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THE LANDORE SIEMENS STEEL WORKS, ENGLAND.

Condensed from The Engineer.

The principal novelty upon which the processes in operation in these works are based is Mr. Siemens' regenerative gas furnace, by means of which most intense heats are obtained without cutting flames or deteriorating influences. The steel processes carried on are of two distinct kinds In the first, which is called the Siemens-Martin process, scrap metal or puddled blooms are dissolved in a bath of pig metal previously prepared on the open hearth of one of these regenerative furnaces, and spiegeleisen is finally added to impart to the metallic bath the requisite percentage of carbon and manganese. In the other process pig metal and iron ores, previously prepared for the purpose, are brought into combination on the hearth of a similar furnace, to produce the same final result, namely, a steel of excellent quality.

The Landore Siemens Steel Company, Limited, was formed three years ago for the manufacture of steel by the processes invented by Mr. C.W. Siemens, C.E. The regenerating gas furnace, which he had previously invented, gave him the power of producing, at a moderate cost, temperatures before unknown in practical metallurgy; consequently, no great time elapsed before he applied this new power to the manufacture of steel, since the intense heat at his command enabled him to keep in a state of fusion, for a lengthened period, a much larger quantity of malleable iron than was practicable before the invention of his furnace. The difference between the Siemens and the Bessemer process of making steel is, that by the former method the metal is kept for any time slowly simmering in a state of fusion, so that, by the addition of varying proportions of the ingredients, at such times as may be convenient to the manager of the furnace, steel of any temper can be made. The process is so completely under control that steel containing any desired quantity of carbon can be made at will, whereas steel containing a predetermined proportion of ingredients can only be made by the Bessemer process with some difficulty. Mr. Siemens, by melting together samples of iron containing different proportions of carbon, produces steel containing any desired quantity of carbon.

The Landore Works were built nearly two and a half years ago; they cover about six acres of ground, on the west bank of the river Tawe, near Swansea, and at the present time they keep about 400 men in constant employment. They consist of fifty two Siemens producers for the manufacture of the gas, a melting shop containing eight furnaces, and a forge department containing two eight tun hammers, capable of hammering 450 tuns a week. There are six reheating furnaces in the forge department. There are also in the works six double puddling furnaces with shingling hammer, and a mill driven by two of Thwaites and Carbutt's 30 inch cylinder engines, with Ramsbottom's reversing gear.

In the mill department there are three double straightening presses, and one double punching press, one "ending" machine, and one cold saw. Some new works are in course of erection, by the same company, on the opposite bank of the river, a little to the north of the Landore viaduct. At present the company do not make their own pig iron, but in the new works four blast furnaces will be erected for the manufacture of pig, which will then be puddled and melted. Sixteen melting furnaces will be built, and five eight tun hammers put up. It is intended to keep a rolling mill at work night and day.

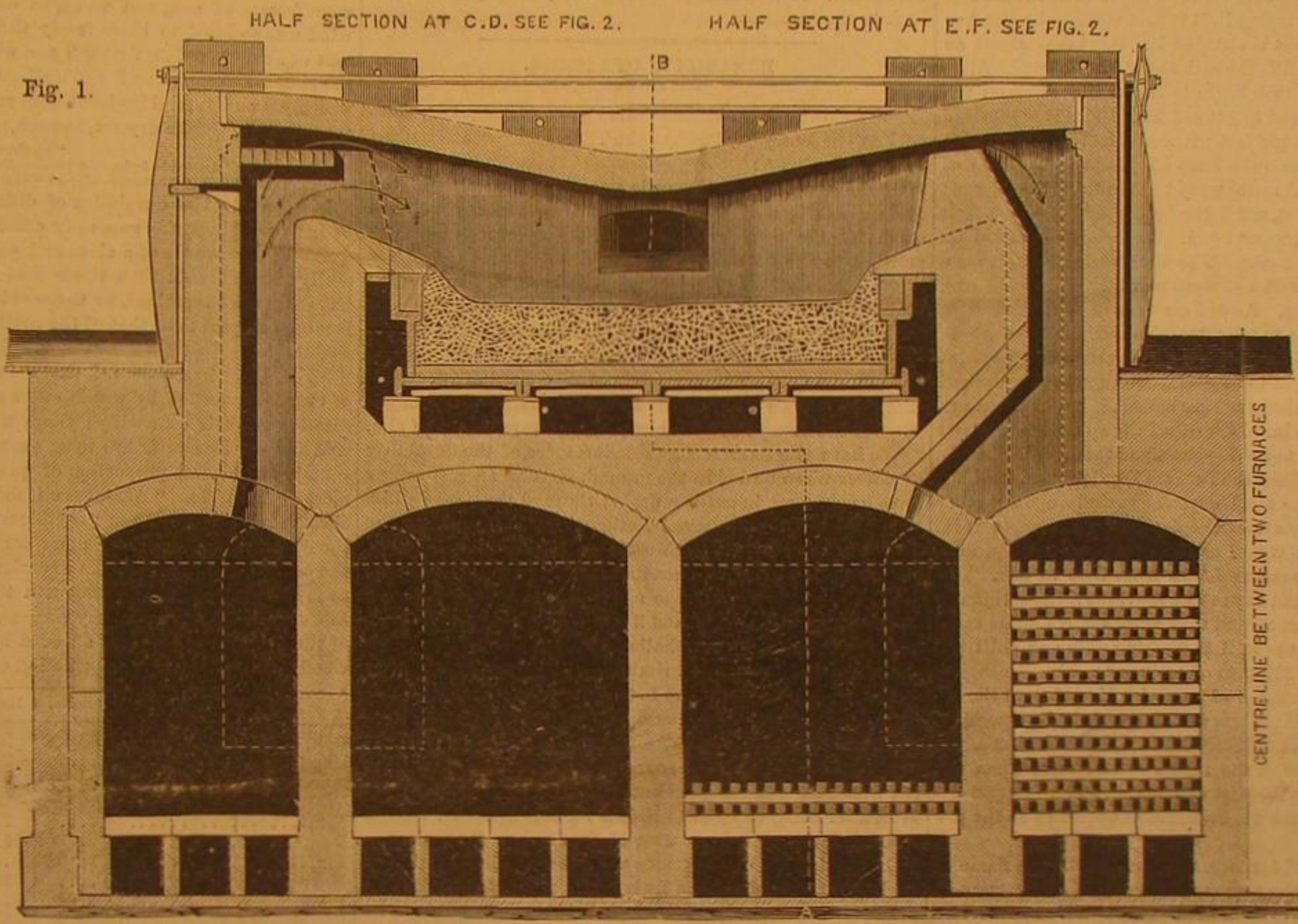
When these new works are completed and the iron trade is brisk, the Landore Siemens Steel Company could find employment for about 1,000 men. In the new steel works gas furnaces only will be used; one great advantage of these furnaces is, that they do not pollute the air with clouds of smoke. The iron ore to feed the blast furnaces will be brought for the most part from Spain.

In the steel works now in operation the fifty-two Siemens producers for the manufacture of gas are arranged in thirteen blocks of four each. The gas is divided into two portions, one of which is conveyed to the melting and puddling furnaces, another portion being conducted by a second large tube to other melting furnaces, and to the heating furnaces for the mill and hammer. The coal used in the manufacture of the gas is obtained from the neighborhood, and consists of equal parts of "slack" of small coal and binding coal.

In the melting shop there are eight furnaces altogether; four of them are for melting up scrap, and about 62 tuns per week are melted in each furnace; the furnaces work about thirteen heats per week. First, about one tun of pig iron is charged in, then sufficient scrap, with very little carbon in, to reduce the carbon in the metal in the furnace to *nil*, or very nearly *nil*. The little carbon in the metal is partly boiled out, and this is one of the peculiarities of the process, for if the charge in the furnace be left to itself, the carbon is slowly boiled away. The necessary amount of carbon to produce steel is introduced by adding spiegeleisen, which at the same time furnishes the requisite quantity of manganese; but after the spiegeleisen is added, it is necessary to tap the furnace as quickly as possible, or the manganese would be burnt away. The pig iron used in the process is of good quality, and as much steel scrap as can be obtained is very quickly used up at the works. The following is a fair sample of an ordinary charge:—20 per cent pig iron, 20 per cent Bessemer scrap, 10 per cent rough puddled iron, 15 per cent Siemens scrap, 15 per cent old iron and borings, 20 per cent shearings.

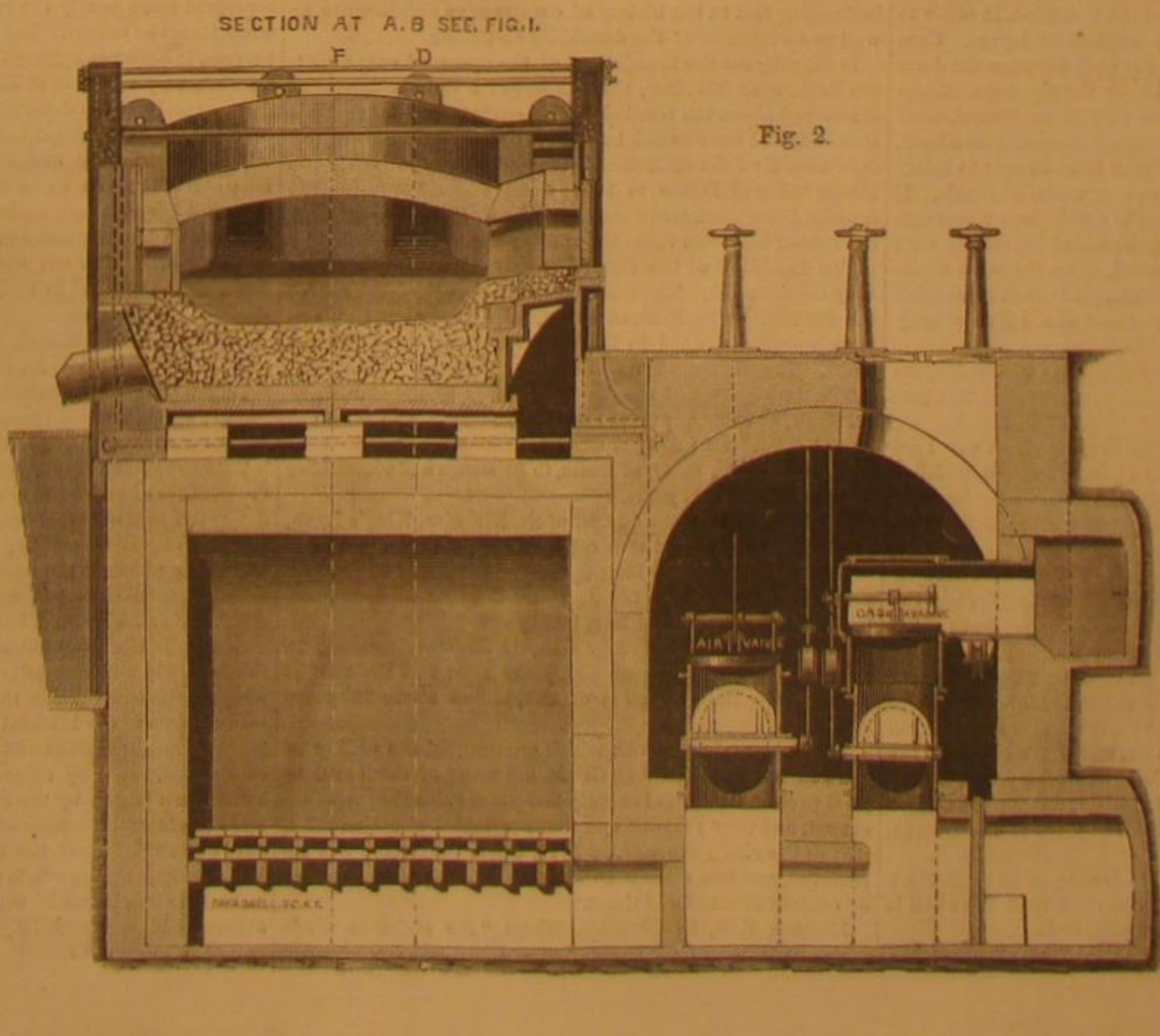
About 7½ per cent of spiegeleisen is then added, which

Fig. 1.



STEEL MELTING FURNACE, SIEMENS STEEL WORKS, LANDORE, ENGLAND.

Fig. 2.



much more than covers the waste. Every now and then a little of the melted metal is taken out in a ladle, and plunged into cold water; the sample is then broken upon an anvil. Its fracture should be bright and crystalline, showing a very small proportion of carbon—not more than 0·1 per cent; it should also be tough and malleable. From 5 to 8 per cent of spiegeleisen, containing not less than 9 per cent of manganese, is thereupon charged through the side openings down upon the bank of the furnace, and allowed to melt down into the bath. The amount of carbon thus introduced determines the temper of the resulting steel. In the event of the sample containing too much carbon, as proved both by its appearance and by chemical analysis, the carbon is allowed to boil out if the furnace is too full, as the addition of more iron might cause accidents; but this boiling out takes time. The quickest way is to add more decarburized iron, if there is room for it in the furnace. In judging the amount of carbon present by the appearance of the sample, the rule is "the more silky the metal, the less carbon does it contain," and, when it is half way between the granular and silky states, then the bath is ready for the spiegeleisen.

The accompanying engravings show the form of the interior of the furnace. In charging it, it is first made quite hot, and then one tun of pig iron is charged in; this takes about an hour to melt, and then fills the bath to the proper level. After it is fairly melted, the men begin to charge the scrap on the bank, where it is allowed to get red hot before it is tumbled down upon the melted pig iron; it would chill the bath if it were added cold. The men keep on placing quantities of more or less carburised metal upon the bank, and tumbling it into the bath when hot, until the bath contains about four tuns, filling it to the proper level. The whole operation occupies seven or eight hours. The time varies a little; on a hot day the furnace will not work so well as on a cold one, because of the draught. After four tuns of iron have been melted, the men begin to take samples out, and then go on charging decarburised iron till the metal gets soft enough, at which point there ought to be about five tuns in the furnace. If it is too hard more shearings are added; if not hard enough a little pig iron is put in. Last of all the spiegeleisen is put in; it is placed on the top of the bank, and tumbled in directly it is warm enough. Then the furnace is quickly emptied, for the forgeability of the steel depends entirely upon getting the charge out directly after the spiegeleisen has been put in, or else the manganese would all be burnt out. The process of melting takes about ten hours from first to last. The furnaces work night and day; there are three men continually attending to each furnace, and they work twelve hours each. At present, however, the mill is working only one shift per day, which turns out 350 tuns of rails per week.

From experiments made in France by M. Sudre, at the expense of Napoleon III., it was found that it is just possible to raise the heat of an ordinary furnace, by means of a fan blast, sufficiently to effect the fusion of tool steel upon the open hearth, but that the cost of the fuel and the rapid destruction of the furnace are commercial obstacles to the use of the method.

In the Siemens steel furnace, the direction of the flame is from end to end, and the regenerators are placed transversely below the bed, which is supported on iron plates kept cool by a current of air; this cooling of the bed is very necessary to keep the slag or melted metal from finding its way through into the regenerator chambers. The bottom of the furnace is formed of siliceous sand. Instead of putting moist sand into the cold furnace, Mr. Siemens calcines the sand, and introduces it into the hot furnace in layers of about one inch in thickness. The heat of the furnace must be sufficient to fuse the surface of each layer; that is to say, it must much exceed a welding heat at the end of the operation, in order to impart additional solidity to the uppermost layers. Care must be taken that the surface of the bath assumes the form of a shallow basin, being deepest near the tap hole. Some white sand—such, for instance, as that from Gornal, near Birmingham—will set, under these circumstances, into a hard, impervious crust, capable of surviving from twenty to thirty charges of liquid steel, without requiring material repair. If no natural sand of proper quality is available, white sand, such as that of Fontainebleau, may be mixed intimately with about 25 per cent of common red sand, when the same result will be obtained. The actual requirement is sand containing about 96 per cent of silica and 4 per cent of alumina or magnesia.

