 4 feet 6 inches. The backs of these walls, however, are carried up 5 feet above the springing line, as shown in Fig. 12, which is a cross section of the tunnel, and the spandrels are filled in with rubble masonry. The masonry of these abutments is gneiss rubble work, laid in cement mortar, with vertical and horizontal joints on the face, the stones being moderately well dressed.

The two inner abutments, which form a continuation of the two inner brick walls of the beam tunnel, are also founded 3 feet below railroad grade, but with a thickness below grade of 5 feet 6 inches. At the grade line, the offset of 6 inches, back and front, again occurs, giving them a thickness of 4 feet 6 inches. From this breadth of bottom, they taper off, with a batter on each face of about ¼ of an inch to the foot, to a thickness of 4 feet 2 inches at the springing line, which is also 8 feet 6 inches above the railroad grade. These abutments are also constructed of gneiss rubble masonry, of the same class as that used in the outer abutments and retaining walls. On top of the four abutments rest three semicircular brick arches, forming the roof of the three tunnels. Each of the arches of the two side tunnels has a span of 16 feet in the clear, from abutment to abutment, and 8 feet rise. These tunnels have thus a width 3 feet greater in the clear than that of the corresponding tunnels in the beam tunneling. Their hight from grade to the crown of the arch is 16 feet 6 inches in the clear. The arch is formed of brick, laid in the usual way and keyed with stretchers, well laid, and has an uniform thickness of 20 inches. The arch spanning the large central tunnel has a span of 25 feet and a rise of 12 feet 6 inches. It is also of brick, laid in the usual manner, but of varying thickness. Its general thickness is 20 inches, but for a distance of 3 feet north and south of the ventilating shafts, its thickness is increased 4 inches, thus forming a kind of rib, 16 feet broad by 4 inches thick. The necessity of this thickening of the arch will appear obvious by a glance at Fig. 13, which represents the tunnels and ventilator, where the thickness is indicated by the dotted lines of the central arch. The spandrels are filled in with rubble masonry and thoroughly drained with clay pipe drains 6 inches in diameter and placed every 50 feet. The backs of the arches are covered with three-ply felt and roofing cement. The centering used in building these arches does not differ so greatly from that in common use as to warrant a detailed description. As regards the manner of joining these arched brick tunnels to the flat roof beam tunnels, it may be mentioned that this connection is always made at one of the rectangular openings which are placed in the roof of the beam tunneling. Thus, for example, the brick tunnel we are describing begins at a point 24 feet 9 inches south of the south side of 67th street, at which point the opening in the beam tunnel ends, the face of the brick tunnel acting as part of the retaining wall of the opening. Some idea of the excellence of the work may be fonned from the following fact: Although the work was carried forward with such expedition that the centering was knocked away but a few hours after the arches were turned, and the arches in their green state loaded with earth, sometimes to a hight of eight feet above the street grade, the greatest settlement has in no case exceeded one quarter of an inch, while in many places no settlement whatever is appreciable, though levels have been taken several times. Such a result, after such a severe test, is one most flattering to the engineers and contractors.

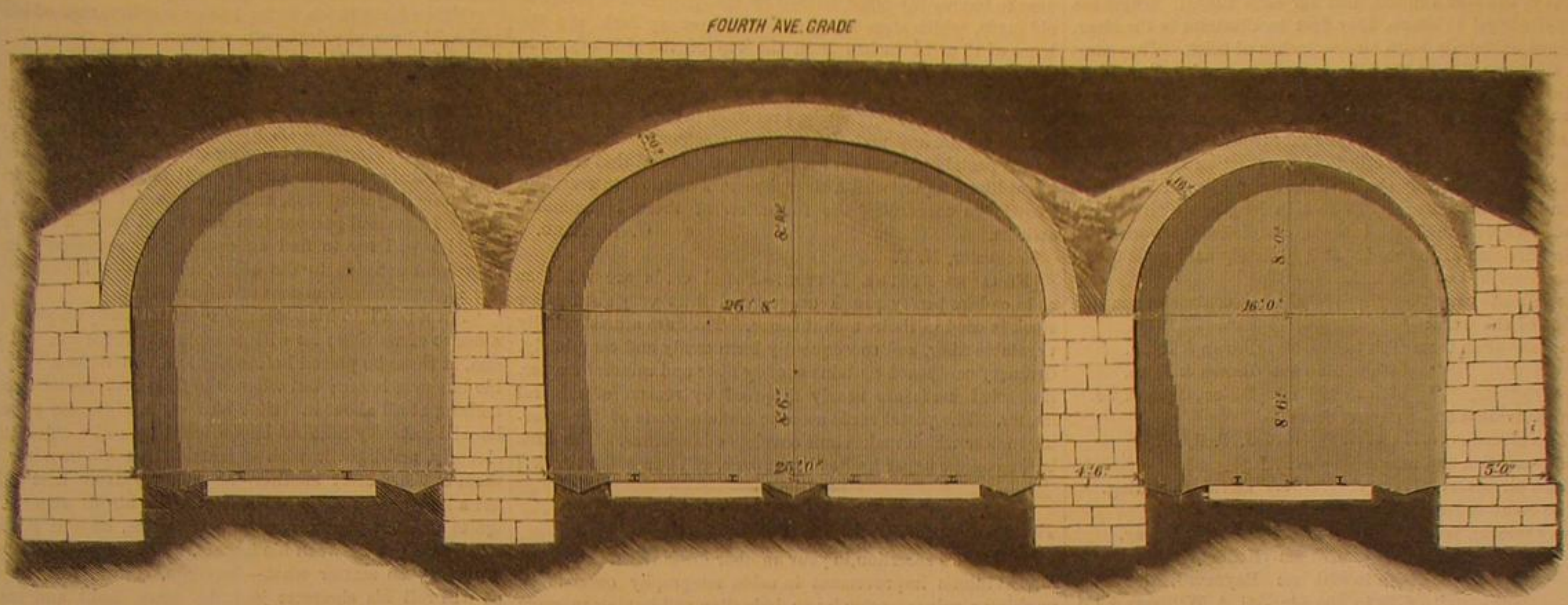


Fig. 12.—THE UNDERGROUND RAILWAY IN NEW YORK.—CROSS SECTIONS OF THE MASONRY TUNNELS.

In front of the Normal College, which fronts the work on Fourth avenue at 69th street, the work on this tunnel was carried on both day and night. The tower of the college stands within a few feet of the tunnel walls, and the excavation for the latter was carried 21 feet below the tower foundation. The total depth of the cut was 33 feet. Not the least injury to the college walls ensued. This portion of the work was done during the protracted drought of the last summer, which was most favorable to its success. The side abutments were raised just as fast as the earth was taken out.

The manner of ventilating these last tunnels is quite a simple one and clearly shown in Fig. 13, which gives a section of the tunnel through one of the ventilators. Those of the central tunnel consist of cylindrical shafts or openings, buit

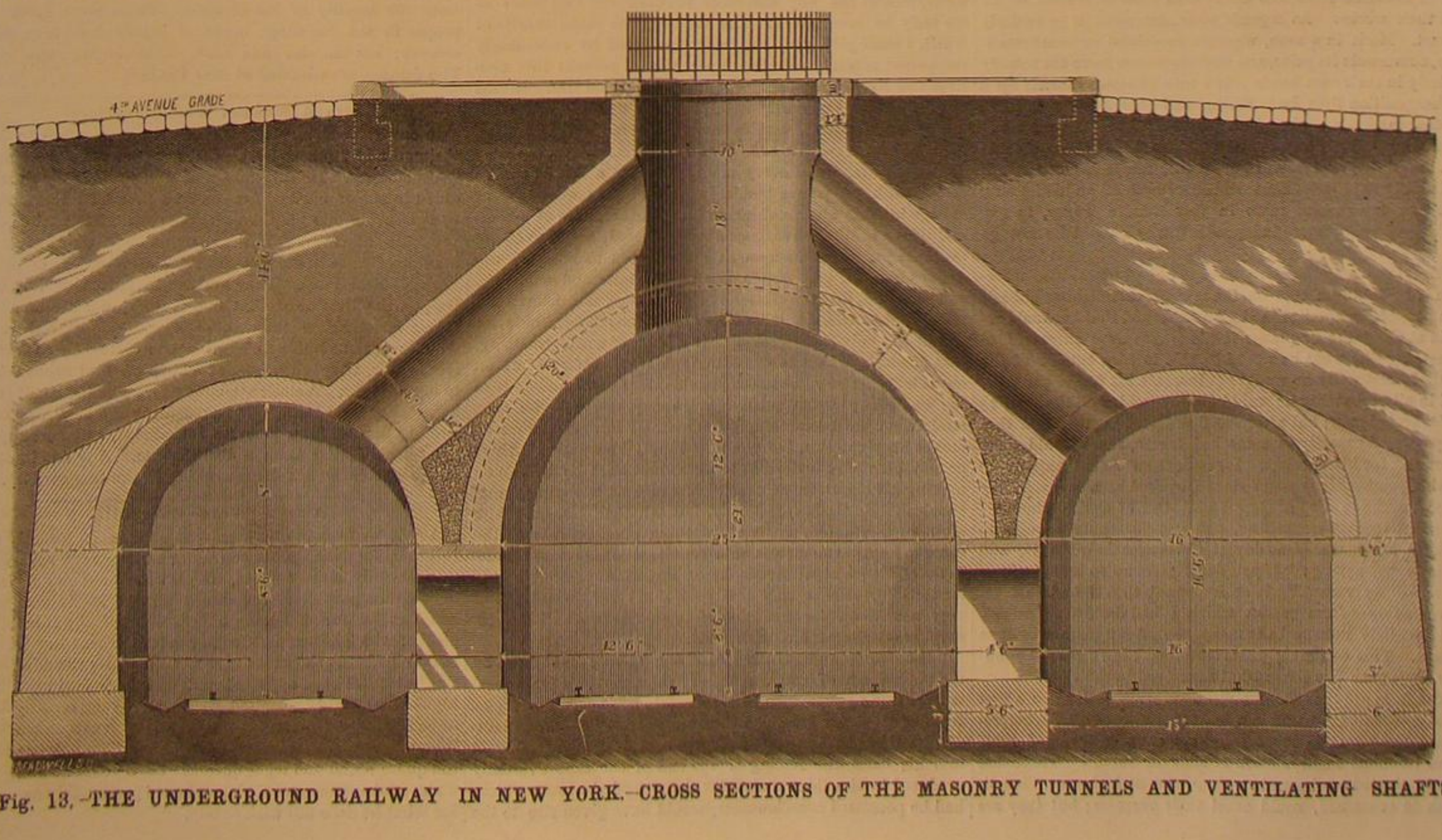


Fig. 13.—THE UNDERGROUND RAILWAY IN NEW YORK.—CROSS SECTIONS OF THE MASONRY TUNNELS AND VENTILATING SHAFTS.

in the crown of the arch, 40 feet apart from center to center, extending from the surface of the street to the roof of the tunnel; they are ten feet in diameter in the clear and lined with brick throughout their whole extent. The thickness of this brick lining varies in the manner shown in the figure. At the street level, this opening is coped with granite coping 10 inches by 18 inches, which is in turn surmounted by an iron railing three feet six inches high, consisting of wrought iron uprights, one inch square, pointed at the top. These uprights are alternately three and six inches above the top rail and are placed four inches apart. The top and bottom rails are one and one half inches by half an inch cross section.

Into the sides of this large ventilating shaft, enter the ventilators of the side tunnels, one for each tunnel. These are also cylindrical in shape, four feet in diameter in the clear, and lined uniformly with twelve inches of brick. They start from the inner side of the side tunnels, some four feet seven and three quarters inches above the springing line, and run out at an angle of 45°, entering the large shaft four feet four and a half inches above the inner face of the central tunnel, which gives them an elliptical cross section at their opening into the ventilating shaft, as shown in Fig. 13. The piece of iron beam tunneling, 2,825 feet in length, which extends northerly beyond the brick tunnels, completes the work upon the first division of the road. It is precisely analogous to the portion described on page 338.

The following are the names of the sub-contractors on this division of the work:

Earth excavation from 49th to 56th sts..Brown & Ryan.
" " " 56th to 67th sts..Brown & Ryan.
" " " 67th to 73d sts..Dillon, Clyde & Co.
Earth excavation and masonry from 73d
to 77th streets........................J. C. Ryan.
Earth excavation and masonry from 77th
to 79th streets........................David Flemming.
Rock excavation from 49th to 56th sts..P. Sessiors.
Masonry (stone), from 49th to 56th sts..Blake & Ripley.
" " " 56th to 67th sts..Redfield & Whittlesey.
" (brick), " 56th to 67th sts..Raymond, Rice & Co.
" (both), " 67th to 73d sts...G. A. Williams & Co.
Iron work from 56th to 67th, and from 73d
to 79th streets........................Watson Manfg. Co.

CORRESPONDENCE

The Mechanic of the Future.

To the Editor of the Scientific American :

In your issue of December 5, you have an article with the above caption, commenting upon the difficulty of finding mechanics qualified to undertake the direction of special works requiring the application of their technical experience in new lines, and you give, as a reason for this difficulty, the animosity of trades' unions to the elevation of their members. I do not dispute this position, for it is not in my line of experience, but may I not take the liberty to point out the fact that there are plenty of skilled mechanics, outside of trades' unions, who are ready and willing to fill any situation they are qualified for? If your correspondent had made a direct appeal to the trade at large, he would not have been disappointed.

You also remark that the ambitious and skilled mechanic leaves his shop and establishes himself as a professional man, living on fees instead of wages, to the detriment of the interests of manufacturers who desire this class to remain to direct their works. As regards your statement, it is entirely correct. Merit in a man, whether machinist or mathematician, commands its price, and manufacturers have the remedy entirely in their own hands. If a man educates himself for a higher position than he is filling, and obtains an opening in another market, in what does he differ from the manufacturer who sells his wares at the highest price he can obtain? If a machinist, by reason of his skill, comprehensive mind, and ability to judge of cause and effect better than his fellows, sees that he can earn more in fees than in wages, to say nothing of being more independent, why should he not go for the fees?

Would any manufacturer listen to one of his skilled workmen if he told him that he thought of establishing himself as a possible competitor in the business, and that he would remain at the lathe or planer if his wages were increased to something like what he would be able to earn outside of the works? Naturally he would not increase his wages one cent, and in all probability he would discharge him on the spot as a disaffected man; but after the disaffected man showed that he possessed capacity in a marked degree, there would arise a demand for his services. I speak from actual experience on this point. Many years since I worked at a lathe in the largest machine shop in New York. Out of working hours, I practised in another calling, and was fortunate enough to make it a success. One day the manager heard of it, and came to me, saying: "If you don't give up so and so, your place will be vacant." It so happened that I had just received an offer from parties which I had decided to accept, and I politely informed the manager that my place was then vacant. This was many years since, and I have earned annually more than five times what I received in the shop.

The facts are that the qualifications which belong to a first class mechanic (manager is a better term, because it comprehends the situation more fully) are entirely removed romf mere technical manipulation of tools or metals. There are plenty of good workmen in a shop, who, so far as mere handiwork is concerned, could excel their overseer; but they are not fit for superintendents. A methodical, systematic, and comprehensive mind, joined to workshop experience and thorough knowledge of human nature, are what make the successful superintendent, and such men are to be found if sought after: not at the wages of a workman, however, for their qualifications command more in other spheres. If manufacturers need them, they will come to the surface fast enough.

42 Cliff street, New York. EGBERT P. WATSON.

Incendiary Postal Cards.

To the Editor of the Scientific American :

Of what materials are postal cards composed? I came very near to having my office burned by the ignition of a parcel of old cards, which were hung on hooks over my desk, at a distance of 12 or 14 inches from the top of the chimney of an argand oil lamp, the light being turned down. When I went to tea, the light was burning, and the office was left alone during my absence. Fortunately, I returned in time to extinguish the fire before any material damage was done. After this, I took a postal card and set fire to it; and I found that the card burnt like a taper, with a clear flame. I am now in search of knowledge concerning the formation of these inflammable articles. G. W. FORD.

Rochester, N. Y.

[REMARKS BY THE EDITOR:—Postal cards are made so as to endure pretty rough usage, and thus very good paper stock is used in their manufacture. They are almost wholly vegetable fiber, and consequently burn easily and completely. Ordinary cardboard contains shoddy fiber and mineral matter. Enameled cards are nearly fireproof by reason of mineral matter. The postal cards seem to contain some of the coloring matter which makes buff envelopes dangerous. The dark buff envelope paper ignites by a spark, and burns like tinder.]

Cable Telegraphy.

To the Editor of the Scientific American.

Mr. Little's assertion, in your number for November 21, that Mr. Winter's improvement in cable telegraphy consists in working a galvanometer by an induction coil having primary and secondary wires, is incorrect, as a reference to the diagram and description printed in a previous number of the SCIENTIFIC AMERICAN will show.

Newark, N. J. T. A. EDISON.

Curious Effects of Brain Wounds.

In the recent brilliant address of Professor Huxley, before the British Association, "On the Hypothesis that Animals are Automata," he says:

"I am indebted to my friend General Strachey for bringing to my notice an account of a case which appeared within the last four or five days in the scientific article of the *Journal des Débats*. A French soldier, a sergeant, was wounded at the battle of Bazeilles, one, as you recollect, of the most fiercely contested battles of the late war. The man was shot in the head, in the region of what we call the left parietal bone. The bullet fractured the bone. The sergeant had enough vigor left to send his bayonet through the Prussian who shot him. Then he wandered a few hundred yards out of the village, fell senseless, but, after the action, was picked up and taken to the hospital, where he remained some time. When he came to himself, as usual in such cases of injury, he was paralyzed on the opposite side of the body, that is to say, the right arm and the right leg were completely paralyzed. That state of things lasted, I think, the better part of two years, but sooner or later he recovered from it, and now he is able to walk about with activity; and only by careful measurement can any difference between the two sides of his body be ascertained. The inquiry, the main results of which I shall give you, has been conducted by exceedingly competent persons, and they report that at present this man lives two lives, a normal life and an abnormal life. In his normal life he is perfectly well, cheerful, does his work as a a hospital attendant, and is a respectable, well conducted man. This normal life lasts for about seven and twenty days or thereabouts, out of every month; but for a day or two in each month he passes suddenly and without any obvious change into his abnormal condition. In this state of abnormal life he is still active, goes about as usual, and is to all appearance just the same man as before, goes to bed and undresses himself, gets up, makes his cigarette and smokes it, and eats and drinks. But he neither sees, nor hears, nor tastes, nor smells, nor is he conscious of anything whatever, and he has only one sense organ in a state of activity, namely, that of touch, which is exceedingly delicate. If you put an obstacle in his way, he knocks against it, feels it and goes to the one side; if you push him in any direction, he goes straight on until something stops him. I have said that he makes his cigarettes, but you may supply him with shavings or anything else instead of tobacco, and still he will go on making his cigarettes as usual. His actions are purely mechanical. He feeds voraciously, but whether you give him aloes, or assafœtida, or the nicest thing possible, it is all the same to him. The man is in a condition wherein the functions of his cerebral hemispheres are, at any rate, largely annihilated. He is very nearly—I don't say wholly, but very nearly—in the condition of an animal in which the cerebral hemispheres are extirpated.

"His state is wonderfully interesting to me, for it bears on the phenomena of mesmerism, of which I saw a good deal when I was a young man. In this state he is capable of performing all sorts of actions on mere suggestion. For example, he dropped his cane, and, a person near him putting it into his hand, the feeling of the end of the cane evidently produced in him those molecular changes of the brain which, had he possessed consciousness, would have given rise to the idea of his rifle; for he threw himself on his face, began feeling for his cartridges, went through the motions of touching his gun, and shouted out, to an imaginary comrade, 'Here they are, a score of them; but we will give a good account of them.' But the most remarkable fact of all is the modification which this injury has made in the man's moral nature. In his normal life he is an upright and honest man. In his abnormal state he is an inveterate thief. He will steal every thing he can lay his hands upon; and if he cannot steal anything else, he will steal his own things and hide them away."

The London *Lancet* gives the following additional particulars concerning the same patient, whose original profession was that of a *café* ballad singer:

"When he is in his fit, he has no sensitiveness of his own, and will bear physical pain without being aware of it; but his will may be influenced by contact with exterior objects. Set him on his feet, and, as soon as they touch the ground, they awaken in him the desire of walking; he then marches straight on quite steadily, with fixed eyes, without saying a word or knowing what is going on about him. If he meets with an obstacle on his way, he will touch it and try to make out by feeling what it is, and then attempt to get out of its way. If several persons join hands and form a ring around him, he will try to find an opening by repeatedly crossing over from one side to the other, and this without betraying the slightest consciousness or impatience.

"Put a pen into his hand; this will instantly awaken in him a desire of writing; he will fumble about for ink and paper, and, if these be placed before him, he will write a very sensible business letter; but when the fit is over, he will recollect nothing at all about it. Give him some cigarette paper, and he will instantly take out his tobacco bag, roll a cigarette very cleverly, and light it with a match from his own box. Put them out one after another, he will try from first to last to get a light, and put up in the end with his ill success. But ignite a match yourself and give it to him, he will not use it, but let it burn between his fingers. Fill his tobacco bag with anything, no matter what—shavings, cotton, lint, hay, etc., he will roll his cigarette just the same, light and smoke it without perceiving the hoax. But, better still, put a pair of gloves into his hand and he will put them on at once; this, reminding him of his profession, will make him look for his music. A roll of paper is then given to him, upon which he assumes the attitude of a singer before the public, and warbles some piece of his repertory. If you place yourself before him, he will feel about on your person, and, meeting with your watch, he will transfer it from your pocket to his own; but on the other hand, he will allow you, without any resistance or impatience whatever, to take it back again.

We may add that Dr. Brown-Séquard, during his recent course of popular lectures in this country, mentioned a number of cases that had come under his notice, presenting phenomena analagous to the foregoing.

Bursting of a Fly Wheel.

On the morning of November 27, the first coupling of the main shaft in Clark's spool thread mills, at Newark, N. J., suddenly broke, releasing the 600 horse power engine from its work, and instantly increasing its velocity to such a speed that the cogged fly wheel, weighing 20 tuns, and another wheel geared with it, weighing 8 tuns, exploded, tearing away the ends of the engine house and stripping the roof off. Some of the fragments of the fly wheel were four tuns each in weight, the other wheel breaking into small pieces, One piece of the former, weighing three tuns, crashed through the roof, struck the tall chimney of the factory, and afterwards buried itself in the earth at a distance of 60 yards from the locality of the disaster. There were 1,100 work people in the building, many of whom had very narrow escapes; but no one was hurt. The engine was ruined. The damage is estimated at over $25,000.

Hard Rubber Thermometers.

In our issue of November 28, we drew attention to the experiments of Kohlrausch on hard rubber for the making of thermometers. He suggests that a strip of ivory should be glued to one of hard rubber, as in a Breguet's thermometer, so as to bring into play the great expansibility of the rubber. We learn, however, that instruments on this principle have been long in use in the Meteorological Observatory of the New York Central Park. They are the invention of Mr. Daniel Draper, the director of that observatory, and are on a much better construction than those suggested by Kohlrausch, which would be liable to hygrometric disturbances from the ivory. Mr. Draper's consist of a strip of hard rubber riveted to one of brass. A clock attachment renders them self-recording. They are considered as presenting the best form of registering thermometer hitherto introduced, and as supplying what has thus far been a desideratum. Any one interested in the matter can see them working in the Observatory.

A Soda Water Law Suit.

A soda water manufacturer was summoned recently at the Longton, England, police court, for selling as "soda water" an artificially aerated water, which was found on analysis not to contain a particle of the alkali from which it was named, and, further, for depriving his customer of the antacid ingredient of which he was entitled to expect the benefit. The magistrate held that the case did not come under the adulteration act, but it has been appealed and will be passed upon by the higher courts. As so-called soda water is universally known to be nothing but water impregnated with carbonic acid gas, it remains to be seen how the English jurists propose to treat the queer social and legal question of a vendor selling wares under a false name, and the buyer hence presumably negotiating for what he does not wish to buy.

PRACTICAL MECHANISM.

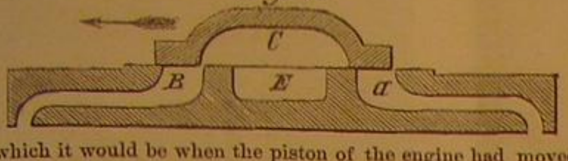
NUMBER XIV.

BY JOSHUA ROSE.

THE SLIDE VALVE.

The common slide valve is a simple device for regulating the ingress and egress of steam to and from the cylinder, as illustrated in Fig. 47. It is here shown in the position in

Fig. 47.



which it would be when the piston of the engine had moved to the end of one stroke and was prepared to commence the next, *a* being the port through which the steam is passing into the cylinder, and B, the port through which the steam which propelled the piston on the previous stroke must now find egress.

The valve, C, is moving in the direction of the arrow, so that the port, *a*, is left open for the steam to enter as the valve recedes from it, and a free communication is at the same time being established between the port, B, and the exhaust port, E, of the cylinder, thus permitting the steam to escape through E.

When the piston has arrived at the other end of the cylinder, the valve, C, will have moved back, so that these conditions will be exactly reversed, B being the port through which the steam will then enter, and *a*, that through which the exhaust steam will escape from the cylinder.

The lead of a valve is the width of opening which the valve permits (by reason of the position to the crank in which the eccentric is set) to the steam port when the piston is at the end of the stroke, as shown in Fig. 47, at the port, *a*.

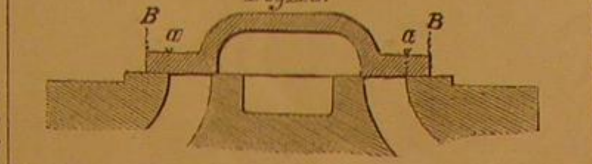
If the valve were set so that it had no lead, both the ports, *a* and B, would be closed by the valve, so that the steam could neither enter nor leave the cylinder until the momentum of the fly wheel had caused the crank to pass the dead center, and therefore the valve to open.

Lead is given to a valve to enable the steam to act as a cushion upon the piston, by admitting the steam to it before it has arrived at the end of its stroke, thus causing it to reverse its motion easily and without noise.

If the working parts of an engine have much play or lost motion in them, the steam admitted by lead will, by opposing a gradual force in a direction opposite to that in which those parts are moving, take up such play before the piston has reversed its motion, and therefore more gradually and less violently than would be the case if the force of the steam came upon the piston at the instant at which it reversed its motion In the latter case the piston, after reversing its motion, would have no load against it until the play of the working parts was taken up, so that it would travel very fast during the instant of time in which such play was being taken up; and the check, given to it on meeting its load again, would cause a thump or pound to the piston. But if the working parts are a reasonably good fit, and the valve has lap on it to give a free exhaust, there appears no necessity for giving the valve more lead than is sufficient to about fill the steam passage and the clearance (that is, the space between the cylinder cover and the piston when the latter is at the end of its stroke) with steam at full pressure, by the time the piston arrives at the end of the stroke: the object of lead to this amount being to supply steam at full pressure to the piston from the instant the crank has passed its dead center and the piston has commenced its stroke, and at the same time to prevent any unnecessary amount of back pressure, for the steam admitted by lead acts at all times as a back pressure upon the piston; so that, if the valve has too much lead, not only is there a consequent loss of power from back pressure, but the piston receives a sudden and violent shock, which is sure in the end to result in damage to some part of the engine, such for instance as loosening the piston upon the rod, or either loosening or breaking the crosshead pin or the crank pin. It must be borne in mind that, as the steam admitted by lead commences to enter the cylinder before the piston has arrived at the end of its stroke, if the amount of lead is so great as to admit sufficient steam to the steam passages and cylinder, and to fill them at full pressure before the piston has arrived at the extreme end of its stroke, the advancing piston will have to force or pump part of such steam back again into the steam chest. At the moment at which this forcing back will take place, the center line of the crank will be nearly parallel with the center line of the bore of the cylinder, so that the effect will be that the whole momentum of the fly wheel, which is traveling fast, is concentrated upon the piston, which is then moving very slowly, to force it ahead against the full head of steam (admitted by the lead); and the whole strain of these opposing forces is accumulated upon the pillar block holding the crank shaft, bearing the crank pin and the crosshead pin in a direction the most favorable for bursting them apart, resulting in a serious loss of power, and (as before stated) in ultimate damage to the engine. In the case of a locomotive, where the piston speed and the wear and tear of the working parts is very great, an extreme amount of lead is admissable to take up such wear and prevent pounding at each end of the stroke; the lightness of locomotive frames (as compared to the heavy frames of stationary engines) enables them to spring from the strain created by any excess of lead, and hence the crank and crosshead pins do not encounter so severe a strain as would be the case if the same amount of lead were given to a stationary engine. One eighth of an inch of lead is sufficient for an ordinary freight and $\frac{3}{16}$ of an inch is sufficient for passenger or express locomotive, the difference being in consequence of the greater running speed of the latter. Engines whose cylinders are vertical and above the shaft are given more lead on the bottom than on the top of the cylinder, because the wear of the various moving parts of the engine is mostly downwards and away from the cylinder, so that the lead becomes more on the top and less on the bottom as the engine wears. If, however, the cylinder is vertical and below the shaft, these conditions are exactly reversed.