After the steel is melted, it is tapped out of the furnace into a ladle, as in the Bessemer process, and is then run into ingots.

The rails for the Metropolitan Railway, made at the Landore Steel Works, have a flange of 6$\frac{3}{8}$ inches across, which is a great width to "bring up" in steel, and can only be done with good metal; the steel, if of second rate quality, will crack along the edges of the flange.

We saw several testing machines in the works where inspectors employed by the different railway companies test the rails before accepting them of the makers. The test for the bridge rails used on the Great Western Railway is a weight of 21 cwt., allowed to fall from a height of 6 feet 4 inches upon the center of a piece of rail supported upon bearings 3 feet 6 inches apart. The blow is repeated three times upon the center of the same piece of rail; and if the center of the rail be then deflected about 7 inches, the steel is considered to be good. Sometimes the result is a deflection of not more than 5 or 6 inches, and sometimes the piece of rail breaks, but not often.

The total fall of the machine is 24 feet, upon an anvil block of solid iron weighing 15 tons. The rigidity of the anvil is an important point in testing steel rails or bars.

The test of the Bristol and Exeter Railway Company is a 10 feet fall of 2,240 lbs.; three blows; 5 feet bearings.

The rails for the Metropolitan Company weigh 86 lbs. to the yard, and are tested, not by a falling weight, but by the dead weight produced by hydraulic pressure. A piece of the rail is placed upon 5 feet bearings, and a slightly curved iron surface 3$\frac{3}{4}$ inches in width is made to press upon the center of the sample rail selected for testing. The test is that under these conditions a pressure of 40,000 lbs. shall not deflect the centre of the rail more than 1 inch; also that 60,000 lbs. shall deflect it 9 inches without breaking it.

A steel rail has fully six times the life of an iron rail, and the difference in price between them is about £5 per ton. Steel rails now cost £12 per ton.

There is a laboratory attached to the Landore Steel Works, under the direction of Mr. A. Wallis, where every sample of iron which enters the melting furnaces is first analysed to ascertain the proportion it contains of sulphur, phosphorus, and silicon. Every charge from the melting furnaces is tried also by the color test for carbon. If the proportion of carbon is found to be rather high, a rail is rolled and a piece of it cut off and tested before the remainder of the ingots are hammered. If it does not stand the test, the ingots are sent back to the furnaces.

DURABILITY OF TIMBER.

The following is an extract from the new edition of "Tredgold on Carpentry," edited by John Thomas Hurst, and noticed in another column:

Of the durability of timber in a wet state, the piles of the bridge, built by the Emperor Trajan across the Danube, are an example. One of these piles was taken up, and found to be petrified to the depth of three fourths of an inch; but the rest of the wood was little different from its ordinary state, though it had been driven more than sixteen centuries.

The piles under the piers of old London Bridge had been driven about 600 years, and, from Mr. Dance's observations in 1746, it did not appear that they were materially decayed; indeed they were found to the last to be sufficiently sound to support the massy superstructure. They were chiefly of elm.

We have also some remarkable instances of the durability of timber when buried in the ground. Several ancient canoes have been found, in cutting drains through the fens in Lincolnshire, which must have lain there for many ages. In the *Journal of Science*, etc., published at the Royal Institution, one of these canoes is described, which was found at the depth of eight feet below the surface of the ground. It was 30 feet and 8 inches long, and 3 feet wide in the widest part, and appears to have been hollowed out of an oak tree of remarkably fine free grained timber.

Also, in digging away the foundation of old Savoy Palace, London, which was built nearly 700 years ago, the whole of the piles, consisting of oak, elm, beech, and chestnut, were found in a state of perfect soundness; as also was the planking which covered the pile heads. Some of the beech, however, after being exposed to the air for a few weeks, though under cover, acquired a coating of fungus over its surface.

On opening one of the tombs at Thebes, M. Belzoni discovered two statues of wood, a little larger than life, and in good preservation; the only decayed parts being the sockets to receive the eyes. The wood of these statues is probably the oldest in existence that bears the traces of human labor.

A continued range or curb of timber was discovered in pulling down a part of the Keep of Tunbridge Castle, in Kent, which was built about 750 years ago. This curb had been built into the middle of the thickness of the wall, and was no doubt intended to prevent the settlements likely to happen in such heavy piles of building; and therefore is an interesting fact in the history of constructive architecture, as well as an instance of the durability of timber.

In digging for the foundations of the present house at Ditton Park, near Windsor, the timbers of a drawbridge were discovered about ten feet below the surface of the ground; these timbers were sound but had become black. Hakewell says that Sir John de Molines obtained liberty to fortify the Manor house of Ditton, in 1396; and it is most probable the drawbridge was erected soon after that time; and accordingly the timber had been there about 400 years.

The durability of the framed timbers of buildings is also very considerable. The trusses of the old part of the roof of the Basilica of St. Paul, at Rome, were framed in 816, and were sound and good in 1814, a space of nearly a thousand years. These trusses are of fir.

The timber work of the external domes of the Church of St. Mark, at Venice, is more than 840 years old, and is still in a good state. And Alberti observed the gates of cypress to the Church of St. Peter, at Rome, to be whole and sound after being up nearly 600 years.

The inner roof of the Chapel of St. Nicholas, King's Lynn, Norfolk, is of oak, and was constructed about 500 years ago.

Daviller states, as an instance of the durability of fir, that the large dormitory, of the Jacobins' Convent at Paris, had been executed in fir, and lasted 400 years.

The timber roof of Crosby Hall, in London, removed in 1869, was executed about 400 years ago; and the roof of Westminster Hall, which is of oak, is now above 340 years old.

The rich carvings in oak which ornamented the ceiling of the king's room in Stirling Castle, are many of them still in good preservation. It is nearly 360 years since they were executed, and they remained in their original situation till a part of the roof gave way, in 1777, when the whole was removed, and has since been dispersed among the collectors of curious relics of old times.

Moreton Hall, in Cheshire, where "the staircase winds round the trunk of an immense oak tree," and the building itself is chiefly constructed of wood, has now existed nearly 300 years.

And Mr. Britton describes an old house at Islington, constructed chiefly of wood, which he has ascertained to be about 240 years old.

Other notices of extraordinary durability will be found in the descriptions of the different kinds of wood. But enough already has been collected to show that timber is very durable where nothing more than ordinary means have been used to render it so; that is, nothing more than judicious selection and good seasoning.

Every permanent support should be formed of a good and sound piece of timber; inferior kinds should be used only for temporary purposes, or where no strain occurs, and where they can be easily renewed without injury to the strength of the building.

Mr. Barrow, in writing on this subject, very judiciously remarks, "that the felling of timber while young and full of vigor, making use of the sapwood, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more frequent and extensive than it was in former times, when our ships were hearts of oak, and when, in our large mansions, the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the paneled wainscot and the wall. In those old mansions, which yet remain, and in the ancient cathedrals and churches, we find nothing like dry rot, though perhaps

"perforated sore
And drilled in holes, the solid oak is found
By worms voracious eaten through and through."

In regard to the durability of different woods, the most odoriferous kinds are generally considered to be the most durable; also woods of a close and compact texture are generally more durable than those that are open and porous, but there are exceptions, as the wood of the evergreen oak is more compact than that of the common oak, but not nearly so durable.

Sir H. Davy has observed that, "in general, the quantity of charcoal afforded by woods offers a tolerably accurate indication of their durability; those most abundant in charcoal and earthy matter are most permanent; and those that contain the largest proportion of gaseous elements are the most destructible. "Amongst our own trees," he adds, "the chestnut and the oak are pre-eminent as to durability, and the chestnut affords rather more carbonaceous matter than the oak. But we know from experience, that red or yellow fir is as durable as oak in most situations, though it produces less charcoal by the ordinary process. The following table of the quantity of charcoal afforded by 100 parts of different woods is added, for the information of the reader:—

Kind of Wood.	Watson.	Mushet.	Proust	Rumford.
Oak, dry	22·92	22·6	19	43
Chestnut	....	23·2	..	....
Mahogany	20.82	25·4	..	....
Walnut	26·04	20·6	..	....
Elm	....	19·5	..	43·27
Beech	....	19·9	..	....
Fir	15·62	....	..	44·18
Norway Pine	....	19·2	..	....
Pine	....	....	20	....
Scotch Pine	....	16·4	..	....
Ash	17·71	17·9	17	....
Poplar	....	....	..	43·57
Lime	....	....	..	43 59
Birch	....	17·4	..	....
Sycamore	....	19·7	..	....
Sallow	....	18·4	..	....

In Count Rumford's experiments a longer period was allowed for the process; and, in consequence, his results represent more nearly the real quantities of carbon in each wood than the others. But even according to the common process, it does not appear that the proportion of charcoal is a satisfactory criterion of the durability.

An experiment to determine the comparative durability of different woods is related in Young's "Annals of Agriculture," which will be more satisfactory than any speculative opinion; and it is much to be regretted that such experiments have not been oftener made.

"Inch and half planks of trees from thirty to forty-five years' growth, after ten years' standing in the weather, were examined and found to be in the following state and condition:—

Cedar, perfectly sound; larch, the heart sound, but sap quite decayed; spruce fir, sound; silver fir, in decay; Scotch fir, much decayed; pinaster, quite rotten; chestnut, perfectly sound; abele, sound; beech, sound; walnut, in decay; sycamore, much decayed; birch, quite rotten.

This shows at once the kinds that are best adapted to resist the weather; but even in the same kind of wood there is much difference in the durability, and the observation is as old as Pliny, that "the timber of those trees which grow in moist and shady places is not so good as that which comes from a more exposed situation, nor is it so close, substantial, and durable;" and Vitruvius has made similar observations.

Also split timber is more durable than sawed timber, for the fissure in splitting follows the grain, and leaves it whole, whereas the saw divides the fibres, and moisture finds more ready access to the internal parts of the wood. Split timber is also stronger than sawed timber because the fibers, being continuous, resist by means of their longitudinal strength; but when divided by the saw, the resistance often depends upon the lateral cohesion of the fibers, which is in some woods only one twentieth of the direct cohesion of the same fibers. For the same reason whole trees are stronger than specimens, unless the specimens be selected of a straight grain, but the difference in large scantlings is so small as not to be deserving of notice in practice.

The Practical Philosophy of Gas Burning.

The secret of gas consumption is to secure good burners, to adapt them to the supply of gas, and to understand the simple principles by which the supply should be regulated. Probably nineteen twentieths of the gas burners now in use throughout the country are of irremediably bad construction, the most economical plan of dealing with which would be to throw them aside at once. A report to the London Board of Trade by the gas referees, containing "the result of their investigations of the principles which regulate the development of light from gas, and the application of those principles to the construction and use of burners in the manner most advantageous and economical to the public," forms the subject of an article in the *Spectator*. That journal says: "If any one is inclined to look contemptuously on so small a matter as the improvement of gas burners, a few of the facts stated in the report will, if he have any of the Englishman's regard for his pocket, very decidedly convert him to a sense of its importance. On an average, consumers of gas, by using well constructed and well adapted burners, instead of the usual clumsy, haphazard kind, may reduce their gas bills by one third or one half of the whole amount, while obtaining a stronger and more steady light than they obtained before. In a middle class household the gas bill is no inconsiderable item; and, even if the health of the family were not concerned, it would surely be desirable to control in some measure the unnecessary and expensive consumption. But we know the carelessness and contempt for thrift which prevails in these countries. It is more remarkable that in great business establishments, where the charges for gas must be of necessity enormous, some effort at improving the burners has not been made. The referees, having examined a quantity of burners supplied by the leading gas fitting firms, and having found the majority hopelessly defective, brought the matter to a practical test by visiting certain establishments, in the city, where night work prevails. As an instance of the waste in such places, we are informed that in the publishing offices of two great daily papers the burners chiefly in use gave out only one half the light that the gas supplied was capable of giving, while a large number furnished only one quarter of the true illuminating power. As compositors and other newspaper *employés* must have a strong light, it is clear that the place of this wasted power had to be supplied by additional burners. In private houses the loss is not so outrageous as this, but it is considerable almost everywhere, and the report affirms that, on a most moderate estimate, one fourth of the annual gas rental of London might be saved by the use of good burners. This rental is £2,000,000 a year, so that it is plain we are throwing away half a million per annum in mere heedless ignorance. Nor are we committing this waste with impunity. By the use of perfect burners we burn less gas to obtain the necessary quantity of light, and the less gas we burn the less do we pollute the air with the noxious products of combustion. The amount of these products, too, is diminished by the employment of burners which completely consume the gas supplied to them. It is obvious, therefore, that the use of ill contrived burners in large establishments, and the resulting waste described may be a prevalent cause of the ill health from which newspaper printers and other night workers suffer.

A good gas burner is not an imaginary article, although a perfect burner has yet to be discovered. The referees in their recent inquiries and experiments have taken as a standard "Sugg's London Argand Burner No. 1," which is not the best invented by the maker, but seems at present the one most adapted for practical use. Comparing with this burner, when burning five feet of gas per hour, those in common use under the names "fish tail" and "bat wing" burners, we obtain some remarkable results. Taking the standard burner's illuminating power at 100, six fish tail burners gave these results:—73, 62, 52, 46, 36, and 19, the latter giving less than one fifth of the light supplied by the standard at the same consumption of gas. The bat wing burners show better results, being 86 and 82, as compared with the standard. It must be observed, however, that the standard is an Argand burner, in which the supply of air to the flame is regulated by a chimney. Comparing three other Argands with the standard, we find the illuminating power still far inferior, being no more than 78, 77, and 34 per cent respectively. These tests clearly prove the superiority, of Sugg's Argand No. 1, to any burner in common use. Of course it remains a question in particular instances whether the cost of supplying these burners would be too great to admit of their general adoption.

A burner is to gas and the development of light, as the report points out, what a boiler is to coal and the generation of steam. In the early days of the steam engine, before boilers were properly adapted to their work, there was an enormous waste of power, so that "one ton of coal in a locomotive of the present day generates as much force as six tons did forty years ago." But a well constructed boiler is fitted to do its work best when consuming a fixed quantity of fuel, and there is in, like manner, in the case of every gas burner, a certain rate of consumption at which the highest illuminating power in proportion to the supply is attained. Above or below this point there must be more or less waste, and there is as much above it as below it. This is a fact which deserves to be taken into account, for many consumers fancy that the more gas they turn on the better light they will get. It is now conclusively established that the quantity of gas does not influence the development of light, that the difference perceived, in the illuminating power afforded by the consumption of different quantities of the same gas, is due to the difference of the burners, each burner "doing justice" to the gas at a particular rate of consumption, and declining in illuminating power when the supply falls short of this rate or exceeds it. It has been proved also that the temperature at which the gas is supplied to the burner makes no practical difference to the light, that an over supply of air to the flame and an excess of pressure in the supply pipe are adverse to illuminating power. Gas, it appears, is in the fittest state to be burned, and to give out its maximum of light, when it streams through the burner under little or no pressure, flowing upwards like a natural flame. The practical suggestion deducible from these conclusions is, that the burners should be improved; and we have called attention to the best type yet brought into use."

The Metric System in the United States.