The steam lap of a valve is the amount by which it exceeds the extreme width of the cylinder ports, as illustrated in Fig.

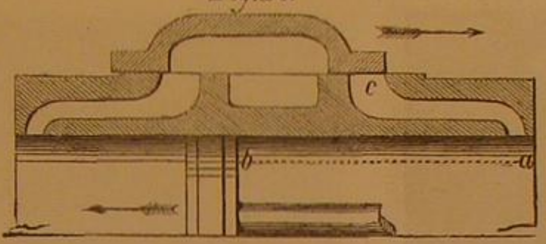
Fig. 48.



48, from *a* to B being, in each case, the lap.

By means of giving steam lap to the valve, the engine is enabled to use its steam expansively, that is, the valve cuts off the supply of steam to the piston before the latter has traveled to the end of the stroke, as shown in Fig. 49, in which the valve is shown as having just closed the port, C, the direction in which the piston and valve are respectively moving being denoted by the arrows.

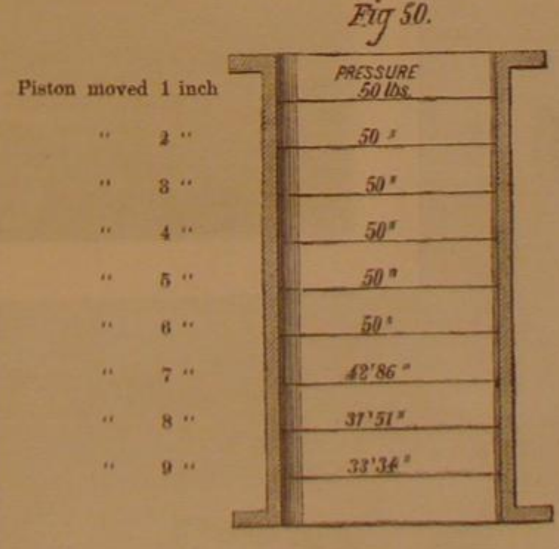
Fig. 49.



Lap on the exhaust side of a valve is a subject to be hereafter treated upon. The advantage derived by using steam expansively may be perceived by supposing the stroke of a piston to be 9 inches, and the steam supply to be cut off by reason of the lap on the valve when the piston has traveled 6 inches; it will then have to travel the remaining 3 inches of stroke, receiving only such pressure as the steam already in the cylinder will impart. The pressure of steam increases or diminishes in exact ratio to the space it occupies, the temperature being maintained equal; that is to say, if the steam occupying one cubic foot at a pressure of 50 pounds is permitted to expand its volume so that it occupies two cubic feet, its pressure will decrease to 25 pounds; but if it were compressed so as to occupy one half of a cubic foot, its pressure would rise to 100 pounds.

In Fig. 49 the steam would occupy that portion of the cylinder from *a* to *b* (that is, 6 inches of its length, supposing the whole length to be 9 inches), at a pressure of, say, 50 pounds per inch. When, therefore, the piston has moved another inch, the steam will occupy $\frac{1}{6}$ more space (that is, 7 inches instead of 6 inches of the length of the cylinder), thus reducing its pressure by $\frac{1}{7}$, bringing it down from 50 to 42·86 pounds per inch, and so on, as illustrated in Fig. 50, in which *a a* represents a section of a cylinder.

Fig 50.



During the first five inches of the travel of the piston, the steam port is open, and the full pressure of the steam is continuously exerted to move the piston; but at the sixth inch, the steam lap on the slide valve closes the port. Going now to the seventh inch, we find one seventh more space between the piston and the cylinder head, while there is only six inches of steam at normal pressure; and so we have one seventh less pressure, or 42·86 pounds. At the eighth inch, the space and the steam are still more disproportionate, there being one fourth more space and of course one fourth less pressure; and at the ninth inch, the end of the stroke, there is, similarly, one third more space and one third less pressure.

The whole pressure of steam on the piston during the last 3 inches of the stroke has been obtained without any supply of steam to the cylinder from the steam chest, and constitutes the gain due to using the steam expansively.

It must be borne in mind that, when the piston commenced its seventh inch of stroke and first inch of expansion, the pressure of steam upon it was 50 pounds, and that not until it had reached its seventh inch of stroke and completed its first inch under expansion had the pressure fallen to 42·86, so that 42·86 is less than the average pressure the piston received during that inch of its stroke, but is as near as we can arrive at it unless we take the movements of the piston and pressures of steam at a greater number of points, as, for instance, at every half inch of piston movement.

It would appear that this saving of steam had been obtained at some sacrifice of the power of the engine, since the piston performed the last 3 inches of its stroke under a reduced pressure of steam; but such is not the case, for if the valve has no steam lap on it, the exhaust port is not sufficiently open when the piston is at the end of the stroke to permit the steam to escape freely; hence it puts a back pressure on the piston, which is a greater loss to the engine than is caused by the reduced pressure due to working expansively: so that an engine whose valve has no lap will not only use less steam, but will become more powerful if lap be added to the valve.

An experiment made two years ago by the author clearly demonstrated this fact. A new engine, fitted with a common slide valve which had no lap upon it, was attached directly to a pump, which drew water 4 feet and forced it through a $1\frac{1}{4}$ inch nozzle, a pressure gage being attached to the air chamber of the pump. Steam at 60 pounds to the square inch was supplied to the engine, whose performance then was to maintain an even pressure of 17 pounds per inch in the air chamber, the engine making 120 revolutions per minute. After running a few days, the slide valve of the engine was taken out and $\frac{5}{16}$ of steam lap was added on each side, a new and larger eccentric being fitted to the engine in order to give the slide valve the necessary increase of stroke. No other part of the engine or pump was altered or removed; but upon turning on the steam, the engine ran up to 175 revolutions, and maintained an even pressure in the air chamber of 34 pounds to the inch.

The Common Hammer.

Few people, says Mr. J. Richards, in witnessing the use of a hammer, or in using one themselves, ever think of it as an engine giving out tuns of force, concentrating and applying power by functions which, if performed by other mechanism, would involve trains of gearing, levers, or screws; and that such mechanism, if employed instead of hammers, must lack that important function of applying force in any direction that the will may direct.

A simple hand hammer is, in the abstract, one of the most intricate of mechanical agents, that is, its action is more difficult to analyze than that of many complex machines involving trains of mechanism; but our familiarity with hammers makes us overlook this fact, and the hammer has even been denied a place among those mechanical contrivances to which there has been applied the mistaken name of mechanical powers.

Let the reader compare a hammer with a wheel and axle, inclined plane, screw, or lever, as an agent for concentrating and applying power, noting the principles of its action first, and then considering its universal use, and he will conclude that if there is a mechanical device that comprehends distinct principles, that device is the common hammer; it seems, indeed, to be one of those things provided to meet a human necessity, and without which mechanical industry could not be carried on. In the manipulation of nearly every kind of material, the hammer is continually necessary in order to exert a force beyond what the hands may do, unaided by mechanism to multiply their force. A carpenter in driving a spike requires a force of from one to two tuns, a blacksmith requires a force of from five pounds to five tuns to meet the requirements of his work, a stonemason applies a force of from one hundred to one thousand pounds in driving the edge of his tools; chipping, calking, in fact nearly all mechanical operations consist more or less in blows, and blows are but the application of an accumulated force expended throughout a limited distance.

Considered as a mechanical agent, the hammer concentrates the power of the arms and applies it in a manner that meets the requirements of the work. If great force is needed, a long swing and slow blows accomplish tuns; if but little force is required, a short swing and rapid blows will serve, the degree of force being not only continually at control, but the direction at which it is applied also. Other mechanism, if used instead of hammers to perform the same duty, would from its nature require to be a complicated machine, and act but in one direction or in one plane.

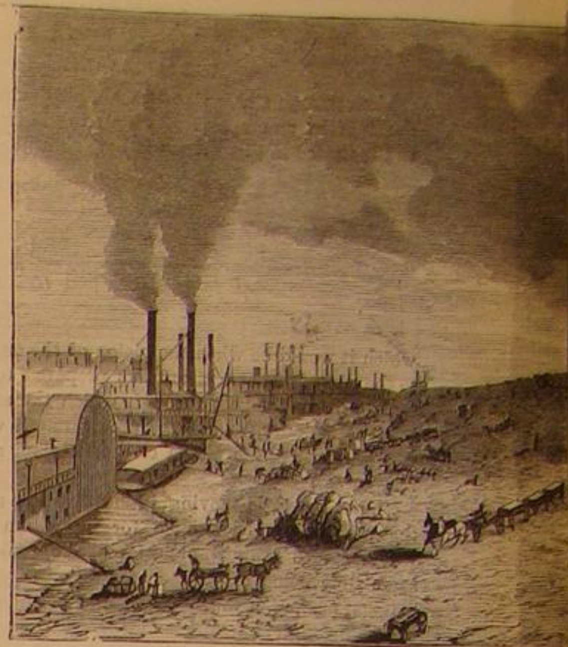
Tin-Canned Butter.

The president of the New York Butter and Cheese Exchange lately received a package of Danish butter, which, although it had been packed in tin for more than seventeen months, was in excellent condition. It came from Bolivia, where it had been sent from London, and was accompanied by a note addressed to the New York butter and cheese merchants, asking if as good a quality of butter could be produced here. If as good butter could be made here, New York would soon have control of the trade of the South American markets, as the cost was too great to get their butter direct from London. It was decided that butter of as good quality could be made in this country. Arrangements will be made to secure the South American trade, and tin will be used for packing purposes instead of wood.

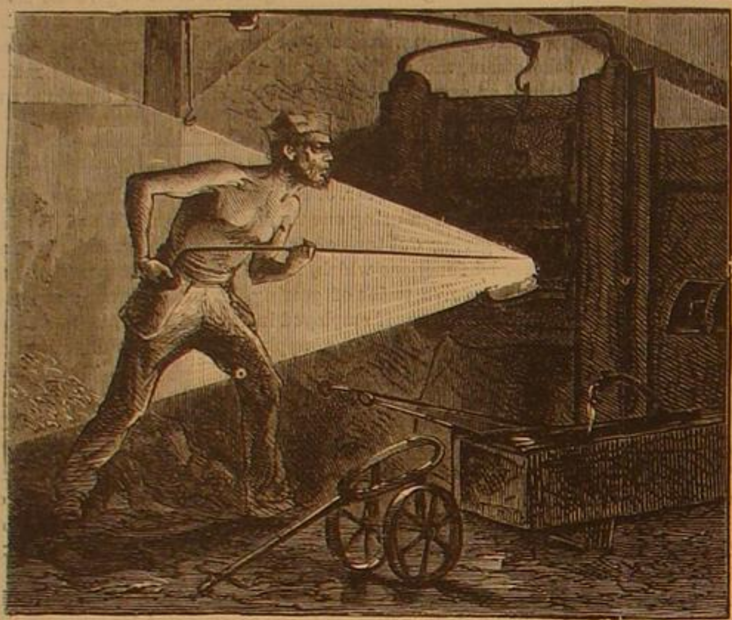
MR. I. LOWTHIAN BELL, President of the Iron and Steel Institute of Great Britain, and one of the most eminent iron masters of England, is now in this country. He is visiting our principal iron works and mining regions.

CHIANG-QUAN-WA, an intelligent Chinaman of San Francisco, has applied for a patent for an improved overall.

MELTING STEEL.



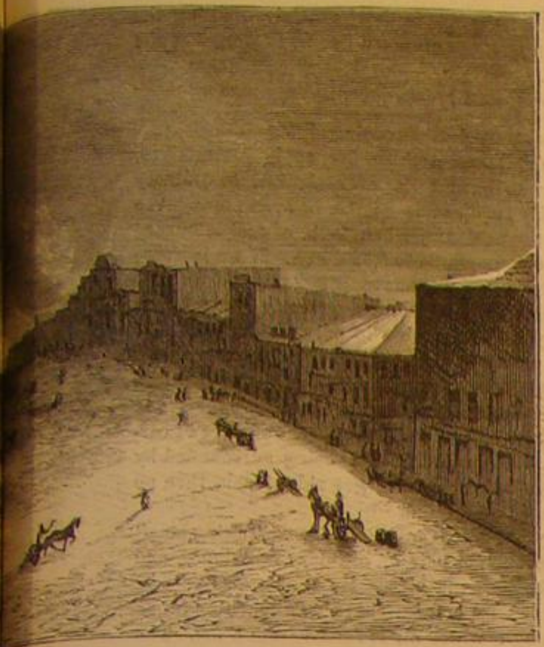
LEVI



PUDDLING IRON.

VIEW FROM MONGT H

PITTSBURGH, PENNSYLVANIA, AND



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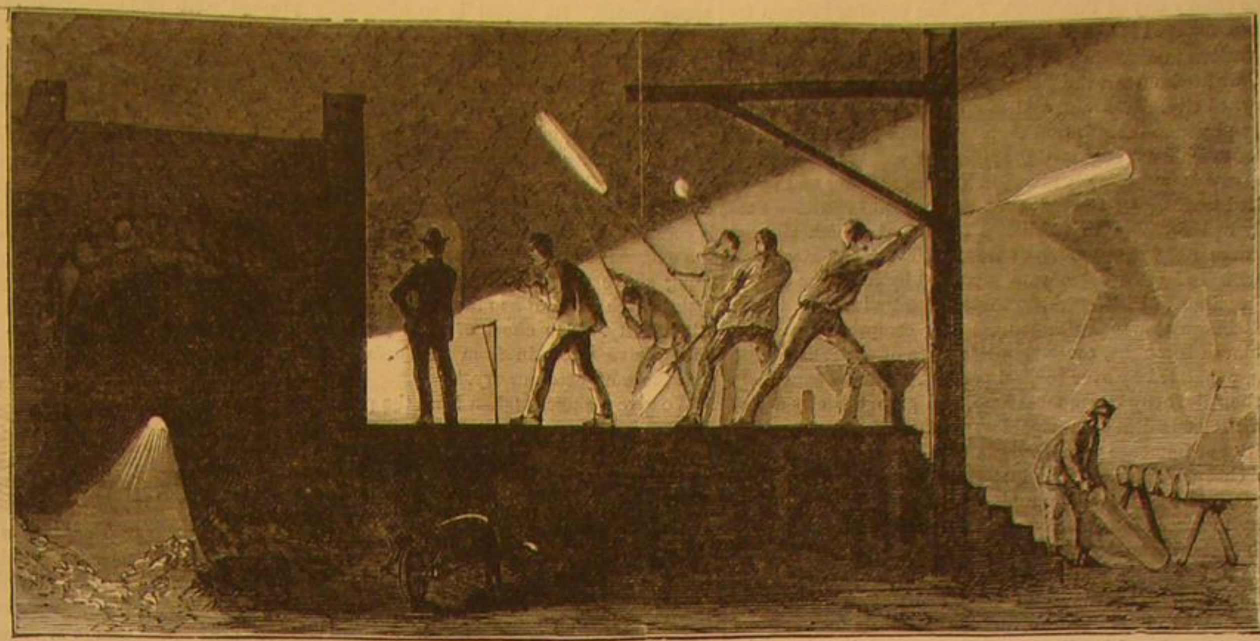
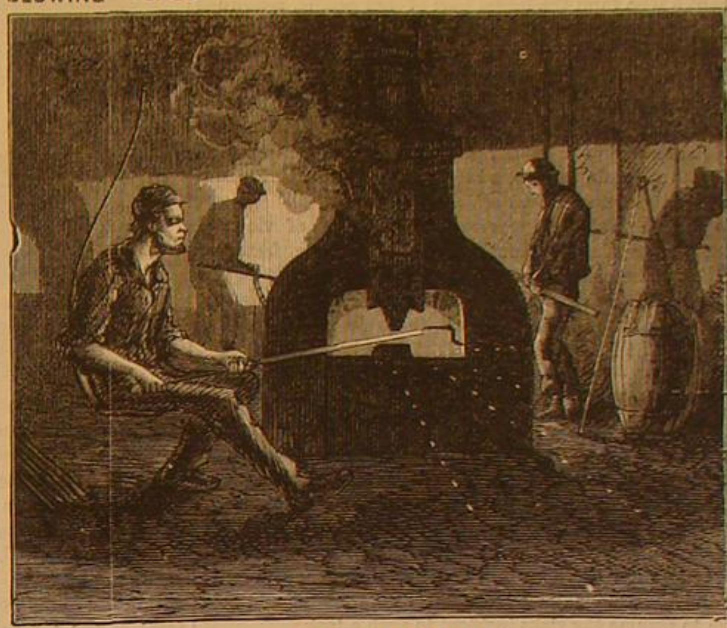
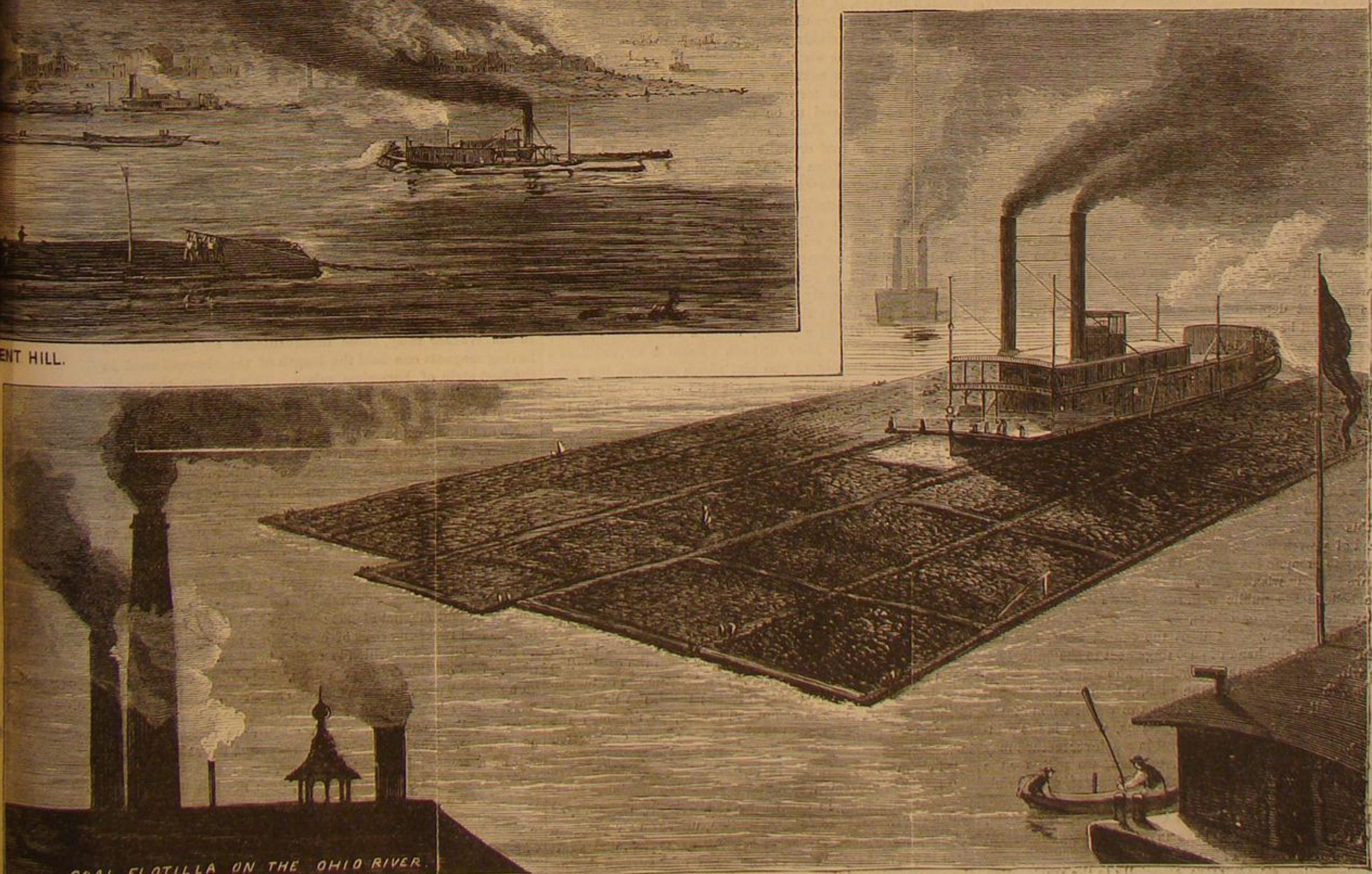


BLOWING GLASS

FROM MONUMENT HILL.



STEAM HAMMER.



COAL FLOTILLA ON THE OHIO RIVER

IA, AND HER PROMINENT MANUFACTURES

THE CITY OF PITTSBURGH AND ITS INDUSTRIES.

The smoky city of Pittsburgh, Pa., has peculiar interest for all men engaged in the industrial arts, on account of her many and various manufactures and the enterprise of her leading men, which hold out the promise of a great future for this renowned city. Iron and coal are of course her leading staples, and where there is iron there is naturally a large production of machinery, engineering appliances, and hardware; and cheap coal is immediately attended by glass making and many kindred trades. Of the extent of these manufactures we recently had occasion to publish a statement, which showed that over $10,000,000 value of iron, $4,000,000 of steel, and $3,000,000 of glass wares were produced by forty-one of the leading firms in Pittsburgh, in these three trades only.

Pittsburgh as a manufacturing center comprises two cities and eleven boroughs, covering a total area of about 25 square miles, populated by over 263,000 persons. The Monongahela and the Allegheny rivers meet here, and give the city access to over 12,000 miles of navigablest reams, affording carrying facilities of immense value, especially in a country where coal is so cheap. The two principal rivers are crossed by nine bridges, and the river shipping is stated by a competent authority to exceed in tunnage even that of New York city.

While the manufactures of Pittsburgh are found in every city on this continent, her supplies are drawn from all parts of the world. The copper of the Lake Superior region is brought here to be worked up, and the chemicals for her glass houses are produced in all parts of Europe and America. The mechanics who form the larger part of her people, renowned everywhere for their ingenuity and skill, are chiefly Americans, but number among them natives of nearly every country which has achieved fame in the industrial arts. The Welsh and Cornish miners, the steel melter of Sheffield and the glass mixer of Birmingham, and the gunsmith and fine metal worker of Liège are here to be found, uniting with the Americans in striving to maintain and extend the renown of the chief manufacturing city of our Great Republic.

We publish on the two previous pages a series of views of this most interesting city, and of some of her manufacturing processes. These engravings explain themselves, and will be examined with interest by our readers, for they represent scenes which all Americans view with pride in the present and hope in the future.

NEW RAILWAY TUNNEL UNDER THE HUDSON RIVER, BETWEEN NEW YORK AND JERSEY CITY.

For many years the project of building a railway tunnel under the bed of the Hudson river, between New York and Jersey City, has been discussed, its importance and feasibility agreed upon, and its successful completion, upon paper, established. Only two things have been lacking for the actual realization of the work, namely, the money to build with, and the company of individuals enterprising and bold enough to assume the risks incident to such a task.

The bed of the Hudson, at New York, is a treacherous substratum, so far as tunneling is concerned, being porous, leaky, and lacking in firmness. All engineering experience in the construction of works in such soils has shown that their prosecution is attended with unusual risk and cost. But now comes along a new and enterprising engineer from California, Mr. D. C. Haskin, inventor of a new Improvement in the Art of Tunneling, expressly designed to make difficult works of this kind easy, patented February 3d, 1874. Mr. Haskin has organized a strong and wealthy company for the trial of his improvements, and the first essay is to be made upon the Hudson river tunnel, work upon which has recently been commenced. The vertical shaft has already reached a considerable depth. It is located near the river shore at the foot of 15th street, Jersey City, and from thence the tunnel will extend across under the Hudson river to or near the foot of Canal street in New York, thence up Canal street to a connection with the Broadway Underground Railway.

The greatest depth of water on the Hudson river over the tunnel will be about 100 feet; the total width of the river, 4,000 feet. The actual length of the horizontal tunnel, however, will hardly be less than 6,000 feet. The New York *Sun* states that Colonel Haskins "is confident of success, that there is no stock for sale, and that the members of the company have plenty of money to complete the work, and are willing to pay all costs and expenses."

It is rumored that the Delaware, Lackawanna & Western Railway Company claim that the Tunnel Company do or will infringe on their landed rights, and that they will obtain injunctions from the Court to stop the operations. We trust that this powerful corporation will do nothing of the sort. Instead of preventing, it should be the aim of the railway company to promote the work. In common with all our citizens, we heartily wish the Tunnel Company success.

We believe the public will resent any attempt, made by railway monopolists or others, to interfere with the work. The citizens of New York want the tunnel built, and will cordially extend the hand of encouragement to the builders.

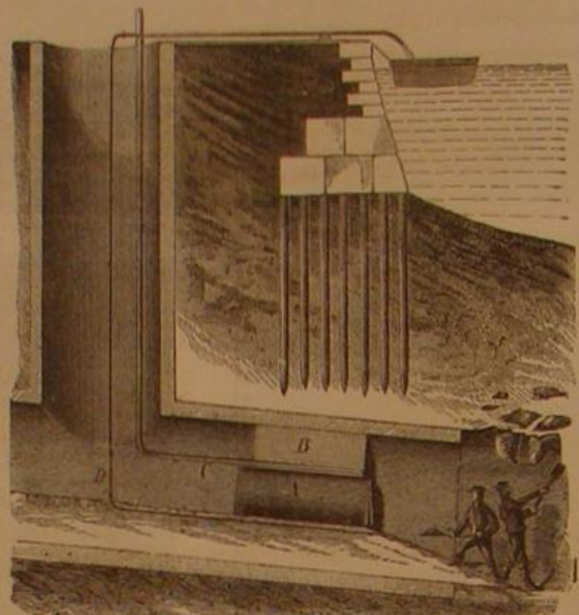
We will now describe this New Art of Tunneling, premising, however, that the failure of the plan, which we consider inevitable, will not, necessarily, stop the construction of the tunnel, as the air-compressing apparatus, which is the principal item of expense, will be useful in whatever method may be hereafter adopted. In our description, we will, for the most part, follow the language of the patentee, who, in his patent, says:

"Be it known, that I, DeWitt Clinton Haskin, of Valejo, Solano County, California, have invented a new and useful Improvement in the Art of Tunneling.

"My invention relates more especially to the construction of tunnels through sands, wet earths under water courses, and under such like conditions where the caving-in of the walls of the excavation or the infiltration or irruption of water is to be apprehended. Its object is to effectually prevent such incidents in a cheap and simple way, to which end my improvement consists in filling the excavation with compressed air of a density sufficient to resist the inward pressure during the construction of the shell or wall of the tunnel.

"The distinguishing feature of my system, however, is that instead of using temporary facings of timber or other rigid material, I rely upon the air pressure to resist the caving-in of the wall or the infiltration of water until the masonry wall is completed. This pressure is, of course, to be regulated by the exigencies of the occasion, and may be varied from anything above that of the atmosphere to 50 lbs. to the square inch, which is about as much as the human system will bear with safety. The effect of such pressure has been found to be to drive water in from the surface of the excavation, so that the sand becomes dry."

We give a sketch, taken from the patent.



HASKIN'S NEW ART OF TUNNELING.

Within the tunnel, a short distance back of the heading where the laborers are at work, is an air lock, A, composed of an iron cylinder, having entrance valves at each end, so arranged that when one is opened the other closes, thus permitting egress or ingress to the front. Above the lock is an airtight packing, B, while below the cylinder is a packing or filling of earth. When the air lock is duly set and sealed within the tunnel, compressed air is driven to the heading in front of the air lock, through air pipe, C. The excavated earth will be discharged from the heading, by the air pressure, through the pipe, D, and delivered into boats or other suitable receptacles at the ground or river surface, in the manner commonly practised in sinking caissons.