President Barnard, in his address before the University Convention of the State of New York, on the French metric system, said: "According to the best authorities I have been able to find, the total population of Europe approaches 260,000,000, of whom 135,000,000 have already accepted the metric system in all its details, or have given, to all the standard units of their own system, metric values. Add to these 25,000,000 more in Mexico and South America, and we have a total of 160,000,000 of civilized people in civilized lands who are irrevocably committed to the metric system, while a considerable proportion of the rest have made progress toward the system by adopting metric values in part, like Denmark, Austria and Turkey; or by adopting the decimal law of derivation without as yet the metric values, like Sweden; and 70,000,000 more, the people of the British Islands and of the United States, have made the denominations of the system lawful in all business transactions within their territory. All this has been accomplished by the pressure of public opinion; it has been distinctly a movement of the people and not of government: it is a social rather than a political phenomenon." In connection with the above, says the *Evening Post*, the following information, recently given by Mr. Hilgard, of the United States Coast Survey, to the *Journal of the Franklin Institute*, will be interesting: There are, in the custody of the Treasury Department, at the Office of Weights and Measures, the following authentic copies of the standard meter and kilogramme of France, viz.: Meter of platinum, compared and certified by Arago; meter of steel, compared and certified by Silbermann; kilogramme of platinum, compared and certified by Arago; kilogramme of brass (gilt), compared and certified by Silbermann. The length of the meter is 39·3685 inches of the United States standard scale, and the kilogramme is 15432·2 grains, or 2 lbs., 3 ozs., 119·7 grs. avoirdupois. There is also another meter, the property of the American Philosophical Society, which is one of the twelve original meters made by the French Government, and was brought to this country by Mr. Hassler, the originator of the United States Coast Survey. A comparison between this bar and the standard of France at the Conservatory of Arts and Trades was made by Dr. F. A. P. Barnard, with the result that, at the temperature of melting ice, there is no appreciable difference, by the most delicate means of comparison, between the platinum standard of the Conservatory and this iron meter. It is, therefore, possible for the Office of Weights and Measures to reproduce, for distribution to the different states, metric standards of great accuracy.

Manual Labor and Maximum Air Temperature.

There is some interesting information, on the maximum temperature of air which is compatible with the healthful exercise of human labor, in the report of the English commissioners appointed to inquire into the several matters relating to coal in the United Kingdom, just issued, the abstract of which we find in the *American Exchange and Review*. The committee, who undertook to determine the maximum depth to which it would be possible to work coal, found this question very difficult to decide. Evidence was given of extraordinary temperatures endured in the stock holes of steamers, and in places where glass blowers work. In some of these cases labor has been carried on, without serious detriment to health, where the thermometer has indicated 180° Fahr. In these instances, however, the thermometer was chiefly acted on by radiant heat, and therefore did not truly indicate the actual temperature of the air. In an experiment made under the direction of the committee, it was found that a thermometer, suspended in a stock hole and exposed to the radiation from the boilers, indicated a temperature of 105°; while another thermometer in the same position, but carefully screened from the radiant heat, stood at only 78°. It is important, also, to observe that the men who work in stock holes and glass houses have ready access to the external air, and avail themselves of numerous intervals in their labor to cool themselves. One of the medical witnesses, who had spent a great part of his life in tropical climates, states that he had experienced a temperature of 125° Fahr. in the shade, and that this great heat was rendered endurable by the dryness of the atmosphere; on the other hand, he had felt a damp atmosphere almost intolerable at the comparative low temperature of 86°.

The committee had information of mining work being executed in a Cornish mine, where the air was heated by a hot spring to a temperature alleged to amount to 117°, and was also by the same cause saturated with moisture. Dr. Sanderson was deputed to visit this mine and make an investigation. He found the highest temperature to exist at the extremity of an excavation forming a short *cul de sac*, where a stream of water entered at a temperature of 114¼°. At a distance of a yard from the end of this *cul de sac* the thermometer indicated a temperature of 103°; but at a distance of only ten feet there was access to air, where the theremometer stood at 81°. According to other evidence, the temperature of the air occasionally reached 123°. The miners remained in their workings six hours out of the twenty-four. Four men were employed at a time, of whom two were always at rest in the cool air, and the other two were not always at work. The total duration of each man's work was less than three hours in the twenty-four. No miner remained more than fifteen minutes in the heat at one time. The condition of each miner on retreating into cool air is described as one of complete exhaustion; but by allowing cool water to pour over his body, the distress and exhaustion quickly passed off. Dr. Sanderson came to the conclusion that the occupation in question was not necessarily inconsistent with the enjoyment of vigorous health; but he found that there were many men who, after trying the work, were compelled to desist on account of the distress and exhaustion which were produced. It is Dr. Sanderson's opinion that labor is not practicable in moist air of a temperature equal to that of the blood, namely, 98°, excepting for very short intervals; and this conclusion is in harmony with the other medical evidence. The question of maximum temperature under which work could be carried on in a coal mine hinges, in a great measure, on the hygrometric condition of the air. The depth, at which the temperature of the air would, under present conditions, become equal to the heat of the blood, would be about 3,420 feet. Beyond this point the considerations affecting increase of depth and temperature become so speculative that the committee felt it necessary to leave the question in uncertainty; but looking to possible expedients which the future may elicit for reducing the temperature, they considered it might fairly be assumed that a depth of at least 4,000 feet might be reached.

Employments for Boys.

In a recent number, we published an article on the propriety of supplying boys with tools, that, in their leisure hours, they may be occupied with healthy and useful employment. In the last number of our most estimable exchange, the *Congregationalist*, of Boston, we find the same subject discussed:

In every family where there are boys, from six to twelve years of age, it is much of the time a pressing question what to do with them: how to employ their thoughts and their hands out of school time. This question is all the more important in view of the extreme desirability of keeping them, at their age, off the streets and away from unhealthful associations, and it is all the more pressing now that the winter, with its out-door cold and long evenings, is at hand. Making due allowance for skating, sledding, and kindred sports, the boys are to be shut up in the house more or less of the time for six months to come, and something else must be found to occupy them than books and study. What now shall it be?

One unfailing resource for boys of certain taste—and a large class they are—is an assortment of carpenter's tools, with a suitable place in which to work. Put a boy of a mechanical turn of mind in possession of a little room which he may call his shop, give him a bench, a set of planes, a couple of saws, a few chisels and gouges, several pounds of nails of different sizes, and a variety of good clear "stuff," and you have provided him with the materials for unfailing recreation. He will, doubtless, make a noise, and perhaps cut his fingers; but worse things than either of these may happen. He will waste his nails and his boards, and, and at first, may spoil his tools; but no matter. The money spent for them will be money well spent, and the return for it, in the providing of a healthful, harmless, attractive occupation, will be prompt and large. We speak that we do know, and testify that we have seen.

Another excellent thing to put into a boy's hands is a small printing press with its accompanying outfit, by no means an extensive or cumbersome or complicated affair, but one which is altogether suited to the capacities of any intelligent lad of ten or a dozen years. We have particularly in mind a small sized Novelty Press, so called, which is simple, compact, and easily worked. Having a small font of type, ink, paper, a press, and his wits at work, who shall say what typographical triumphs our boy may not produce? He may blacken his hands; but there are far deeper stains than those of printer's ink. The printing establishment will quicken the boy's mind as well as exercise his fingers—for he must be his own editor; composer as well as compositor; proof reader as well as pressman.

When this article was projected—composed, in fact—we had not a thought of the arrangements just announced whereby we are able to offer tool chests and Novelty printing presses as premiums for new subscribers to the *Congregationalist*. But we are now pleased to think that the paper may serve as a means of placing these really valuable articles in many families where we are sure they will render a most useful ministry in the manner indicated.

There is this additional reflection. The boy who half plays, half works in a miniature shop, or with a miniature printing office, is certain to familiarize himself with the rudiments of a trade, of which he *may* find it very convenient to know something in after days.

WE have, says *Nature*, on various occasions, alluded to the large amount of encouragement to the pursuit of science afforded by the governing powers of the United States, both by the Central Federal Government at Washington, and by those of the individual states. The sums of money voted for such purposes by our American relations would make the hair of our economical Government officials in this country stand on end, and would be certain to provoke angry comment in our House of Commons; while the number of scientific men, paid for carrying out the investigations and preparing reports on various subjects of great practical value for the welfare of the country, would almost bear comparison with the number we pay for doing nothing or for obstructing all rational improvements.

Life in Japan.

The following are extracts from a volume of "Travels in Japan," from the pen of Bayard Taylor, Esq., just published by Scribner & Co., 654 Broadway, N. Y.

RICE PLANTING IN JAPAN.

"As we advanced through the country, both men and women were busily employed in planting out their rice. This was the first time I had seen any but isolated cases of women being engaged in field labor in Japan; for the Japanese appear to me to be honorably distinguished among nations of a higher civilization, in that they leave their women to the lighter work of the house, and perform themselves the harder out door labor. Indeed, I was at first in some doubt here, for it was by no means easy to distinguish the women from the men at a little distance. To guard the legs, probably from leeches, as they paddled in the mud, they all wore gaiters up to the knees and short cotton trowsers. When the neck was covered, there was no very distinguishing difference between the sexes, as the men never have any hair about the face. The wheat in Japan never appears to be sown broadcast. All that I have seen has been drilled and planted in rows, much as the rice is, a few stalks together. Labor is cheap, and it is to be presumed they find this the more profitable way."

JAPANESE JUGGLERS.

"The jugglers and mountebanks are also distinguished by the variety and originality of their feats. For instance, they perform a series of tricks by means of an enormously long false nose. One will lie down on his back, with a boy balanced on the end of the nose, the boy supporting an open umbrella on the end of his own nose. Another will hold up his foot, upon the sole of which a boy plants his nose, and balances himself in the air. Some of these feats seem impossible, without the aid of some concealed machinery.

"I was witness to some astonishing specimens of illusion. After a variety of tricks with tops, cups of water, and paper butterflies, the juggler exhibited to the spectator a large open fan which he held in his right hand, then threw into air, caught by the handle in his left hand, squatted down, fanned himself, and then turning his head in profile, gave a long sigh, during which the image of a galloping horse issued from his mouth. Still fanning himself, he shook from his right sleeve an army of little men, who presently, bowing and dancing, vanished from sight. Then he bowed, closed the fan, and held it in his two hands, during which time his own head disappeared, then became visible, but of colossal size, and finally reappeared in its natural dimensions, but multiplied four or five times. They set a jar before him, and in a short time he issued from the neck, rose slowly into the air, and vanished in clouds along the ceiling.

"At the fair of Asaksa, in addition to the performances of jugglers of all kinds, there are collections of animals which have been taught to perform tricks—bears of Yeso, spaniels which are valuable in proportion to their ugliness, educated monkeys and goats. Birds and fish are also displayed in great quantities. But the most astonishing patience is manifested by an old Corean boatman, who has trained a dozen tortoises, large and small, employing no other means to direct them than his songs and a small metal drum. They march in line, execute various evolutions, and conclude by climbing upon a low table, the larger ones forming, of their own accord, a bridge for the smaller, to whom the feat would otherwise be impossible. When they have all mounted, they dispose themselves in three or four piles like so many plates.

JAPANESE GYMNASTS.

M. Humbert gives the following description of the performances of this class, both in the streets and in booths. "In the public squares, the shouts and the sound of tamborines of two troops of gymnastic mountebanks, installed at opposite corners, are heard above the voices, songs, and clatter of implements of labor in the surrounding workshops. One of these troops performs in the open air, its heroes being the swallower of swords, and the prodigious jumper. The latter leaps with impunity through two hoops crossed at right angles, fixed on the top of a pole, which also supports a jar carefully balanced on the intersecting hoops. But his most remarkable feat consists in leaping, or rather flying, from end to end through a cylinder of bamboo lattice work six feet long and placed on trestles. When he wishes to excite the amazement of the spectators to the highest pitch, the performer lights candles and places them in a line, at regular intervals, in the interior, of the cylinder; after which he passes through like a flash without extinguishing or deranging them.

"His gentle spouse, seated on a box beside the cylinder, accompanies the different stages of the performance with airs on her guitar. To the shrill sounds of the instrument she adds, from time to time, the tones of a voice which is either hoarse and hollow, or piercingly elevated, according as she judges it better to encourage sternly or to celebrate triumphantly the prowess of the astonishing man whose fortunes she is permitted to share."

Electromagnetic Burglar Proof Curtain.

This invention consists in the arrangement of a burglar proof curtain to be suspended in front of safes, vaults, behind windows, or in other suitable places, and connected with an electric alarm apparatus in such a manner that it will, when moved or pierced, cause the alarm to be sounded.

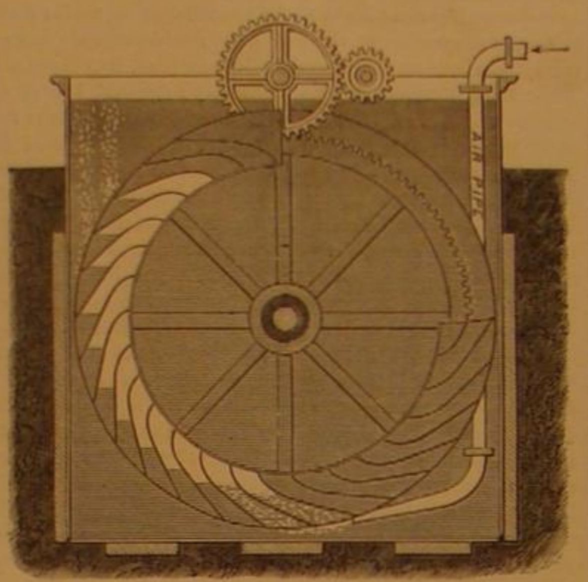
By the use of such curtain a very cheap and, it is claimed, most effective guard is obtained, which can, over night, be suspended in front of the things or openings to be protected, while during day time it can be rolled up out of the way or otherwise do the service of ordinary curtains.

Any attempt to enter by cutting through the curtain will cause an alarm to be sounded by the establishment of a complete circuit, while, on the other hand, any attempt to roll up the curtain or lift the roller from the brackets will, by entirely breaking the circuit, also cause an alarm to be sounded.

Messrs. Edwin Holmes, of Brooklyn, N. Y., and H. C. Roome, of Jersey City, N. J., are the inventors.

CALLES' HYDRO-AERO-DYNAMIC WHEEL.

A mode of transmitting power to great distances, proposed by an exhibitor at the Paris Exposition, from Belgium, Mr. A. Calles, makes use of air under a certain degree of compression as the vehicle of the force to be transmitted, not by accumulating the air thus employed in reservoirs, but by driving it, by the operation of the original motor, directly into a tube extending to the point of final application, where it is to be discharged beneath a wheel submerged in water, which it is to turn by its ascensional force. The mode of application is illustrated in the accompanying engraving, and is described as follows in Dr. A. P. Barnard's report on machinery and processes:



The idea of employing compressed air as a means of transmitting power is not new; but the mode here suggested of using the power so transmitted is sufficiently original. The exhibitor claims originality in another point of view. His application of the power is not only original in form but in principle also. At Mont Cenis, where air is employed as a vehicle of force, it is the elasticity of the compressed air which furnishes the motive power. Consequently, it is there important that the compression should be carried very far. It is carried, in fact, up to six atmospheres. The present apparatus proposes to derive its mechanical advantage not from elasticity, but from volume. It is, therefore, here equally important that there should be as little compression as is compatible with the attainment of the object.

The air being employed to turn a submerged wheel, it will be easily understood that the wheel must have the form of an ordinary overshot water wheel reversed. In the overshot wheel, it is the weight of water, which is in the buckets of the descending side while those of the ascending side are empty, which causes the wheel to turn. The motive power is the difference between the counteracting weights of the two sides. In the submerged wheel driven by air, on the contrary, it is the weight of water which is displaced from the buckets of the ascending side, while those of the descending side are full, which is the measure of the driving power. In the present case, as in the former, this driving power is the difference between the weights of the two sides.

It is assumed by the inventor that air immerged in water ascends to the surface with a velocity of one meter per second. In point of fact, the rapidity of ascent of air in water will depend very much upon the volume ascending, and will be, on an average, materially greater than is here stated. But assuming the statement to be correct, it would furnish a limit to the velocity which can be given to the circumference of the wheel; and a given wheel will perform its maximum of work when the supply of air is sufficient to keep its ascending buckets full at half this velocity. Considering, however, that the motive power in the case is gravity, the most advantageous velocity must be necessarily not greatly different from that which experience has shown to be best with the ordinary overshot wheel working in the air—that is to say, must not exceed one meter per second at the circumference.

The compression of the air must evidently be sufficient to overcome the pressure of the water at the point of efflux beneath the wheel. This point may be taken at three or four meters of depth, and the corresponding pressure will amount to three or four tenths of an atmosphere. As the air ascends, it resumes by degrees the bulk which belonged to it before compression. In order to take advantage of this circumstance, the velocity of discharge must be so adjusted to that of the wheel that the buckets may not be entirely filled at the bottom. Otherwise there will be an overflow from the rising buckets, and to that extent a loss of motive power.

The inventor takes no account of the resistance of tubes to the flow of air through them. He supposes that at low pressures and low velocities this resistance will be insensible, so that the power received from the source may be almost wholly re-established by the wheel. He has erected a wheel in the park of the Exposition, which is designed to demonstrate the truth of this proposition, and to illustrate his system generally. It is driven by air compressed by an engine in the palace, and transmitted through a tube nine and a half centimeters (3¾ inches) in diameter, and one hundred and fifty-seven meters (more than 500 feet) in length. This tube makes in its course fourteen right angles in order to avoid the constructions which it encounters on its way. It is computed that a force of nine and a half horse power is expended in compressing the air, and that the velocity of efflux is thirty-two meters (more than 100 feet) per second. On the other hand, the power of the wheel turned by the escaping air is stated at nine horse power. From these figures it would result that the loss in the present instance is but about five per cent. That there is a fallacy in the calculation is evident from the consideration that the loss of a submerged wheel, driven in this way by air, cannot be less than that of an ordinary overshot water wheel of the same dimensions; and that this loss is at least one fifth, and is often more than one third. And it results from the experiments of the Italian engineers at Coscia, on the resistance of tubes to columns of air driven through them, that to maintain such a velocity as is stated to be given to the air in this experiment, and to the distance named of one hundred and fifty-seven meters, there would be required an expenditure of force without return, sufficient to produce a compression of nearly an atmosphere and a half.

Locomotive and Traction Engines.

Thomas Aveling, of Rochester, England, well known in connection with the celebrated Aveling & Porter's steam road rollers and traction engines, has just patented, through the Scientific American Patent Agency, an improvement the object of which is to construct agricultural, road, traction, and portable steam engines, and tramway locomotives, in a simpler and more economical manner than heretofore, and at the same time to render them stronger and more durable.

At each side of the fire box end of the boiler is fixed a strong wrought iron horn plate. These horn plates are riveted to the boiler and firebox. They project beyond the end of the fire box, and above the top of the boiler. The projecting portions of the horn plates are connected to the crown of the boiler by curved or bent plates, between which and the horn plates are secured the bearings for the crank shaft. The axle of the traveling wheels works in bushes secured in screw bolts to the rear ends of the horn plates. Above this axle is a shaft, also working in bushes and carried by the horn plates. To this shaft is keyed the gearing for transmitting the rotary motion of the crank shaft to the axle of the traveling wheels. The crank shaft receives rotary motion in the usual manner from the cross head and connecting rod of the engine, and is fitted at one end with a spur pinion which drives intermediate gearing; and, through the spur wheel, gives rotary motion to the axle of the traveling wheels. A fly wheel, on the opposite end of the shaft, is employed to carry the crank shaft over its dead points. The engine is fitted, as usual, with a tank, and it is provided with any approved steering apparatus for guiding the front wheels.

From the above description, it will be understood that as the wrought iron horn plates will take all the thrust from the piston acting on the crank shaft the boiler and fire box will not be so liable as heretofore to be damaged or strained by the working of the machinery.

Resistance of Nickel to the Action of Water.

A small square bar of steel coated with nickel has been repeatedly immersed in water for hours together without showing any signs of rusting, and Mr. John Spiller states, in the *Photographic News*, that he finds it possible to bury it in flowers of sulphur for several days without tarnishing the lustre of the nickel surface. Neither has this latter severe test any effect upon the copper and brass bars upon which the nickel coating has been applied, and these metals may even be immersed in aqueous solution of nitrate of silver without effecting the reduction of that metal. In one of the angles only, where the coating seemed to be imperfect, was there any indication of silver reduction in the case of the brass tube, the steel bar being perfectly protected over the whole surface against the action of silver and copper solutions.

Here, then, is a most valuable property in electro-deposited nickel. A metal of the zinc and iron group is proof against the action of nitrate of silver; the experiment proves it to be so, and we must regard pure nickel as belonging (from this point of view) to the class of noble metals, resisting, like gold and platinum, the attacks of sulphur and of highly corrosive metallic solutions. The nickel facing, when burnished, has a whiter color than polished steel, although not equal to silver itself, its aspect being rather that of rolled platinum. It withstands the action of heat also remarkably well, for the fusion point is very high, and oxidation occurs only at elevated temperatures. For fine balance beams and weights, lens mountings, reflectors, laboratory microscopes, Sykes' hydrometers, still worms, egg beaters, camera fittings, and a variety of apparatus used by the chemist and photographer, the nickel coating will, probably, find extensive application.

THE steamer *New London*, recently burnt in Long Island Sound, is reported to have been scandalously ill furnished with appliances for subduing fire and for saving life. "The life preservers and the boats were inaccessible, and the people on board the steamer had to make their escape as best they could, throwing planks and state room doors into the water, and then leaping after them in hopes of reaching shore by their friendly aid. The fire extinguishing apparatus, too, could not be promptly and effectually used." The *Commercial Advertiser* thus accounts for a calamity in which at least twenty persons lost ther lives.

Improved Safety Water Gage.

It is needless for us to say anything in regard to the value of a reliable water gage as an adjunct to steam boilers. The gage shown in our engraving, however, has certain peculiarities of construction not to be found on ordinary water gages, which improvements render it perhaps better adapted to general use than any hitherto brought before the public.

It is called the "Safety Water Gage" from the fact that if, as frequently occurs, the glass tube should be broken, the escape of water and steam is prevented by the action of valves which automatically close the communication between the boiler and the tube.

The method by which this is accomplished is indicated in the engraving, where A represents the lower valve, B the knob on the stem of the upper valve, C a pet cock for keeping the gage free from sediment, and D hand knobs on the stems of valves which control the passage of steam and water from the boiler, but do not act automatically.

As will be seen, the lower valve, A, receives the pressure of water upon its under side, so that if the pressure upon its upper surface be removed by breaking the tube, the valve is immediately forced up to its seat, thus preventing the outflow.

The upper valve attached to the stem, B, is of the same form, and prevents the efflux of steam in the same manner, the passage of the steam being out, through the upper cock which connects boiler and gage, into a chamber, thence up through the valve attached to B, and down through an annular passage to the glass tube. It is evident that the moment the pressure in the glass ceases, these valves will immediately close.

A very great advantage is obtained by this construction, namely, that the cocks connecting the gage and boiler may be made so large as to obviate all danger of clogging, without the danger of any one getting scalded or burnt, should the glass tube break. The gage is therefore not only safe in its action, but much more reliable in its indications than the old form of gage.

When it becomes necessary to put in a new tube, all that is required to set the gage in operation after its attachment is to press down the knob, B. This first lets steam into the tube; the pressure then being equalized on the top and bottom of the valve, A, the latter drops and allows the water to rise to its proper level. In order that the valve areas above and below, which receive the pressure, shall be equal, the valves are given conical faces, which meet the sharp edges of the port, as shown in the lower valve, at A. Several hundred of these gages are in use and giving great satisfaction. Patented June 11, 1867. For further information address the manufacturer, Augustus P. Brown, 57 Lewis street, New York.

Cook's Evaporating Apparatus.

Mr. Justus Cook, of Wellsville, N. Y., has nvented a new evaporating apparatus for the convenient and economical heating and evaporating of liquids in the process of extracting the juices of plants, roots, barks, etc., as well as in the manufacture of sirups and sugar. It consists in an evaporating vessel with a flat bottom and circular or square ends, and with a false flat bottom so placed as to leave a steam space between the true and false bottoms, and in one or more rotating agitators or stirrers.

Between the true bottom and the false bottom, the steam is introduced, and made to pass back and forth beneath the liquid in the vessel. Timbers beneath the vessel, on each side, are made adjustable by means of a joint connection and a screw for each pair of timbers, by means of which the vessel may be brought to a true level, and the liquid properly distributed or discharged. The agitators or stirrers are attached to vertical shafts, and suspended from transverse trusses. The latter are supported by the sides of the vessel.

When the evaporating vessel is full or nearly full, the stirrers will revolve beneath the surface of the liquid and keep the liquid in a constant state of agitation. Sweep plates, attached to the vertical shafts, stand edgewise above the heads of the agitators. These plates are designed to fan the surface of the liquid and blow off the steam to increase the evaporation.

As the heating agent employed for this evaporation is steam, the vessel may be made of wood, and also the lower or true bottom. The false bottom is made of metal, on account of its being a better conductor of heat.

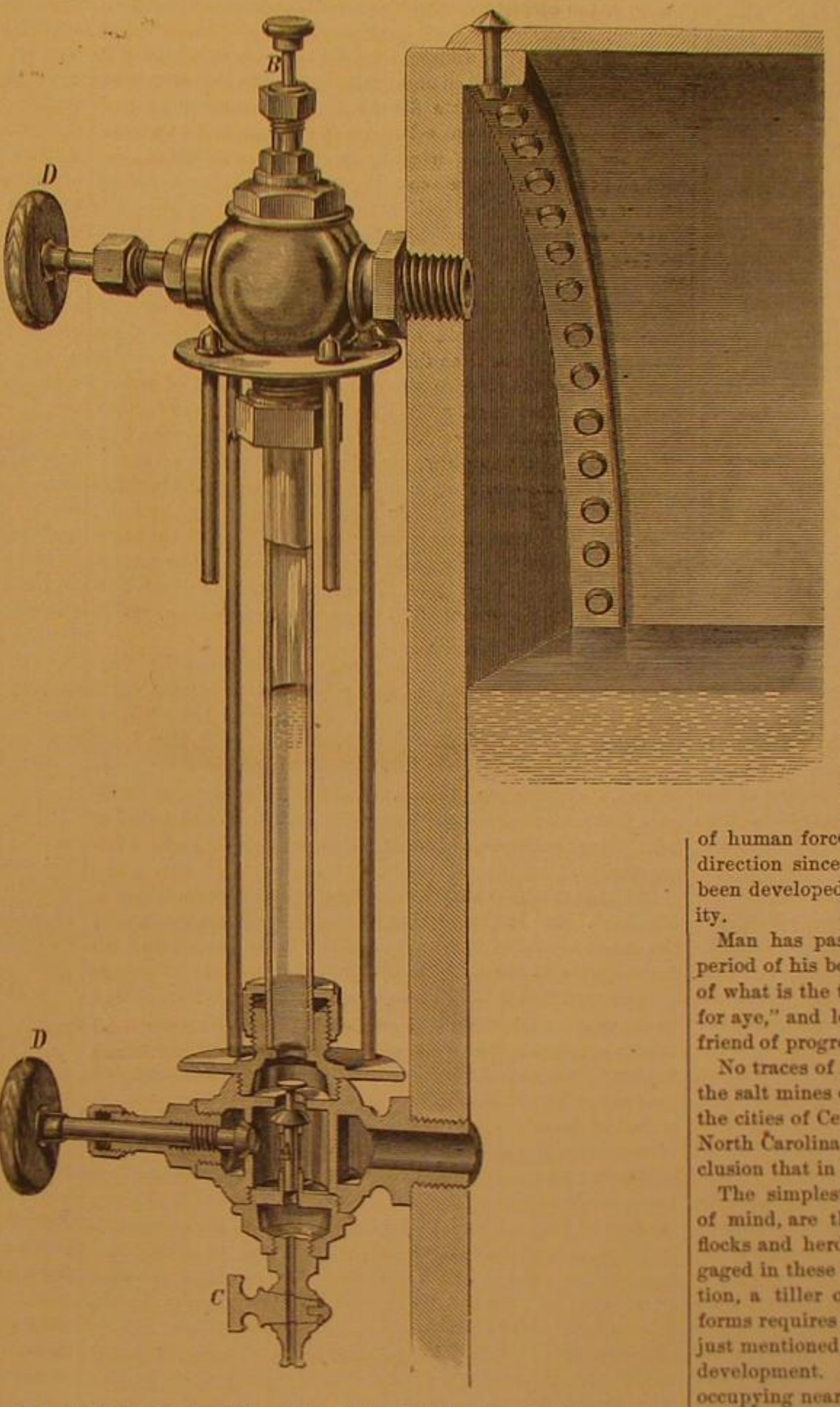
Pierson's Frames for Diking Sheets.

This invention furnishes an improved frame for diking sheets, which enables them to be handled, transported, and placed or driven without danger of breakage, thus removing one great source of expense in using diking sheets.

The diking sheet may be made of metal, cement, or other suitable material or combination of materials. These sheets are designed to be driven into the ground where the dike is to be formed, and should extend from about six inches below the low water line to about six inches above the high water line, to prevent rats, crawfish, etc., from working through the dike.

As heretofore made, many of the sheets, even when made of metal, are broken in the operation of driving, and very many, especially when made of composition, are broken by handling and transportation, thus entailing great loss. To prevent this loss, a frame is put upon the sheets, the bottom bar of which is preferably made wedge shaped upon its lower edge, so that it may more readily be forced into the ground. The top bar of the frame rests upon the top edge of the sheet, and should be sufficiently strong and heavy to allow the sheet to be driven without being broken. The side bars of the frame cover the sides of the edges of the sheets, and the ends of these side bars are attached to the opposite sides of the ends of the top and bottom bars, so that the edges of the sheet may be flush with the outer edges of the side bar. This construction allows the adjacent edges of the sheets, when arranged in place, to be in contact with each other, so that there may be no space between the sheets when the frames may decay or be removed. The frames may be made of wood or metal, and permanently attached to the sheets. Or, if desired, the frames may be so made and attached to the sheets that they may be detached and removed, in whole or in part, after the sheets have been driven to their places.

Mr. James S. Pierson, of New York city, is the patentee of this improvement.



BROWN'S PATENT SAFETY WATER GAGE.

Indian Cotton Cloth.

The marvelous delicacy of touch possessed by the Indian women (says an English writer) counterbalances the inferiority of Indian cotton in weaving the fine and delicate muslins to which the names of "webs of woven air," "dew of night," "running waters," etc., are given by the natives. They now use the spinning wheel generally for the ordinary fabrics, but "the spindle still holds its place in the hands of the Hindoo woman when employed in spinning thread for the finer muslins. For these the Hindoo woman first cards her cotton with the jawbone of the *boalee* fish; she then separates the seeds by means of a small iron roller, worked backwards and forwards upon a flat board. An equally small bow is used for bringing it to the state of a downy fleece, which is made up into small rolls, to be held in the hand during the process of spinning. The apparatus required for this consists of a delicate iron spindle, having a small ball of clay attached to it in order to give it sufficient weight in turning, and imbedded in a little clay there is a piece of hard shell, on which the spindle turns with the least degree of friction."

Very great attention is paid to the temperature of the air during the process of spinning, and the spinners in the dry climate of the Northwest of India work underground to secure a moist and uniform atmosphere. The cheapness of English manufactured goods seems to have greatly depressed the cotton fabrics of India, but the fine muslins of the latter country yet maintain undisputed celebrity, and are valued as highly as ever. The Dacca muslins are the very finest of all. One of the best pieces which found its way to England was ten yards long by one yard wide, weighed only three ounces two pennyweights, and could be passed through a very small ring.

Improvement in Architecture.