In carrying on the work, the laborers will excavate a chamber in the earth in advance of the finished masonry, which will then be carried forward, while the men dig out a new space in advance, and so on until the tunnel is completed. Any loose boulders, stones, earth, quicksands, or water, encountered in the roof or walls of the heading, are to be held up and prevented from caving-in upon the workmen by the air, like flies upon the ceiling. The clumsy, costly caissons, shields, and other appliances, heretofore deemed necessary by cautious engineers, are discarded in this New Art. It is, indeed, a new wrinkle in the science of engineering.

But we think the statement of the patent, that only 50 lbs. air pressure will be required, must be a mistake. Several cyphers have evidently been omitted from the figures, perhaps by a blunder at the Patent Office. A cubic foot of air weighs only 0·075 of a pound, while a cubic foot of stone weighs 165 lbs. To buoy up such a stone in air, requires a corresponding density of the air: which involves the compression of 2,200 cubic feet of air into every cubic foot of air contents within the heading, or a pressure of 33,000 lbs. to the square inch.

Our author makes another rather incongruous statement in his patent. He says: "In case a jet seam or small stream of water is encountered, I supply a temporary shield of canvas, leather, or other light flexible integument to the wall, against which the pressure instantly forces it and seals the leak."

Water weighs only 62½ lbs. per cubic foot, or less than half the weight of granite. If the direct air pressure, against the loose earth, sand, and stones, is sufficient to prevent their downfall in the excavation, surely no streams of water can come in, and the leather will be unnecessary.

"These three features," says the patentee, "constitute the leading characteristics of my invention, namely: First, the use of compressed air acting directly upon the excavation walls to prevent leakage or caving; second, the use of temporary flexible integuments to stop leaks; third, the partial refilling with earth of the completed tunnel, to diminish the area of the surface exposed to the action of the compressed air.

"I claim as my invention:

"1. The improvement in the art of tunneling herein set forth the same consisting in excavating in a working chamber, of which the tunnel head forms a portion, under an air pressure acting directly upon the surface being excavated, and sufficient to prevent the caving or leakage of said surface during the construction of the masonry walls.

"2. The method herein set forth of preventing leakage in the excavation surface of the working chamber, by the application thereto of a flexible integument held in position by atmospheric pressure.

"3. The method herein set forth of partially refilling the completed tunnel in advance of the air lock, to diminish the air surface thereof.

"In testimony whereof I have subscribed my name."

The Economy of Powdered Fuel.

With a quick draft and a thick fire, as in locomotives, 18 lbs. of air suffice to burn 1 lb. of coal; but in ordinary furnaces the quantity required is 24 lbs. or even more. We have seen that the temperature, when 1 lb. of coal is burned with 12 lbs. of air, only amounts to 4,580° Fah. If we increase the admission of air to 18 lbs., the resulting temperature falls to 3,200° Fah. while if we double the quantity of air it falls to 2,440° Fah. Oxygen of dilution is only required because the carbon cannot, unless oxygen is present in the furnace in excess, obtain what it wants; and this is due to the fact that the coal in combustion does not expose sufficient surface to the air passing over it. If we can increase the surface of carbon exposed, prevent the carbon from being surrounded by an atmosphere of carbonic acid, and get rid of ash, then no excess of oxygen will be required.

Now this is just what Mr. Crampton does. Taking small coal, he grinds it between a pair of ordinary millstones, and bolts it in a coarse bolting machine. He thus procures coal flour. This coal is fed by a most ingenious machine into a nozzle or tweer through which air is forced from a fan. The coal flour is thus blown in a cloud into the furnace or combustion chamber; and there igniting, it is converted into a body of flame. The grinding of the coal really is nothing more or less than an expedient for increasing the oxidizable surface exposed to the air; for let us suppose that one pound of coal in a block has a surface of, say, one fourth of a square foot, it is obvious that by grinding this pound of coal to flour its surface will be augmented, possibly a thousandfold, and each little molecule will expose to the oxygen an enormous surface as compared with its cubic capacity—indeed, a surface out of all proportion greater than that supplied by a pound of coal in mass as compared with *its* cubic capacity. The direct result is just that which might be anticipated. Mr. Crampton burns powdered coal with as little as 13 lbs. or 14 lbs. of air per pound of fuel, and has, we believe, obtained satisfactory results when but 12 lbs. of air were admitted.

The direct effect of the admission of a minimum quantity of ar to a furnace is a direct and enormous saving in fuel. Let ius take, for example, the operation of puddling. In the ordinary puddling furnace, at least 20 lbs. of air are burned per pound of coal. Now, to puddle a tun of iron with a tun of coal is an exceedingly good result. Let us say that in ordinary fair work 2,500 lbs. of coal are required. By an actual experiment, if such it may be called, which we saw carried out at Woolwich with the Crampton furnace—10 cwt. of old shells were charged into this furnace, and at the end of about one hour and forty minutes, 11 cwt. 2 qrs. of excellent iron was taken out of it. During the puddling of the charge in question, 4·5 cwt. of damp coal was blown into the furnace per hour. Thus 11·5 cwt. of wrought iron were made, while about 7·5 cwt. of coal was consumed.—*The Engineer.*

New Telegraph Relay.

A new form of relay, the invention of Mr. E. P. Warner, of the Western Electric Manufacturing Company, Chicago, has lately been introduced. The objects sought to be gained in this relay are the reduction of the coercitive force of the iron cores to a minimum, the exemption from the retractible force of springs acting in opposition to the force of the magnets, the abolition of an unpolarized armature, and the utilization of the attractive and repulsive force of a permanent magnet upon the tongue operating the local circuit.

It is well known that soft iron armatures retain the polarity impressed upon them by the electromagnets for a short time after the current ceases, also that the longer the electromagnet the greater its retaining power and consequent sluggishness. In the Warner relay, these disadvantages are overcome by having magnets one half the length of the shortest used in the best style of horseshoe relays. This insures the quick discharge of each core, and reduces its retaining power to the lowest point, especially as the purest iron is used.

No armature has to be magnetized by induction from the poles of an electromagnet. The cores are simultaneously magnetized by the same current, and their extensions have sufficient metal section to reduce their magnetic resistance to a very low point, and, at the same time, the weight of the movable core, its extension and tongue, does not exceed, to any great extent, the weight of an ordinary armature tongue and axis.

The relay has been severely tested in circuits of all conditions, and performed admirably. Unlike many other relays, the permanent magnet stands separate and apart from convolutions and reversing coils of every kind, and will not undergo that deterioration which is experienced in other combinations. One of the Warner relays, 150 ohms, was worked on a straight wire, between Chicago and New York, with no intermediate battery, and recorded fairly the signals, which were very light and unsteady on a 600 ohm testing relay of usual make. The *Journal of the Telegraph* says that the result of a comparative test, however, made at the Western Union Telegraph Office in this city, does not indicate any superiority over the regular form of relay now in use.

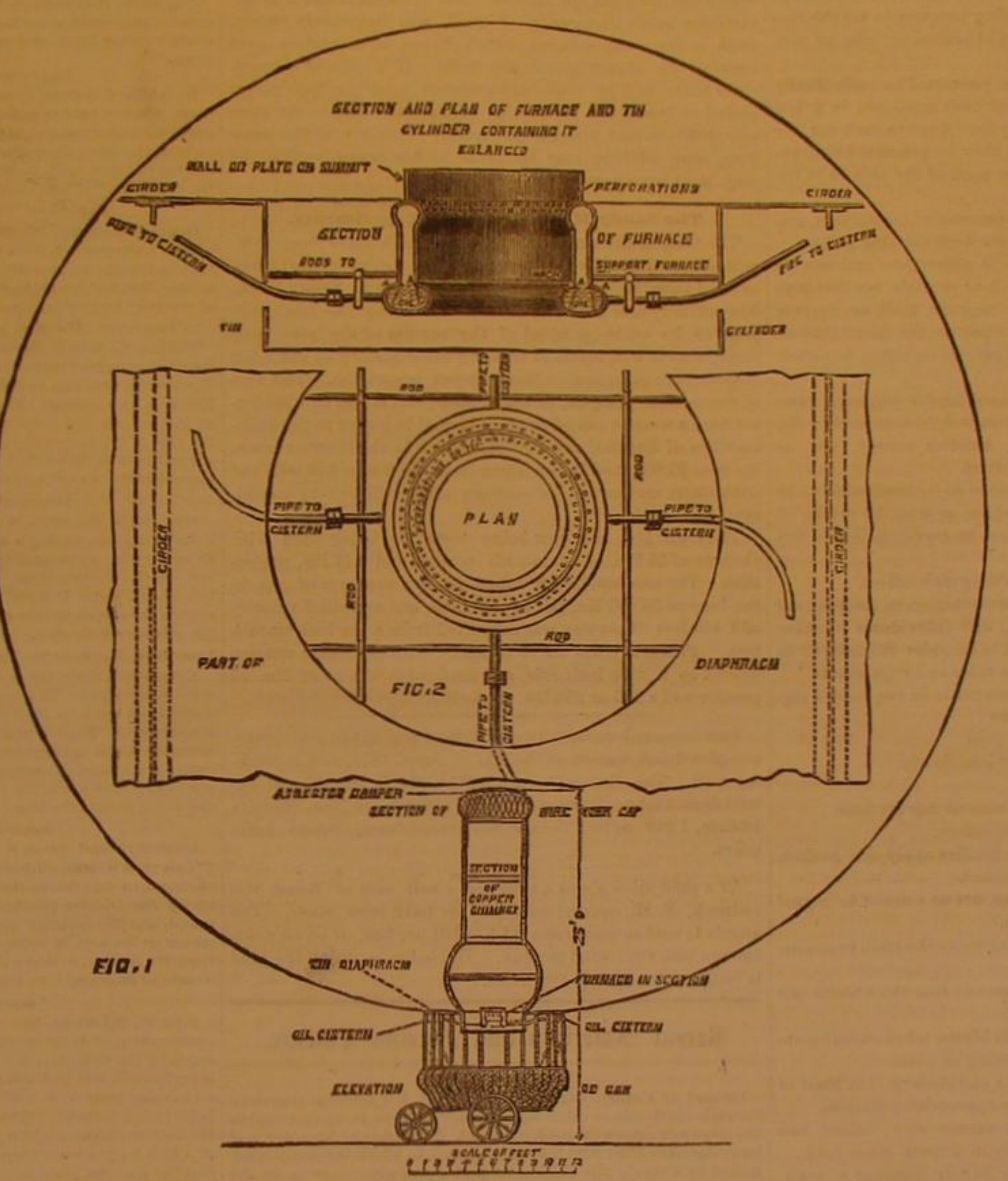
THE Academy of Sciences of Berlin has offered a prize of of $200, payable July, 1876, for the best essay recording experiments as to whether changes in the hardness and friability of steel are due to chemical or physical causes, or both. Papers, in German, Latin, English, or French, are to be sent in before March, 1876.

A NEW HOT AIR BALLOON.

The possibility of ascending in a balloon filled with hot air was long since demonstrated, but the death of one of the earliest experimenters, followed by the manufacture of coal gas, led to the abandonment of the system. A Frenchman named Ménier has recently revived the idea, and has made experiments on a scale of considerable extent. His scheme is to employ a balloon filled with hot air, in a captive condition only, as a means for obtaining observations from a considerable altitude for an army upon the line of march; and experiments have been instituted at the Woolwich Arsenal, England, with a balloon of gigantic size, which has been constructed under the supervision of the well known aeronaut, Mr. Simmons, for this purpose, a paraffin lamp being used for heating, which is the invention of M. Ménier.

The accompanying plan engraving will give the reader an idea of the proportions of this balloon, and of the apparatus employed for heating it. The balloon is nearly circular, 70 feet in diameter, the aperture at the neck being almost closed by a tin diaphragm which separates the balloon from the car, suspended 4 feet beneath by cords surrounding the balloon. A manhole is contrived in the diaphragm, so that observations can be taken of the interior of the balloon during an ascent. The car is of wirework, with a wooden hoop round the top and bottom, and runs upon three light carriage wheels, by means of which it can be transported from one place to another, with the whole of the balloon and its attendant gear packed upon the top. The wheels remain attached to the car during an ascent. The heating apparatus, which consists of a huge paraffin lamp with a copper chimney, the whole being 25 feet high from the ground, rests upon the tin diaphragm, being supported by light girders of wrought T iron, crossing the ring round the diaphragm (see the section, at the upper part of the illustration, for the girders). The furnace for the lamp, the details of which will be described presently, rests within a tin cylinder projecting beneath the diaphragm, being supported by bent rods of iron crossing the cylinder. It has four feed pipes, leading into it and communicating with two oil cisterns suspended from the diaphragm ring, two to each cistern. The cisterns are filled from cans of oil, by means of small force pumps and a supply pipe—a waste pipe being also attached to each, leading away into an empty can. The furnace is immediately beneath the chimney, which is constructed of thin sheet copper, having a bulb at the bottom 6 feet in diameter. The chimney is divided into several portions, as may be seen in the engraving, which take to pieces, and are capable of packing into a small space for easy transit. At the top is a head of open wirework, crowned with an asbestos mat or damper, to prevent the heat striking directly upwards and burning the roof of the balloon. The substance of the balloon is French cambric, an excessively fine fabric, with a double crossed woof, so as to be impervious to the air. It is slightly heavier than the silk usually employed for balloons, but requires no preparation or dressing of any kind to render it airtight. The furnace or burner is of annular character, constructed of copper, hollow, with a bulge all round at the bottom, to contain the oil. At the junction of the bulge and the walls of the furnace, on both sides, is a ring of wick (see AA.) At the summit of the burner or furnace are numbers of perforations piercing into its interior. A wall or ring of metal is erected on the top to direct the flame upwards. The action of the apparatus is as follows: Upon filling the bulge with oil and lighting the wicks, the walls of the furnace are quickly heated, the surface of the oil inside being rapidly converted into inflammable gas as its body becomes hot. The gas escapes at the perforations before alluded to, and very shortly ignites outside the burner with a loud roar, continuing to burn fiercely until the cisterns are exhausted. These are of course replenished from the tin cans carried in the car, as previously explained. The average heat generated throughout the balloon is about 100° above the surrounding atmosphere, a higher temperature than that being considered dangerous for the fabric of the balloon. It has been found, however, experimentally, that a temperature of 22° above the surrounding atmosphere will actually lift the balloon off the ground.

The actual lifting power of M. Ménier's hot air balloon, says the *Engineer*, from whose pages we select the engraving, can easily be calculated. Air, when heated from 50° to the boiling point, 212°, expands to the extent of 33 per cent beyond its original bulk. Assuming then the average temperature of the surrounding atmosphere up to a short distance from the earth's surface, say 300 yards, to be 50°, we should expel from the balloon, by heating it to 150° of heat, about 20 per cent. of its original contents. Now a globe of air 1 foot in diameter weighs as nearly as possible $\frac{1}{25}$th of a pound; and as Ménier's balloon is very nearly spherical, its contents would weigh, in pounds, $70 \times 70 \times 70 \times \frac{1}{25}$, or 13,720 lbs., because the contents of spheres are directly proportional to the cubes of their diameters. Hence, by the above process we should reduce this weight by 13,720 divided by 5, or 2,744 lbs. This, then, would be the total lifting power of the balloon, or exactly 23½ cwt.; and deducting 13 cwt. for the weight of the entire apparatus, we find that 10½ cwt. is the excess of lifting power arrived at. Occupants, freight and ballast to that extent could therefore be carried in M. Ménier's balloon.



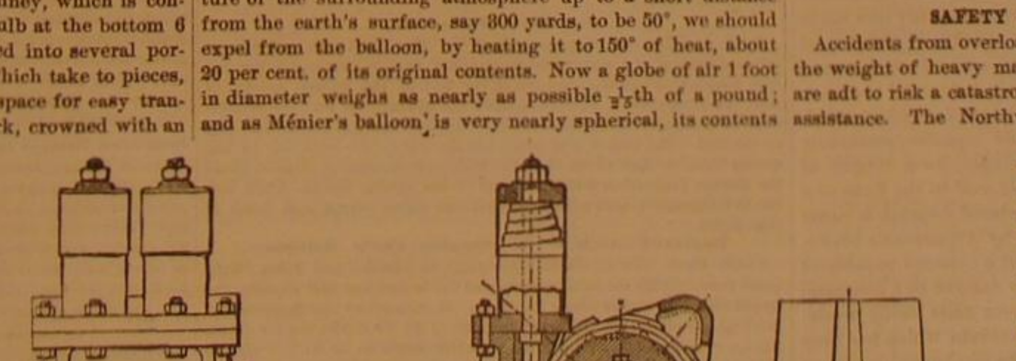
MENIER'S HOT AIR BALLOON.

Magnetic Condensation.

It is well known that a bar of soft iron, surrounded by an induction coil of wire, becomes magnetized on the passage of a current through the latter. Large magnets are frequently thus constructed; and in one capable of sustaining 330 lbs., M. Lallemand has noticed a curious condition. He states that, after allowing the above weight to be supported by the magnet, he removed all but 110 lbs., and then interrupted the current. The weight, however, remained supported, as it appeared, by residual magnetism in the iron. On removing the armature and weight, and then trying to replace the armature, it was found that the magnetism in the bar had disappeared and that there was not sufficient to hold the armature alone. *La Nature* mentions this as a new discovery, and suggests experimenting them. In this view our cotemporary is at fault, as a well known electrical expert informs us that, in using large magnets, he has repeatedly remarked the same phenomenon, and is, besides, under the impression that even a greater proportion than one third the weight can be sustained by the residual magnetism left in the bar. The explanation is doubtless to be found in the re-arrangement of the atoms of the iron under the influence of the current, a condition which, though of course not visible, can nevertheless be made to demonstrate its presence, as Professor Tyndall has shown, by a click at the establishment and interruption of the electric flow. The magnet and its armature and weight thus form a circuit, which may be likened to a band of steel held in annular form. The atoms retain their altered places even after the stoppage of the current; but the instant the continuity of the ring is broken, they return to their normal position, just as do the particles of steel when strain is removed.

SAFETY CATCH FOR CRANES.

Accidents from overloading cranes frequently take place, as the weight of heavy masses is not always known; and men are apt to risk a catastrophe rather than stop work or wait for assistance. The Northwestern Railway of Austria has recently brought into use an appliance which prevents the machine being overtaxed, and makes it impossible to lift a weight heavier than that for which the crane is designed. The end of the lifting chain, instead of being fastened to a fixed link at the end of the jib, is attached to a link hung to a crossbar, at each end of which is a vertical bolt rising through a casting in the head of the jib, and carried by a pair of volute springs. The arrangement is clearly shown in the engraving. These bolts can be adjusted with the greatest nicety, and the strength of the spring is made to correspond with the maximum load that the crane is to lift. Fastened to each of the bolts is a triangular block, with a feather at the back, serving as a guide, and moving in a groove, and with a number of V grooves in the front or inclined side. The sheave, over which the chain passes, is indented to a pitch corresponding to that of the chain itself, and on either side, and being a part of it, it is formed with a number of V grooves corresponding to those in the blocks above mentioned. So long, therefore, as the



SAFETY CATCH FOR CRANES.

weights placed upon the crane do not exceed the set limit, these blocks are not moved, but if a heavier load is added, the springs are compressed, and the brake blocks, coming in contact with the sheave, lock this latter, and prevent all motion.—*Engineering.*

Pennsylvania Railway Regulations.

A new book of orders has been recently issued, which contains some rules which are worthy of notice and imitation, and which, if enforced, will certainly add much to the comfort of passengers. Among them are the following:

"Brakemen must announce the name of each station, and the length of stop when it exceeds two minutes. Baggage masters are prohibited from receiving perquisites for the care of articles. The order will go into operation as soon as possible.

"Newsboys on trains will not be permitted to individually importune or annoy passengers, but may announce in a low voice, or at intervals not exceeding four times in each car, the articles offered for sale. Nor will they be permitted to deposit their papers, books, etc., on the seats of the cars or in the laps of the passengers.

"Depot masters and assistants, passenger conductors, and brakemen and baggage masters must wear suitable badges.

"Passenger conductors must seat passengers and see to their comfort and enjoyment as much as possible, see that none stand on the platforms, or ride on baggage, mail, or express cars; put off passengers refusing to pay at the next station; not permit drunken and disorderly persons on trains, nor allow profanity.

"Baggage agents and masters must handle baggage carefully; the former to charge for extra weight invariably; the latter to carry only such packages, bundles, money, etc., as the Division Superintendent authorizes.

"No tickets must be sold to persons so intoxicated as to be incapable of taking care of themselves, or who, by reason of such condition, might risk their lives by traveling, nor to any one incapable of self care.

"Loungers are not permitted in telegraph offices.

"United States mail agents, express managers, sleeping car conductors, porters, news agents, and individuals running private cars are to be regarded and to consider themselves as employees, and to conform to these rules and regulations."

Some important changes have been made in the code of signals used. They are now as follows.

"Red signifies danger, and says stop.

"Green signifies caution, and says go slowly.

"White says go on, all right.

"Green and white is a signal to stop at flag stations.

"Blue is a signal used by car inspectors.

"One short blast of the whistle signifies apply the brakes.

"Two long blasts, release the brakes.

"Two short blasts, when running, are an answer to signal of conductor to stop at next station.

"Three short blasts when standing mean the train or engine will back.

"Four long blasts call in the flagman; four short blasts call for signals.

"Two long followed by two short blasts, when running, are a signal on approaching a road crossing at grade.

"A succession of short blasts is a cattle alarm. A blast of five seconds duration is a signal for approaching stations.

"A lamp swung across the track means stop; raised and lowered vertically, go ahead; swung in a circle, come back.

"The engine bell is always rung before starting a train, when passing or meeting trains, through tunnels or through streets; also, until each road crossing is passed."

An Eighty Tun Gun.

The London *Standard* says: "It may not be generally known that the principle upon which all our guns are now made is that discovered by Colonel Fraser. Briefly, it consists of a series of coils, welded together in such a way that the grain of the iron is best opposed to the explosive force of the powder, and encircling a steel tube, the interior of which is rifled. A long bar of iron—say of eight inches square—previously prepared is slowly drawn from a furnace, to a length of about 300 feet, and wound in a double coil in the form of a cylinder. This is again heated and placed beneath a steam hammer, where it is welded together by tremendous blows, which so effectually do their work that a cylinder capable of bearing the greatest possible strain is formed at a comparatively trifling expense. Several of these coils being made, they are placed in order upon a long steel tube which has been made in Sheffield, and the weapon is finally turned out at an average cost of about $300 a tun, as against nearly $750 at Krupp's factory in Essen. Upon this principle, then, it was resolved to construct an eighty tun gun, which should be able to pierce twenty inches of iron at a distance of a thousand yards, with a shot 1,600 pounds in weight, and by the aid of 300 pounds of powder. The length of this magnificent piece of artillery was fixed at twenty-seven feet, its diameter at the trunnion six feet, and at the muzzle sixteen inches, inside measurement. It was calculated that such a gun would be able to deliver its mischief-working missile at a distance of nearly ten miles, and that it would, at the same time, be easily placed in the turret of a war ship or the embrasure of a battery, and worked quickly and without difficulty. Of course there were many difficulties in the way of the construction of such a weapon. No steam hammer such as that which Krupp possesses at Essen was to be found in England; no forges were built large enough for such a tremendous heat; no cranes were in position to hoist such a weight. But all these difficulties were speedily overcome by the skillful officials at Woolwich. The forges were built, a huge steam hammer of forty tuns weight, with double action arrangement and a striking power of nearly 1,000 tuns, was made, and very soon all was in readiness to begin the construction of the great gun. Curiously enough, His Majesty the Emperor of Russia was the first to see one of its coils welded, and since that time the work has been gradually going on, till now the steel tube, the breech piece, one coil, and the trunnion are finished; so that it is certain that by June next the gun will be ready for trial. It will then consist of the following parts: A tough steel tube inside, weighing nearly sixteen tuns and measuring about twenty-four feet in length, a breech piece coil twelve feet in length, one central coil, another coil nearer to the muzzle, and the trunnion coil. The cascabel through which the fire from the friction tube is communicated to the cartridge inside the gun is of steel, and immensely strong. Such is the weapon upon which hopes of a victory over twenty-inch armor plates are built. If it should succeed, three more will be made immediately, and the four pieces placed on board the Inflexible, which will then be the most powerfully armed vessel in the world. Possibly, at the same time, some addition may be made to her armor, so that she may be as invulnerable as she is terrible."

The Sandy Hook Ordnance Experiments.

The tests of the smooth bore guns which have been converted into rifles, by the insertion of a grooved wrought iron or steel tube, are making favorable progress at Sandy Hook. The artillery and ordnance officers conducting the trials appear to be quite confident of the success of the plan, and assert that it will result in trebling the efficiency of the 2,000 smooth bore guns now in Government possession. The cost of conversion, per gun, is about $500; and if for this moderate sum a weapon can be produced equal in power to the built-up rifles of England and Prussia (which in the former country cost $5,000, and in the latter from $8,000 to $10,000) the advantages on the score of economy alone will be very considerable.

The eight inch rifle now being tested is being fired with charges of 35 lbs. of mammoth powder and 175 lbs. projectiles. The one hundredth round gives a pressure of gas in the bore of 35,000 lbs. per square inch, and an initial velocity of 1,420 feet. This gun was converted from a ten inch smooth bore. Further trials are to be made with the same weapon altered to a nine inch rifle, and fired with 40 and 50 lbs. of powder and a 225 or 250 lbs. projectile.

THE telegraph cable between Europe and Brazil was finally completed and opened on the 23d of June, 1874, and is working well. The line cables are 3,213 miles in length, and extend from Lisbon, Portugal, to St. Vincent, in the Madeira Islands, 1,260 miles, thence to Pernambuco, Brazil, 1,953 miles.

AT a gold mine about a mile and a half east of Mount Monadnock, N. H., several assays of ore have been made. The quartz is said to vary from $5 to $840 per tun, or on an average not less than $100 per tun. The ledge in which the gold is found covers thirty-two acres.

Recent American and Foreign Patents.

Improved Filter.

Richard L. Gentry, Richmond, Ky.—This is a filtering apparatus through which rain or other water is passed before being collected in the cistern or otherwise applied for use. It consists of an outer and inner chamber filled with filtering material, to which the water is admitted by a supply pipe passing through a perforated bottom of the outer chamber and side apertures of the inner chamber into the latter, rising therein until reaching the hight of the central discharge pipe, from which it is carried to the cistern or other place. A perforated outlet hole of the discharge pipe, near the bottom of the inner chamber, drains the filtering material from the remaining water, while a screw spout of the outer chamber allows the cleansing of the filter from impurities.

Improved Mainspring.

James C. Edwards, Binghamton, N. Y.—This invention consists of the mainspring of a watch, clock, or other spring power, having the hole which receives the stud pin in the face of the barrel, arbor, or hub, for attaching it thereto, placed the distance of one circumference of the barrel or arbor from the end, and tapered from the hole to the end. The object is to graduate the rise of the next coil of the spring from the face of the barrel or hub on to the spring, so as to avoid the abrupt projection which the end of the spring forms when left the full thickness, and which produces an extra strain and bend at that point.

Improved Machine for Shaping Chair Bottoms.

Jacob Shuh, Berlin, Canada, assignor to himself and John Shuh, same place.—This machine is designed for hollowing and shaping the upper side of wooden chair bottoms. It comprises mechanism for holding the plank, of which the bottom is to be made, upside down over a rotary cutter, and gaging it to the cutter so as to cut to the required depth and shape, both on the bottom and the back, and at the same time feed it forward and backward laterally, and also from front to rear, so that one tool will perform all the work. The holding contrivances are adjusted for seats of different sizes, as well as for varying the depth and form of the hollow.

Improved Combined Step Ladder and Wash Bench.

Frederick S. Bidwell, Thompsonville, Conn.—The object of this invention is to improve the combined step ladder and wash bench patented February 3, 1874. This invention consists in the introduction of a supplementary brace frame pivoted to the lower part of the ladder-supporting frame, so that when the ladder is used as a wash bench and the supplementary frame set into the sockets of the latter part, the supporting frame, jointly with the shelf brace, forms diagonal braces for the wash bench, and stiffens the same more fully for the heavy weight generally placed thereon.