The earliest periods were characterized by the utmost simplicity of invention and construction. Later, the efforts for defence from enemies and for architectural display, which have always employed so much time and power, began to be made. The megalithic period has left traces over much of the earth. The great masses of stone piled on each other in the simplest form in Southern India, and the circles of stones planted on end in England at Stonehenge and Abury, and in Peru at Sillustani, are relics of that period. More complex are the great Himyaritic walls of Arabia, the works of the ancestors of the Phœnicians in Asia Minor, and the Titanic workmanship of the Pelasgi in Greece and Italy. In the iron age, we find granitic hills shaped or excavated into temples; as, for example, everywhere in Southern India. Near Madura the circumference of an acropolis like hill is cut into a series of statues in high relief, of sixty feet in elevation.

Easter Island, composed of two volcanic cones one thousand miles from the west coast of South America, in the bosom of the Pacific, possesses several colossi cut from the intrusive basalt, some in high relief on the face of the rock, others in detached blocks removed by human art from their original positions and brought nearer the sea shore.

Finally, at a more advanced stage, the more ornate and complex structures of Central America, of Cambodia, Nineveh, and Egypt, represent the period of greatest display of architectural expenditure. The same amount of human force has perhaps never been expended in this direction since, though higher conceptions of beauty have been developed in architecture with increasing intellectuality.

Man has passed through the block and brick building period of his boyhood, and should rise to higher conceptions of what is the true disposition of power for "him who builds for aye," and learn that "spectacle" is often the unwilling friend of progress.

No traces of metallic implements have ever been found in the salt mines of Armenia, the turquoise quarries in Arabia, the cities of Central America, or the excavations for mica in North Carolina, while the direct evidence points to the conclusion that in those places flint was exclusively used.

The simplest occupations, as requiring the least exercise of mind, are the pursuit of the chase and the tending of flocks and herds. Accordingly, we find our first parents engaged in these occupations. Cain, we are told, was in addition, a tiller of the ground. Agriculture in its simplest forms requires but little more intelligence than the pursuits just mentioned, though no employment is capable of higher development. If we look at the savage nations at present occupying nearly half the land surface of the earth, we shall find many examples of the former industrial condition of our race preserved to the present day. Many of them had no knowledge of the use of metals until they obtained it from civilized men who visited them, while their pursuits were and are those of the chase, tending domestic animals, and rudimental agriculture.—*Professor E. D. Cope, in Half Hours with Modern Scientists.*

Goodrich's Improvement in the Manufacture of Iron.

This improvement in the process of puddling and boiling and smelting iron ores, and melting iron, is especially adapted to the manufacture of wrought iron from the ore in the processes of puddling and boiling. It consists in the use of agglomerate balls or masses, composed of ingredients hereinafter described, and used in combination with the iron or iron ore; the temperature of the furnace and the circulation of the blast being, in a great measure, controlled by the size and quantity of the agglomerate balls; and the effect produced upon the ores and iron treated being, in a great measure, dependent upon the proportions of the ingredients of which the balls or masses are formed.

The chemical character of the different iron ores varies so much that the true proportions of the ingredients of which the agglomerate balls are formed can be ascertained only by experiment. This the metallurgist can readily ascertain in working the ore or smelting and melting iron. Different ores melt at different degrees of heat and require different quantities and kinds of flux. The flux being one of the ingredients of the agglomerate balls, the quantity and kind of flux must be varied to properly flux each particular kind of ore.

The invention combines, into hard balls or masses of any desired form and size, iron ore reduced to a granulated state or to a sufficient degree of fineness, pulverized coal or carbon, and lime or other flux. Gum or gluten of any kind may be added to produce sufficient cohesion in the mass. The entire quantity of ore used in the furnace may in combination with carbon and the proper flux) be formed into these ball or masses; or the balls thus formed may be used in combination with ores in puddling, melting, or smelting.

He claims that by thus combining, with the ore, carbon and the proper kind and quantity of flux in the deoxidizing and carbonizing of ores, he overcomes obstacles which have hitherto been considered insuperable.

The balls are composed of seventy-five parts of iron ore; twenty parts carbon; three parts slaked lime; one part nitrate soda; and one part molasses. The ore, carbon, and lime are mixed intimately together, and the molasses and nitrate of soda dissolved in water enough to form the whole into a mass, which is then formed into balls and dried in the sun. This is about an average proportion, which, as before said, varies with different ores. The object is to avoid the melting point in carbonizing, but to go as near it as possible. He thus charges the ore as highly with carbon as possible, before it reaches the melting point. For puddling, he uses say eighty parts burnt iron ore made very fine; sixteen parts carbon; two parts slaked lime; one fourth part nitrate soda; and one and three fourths parts of molasses; mixes the ore, carbon, and lime minutely, dissolves the molasses and nitrate soda in water enough to mix, and then forms the mass into balls and dries them. For melting iron ore, he uses seventy parts ground carbon; three fourths part lime; one fourth part nitrate of soda; twenty-eight parts finely ground ore; and one part molasses. For smelting iron ore, sixty-eight parts ground and burnt iron ore; twenty-five parts carbon; five parts lime; one part nitrate so la; and one part molasses.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Psychic Force.

To the Editor of the Scientific American:

Under this head I will introduce to your notice an experiment, which is akin to or identical with the power possessed by Mr. Home, and which experiment can be tried by any person for himself in less than five minutes.

A slip of thin writing paper, one and a half inches in length and a quarter of an inch broad, is creased in its middle, lengthwise and crosswise. This makes a dipping of the two ends, by which it may be poised on a needle point. The needle is set perpendicularly in a piece of cork, this forming a stand or support.

Now hold the hand, curved to the form of the quarter arc of a circle, near to the outer circle to be described by the paper arrow, and this will move circularly, not always immediately, for sometimes you may have to wait several minutes. For some persons, it will revolve over a hundred times per minute. In most instances it revolves towards the tips of the fingers, but not always. By putting the other hand near, in such manner as to point the fingers in the same circular direction the motion is generally increased. *Voila!* Try it and study its mystery!

"Heat!" is the first exclamation of many; but if it were caused by an upward current of air, the direction of revolution would be determined by the pitch of the ends of the arrow. Experiment has proved that pitching the ends propellerwise has no effect; and reversing the pitch does not change the direction of motion.

Gentlemen of the other side, I charge that if I were to announce that very few persons could do the above, you would cry "deception," "delusion," "weak minded," etc. But, the experiment being within the reach of all, there will be no such rejoinders as Professor Crookes has been annoyed with. In this experiment, the requirements pointed out by the Editors of the SCIENTIFIC AMERICAN are also met, and it may prove to be an anticipation of the delicate apparatus to be devised by Professor Crookes, showing that all persons are more or less possessed of this power.

J. A. SOLLIDAY.

Philadelphia, Pa.

[We tried this experiment, which our correspondent affirms will always succeed, but we had not enough psychic force to make the paper turn, except when we blew it. Perhaps some of our readers are better endowed.—EDS.

Railroad Gages.

To the Editor of the Scientific American:

I have felt for some time that the thanks of the engineering profession are due to the SCIENTIFIC AMERICAN, for the timely and efficient effort it has made to anticipate and prevent the error into which capitalists are likely to be led on the subject of railway gages reduced below the ordinary 4 feet 8½ track. I am glad to see that an engineer of Colonel Seymour's experience has spoken emphatically on this subject.

The necessity of uniformity in such a country as ours ought to supersede any ordinary questions of detail; and it would be a very great advantage to the railway interest of the United States if our engineers would agree, with one consent, to hold to the gage which has come to us from the old country, and which practically meets the problem of railway operation as well as can be desired. In fact, it would be well if this gage question, like that of standard weights and measures, could be made a matter of Congressional law, so as to relieve us from the continued confusions and embarrassments resulting from the want of a common standard. The arguments advanced in favor of a narrower gage are fallacious, as the arguments in favor of an increase have proved to be by much experience and very great outlay; and while there are times when engineers and scientific authorities need to advance far beyond the current of popular sympathy, there are other occasions when a conservative and guarded course is equally essential; and a popular paper deserves commendation and endorsement as much in one case as in the other.

SAMUEL MCELROY

Brooklyn, N. Y.

[For the Scientific American.]

ON SPECIFIC HEAT.

BY P. H. VANDER WEYDE.

The adoption of a unit of heat (explained on page 356, of the last number of the SCIENTIFIC AMERICAN), has given occasion to the correct investigation of different classes of phenomena, formerly not well understood; one of these is the peculiar property, of different substances, of requiring different amounts of heat in order to be heated to the same temperature. These amounts differ whether we take the equal quantities of the different substances by weight or by volume. They are of course measured by the accepted standard; the unit and the numbers representing these amounts (accepting that of water as 1) are called the specific heat of the substance, even as the weight of equal volumes of different bodies (accepting water as 1) is called the specific weight. Thus it was found that the amount of heat sufficient to raise the temperature of one pound of water a certain number of degrees was equal to the amount required to raise to the same temperature not less than thirty pounds of mercury, a mass of mercury more than twice the volume of a pound of water, because mercury is only 13·5 times heavier. It was further found that 31 lbs. of gold, 17 of silver, 10·5 of copper, 8·75 of iron, and 5 of sulphur, contained respectively as much heat as 1 lb. of water; or, in other words, required the same amount of heat to raise their temperatures to the same degree. We must, then, necessarily conclude that, at the same temperature, water contains 30 times as much heat as mercury, 31 times as much as gold, 17 times as much as silver, 10·5 times as much as copper, 8·75 times as much as iron, and 5 times as much as sulphur.

Consequently it is easy to deduce from this, when dividing 1,000 by the above numbers, that when water contains 1,000 units, mercury will contain 1,000÷30—33, gold 1,000÷31—32, silver 1,000÷17—57, copper 1,000÷10·5—95, iron 1,000÷8·75—1·14, and sulphur 1,000÷5—200; or, by taking water—1, their numbers become, respectively, for mercury 0·033, gold 0·032, silver 0·057, copper 0·095, iron 0·11, and sulphur 0·2. These numbers, then, are called the specific heat of the substances.

Different methods may be employed to determine this specific heat. One is the melting of ice by a certain amount of the substance (after having heated the latter to a certain definite degree of heat), and to compare the amount of ice thus melted with that melted by an equal weight of water, heated to the same temperature as the substance in question. Of course peculiar precautions are necessary in order to prevent the ice from being melted by exterior causes other than the heat of the heated body under investigation. Another method is that of mixture. It consists in raising the substance to a certain definite temperature, and then throwing it into a vessel containing an equal weight of water at another definite low temperature. The amount of heat communicated to the water will be proportional to the specific heat of the substance. Suppose, for instance, we mix one pound of water at a temperature of 156°, with another pound of water at a temperature of 32°, we shall find that the temperature of the mixture will be the mean, or 94°. But when we mix one lb. of mercury of 156° of temperature with one lb. of water at 32°, the temperature of the mixture will only be 36°. The water, therefore, will have gained only 4 units of heat, in compensation for the 120° lost by the mercury. It is evident from this that the amount of heat required to raise the temperature of one lb. of mercury four degrees, is equal to one thirtieth of that required to effect the same result on water; or, in other words, one thirtieth of the adopted unit of heat. This experiment becomes still more striking if we take equal quantities in bulk of both these substances. Suppose we take a pint of water of 32°, and a pint of mercury of 156°, and mix them; the temperature of the mixture, in place of being the mean or 94°, as is the case when mixing equal volumes of water, will only be 69°. The water has gained only 37°, in compensation for 87° lost by the mercury. It is clear from this, that the amount of heat required to raise the temperature of one pint of mercury 37°, is equal to about two and one third of that required to produce the same effect on a pint of water, notwithstanding that the pint of mercury is more than thirteen and one half times heavier than the pint of water; in fact, three pints of water contain as much heat as seven pints of mercury, notwithstanding the latter surpasses the first some thirty times in weight.

The heavier metals have almost all very nearly the same specific heat as mercury. Thus, lead—0·031; iridium, 0·032; osmium, 0·031; platinum and gold, 0·032; thallium, 0·034; bismuth, 0·031; tungsten, 0·033. However, in another class, the specific heats are nearly double the above numbers; thus palladium—0·059; rhodium, 0·053; silver, 0·057; tin, 0·056; cadmium, 0·057. While, again, in another class, they are triple, or more than triple the first. Thus copper—0·095, zinc, 0·096; cobalt, 0·1; nickel, 0·11; iron, 0·114. The light metals have the largest specific heat, but always far inferior to that of water, and most of them nearly equal to that of sulphur. Thus aluminum—0·21; magnesium, 0·25; sodium, 0·20; potassium, 0·16. The two latter are so light that they float on water, while the lightest of all metals, lithium, has the greatest specific heat, namely 0·94, almost that of water. In fact water has a greater specific heat than any other substance, perhaps a few solutions excepted. For instance, a solution of cane sugar has a specific heat of nearly 1·1.

This shows what an immense store of heat may be contained in the waters of our planet, especially the ocean, which covers about three fourths of its surface. If, then, we take into account that, for equal weights, the specific heat of air and gases is about one fourth that of water, and that our atmosphere has only the weight of a layer of water, at most, of 34 feet, it is clear that its heat is only equivalent to that of a layer of water of 34÷4, or 8½ feet high. This depth of water, therefore, is capable of storing up as much heat as the whole atmosphere; and, in giving off its heat, is able to communicate half its excess of temperature to the air, retaining the other half. Suppose, for instance, a certain portion of the Atlantic ocean to have a temperature of 80°, while the atmosphere over it is 20°; eight and one half feet depth of water will then be capable of heating the air 30°, bringing it to 50°, while the water itself descends 30°, also reaching 50°. No wonder, therefore, that the Gulf Stream, which continually is pouring the warm water from the tropics against the northwestern coast of Europe and its islands, modifies the climate of this part of the world to such a degree as to make it much warmer than the regions in the same latitude on the continent of eastern Europe, Asia, or America. When we fully consider that water is about 800 times heavier than air at the ordinary pressure, it is clear that one cubic foot of water contains as much heat as 800×4, or 3,200 cubic feet of air, or one cubic inch of water nearly as much as two cubic feet of air.

In applying these facts to the heating of buildings, we must not, however, forget that the cold walls and objects in buildings require much more heat than the air (they have a greater specific heat), and therefore we cannot succeed in heating a room before we have brought all the objects in contact with the air to the same temperature. Applying this on a large scale again to the Gulf Stream, it is clear that west winds blowing over the same are heated to a moderate temperature, and will very soon lose this heat when passing, in winter, over the cold or perhaps frozen ground of the British Islands, France, Belgium, Holland, and the western parts of Germany. In giving them a portion of their heat they will have lost most of it before reaching Russia; wherefore the influence of the Gulf Stream does not extend beyond the lands of western Europe, which enjoy the sole benefit of the same.

New York.

SYRACUSE---ITS MECHANICAL INDUSTRIES.

A correspondent, in the New York *Daily Times*, gives a lengthy account of the mercantile and manufacturing industries of Syracuse, N. Y., from which we make the following extracts. In describing John Greenway's brewery, the writer says:

In this Syracuse brewery, looking, as it does, like some great orphan asylum or other State institution, the manufacture of beer is carried on, on so large a scale and with such mechanical precision as in itself to create more than a gastronomical interest. The first point is the wing of the building used for malting purposes. No less than twelve floors, each ninety-one by sixty-five feet, are used for the laying out of the malt for sprouting, after it has remained for forty-eight hours in the thirty-one steeping tubs, which hold 225 bushels apiece. The malt is in every stage of progress—some just taken from the water, some again almost ready for the drying kilns, where it is taken seven days after it leaves the tubs. There are two kilns to each floor. The kilns are heated by enormous furnaces, with twenty-four flues, in the basement. The flooring of the kiln is of iron, and the temperature, even on the top floor, is kept up to 90° Fahrenheit.