Improved Iron Fence.

Henry D. Stimson, Covington, Pa.—This fence is formed of a series of overlapping metallic rings, attached to central connecting bars, and secured below to a base sill.

Improved Pruning Implement.

Samuel J. Vance, Palmyra, Ill.—This is a pruning knife, which cuts the limbs or twigs by lever power exerted on the cutting knife and hook by the downward pulling of the handle. To the upper end of the handle, the rear end of the cutting knife is pivoted, while the front part is pivoted sidewise to a hook, having a slide guide plate and a guide band for sliding along the handle part.

Improved Litholycite.

Henry W. Bradford, Randolph, Mass.—The inner tube of the apparatus is arranged within another tube, which forms the confining tube for holding a bag, and springs within such compress as will admit of inserting both in the bladder and withdrawing them from it. Spring jaws have the edge of the mouth of the bag fastened to them, and are pivoted together at one end, and at the other end are connected to small steel rods between the tubes. These jaws are provided with mechanism so as to grasp the stone, and a small tube of platinum is inserted after the stone has been secured in the bag, for conducting nitric acid into it for dissolving the stone, so that it will flow out through the inner tube. The invention mainly consists of ingenious mechanism for governing the jaws, etc., to understand which a drawing would be requisite.

Improved Door Check.

Conrad W. Breidenbach, Dayton, O.—This consists of a stud, provided with a cushion for the door to strike against and having beneath a spring latch, which catches under the door and holds the same.

Improved Shutter Fastening.

Josephine S. Keator, Kingston, N. Y.—This consists of an angular hook, which is held in position by the window sash, and which engages with the staple of the blind. The butt end is turned to form a right angle, and a lip projects upward from said portion and bears against the sash when an effort is made to unfasten the blind from the outside. The lower rail of the sash bears against the lip.

Improved Steam Fountain Washer.

Henry R. Robbins, Baltimore, Md.—This invention relates to means whereby the steam boilers of hotels, laundries, and other buildings may be readily utilized for washing purposes, thereby greatly economizing fuel, and lessening the cost of washing over ordinary methods of specially generating steam for each tub or vessel.

Improved Handle and Covering for Burial Cases.

William S. Wood, Newtown, N. Y.—This handle is attached to rounded or angled corners of the lid, so that there will be two handles at each end, and so that thus the lid can readily be lifted and adjusted by two persons. The same inventor has also patented an improved process for covering metallic burial cases. The shells and the caps of the casket are submerged in a vat of melted beeswax, and while the wax is warm the cloth or velvet is put on and rubbed or pressed to the waxed surface.

Improved Carpet Stretcher.

John Niver, Sherman, N. Y.—The invention consists of three parts, a stretching bar, having a series of hooks and a perforated flange on its under side, a standard for supporting it, and a detachable brace rod, which connects them, and is made adjustable. The construction of said parts is such that the stretching bar may be used to stretch the carpet in two opposite directions from the point where the standard is located.

Improved Machine for Trimming Keys of Musical Instruments.

Milon Pratt, Deep River, Conn., assignor to himself and Pratt, Read & Co., same place.—This is a machine for trimming off the wood remaining on the keys after the pieces commonly known as "sharps" are removed. The keyboard is moved along under a cutter, and the spaces between the keys are cut on a bevel down to the ivory. The cutter is actuated by means of a treadle applied to the pitman. By means of a gage screw, the cutter is made to stop when it cuts through the wood, so that the ivory is not injured.

Improved Coupling Rod.

John Way and Alvan S. Hoffman, Napanock, N. Y.—This consists mainly of a weight attached, by an arm, to the coupling rod, and in the mode of supporting the weight before coupling. The arm is held up by the friction produced by a spring; but when the weight is raised, and the coupling rod is set for coupling, the pressure of the spring on the arm is reduced by a catch, which holds the spring out from the hanger, so that a slight concussion releases it, and allows the weight to drop and turn the coupling rod.

Improved Lamp Stove.

John W. Schreiber, New York city.—This invention relates to the construction of lamp stoves, in which a lamp or burner, already patented by the same inventor, is employed. The bottom of the fire box is perforated, and beneath are a series of wires. Beneath the wires is an annular plate with holes, which are arranged directly below the holes in the bottom. There is a space beneath this annular plate and the bottom through which air is furnished to the burner, the bottom of which burner is perforated. The bottom of the fire box, the wires, and the annular plate are arranged in two separate parts, one part being stationary and forming the greater portion of a circle, and the other part being attached to the door. When the door is closed, the two parts form a complete circle. The annular plate has a narrow flange on its outer edge, which prevents the air from escaping outward.

Improved Cone for Smoke Stacks.

James Hughes, Scranton, Pa.—The object of this invention is to break the striking force of the products of combustion before they reach the reticulated cover of the bonnet; and it consists in placing under the cover, and directly over the top of the smoke pipe, a concave spiral plate, which will readily allow the products of combustion to pass through the center and between the convolutions, but will cause all to strike the plate at some point.

Improved Process for Restoring and Purifying Caustic Alkali.

David Hanna, Jersey City, assignor to Henry C. Ohlen, Madison, N. J.—The lye is gathered in iron tanks and agitated to throw off the gaseous residuum it retains from the oils. After filtering, it is run into evaporating pans, where it is kept boiling till reduced to 30° or 40° gravity, and is then drawn off into settling tanks, and a quantity of finely pulverized quicklime added; also a little ammonia is sprinkled over the top. After standing a few days, the alkali is drawn off and put up in packages.

Improved Sewing Machine Table.

William Whitworth, Cleveland, Ohio.—The middle piece is of soft cheap wood. The side pieces and the end piece are of walnut or other fine and expensive wood. The soft wood portion is arranged with the grain running crosswise of the table, and it will be tongued and grooved to the side and end pieces, and these pieces will be framed together at the ends in any approved way. The veneer will be glued on in the ordinary way. The table thus constructed will not shrink, nor swell, nor warp by atmospheric influences, and will have the appearance of a table of solid fine wood.

Improved Detachable Horseshoe Calk.

Bushrod O. Bradfield, Pittsburgh, Pa.—This horseshoe calk has a rear aperture and horizontal lips, the lower preferably a little longer than the upper, and somewhat thicker. These lips embrace the body. A bolt is passed diagonally from the highest point of the calk through the body and lip. The lip, being comparatively thin, will not be objectionable, while the rivet or pin is out of the way of the hoof, and is yet made to take a good hold upon the shoe.

Improved Traveling Bag Retaining Device.

David L. Holbrook, Sing Sing, N. Y.—This invention consists in an improved traveling bag fastener formed of an angle plate, provided with a bent arm with a chain and a link or ring. In using the device, the chain is passed around the arm of the car seat, or around any other object to which the bag is to be secured. The angle plate is then passed through the ring, and placed within the traveling bag. The jaws or frame of the traveling bag are then closed upon the arm and the bag locked. With this fastening, the bag cannot be removed without first unlocking it.

Business and Personal.

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

Answers to Correspondents

C. J. A. can repair his rubber boots by following the directions on p. 203, vol. 30.—E. A. A. can japan iron castings by the process described on p. 298, vol. 26. Bronzing is detailed on p. 298, vol. 27.—M. can remove fruit and wine stains from table linen by the process explained on p. 171, vol. 30.—A. F. can repair his glue kettle with the cement described on p. 42, vol. 25.—A. E. S. will find a recipe for paste for paper labels on tin on p. 235, vol. 30.—W. H. P. does not send his name and address.—F. H. B. will find directions for making modeling wax on p. 58, vol. 24.—E. will find that Colburn's books on the locomotive engine are complete and authentic.

(1) P. asks: If two horses are drawing 1 tun with a four foot double tree, and one of them be given his end shorter by 1 inch, what would be the apportionment of the draft to the horse with the shorter end of the double tree? What would be the proportion if his end were two inches shorter? A. This case is analogous to that of two men carrying a weight suspended from a pole, the force exerted by each being inversely proportional to the length of lever between the hand and weight.

(2) H. P. asks: Does color exert any influence on the heat-radiating powers of bodies, boilers, etc., being usually painted black in preference to any lighter color? A. According to Melloni, color exerts no influence upon the radiant power of surfaces, white, black, and red radiating alike; so that, as regards the loss of heat from this source, the color of a substance is of no importance. On the contrary, color powerfully influences the absorption of luminous heat. Dr. Franklin spread differently colored pieces of cloth upon the snow in the sunshine. The black sunk farthest, that is, melted the most snow, and of course received the most heat. The blue sank to a less depth, the brown still less, and the white hardly at all. Hence by scattering soot over snow, its melting may be hastened.

(3) E. M. W. asks: Has anything been discovered that will harden gutta percha as sulphur hardens rubber? A. We believe not.

(4) A. M. asks: How can I construct a battery strong enough to charge a horseshoe magnet 12 inches long, with an electromagnet 5 inches long made out of ¾ iron, wound with 800 feet of No. 22 wire? A. A Bunsen battery would be the best for the purpose, and your cheapest plan would be to buy it from the regular dealers in the article.

(5) L. P. asks: Is white a color? A. If the separate colors of the spectrum are considered each as an element, white light is a compound, formed by perfectly blending together all these elements, and cannot, therefore, be properly termed a color.

(6) G. C. J. asks: 1. How long does it take to transmit one word across the ocean by cable? A. About one minute, although it is constantly varying. 2. What is the charge per word? A. To England, the charge per word is $1, gold.

(7) W. L. C. asks: How can I preserve the color of fascicled evergreen leaves, and prevent them from falling from the branch? A. Try dipping in pure dammar varnish.

(8) P. E. W. says: I wish to make brick out of the clay dredged from a channel at a seaport. The salt causes the bricks to glaze, and makes them worthless. How can the difficulty be obviated? A. To our knowledge, there is nothing that would accomplish this.

(9) F. R. R. says: I have a large glass globe, mounted on a pedestal of the same material. In the former, near its junction with the latter, is a fracture extending around two thirds of its circumference at that point. Can you tell me of a composition with which I may cement the interior of the globe, so as to strengthen it at the fractured point, have no deleterious effect upon the water contained therein, and at the same time prevent leakage? A. Try diamond cement.

(10) M. C. asks: 1. Can you give me a good recipe for soft soap, made with potash and domestic grease? A. Add 3 galls. rain or other soft water to 1 lb. of concentrated ley; boil it and put into it 4 lbs. tallow and soap fat. When the solution becomes clear, add 12 galls. more water. It is ready for use when cold. 2. Is a cellar a good place to keep it in? A. Yes. 3. Would freezing hurt it? A. Very probably. 4. Does the addition of salt to soft soap (to make hard soap) injure its quality? A. Yes.

(11) G. W. D. asks: What kind of varnish can I put on metal, so that the latter will not be injured when coming in contact with a solution of nitrate of silver? A. Try paraffin varnish. See p. 91, vol. 31.

(12) J. A. asks: Is there any elastic substance that would take the place of rubber in cloth, and resist boiling water? A. We do not know of any such substance.

(13) P. V. C. asks: Please give me a description of the spectroscope. A. You will find descriptions on pp. 64 and 276, vol. 30.

Can iron be decomposed by any acid, and will its decomposition generate electricity? A. Iron, being an elementary body, cannot be decomposed; but with strong nitric acid, it may be used as the positive element in the battery.

(14) S. A. asks: Is there any means whereby the color may be taken from the heavy black residue or tar left in the still after running the burning oils off from the crude petroleum, at the same time letting it retain its former body or consistence? A. This cannot be done without altering some of its properties.

(15) H. P. G. asks: 1. What will effectually disguise the smell of ammonia? A. The smell of free ammonia, that is, ammonia not in combination, cannot be disguised nor destroyed; but by combining it with a base, not volatile at ordinary temperatures, this may readily be accomplished. 2. What will prevent alcohol from evaporating? A. We know of no better method than that of keeping it in airtight vessels.

(16) H. C. J. asks: What book explains the terms marcasite, biotite, muscovite, blende, etc.? A. If you do not possess a dictionary, we cannot help you, since a certain amount of knowledge must be possessed by all readers of scientific publications. You can find full definitions of the names of these minerals in Webster's "Unabridged Dictionary."

Can you explain scientifically the operation of salt raising bread? A. Your meaning is not very clear. Raising salts or yeast powders commonly consist of such salts as cream of tartar (bitartrate of potash) and bicarbonate of soda. The leavening is due to the action of the liberated tartaric acid on the soda salt, which liberates the carbonic acid.

(17) W. E. J. asks: What kind of battery is required to operate the Atlantic cable? A. A modification of the Daniell battery, called the Minotto or sawdust battery, is employed for the purpose, twenty cells being used.

(18) J. C. C. asks; 1. What should be the temper of the steel in a permanent U magnet? A. See p. 175, vol. 30. 2. Which will magnetize a U magnet the better, a helix in two parts, one for each leg of the magnet, or a single coil? A. The latter.

There is a law in Ohio imposing a fine or imprisonment upon any person who sells, or offers for sale, a patent in any county without having first exhibited the letters patent to the probate judge of the county wherein the patent is sold or offered for sale, and having made oath, in his presence, of ownership, name, and place of residence. Is such a law constitutional? A. No. See p. 137, vol. 25.

(19) G. H. J. asks: How is black paint for steam boilers made? A. Common asphalte dissolved in turpentine is a very good paint for this purpose.

What is Venice turpentine? A. Turpentine prepared from the sap of the *larys Europæa*, or larch.

What is the theory of a draft in a chimney when there is no hot air to produce a draft? A. Unless there is a difference of temperature, between the air within and the air without the chimney, there is no draft.

(20) S. W. says: When our nickel five cent pieces were issued, it was reported in newspapers that their diameter was a certain number of centimeters, so that the measures of the French metric system might be derived from them. Is this true? A. The diameter of our five cent nickel coin is two centimeters.

How shall I rid my house of roaches? A. There are several good preparations for this purpose for sale by druggists and others, than which we can recommend nothing better.

In making a chess board by gluing veneers upon a board, the veneers curled up as soon as wet with the glue. How can I get over the difficulty? A. It is common, on applying the thin glue to such veneers, to moisten the opposite side with warm water.

(21) W. D. P. K. asks: Is there any chemical that, placed on or near a gas jet, will increase the luminosity? A. A device, used for this purpose, consists of a jet placed at the side of the gas burner, through which a supply of oxygen is allowed to escape.

Is there anything that I can take with me in a boat to keep me warm on a cold day? A. It is customary to use for this purpose a watertight vessel, previously filled with boiling water.

(22) J. B. T. says: We have a drug store in a wooden building, and are using kerosene, as we have no gas. We are always uneasy for fear of fire. Would it cost very much more to light the store by electricity? A. Yes. An electromotive force equal to forty Grove cells is the least that a suitable light could be produced with, and this would cost at least $1 per hour for one light sufficient for the store.

(23) L. F. R. asks: Can a Bunsen or a bichromate of potassa battery be changed to a Leclanché, simply by using the proper chemicals? A. Yes.

How are round balls of soap formed? A. They are cast or pressed in molds.

Please describe the manner of finding the latitude on board ship. A. The latitude is equal to the zenith's distance plus or minus the declination for the day. The latter is found by referring to the *Nautical Almanac*.

What is made of chromate of iron? A. Chromic acid.

(24) C. T., writing from Valley Falls, N. Y. says: A controversy has arisen in our community caused by the bursting of a flume, and we appeal to you to settle the question. All parties are agreed to abide by your decision. What is the difference between the side pressure of a flume of water ten feet deep and twenty feet square, and one ten feet deep and ten feet square? A. The pressure per square foot upon the sides of the flume is the same in both cases, namely, 312½ lbs. per square foot. To compute the pressure in such cases, multiply the area of the side of the flume by the hight of the center of gravity of the water in feet. In this example the hight of the center of gravity is 5 feet. Multiply the product by 62½ lbs., the weight of a cubic foot of water.

(25) J. S. H. says: On. 203, vol. 31, you gave directions for making a phosphorescent lamp. I tried it, but the phosphorus would not dissolve in the oil. What shall I do? A. Phosphorus should dissolve in the oil. If you follow the recipe and your phosphorus and oil are pure, the process will not fail. Enough phosphorus should be used to keep the oil saturated.

(26) E. H. asks: 1. Does a large body of liquid require a greater proportion of battery power than a smaller one? I have a copper bath 2 feet long containing about 20 gallons, which I can drive with 4 Callaud batteries, the zincs of which are 8½ inches in diameter, or with 3 small Bunsen batteries, and I have another copper bath 6 feet long, holding about 80 gallons, which I cannot drive with 14 Callaud batteries. If I put more goods in the large one than in the small one, the deposit is very slow, and soon ceases. Is nickel more easily deposited than copper, and does it require greater or less power than a copper bath of equal size, filled with the same amount of goods? A. So much depends upon the relative distance between your electrodes, the strength of your bath or electrolyte, and the coupling or arrangement of your batteries, as to the requisite quantity and tension of current, that, with so limited a description, we can give you no definite answer. 2. What is the relative power of Daniell's, Callaud's, and Smee's batteries? A. The electromotive force of a Grove being 100, Bunsen's is 98, Daniell's 56, Smee's about 25, Callaud's about 45

(27) W. P. asks: In adding the malt or diastase to a mashing of raw grain (which action is supposed to first convert the raw grain into starch, then, after standing a proper time at a certain temperature, to transform the starch into grape or starch sugar), how am I to know when the starch sugar is formed? A. The boiling of the starch with dilute sulphuric acid is effected on a small scale in leaden pans, but in an extensive preparation iron pans are employed. The requisite quantity of water is first heated to the boiling point, and to this is added the sulphuric acid, diluted with about 3 parts by weight of water. The starch is also brought, by the previous addition of water, to a milky consistency. The liquids so prepared are mixed, and the boiling continued until all the starch is converted into sugar. An intermediate stage, not usually noticed by the manufacturer, is the conversion of the starch into dextrin, which in turn suffers decomposition into grape sugar. The entire conversion of the dextrin into grape sugar cannot be ascertained with certainty by the iodine test, as sometimes a purple-red tinge is produced, while in others there is no change. The most reliable test is that with alcohol, founded on the known insolubility in that menstruum. To one part of the solution to be tested there are added 6 parts of absolute alcohol; if no precipitate is thrown down, there is no dextrin remaining, and the conversion has been entire. The proportions of the materials are generally, to 225 lbs. of starch meal, 8 lbs. of ordinary sulphuric acid at 60° Baumé and 75 to 100 gallons of water. The separation of the sulphuric acid from the sugar solution is a most important operation, for the color, purity, and flavor all depend upon success in this stage of the process. The acid is neutralized by baryta or by lime, with either of which it forms an insoluble salt. The baryta can be employed as carbonate (witherite). Lime is most generally used, for its greater cheapness.

(28) I. F. A. asks: What is the best paint or coating to resist the action of sulphuric acid, to be applied to the inside of an open vessel? A. The best covering for the inside of tanks, etc., to hold sulphuric acid is sheet lead. This will perfectly resist all action.

(29) S. E. M. says, in reply to J. E. W., who asked how to burn coal slack: We use it all the time in our boiler, starting the fire with soft coal, and then using half soft coal, mixed with slack. Our draft is not very good. In one place they think they cannot burn this mixture, without wetting it and then draining well before burning. I have tried this, but failed to see any good results. If J. E. W. will fire often and break up the crust that forms on top, he will have no trouble in using this mixture. I have put in steam blowers above and below the fire, but was glad to take them out again, because they took too much steam.

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

C.I.F.—Your specimen of a Californian mineral is disintegrated mica schist, of no value.—J. P. L.—Your specimen is antimony.—I. P. D.—The quartz contains galena and iron pyrites.

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 Freak of Lightning. By E. J. M.
On Capital and Labor. By B. E. G. J.
On the Phylloxera. By L. W. G.
On the Squirrel Question. By L. M. B.
On Curious Apples. By A. T. N.
On Terrestrial Gyration. By J. H.
On Power in Cotton Mills. By T. T. D.
On the Business Outlook. By J.

Also enquiries and answers from the following:
H. R. S.—C. E. S.—E. J. G.—J. R. B.—W. T. B.—T.C.—J. R. V.—J. G.

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 machines for hulling castor beans? Who sells cotton seed lint machines? Who makes match making machines, and what composition is required for the matches? Whose is the best force pump?" 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.]

INDEX OF INVENTIONS

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November 10, 1874,

AND EACH BEARING THAT DATE.

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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:

31,278.—HARVESTER.—R. Dutton. Jan. 27.
31,394.—POTTERY MOLDER.—W. Linton. Jan. 27.
31,402.—GRAIN BINDER.—S. Reynolds. Jan. 27.
31,511.—LAMP.—C. W. Cahoon. Feb. 3.

DESIGNS PATENTED.

7,848.—FLOOR CLOTH.—J. Barrett, New York city.
7,849.—BOXES.—J. Comly, Philadelphia, Pa.
7,850.—CLOCK FRONT.—S. B. Terry, Waterbury, Conn.
7,851 to 7,853.—WOVEN FABRICS.—W. B. Weeden, Prov., R. I.
7,854.—CENTER PIECE.—H. Berger, New York city.

TRADE MARKS REGISTERED.

2,060.—RYE WHISKY.—T. G. Carroll, Baltimore, Md.
2,061.—DESICCATED VEGETABLES.—A. Godillot, N. Y. city.
2,062 & 2,063.—GRAIN BAGS.—Graham & Co., Rockford, Ill.
2,064.—COTTON BALE TIES.—C. G. Johnson, N. Orleans, La.
2,065.—CORN SALVE.—J. H. Bicheiderfer, Philadelphia, Pa.
2,066.—MUSTARD.—C. L. Stickney, New York city.
2,067 to 2,070.—FLOUR.—Thornton & Chester, Buffalo, N. Y.
2,017.—SPICES, ETC.—Weikel & Smith Co., Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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On filing each application for a Patent (17 years)	$15
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On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

NOVEMBER 17 to 18, 1874.

4,054.—D. Sullivan, Bangor, Penobscot county, Me., U. S. Improvements in steam boilers, called "Sullivan's Improved Steam Boiler." Nov. 17, 1874.

4,055.—F. A. Hibbard, East Stanbridge, Missisquoi county, P. Q. Improvements in steamers and heaters, called "The Safety Combination Steamer and Heater." Nov. 17, 1874.

4,056.—A. De Garis, New York city, U. S. Improvements in apparatus for fattening fowls, called "Garis' Improved Fowl Fattening Apparatus." Nov. 17, 1874.

4,057.—E. B. Meatyard, Geneva Lake, Walworth county, Wis., U. S. Improvements in elastic railway car wheels, called "Meatyard's Patent Elastic Railway Car Wheels." Nov. 17, 1874.

4,058.—J. Bowman, Harrisburgh, Brant county, Ont. Improvements in hot air drums, called "Bowman's Revolving Angle Damper Parlor Heater." Nov. 17, 1874.

4,059.—J. M. Grover, Oxford, Oakland county, Mich., U. S. Improvements on a straw-binding attachment to harvesters, called "Grover's Grain Binder." Nov. 17, 1874.

4,060.—S. Rue, Philadelphia, Pa., U. S. First extension of No. 2,849, called "Rue's Little Giant Injector." Nov. 17, 1874.

4,061.—S. Rue, Philadelphia, Pa., U. S. Second extension of No. 2,849, called "Rue's Little Giant Injector." Nov. 18, 1874.

4,062.—E. S. Scripture, Brooklyn, Kings county, N. Y., U. S. Improvements on adjustable wrenches, called "Scripture's Champion Cast Steel Adjustable Slide Wrench." Nov. 18, 1874.

4,063.—J. E. Watson, Louisville, Jefferson county, Ky., U. S. Improvements on water gages, called "Watson's High and Low Water Alarm Gages." Nov. 18, 1874.

4,064.—A. Hadden, Goderich, Huron county, Ont. Machine for cramping, called "The Cramping Horse." Nov. 18, 1874.

4,065.—T. M. Chapman, Oldtown, Penobscot county, Me., U. S. Improvements on machine for sharpening saws, called "Chapman's Saw Sharpening Machine." Nov. 18, 1874.

4,066.—H. E. Champion, Detroit city, U. S. Improvements on steam boiler furnaces, called "Champion's Improvement in Boiler Furnaces." Nov. 18, 1874.

4,067.—T. Branigan, Beloit, Rock county, Wis., U. S. Improvements on a boot tree, or a device for treating boots called "Branigan's Champion Boot Tree." Nov. 18, 1874.

4,068.—A. W. Covell, South Elmsley township, united counties of Leeds and Grenville, Ont. Improvements on saw shareners, called "Covell's Saw Sharpeners." Nov. 18, 1874.

4,069.—J. Steel and J. McInnes, Glasgow, Lanark county, Scotland. Improvements on apparatus for actuating the brakes of railway trains by compressed air, part or parts of which are also applicable for signaling in railway trains, called "Steel & McInnes' Improved Air Brake and Train Signal." Nov. 18, 1874.

4,070.—C. F. Murdock, Detroit city, Mich., U. S. Improvements in stop valves, called "Murdock's Champion Stop Valve." Nov. 18, 1874.

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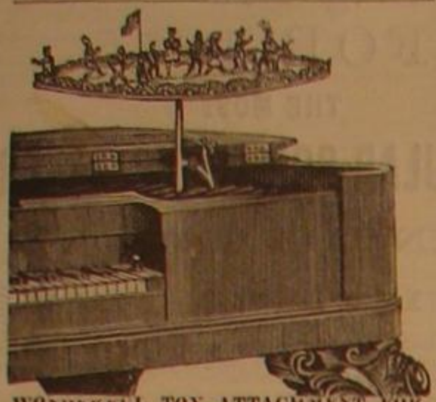

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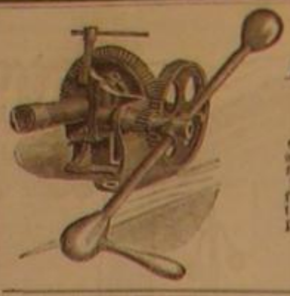

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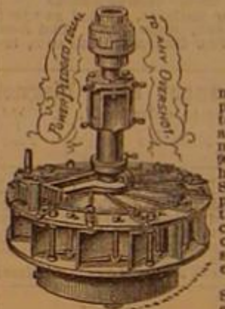

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Agents' and Wardens' Office, Sing-Sing Prison, November 18, 1874. Pursuant to a resolution of the Board of Inspectors, sealed proposals will be received by the undersigned, at his office, Sing Sing Prison, up to the 3rd day of December, 1874, at noon, for the labor and services of five hundred (500) male convicts confined in this prison, to be employed in the Laundry business, to commence on the 1st day of December, 1874, for the term of five years (5).

Also, proposals for the labor and services of Fifty Male Convicts confined in this Prison, to be employed in the manufacture of Brooms, for the term of 5 years.

Also, proposals for the labor and services of Fifty Male Convicts confined in this Prison, to be employed in the manufacture of Wooden Ware for the term of five years (5), to commence on the 1st day of December, 1874.

Also, proposals for the labor and services of Fifty Male Convicts confined in this Prison, to be employed in the manufacture of Machinery for the term of five (5) years, to commence on the 1st day of December, 1874.

Also, proposals for the labor and services of Fifty Male Convicts confined in this Prison, to be employed in the manufacture of Cigars for the term of five (5) years, to commence on the 1st day of December, 1874.

With such labor and services will be furnished shops and premises in the Prison Yard. No Hydraulic, no steam power or Machinery will be furnished with such labor and services. The use of the Croton Water will be allowed at a reasonable rate.

Proposals for the labor and services of Male Convicts to be employed in the Laundry Business must be addressed to the undersigned, marked: Proposals for the Labor and Services of Male Convicts to be Employed in the Laundry Business. And each of the other proposals must be addressed in like manner and specify what the services are required for.

Blanks for such proposals will be furnished by the Clerk of this Prison to any person applying therefor. They must be accompanied by the written consent of the persons to become sureties in the said Contract, and they must have annexed a justification of the sureties in a sum not less than five thousand dollars, as provided by Section 9, Chapter 431, Laws of 1874. No proposals will be entertained which offer more than one price per day; and the right is reserved to the Inspectors, with the assent of the undersigned, to reject all or any of the proposals made, if they shall deem it for the interest of the State so to do.

ALFRED WALKER, Agent and Warden.

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