Malt is only made during eight months of the year, but in that time Mr. Greenway generally makes from 225,000 to 250,000 bushels. When the malt is properly dried it is transferred on a "carrier" to the storing bins below, which hold about 45,000 bushels. These "carriers" are very ingenious contrivances. They run the whole length of the malt house and granaries, 335 feet, and communicate with the elevators and hoppers.

A "carrier" is a narrow endless sheet of cloth, about two feet in width and bagging slightly on the middle, which runs backward and forward on rollers moving on a staging four feet from the ground, and either discharges the malt into the hoppers, or carries the raw barley from the elevators to the malting rooms. It will carry 1,000 bushels an hour. The granaries consist of three floors, 162 feet long and 65 feet wide; two of them being 14 feet, and the third 11 feet high. They have a storage capacity of 175,000 bushels of barley. The hop room is 65 by 40 feet. Its contents vary in quantity, according to requirements and market values; but 350,000 pounds is about the average annual consumption.

"The two huge vats, in which the malt, hops and water are converted into beer, hold 300 barrels each. The fluid in them is boiled by a steam worm which covers the bottom and is fed from the boilers in the basement. All the beer is boiled by steam. One engine of forty-five horse power suffices for boiling the beer and heating the building in winter time. It consumes 700 tuns of bituminous coal in the course of the year. The coal bunkers of the establishment hold 300 tuns.

"An admirable contrivance, the patent of a Frenchman named Baudelot, is used for cooling the beer before it is run into the fermenting vats. The boiling beer is forced up to the floor above into a horizontal pipe seven feet from the ground. From this pipe it issues with great force from innumerable little jets, and dashes down on a succession of highly polished wooden bars about an inch in thickness and four inches across, placed like the laths of sun shutters when they are turned so as to admit the light. These bars are hollow, and are filled with constantly flowing iced water.

The bars being polished and their edges rounded off, the beer always runs underneath and drops on the middle of the next one. Consequently, though very hot when it leaves the jets, it is quite cool when it reaches the trough at the bottom from which it is conducted through copper pipes to the fermenting vats. This apparatus will cool 120 barrels in an hour. By the way, there are nearly twenty miles of copper piping in the building.

"The foam caused by the fermentation of the beer, after the yeast has been mixed with it, assumes fantastic and even very beautiful shapes. Sometimes it resembles undulating slopes of smooth fresh snow; sometimes it works into masses like drifts of snow, and, again, it will assume the rugged, riven, appearance of a Swiss glacier. And, to add to the simile, there are constant avalanches of the foam in consequence of the continual escape of small quantities of the car bonic acid gas which sustains it.

"Six or eight inches above the suface of the foam, the gas is so powerful as to produce asphyxia in a very few seconds. Brewers have often lost their lives by carelessly inhaling it. Over the tun room, as it is called, there is an immense ice house, one of Brainerd's patent refrigerators, 150 feet by 11 feet, and 14 feet high. By a simple arrangement the cold strikes down, and in the hottest summer weather the beer is kept perfectly cool. The store rooms, three in number, hold together 8,000 barrels of beer. Last year the brewery sent out 50,000 barrels of beer and 12,000 barrels of lager beer. It is a common occurrence for the firm to pay $300 or $400 in one day to the Government for stamps. The ale from this brewery is shipped to all parts of the State, more especially the central and western divisions.

"Adjoining Mr. Greenway's great brewery are the Syracuse Flour Mills, owned by J. W. Barker & Co. The mill, which is built of red brick, is 140 feet by 80 feet, and has five stories and a basement. It is run almost entirely by water power, though it is provided with an auxiliary engine of 100 horse power. Under an old lease, granted twenty-five or thirty years ago, the proprietors are empowered to use the surplus water of the Erie Canal for driving their machinery. A stone wall, built into the bank of the canal, at the hight established by law, prevents the use of the water when the canal is low. The engine has been in use for one month this fall, in consequence of the extensive dryness of the season, but previously it had only been used in the aggregate six weeks during the five years which have passed since its erection. The water, after driving the wheel passes through the mill and runs away into the Onondaga Creek. The granaries of the mill have a storage capacity of 80,000 bushels of wheat, and the nine run of stones grind about 1,400 bushels a day.

"The wheat is passed from the granaries to the grind stones on a "carrier" similar to that in use in Mr. Greenway's brewery. The flour falls from the stones into receptacles below, from which it is carried by elevators to the cleaning and winnowing floors. There it is passed through four revolving cylinders, one within the other, made of very fine hair sieve cloth. These cylinders are erected at a slight incline, so that the flour and impurities are constantly passing out of them; the flour to the stores over the packing room, the impurities to the waste room.

The flour is barreled by a very simple contrivance, called the "packer." From the stores above, a large pipe runs down to within about four feet of the ground, the bottom of which will just fit the top of a barrel. The barrel after being weighed, is placed on an iron stool and raised by machinery to the pipe. The filling machinery is then set in motion. A small governor, which can be regulated to any weight, detaches the barrel, by letting the stool fall till the bottom of the barrel is level with the floor, as soon as the required weight of flour is in it. At the same time it closes the mouth of the supply pipe. The barrels of flour are at once shipped, as the firm have always as many orders on hand as they can fill. They generally ship about four hundred barrels a day, and averaging ten months running throughout the year, sell from forty thousand to forty-five thousand barrels a year."

REPORT OF EXPERIMENTS FOR TESTING THE RELATIVE VALUE OF LUBRICATING OILS.

BY A. H. VAN CLEVE.

An experimental shaft with journals seven inches long, six nches diameter, was carefully fitted to brass bearings, suported by cast iron frames secured to a suitable foundation. spur wheel attached to the center of the experimental haft was geared to a pinion wheel, on the center of a driving aft, with its bearings also attached to the cast iron frames. A set of scale beams, arranged to apply any required presre (within their capacity) to the lower half of the brass arings, were also accurately fitted to the cast iron frames d foundation. The experimental shaft was driven by a e horse power oscillating engine, at a given number of revtions per minute, on each experiment.

The velocity was determined by a counter attached to the l of the shaft. The brass bearings of the experimental ft were kept at an average of 96° Fahr., which was deter ed by thermometers, inserted through them to within e eighths inch of the journals. An oil cup was placed each bearing, graduated to fractional parts of a gill. A mometer, to determine the temperature of the oil when ied, was placed in each cup. The experiments proved the consumption of oil varied with its temperature when ed. The quantity of oil applied per minute was varied tervals, as was required to keep the bearings as near Fahr. as possible, as abrasion of the metals took place w it rose above that point. The total consumption of oil, at close of each experiment, was averaged with the number of hours occupied in making the experiment. The pressure upon the journals was varied, for each kind of oil, as was necessary to preserve the uniform temperature of 96° Fahr., at the required revolutions of the shaft per minute on each experiment.

Hence, the number of square feet of the journal's surface travelled per minute, the pounds pressure upon them, and the quantity of oil applied, determined the lubricating value of the oil. The method of applying the pressure by the scale beams accurately indicated the power consumed by the engine to keep the shaft in motion during the experiments with each kind of oil.

A second series of experiments was made. (See Table No. 2.)

A shaft, with journals 6 inches long and 2¾ inches diameter, was fitted in place of the 6 inches diameter and driven at a corresponding number of revolutions per minute, for the purpose of testing the value of car box oils.

The experiments on each shaft were conducted with the same care, with corresponding results.

RESULTS.

The accompanying Table (No. 1.) exhibits the results of several tests, from which it will be seen that winter sperm oil, from three houses, sustained the heaviest pressure, and the best of them was taken as the initial of comparison for all others, and their per cent of lubricating value determined by it. The tests of mineral oils and mixtures of animal and fish oils with them would not sustain an equal pressure with the sperm, when equal quantities of the oil were applied, without rapidly increasing the temperature of the journals, and producing an abrasion of their surfaces.

The experiments, as shown by Table (No. 2.), on car box oils, with a shaft having bearings 2¾ inches diameter, by 6 inches long, also proved that when the pressure on the bearings was made equal with winter sperm, it required from 100 to 400 per cent increase of oil, to keep the temperature of the journals below 100° Fahr. In no instance could the pressure on the car shaft be raised to 8,000 pounds (with mineral oils), it being the average pressure on an axle of a loaded coal car. Hence, it is to be inferred that the expenditure of locomotive power, and the cost of repairs on all loaded trains, must be in ratio with the quality of lubricating material applied.

Experiments were made at varied velocities, (see Table No. 3.) with the same oils. The results proved that as the velocity was reduced the pressure could be increased, and the relative consumption of oil, applied at equal temperatures, was decreased in almost equal ratio.

The experiments were continued during a period of fourteen months, on the oils purchased for the Camden & Amboy Railroad Company's use; the following results are deemed sufficient for illnstration:

TABLE No. 1.

With Locomotive Axle Bearings, 6 in. diameter, 7 in. long.

KIND OF OIL, PURCHASED OF VARIOUS DEALERS.	Revolutions of shaft per min.	Pressure on journals—pounds	Temperature of bearings—Fahrenheit	OIL. Applied per hour—gills.	Per cent of lubricating value less than Flanders winter sperm	Temperature Fahrenheit: Began to thicken	Too thick to run	Congealed at	Horse power of engine consumed by each experiment.
Winter Sperm	131	7500	96°	.73	1.00	28°	26°	24°	3.55
Winter Sperm	125	7500	98°	.68	.04	30°	28°	27°	3.39
Winter Sperm	128	7000	96°	.82	.09	32°	26°	24°	3.24
Engine Oil	130	6632	96°	.48	.12	34°	32°	30°	3.12
Engine Oil	130	6543	96°	.44	.13	19°	18°	8°	3.08
¾ Winter Sperm, ¼ Lard	129	5600	97°	.86	.26	...	...	...	2.61
½ Winter Sperm, ½ Lard	129	5260	97°	.84	.31	...	...	...	2.45
¼ Winter Sperm, ¾ Lard	132	4500	96°	.76	.40	...	...	...	2.15
Engine Oil	131	4125	97°	.82	.45	...	...	...	1.94
Mason's Sperm	127	4264	97°	.74	.45	...	...	...	1.96
Lard Oil	129	4000	98°	.69	.47	...	...	...	1.86
Engine Oil	129	3844	97°	.81	.50	...	...	...	1.77
Engine Oil	129	3500	97°	.75	.54	...	...	...	1.62
Engine Oil	125	3471	97°	.72	.56	...	...	...	1.56
Engine Oil No. 2	125	1452	97°	.68	.81	...	...	...	.66
Engine Oil.*	124	758	96°	.73	.90	...	...	...	.34
Refined Mecca	127	366	98°	.71	.97	...	...	...	.12

TABLE No. 2.

With Car Axle Bearings, 2¾ in. diameter, 6 in. long.

Winter Sperm	251	7000	95°	.35	.09	28°	26°	24°	3.18
Car Box Oil	237	4854	93°	.17	.35	17°	15°	10°	2.08
MINERAL. Car Box Oil	225	4684	96°	.15	.40	31°	24°	12°	1.91
MINERAL. Car Box Oil No. 1	241	4014	96°	.16	.41	20°	18°	17°	1.75
MINERAL. Car Box Oil No. 2	240	4171	95°	.15	.43	12°	10°	...	1.81
MINERAL. Car Box Oil No. 3	245	4071	95°	.16	.43	16°	14°	13°	1.79
MINERAL. Car Box Oil No. 4	242	2500	95°	.18	.66	28°	26°	10°	1.09
MINERAL. Car Box Oil No. 5	243	4000	94°	.14	.45	15°	13°	10°	1.76

TABLE No. 3.

With Locomotive Axle, at different velocities.

Winter Sperm	130	7000	97°	.40	....	...	...	...	...
Winter Sperm	100	7200	94°	.26	....	...	...	...	...
Winter Sperm	70	8000	94°	.18	....	...	...	...	...
Winter Sperm	60	9800	94°	.14	....	...	...	...	...
Winter Sperm	130	7000	98°	.36	....	...	...	...	...
Winter Sperm	100	7500	96°	.25	...	...	...	...	...
Winter Sperm	70	8000	91°	.19	....	...	...	...	...
Winter Sperm	60	9500	90°	.16	...	...	...	...	...
Engine Oil	130	6500	96°	.24	....	...	...	...	...
Engine Oil	100	7500	96°	.18	....	...	...	...	...
Engine Oil	70	8000	92°	.14	....	...	...	...	...
Engine Oil	60	9500	87°	.06	....	...	...	...	...
Lard Oil	130	4000	98°	.31	....	...	...	...	...
Lard Oil	100	5000	95°	.18	....	...	...	...	...
Lard Oil	70	5500	93°	.12	....	...	...	...	...

Rogers' Fire Kindlers--A Curious Invention.

Mr. Noah Rogers, of Thomasville, Georgia, has invented an automatic fire kindler, which is a curiosity in patented inventions. It is a machine so constructed as to enable the fire to be kindled by any one in another part of the house, and without getting out of bed.

A CORRESPONDENT of the *English Mechanic* suggests two new uses for india rubber. One is for springs for locks, especially on gates and in other places exposed to the weather; the other is for proportional measuring, and the mode of application for this purpose will be obvious to our readers.

Scientific Lectures to the New York Young Men's Christian Association.

The second of the above named series was delivered on Tuesday, November 28th, by Professor Doremus, the subject under consideration being "Fire and its Treatment." In the course of the lecture, Professor Doremus said:

Fire is the most awful exhibition given to man of the potency of the Creator, its power, either for good or evil, being incalculable. Various have been the theories held at different times as to the nature of heat. Lord Bacon maintained it was a mode of motion; the same view was held by Sir Isaac Newton, and in our own time the theory has been revived by a number of eminent chemists, chief among them Mr. John Tyndall who has written a book in defence of its truth. Fire had been considered by the ancients to be one of the elements; but this is not maintained at the present day, and we are in a certain sense at sea as to its proper place in creation.

We frequently read of instances where the leaves of trees, rustled by the blast, ignite and produce terrible conflagrations, such as have lately occurred in Wisconsin and Michigan, where whole forests were destroyed from this simple cause. On the same principle a body, traveling with great velocity, coming in contact with an opposing force, produces fire—as, for instance, a projectile striking against the side of a ship will send forth sparks of flame. The popular theories, which will be intelligible to all, relative to the production of this element are easily explained. It is by chemical means that we are daily mastering all the difficulties of science, and among them this principle of fire. If carbon or charcoal be exposed to the air it can easily ignite, and in the same way soft. In one year the Metropolitan Gas Company lost $125,000 by the burning of their soft coal when exposed to the air and in the same time twenty-eight of the coal ships which left Liverpool were supposed from the same cause to have been lost. Another great cause of fire is electricity, which has been fearfully illustrated by the destruction of Chicago. The air is surcharged with the electric force, and in such weather as we have at present this can be easily proved. If a person who walks a distance a day like this comes into a warm room, and rubs his feet for a length of time on a carpet or rug, in a short time the electricity will penetrate to the very tips of his fingers, and a match applied to them will ignite a flame.

This theory explains such phenomena as we read about in the papers in connection with the destruction of Chicago. People who lived long distances from where the fire was raging, who had no idea of moving to a place of refuge, suddenly discovered their houses on fire in a manner that seemed inexplicable to them. The truth of the theory is easily explained. Great fires, such as that one, create a strong current of electric air, which travels over great distances, frequently firing a city in places widely apart. The knowledge of this principle should create a counter element to prevent such disasters, and it is believed chemistry is able, with its comparatively limited knowledge, to suggest one. Apart from this, some valuable hints are being thrown out by men of science relative to the building of our cities. The long narrow streets are, it is said, very dangerous in the presence of a fire, short, broad streets on the European plan being much safer and less exposed to the action of the flames. Some improvements might be made in our Fire Departments. It has been suggested that, instead of water being solely depended upon as an extinguisher, a reservoir should be provided in all our larger cities, filled with either carbonic or sulphurous acid, which would be much more efficacious than water if pipes were connected with the reservoirs, leading to our large establishments. In case of a fire breaking out at any time, the mere action of turning on a valve and filling the burning apartment with the gas would extinguish the flames. The same method could be employed on ships at sea, and the disasters that are now so frequent could be easily prevented and controlled.

To Filter Alcohol.

The following method of filtering alcohol or its solutions is said, by the *Druggist's Circular*, to be very satisfactory, and to be used extensively in North Germany, where it constitutes one of the secrets of the trade. Clean, unsized paper (Swedish filtering paper is the best), is to be torn into shreds and stirred into the liquid to be clarified. The whole is then to be strained through a flannel bag, when the resulting liquid will be found to possess the utmost clearness and limpidity. A filter may also be made by spreading thin paper pulp evenly upon stretched flannel or woolen cloth. When dry, the cloth so coated will be found to give better results than the felts, etc., commonly employed as filters.

PROFANITY never did any man the least good. No man is richer, or happier, or wiser for it. It commends no one to any society. It is disgusting to the refined, abominable to the good, insulting to those with whom we associate, degrading to the mind, unprofitable, needless and injurious to society.

PUBLIC LIBRARY AT MONTREAL.—We learn with much pleasure that the Messrs. de St. Sulpice intend to open, at Montreal, a library where students can consult, gratuitously, works of art and science which are difficult to procure. Students in medicine and law especially, who are considerably hindered in their studies for want of books, will appreciate this liberality.—*Journal de L'Instruction Publique.*

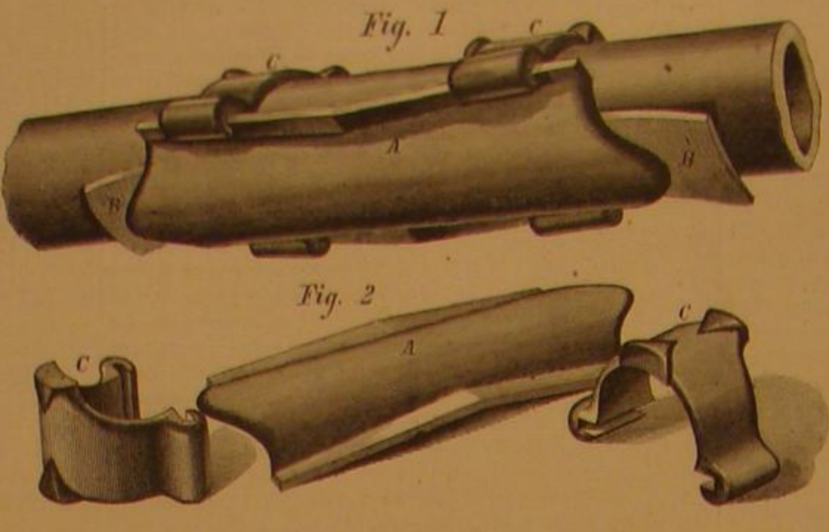
GREATNESS lies not in being strong, but in the right use of strength.

Improved Pipe Leak Stopper.

This is a very practical invention, having for its object the stopping of leaks which frequently occur in metal pipes. In the use of steam, leaks in the pipes are of more or less frequent occurrence, sometimes owing to the bursting of the pipes from over pressure, and often in cold weather from the freezing of the condensed steam. The difficulty of making repairs, in such cases, has been a source of trouble to most users of steam. A leak in the supply pipe of a boiler or engine often causes the stoppage of a factory for hours. By use of this invention, the delays incident to such cases are avoided. This leak stopper can be put on in from two to three minutes, and it not only quickly but effectually closes the leak. If, when making general repairs, the old pipes are replaced by new ones, the stoppers can be saved to be used again, as they will last indefinitely. It is believed that a supply of these, kept on hand against times of need, will save many times their cost to any user of steam. For dye houses especially, where pipes corrode rapidly, they are invaluable. Hundreds of manufacturing corporations and manufacturers in New England have proved these facts during the last twelve months.

The device consists of an overlap, A, a piece of rubber packing, B, and clamps, C, to hold the overlap and packing firmly down upon the leak. The application is so obvious as to need no further description.

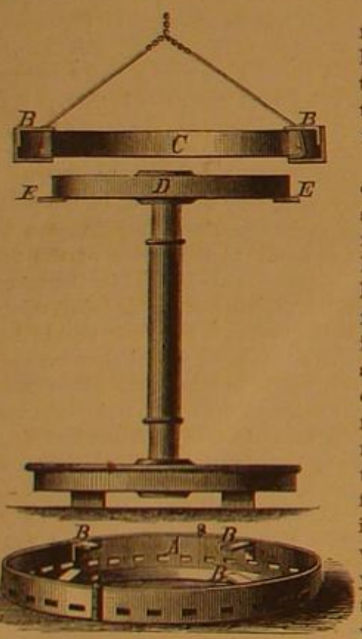
This invention was patented July 6, 1869, by Stephen Moore, of South Sudbury, Mass., who has assigned his right to himself and Homer Rogers, of the same place. The stoppers are manufactured and sold by James J. Walworth & Co., 1 Bath street, Boston, Mass., whom address for further information.



MOORE'S PIPE LEAK STOPPER.

SMITH'S PORTABLE FURNACE FOR SHRINKING ON TIRES.

We regard this invention as one of those practical, common sense improvements, meriting notice, not only on account of its simplicity and adaptation to the purpose designed, but because it is calculated to cheapen and render more perfect an operation that requires much exercise of judgment and care on the part of the workmen performing it. It also spares the workmen exposure to the intense heat to which they are subjected in the old method of setting tires.



Mr. William S. Henerey, of Meeting Street Foundery, Charleston, writes, in a letter to the inventor, as follows:

"To give an idea of its capacity, I will state that I saw a five feet tire, two and a half inches thick, hung in one of your furnaces, with shavings and kindling and one bushel of charcoal spread around it, and in 20 minutes from the time of lighting the fire the tire was set in position on the wheel. It is due to you to state that in this trial the work would have been done in three to five minutes less but for the haste of the workmen trying it on in thirteen minutes when the tire was not sufficiently expanded, thereby giving out heat to the wheel and causing a loss of at least three minutes to overcome this extra expansion, but at the same time clearly showing its great superiority over the old process, where the tire is taken out of the furnace; for instead of a disagreeable and troublesome failure, it only required to wait on the increasing heat for a few minutes to see it drop nicely into its place. I look upon its adoption as certain by all who have this class of railroad work to do, as it certainly is a great labor saving machine."

Mr. H. T. Peake, Superintendent of the South Carolina Railroad, says: "I would earnestly advise its adoption by all railroad companies, engine builders, etc."

Mr. E. F. Raworth, General Superintendent of the Vicksburg and Meridian Railroad Company, says, "the method is unquestionably superior to any now in use."

These testimonials from practical men show that the invention is worthy the attention of railway officials and builders of engines throughout the country, and their interest thus attracted will be hightened by the simplicity of the apparatus as it is shown in the accompanying engraving.

It consists of a fire box, A, made in halves, of No. 10 sheet iron, open at the top, and held together by hinge joints, so as to be easily separated. Brackets, B, are secured to the sides of the box, to rest on the top of the tire and support the box. Holes are punched around the sides and bottom of the box for the admission of air to the fuel (charcoal), which occupies the space of four inches around the tire.

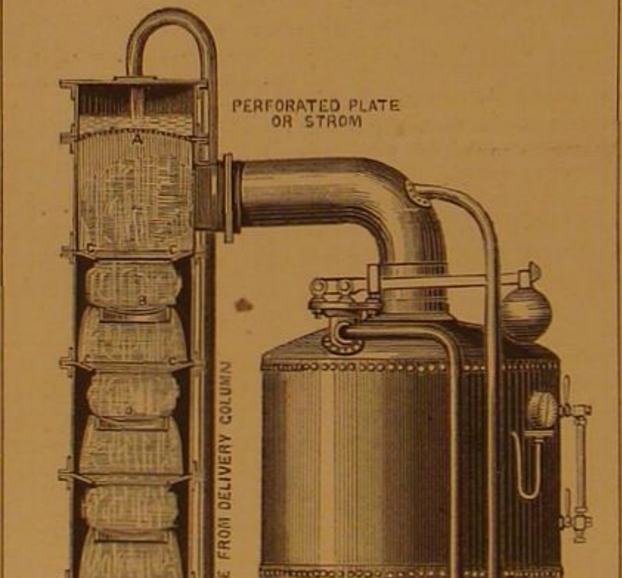
The tire, C, is suspended to a crane, the furnace then placed around it, and the charcoal put in and ignited. When the tire is sufficiently expanded (which may be readily determined by measuring with a rod), it is then placed on the wheel, D, resting on the gages, E; the furnace is then removed, the tire cooled off, and the unburned charcoal saved for the next operation. The furnace remaining around the tire until the operation is completed, obviates all danger of the tire sticking before reaching its destination.

It is claimed that one bushel of charcoal will shrink on any size tire, two and a half inches thick, with one sixteenth allowance for expansion, in less than thirty minutes from the lighting of the fire; and will remove an old tire in less than twenty minutes, not heating the wheel center sufficiently to injure the paint, and employing the labor of only four men.

For further particulars address the patentee, Mr. Wm. Bell Smith, M. S. C. R. R., Charleston, S. C.

TANGYE'S SMOKE AND HEAT PRECIPITATOR.

The annexed engraving shows an apparatus manufactured by Messrs. Tangye Brothers and Rake, St. Nicholas' buildings, Newcastle-on-Tyne, for precipitating soot and smoke arising from steam boilers, etc., in coal mining and underground and confined operations, and also for condensing sulphurous and other fumes from copper and chemical works.



The principle of the invention is at once seen on reference to the sketch, and consists in leading the chimney of the boiler into the top of the vessel termed the "precipitator," immediately beneath a jet of cold water, taken from the delivery pipe of a pump, which is distributed over the area of the vessel by means of the "strum," A. The water, in falling, has the effect of reducing to a minimum the heat passing from the boiler, and, at the same time, precipitating and absorbing the particles of soot and other products of combustion. In cases where a large supply for the jet is available, the cups and saucers, B C D, are unnecessary and not used, the copious shower falling from the strum to the bottom of the precipitator being quite sufficient.

IMPROVEMENT IN THE MANUFACTURE OF WHITE LEAD.

Mr. Decius Wadsworth, of Brooklyn, N. Y., has invented an improvement in the manufacture of white lead, for which he has recently obtained a patent through the Scientific American Patent Agency.

It is an improved arrangement of means for introducing and distributing the carbonic acid, used in the manufacture of white lead, in the basic solution of lead for precipitating, which consists in the application to the bottom of a tank containing a stirrer or agitator of one or more—preferably two—perforated pipes extending across the bottom in a groove or grooves, so that the stirrer or agitator will pass over them, the pipe or pipes extending through the side of the tank and being connected with a main pipe leading from the furnace in which the gas is generated, and having an air pump connected with it for forcing the gas into the solution in fine jets at intervals along the pipe, for exposing the whole mass uniformly to the action of the acid. The pipes are also arranged, at the projecting ends, to admit of the introduction of a brush or scraper from time to time, on the removal of a plug, for clearing them of the deposit of lead which enters the holes and obstructs the passage of the air and gas.

The tank is provided with a strong thick floor, in which are arranged two grooves, extending across it, one on each side of the center and parallel with each other. At one side of the tank are holes through it, coinciding with the grooves. These grooves are of suitable size to admit perforated tubes —say about three inches in diameter—so that they will not rise above the level of the floor. The tubes are arranged in the grooves, with one end projecting through the wall of the tank, and connecting with a supply pipe, which communicates with the furnace in which the gas is generated and has an air pump connection for forcing the gas into the tank through the small perforations. The agitator is kept in motion, while the acid is thus introduced, to thoroughly mix the acid with the solution. The pipes are connected with the main pipe in such a way that the outer ends, which are closed by plugs, may admit, when opened, a brush or scraper for removing the deposit of lead accumulating in them by settling in the holes. The pipes may be made of wood, copper, galvanized iron, or other suitable material.

By this improved means, the inventor claims to make the necessary uniform application of the acid to the lead with certainty and rapidity.

The process above described, namely, the distribution of carbonic acid over lead by means of a complicated arrangement of tanks, pipes, and other auxiliary parts, is old; but the improvement is intended to facilitate the operation and render it much more economical.

Curtis' Improvement in the Manufacture of Gunpowder.

Mr. Charles William Curtis, of London, England, has invented and patented, through the Scientific American Patent Agency, an improvement in gunpowder for use in heavy ordnance, known as "pellet" powder, which is usually made by compressing meal powder in molds, whereby it is formed into pellets of cylindrical form. Mr. Curtis' improvement consists in splitting such pellets longitudinally into halves forming grains of semicylindrical form, the result attained in use being claimed to be a higher velocity of the projectil without increasing the strain on the gun.

He takes unglazed pellet powder, or powder compressed into short cylinders or pellets, the manufacture of which completed with the exception of the glazing and stoving pr cesses, and subjects each pellet to the action of a knife other instrument, operated by hand or otherwise, where the pellet is fractured or split in a longitudinal directi The split pellets are afterward glazed and stoved in the dinary manner, which completes the process of manufactu

The pellets, when whole, instead of being cylindrical, n be of other form, cubes or parallelopipedes, for instance, cording to the shape of the molds in which the meal pow is compressed, and the shape of the pellets when split be varied accordingly, instead of being semicylindrical. any case, each split pellet has one roughened or fract surface, as above mentioned. The compression of the pow into pellets may be effected by the aid of any suitable chinery, as the present invention does not consist in the chinery for molding the powder, or in any particular struction of knife or other sharp or pointed instrument machine for splitting the pellets, as any suitable instrument or machine may be employed for that purpose.

The Boiler Experiments at Sandy Hook.

The experiments in the explosion of steam boilers under the authority of the United Railroad Companies of New Jersey, and the immediate direction of Mr. Francis B. Stns, were commenced Nov. 22nd, on the U. S. Reserve at Sandy Hook. Nine boilers were set up and three were loaded under conditions which will form the subject of future article. We prefer to defer a comprehensive review the experiments until they have proceeded farther. The only important result yet reached seems to be the final corroboration of the fact, heretofore supported by much reliable testimony, that boilers may explode with terribly destructive violence, when amply supplied with water, and when pressure is not in excess of that commonly used in high-pressure engines.

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Contents:

(Illustrated articles are marked with an asterisk.)

SOMETHING ABOUT LUBRICATORS.

What is a lubricator? A common reply to this question would be "anything that has the power of reducing friction." But how these things act to reduce friction is a matter upon which we have no absolute knowledge, though there are some facts whereupon to base theories. While, as our readers are aware, we believe it to be the proper function of abstract theory to guide actual investigation and experience, and that the indulgence of the habit of theorizing on hypothetical premises generally proves unprofitable, it may not in this instance be amiss to base a theory upon a belief generally prevailing, though not demonstrated, relating to the molecular structure of fluids.

The hypothesis is that the particles of liquids and fluids are spherical, and so smooth and hard as never to wear by attrition. This conception is about the only one the mind can make of bodies in which the particles are capable of moving with perfect freedom throughout the mass and among each other.

Viscosity of liquids is attributed to the cohesion of molesules, rather than to interlocking through irregularities in form. The latter will not satisfactorily account for all properties of viscous liquids. A quantity of ordinary fine lead shot approximates feebly the character of a similar quantity of liquid. The spheres of lead lack, it is true, the hardness and smoothness attributed to the molecules of fluids, but if we suppose fine shot to be obtained infinitely hard and smooth, such shot would flow almost like a liquid, and the physical properties of a mass of them would not vary greatly from those of some liquids.

These shot could be used as a lubricator, and the investigation of how they would act to reduce friction will give a clue to the probable way in which all lubricators act.

In the first place, being infinitely hard and smooth, the surfaces of the spheres cannot in the least interlock. They, therefore, slide over each other with the greatest facility. Placing a layer of these spheres between two plane material surfaces and moving one surface, we should see each of the shot rolling along under its burden, thus changing sliding friction to rolling friction, and notably reducing the power required to move the given surface. The sporules also flow into and thus rectify irregularities of the bearing surfaces. This is lubrication.

Placing the shot in the same way between an ordinary journal and its bearing, we should find difficulty in keeping them in place; but could they be retained, there would still be the same conversion of sliding into rolling friction. The tendency of the shot to gravitate to the lowest point in the bearing, would gradually force out all of them except a single line or row, which would then sustain the weight of the journal and would so far indent the metal as to cease rolling. The conversion of sliding friction into rolling friction and the lubrication would practically cease, and it would be necessary to supply more shot.

If now we could supply some bond of union between the shot, sufficiently strong to overcome in great measure their tendency to gravitate, and could also supply a bond of attraction between them and the journal, without detracting materially from their power to flow about among each other, the journal would carry them along in its revolution against the action of gravity, and so long as the shot would remain unchanged in character, the journal would remain lubricated. The attraction of cohesion and adhesion are just such bonds, and it is because oils possess these attractions in higher degree than water and some other liquids that the former are better adapted to lubrication than the latter. There is no better lubricator than water when it is convenient to keep it constantly supplied to bearing surfaces. As examples we may refer to Girard's *Palier Glissant*, illustrated and described on page 6, Vol. XXII, of this journal, and to the water bearing of Shaw's propeller pump, illustrated and described on page 118, current volume. In these applications of water to lubrication, the water is forced between the bearing surfaces by hydrostatic pressure.

We see then that, for general use, lubricators must possess a certain amount of cohesive and adhesive attraction. But they must also have the power to retain their cohesion and fluidity under the action of moderate heat, heavy pressure, and contact with metals and air. The oxygen of the air attacks many kinds of oils, rendering some acid and others resinous; and moreover some oils of mineral extraction are contaminated with acids, used in their rectification, which attack metallic surfaces, the oxides of the metals thus produced increasing friction mechanically. The oxides of metals have the power of saponifying vegetable and animal oils, and no doubt this combination often takes place when oils of this kind are used on rusty bearings.

The soaps formed by the union of the saponifiable parts of oils with metallic oxides are hard and insoluble, and are, therefore, much less perfect lubricators than the oils themselves. Some oils, more particularly those extracted from petroleum, are volatile, and evaporate as soon as journals become slightly heated. Oils possessing these defects are unfit for purposes of general lubrication.

Probably nothing else has ever been discovered that possesses in so high a degree all the properties desirable in a lubricator as good pure sperm oil. There have been, however, some close approximations to it in oils extracted from petroleum. Many of the latter are, however, very inferior. Some excellent lubricating oils are also obtained from various seeds. The olive and the castor bean furnish oils very good for lubrication. Olive oil is, however, too expensive for general application to this purpose.

But as no amount of theory can take the place of actual test in mechanical science, we are glad to notice in this connection some recent and important experiments made by Mr. A. H. Van Cleve, General Purchasing Agent for the Camden and Amboy Railroad, relative to the value of different lubricating oils. A full report of these experiments will be found in another column, and we call our readers' attention to it as being perhaps as important a contribution to our knowledge upon this subject as has yet been published.

Of late graphite has been prepared so pure, and has been reduced to so impalpable a powder as to enable it to enter as a competitor with oils for purposes of lubrication. It is probable that the action of this substance on bearings is not analagous to that of oil in the conversion of sliding into rolling friction, but that it acts beneficially because its coefficient of friction on metals and wood is so much smaller than that of metals on metals or metals on wood.

As yet its value as a lubricator is not generally admitted, although we have seen the strongest testimonials in favor of an article called plumbago grease, manufactured by a house in this city.

The "metalline," about which such incredible stories were told a year or two ago, and about which we hear nothing latterly, was prepared in part from graphite. It is possible that this substance (graphite) in a perfectly pure state, or mixed with other substances, may eventually take its place among standard lubricators in general use for machinery; but it has yet to earn its reputation.

TO SMOKE OR NOT TO SMOKE.

The use of tobacco is an evil, or it is not an evil. In the enormous and increasing consumption of this plant it has become a question of very great importance what effect upon the general standard of health is produced by it. The agitation of this subject has been increased during the last two years, and pamphlets, essays, and lectures have developed in full strength the arguments for and against tobacco using. As smoking is the most popular and most powerful method by which the stimulant effect of the plant is obtained, it is principally upon this habit that the battle is waged.

We have from time to time presented some of the arguments on both sides of the question, our object being to assist in arriving at truth in so important a matter; and though our confirmed taste for smoking and the natural desire to find it a harmless practice have led us to peruse, with peculiar care, all that has been said in its favor, we avow that neither reading nor experience has convinced us that the general use of tobacco is other than an unmitigated evil.

The *Dublin University Magazine* for September of the present year contains by far the most comprehensive review of the subject that has met our notice, and it is the purpose of this article to place some of the facts, stated in this paper and gleaned from the experience and observation of a very large number of eminent physiologists and pathologists, before the American public in a more prominent manner than they would otherwise appear.

Every page of this remarkable paper is so replete with references that from it might almost be compiled a bibliography of the history, uses, and abuses of "the weed."

The first thing that forces itself upon our attention is the enormous consumption of tobacco. The *Food Journal* states that as much money is spent upon tobacco in England as upon daily bread, yet England undoubtedly consumes less of this narcotic in proportion to its population, than Germany or the United States. The consumption in England has very nearly doubled in twenty years. The annual consumption in Asia, Europe, America, and Australia, as computed by the eminent German statistician Ausland from the most reliable data obtainable, is not less than 970,000,000 pounds. This affords food for comment, but we will confine ourselves to facts and authorities.

M. Barral, who made the official report on specimens of tobacco exhibited at the Paris Exposition, in his surprise at the footings of his estimates of annual production, remarks: "The enormous figures which have passed before the reader's eye testify to the facility with which people fall into excessive expense for the gratification of a pleasure which has for its principal aim to kill time and to stupefy the mind."

The active principles of tobacco are nicotine, a concrete oil called tobacco camphor, and an empyreumatic oil. The two last are active poisons, but not so deadly as the first, which, according to Taylor, is one of the most virulent poisons known. One drop of it kills a rabbit in three minutes and a half. We need not quote other authorities on this point, as all agree with Taylor as to the character of these substances.

The disease called locomotorataxy, which is a general paralysis of the nerves, is a disease that was unknown forty years ago. Now it has become quite common. Martin ascribes its origin and prevalence to the use of tobacco.

Dr. Richardson, himself a smoker, says: "Smoking produces disturbances—(*a*) in the blood, causing undue fluidity, and change in the red corpuscles; (*b*) in the stomach, giving rise to debility, nausea, and, in extreme cases, sickness; (*c*) on the heart, producing debility of that organ and irregular action; (*d*) on the organs of sense, causing, in the extreme degree, dilatation of the pupils of the eye, confusion of vision, bright lines, luminous or cobweb specks, and long retention of images on the retina; with other and analogous symptoms affecting the ear, namely, inability clearly to define sounds, and the annoyance of a sharp, ringing sound, like a whistle or a bell; (*e*) on the brain, suspending the waste of that organ, and oppressing it if it be duly nourished, but soothing it if it be exhausted; (*f*) on the nervous filaments and sympathetic or organic nerves, leading to deficient power in them, and to over secretion in those surfaces—glands—over which the nerves exert a controlling force; (*g*) on the mucous membrane of the mouth, causing enlargement and soreness of the tonsils—smoker's sore throat—redness, dryness, and occasional peeling off of the membrane, and either unnatural firmness and contraction, or sponginess of the gums; (*h*) on the bronchial surface of the lungs when that is already irritable, sustaining the irritation and increasing the cough."

This authority, however, claims that the diseases caused by tobacco are functional, not organic or specific. This does not matter much, except as encouragement to those who desire to recover from ill health resulting from smoking.

M. Decaisne recognizes a functional disease of the heart (narcotism of the heart) as caused by tobacco, distinct symptoms of which were observed by him in twenty-seven out of thirty-eight, boys aged from nine to fifteen, who smoked more or less.

It is a fact well established that before adult age the use of tobacco produces more serious disturbance than later in life.

M. Beau notices eight cases of *angina pectoris* caused by the use of tobacco.

Professor Lizars records several cases of cancer of the tongue and lips caused by the use of the pipe. The writer has known one such instance, and never wishes to see another example of such terrible suffering resulting from a worse than useless habit.

Dr. Taylor says those who suffer from functional disorders are ready "to attribute the derangement to any other cause than the real one."

Experiments made by Dr. Druhan seem to indicate that tobacco poison in an overdose may produce effects which render even small doses dangerous ever after.

Dr. Corson corroborates the opinion of M. Beau as to *angina pectoris*.

But we will make no further citations. If tobacco has any applications useful to mankind, we are satisfied that smoking, chewing, and snuffing are not of them. We may use tobacco to kill the insects which infest our rosebushes and conservatories; but, if we will continue to poison ourselves with it, let us make no pretences about it. We do it to gratify a depraved appetite from which we are irresolute to break loose. Let us neither believe nor pretend to believe that it is a blessing. If tobacco poisons our bodies, let it not also corrupt our morals and make hypocrites of us.

THE CONDITION OF MECHANICS AND LABORERS IN ENGLAND.

The condition of the working classes in England has become so low and degraded that the attention of thoughtful men of all shades of opinion is attracted to it; and it is a serious question to know what remedy to apply to save a vast population from sinking to a depth of corruption and misery unparalleled in the history of modern civilization.

A plan has been proposed by Mr. Scott Russell, the architect of the Crystal Palace, the Great Eastern and other large works, to form two Committees, "a Council of skilled workmen," and "a Council of legislators," to whom shall be referred the discussion of the whole question and the suggestion of proper remedies.

Mr. Russell says: "While there is no finer breed of working men in the world than the British skilled workman, there is no civilized country in which his interests are so little cared for, and in which the institutions, laws, and customs are so unfavorable to his material well being and to his moral development." This is pretty strong language, but it appears to be confirmed by the observations of other reformers. As the result of careful inquiry among workmen, and extensive visitation of manufactories and dwellings, both in England and on the Continent, the chief evils to be remedied were classified under the following seven heads:

1. The want of family homes, clean, wholesome, and decent, out in pure air and sunshine.

2. The want of an organized supply of wholesome, nutritious, cheap food.

3. The want of leisure for the duties and recreations of family life, for instruct'on, and for social duties.

4. The want of organized local government, to secure the well being of the inhabitants of villages, towns, counties and cities.

5. The want of systematic, organized teaching, to every skilled workman, of the scientific principles and most improved practice of his trade.

6. The want of public parks, buildings, and institutions for innocent, instructive and improved recreation.

7. The want of adequate organization of the public service for the common good.

While the English legislators and Council of skilled workmen are discussing the seven points raised by the above classification, it may be well for us to consider how far we are better off than our neighbors across the water. We recently took up the first topic—the want of family homes out in pure air and sunshine—and tried to show that it was the duty of capitalists to see that the homes of mechanics were in the open air and made as comfortable as possible.

Such a result can only be attained in New York by a system of rapid transit, for it is in vain to look for decent dwellings and wholesome air in the crowded tenements of the city. The question of cheap food is of hardly less importance, and as it is possible by organized effort to feed a vast army with nutritious meat biscuit, good bread, and fresh provisions, we have the best of information that an organized supply of wholesome food is profitable for our working men. If half the effort were to be made, to form our workmen into associations for the purchase of provisions, that there is to inveigle them into time-consuming, wasteful and extravagant political clubs, a vast amount of good could be accomplished; and if the late Commissioners of Public Parks had used the organization of their office for the protection of the men under their employ, instead of setting them an example of prodigality by spending nearly five million dollars in a little more than a year in doubtful experiments, they would have earned the thanks of the whole community. Our mechanics have so long felt the want of leisure for recreation and amusement that, when they do have a holiday, they hardly know what use to make of it. They are as graceful in their efforts at fun as an elephant would be in a china shop. They have had no experience at amusement, and do not know where the fun comes in. It is not their fault, but the misfortune of the circumstances in which they have lived; and it is high time that workmen were secured proper time for the recreations of family life, and for social duties. Our German citizens possess the secret of obtaining their share of amusement in the most economical and innocent manner.

It was partly in consequence of a knowledge of this fact that Prince Albert joined so heartily with Mr. Scott Russell in all of his efforts to alleviate the condition of the English poor. Prince Albert had witnessed the merry gatherings of mechanics and humble tradespeople on the Continent, and the sombre and sad fate of the English workmen could not fail to attract his notice by the contrast it afforded. We inherit too much of the English trait in this matter, and can afford to take more kindly to amusements of a proper character than we are now accustomed to do. The want of systematic teaching to every skilled workman is a topic which has been fully discussed in our columns. The loss to manufacturers, in teaching their workmen by experience, is one of the heaviest discounts to be made from the profits of any enterprise in the country. No way of acquiring knowledge is so costly as this. We have heard a large manufacturer say that it had cost him five hundred thousand dollars to teach his workmen how to conduct his business, a greater part of which sum could have been saved if the men had had an opportunity to acquire a knowledge of the scientific principles upon which the business was based. And this knowledge could easily have been taught them in our public schools.

The English are very right in demanding systematic, organized teaching to workmen of the principles involved in the practice of their trades. And a good form of protection for us would be to meet skilled labor by something better, and to do this we must look well to our schools.

The want of a suitable public park is not so much felt in New York. Our Central Park is visited by many thousand persons, and is of incalculable value to all classes of citizens, the rich as well as the poor; but "buildings and institutions for innocent, instructive and improving recreation" are quite as much a want and a necessity with us as in England. The present appears to be the time of great awakening for the aid and improvement of laboring men of all classes.

For those who work with their brains, life assurance societies have been organized,—for the toilers with hands, we trust that cheerful homes, wholesome food, suitable leisure, and systematic teaching will grow out of the agitation of the question, in this country and Europe.

THE lowest education that teaches self control is better than the highest that neglects it

PROTECTION TO AMERICAN INDUSTRY.

The city of New York and the country at large owe a debt of gratitude to Mr. Peter Cooper, which entitles the opinions of that gentleman, upon any public question, to the most respectful attention. A pamphlet from his pen upon the subject of "Protection to American Industry" has reached our table, and is, we understand, being widely circulated.

While we concede to Mr. Cooper a high place among philanthropists, we cannot accord him equal rank as a political economist; and though we are in favor of "protection" as we understand it, we find, in this pamphlet, neither any new argument, nor any old one so repeated as to add to its force. In fact, the chief weight and importance possessed by the essay lies in the influence of the name of its author.

The principal part of the document is occupied with an arraignment of the English government for its crimes against colonial commerce. The present embarrassment of commerce and trade are attributed to the inflation of paper money. The nations are considered as engaged in what Mr. Cooper styles "a commercial war," in which, if we would conquer, we must adopt "a policy that will maintain the National Government and pay the nation's debt out of duties on imports. The heaviest duties should be laid on all articles of luxury, and the lightest duties on all articles that will aid in securing a diversified employment to our people."

This is, we think, a fair synopsis of the essay, which is, as we have intimated, mainly a historical *resumé* of the acts of commercial greed committed by the English nation, and which greed, upon the maxim that "all is fair in war," we understand Mr. Cooper to counsel us to imitate, at least so far as will maintain and vindicate "the political and financial power" of our nation.

It will be seen that Mr. Cooper makes the great mistake of most old school business men, namely, that paper currency is the origin of our commercial depression. We think it can be proved (though we shall not attempt the proof in this article) that a self regulating paper currency is the best for all commercial purposes. The trouble has been that instead of thus being self regulating—that is, convertible into interest bearing bonds at will of the holder, and *vice versâ*—the supply has been increased or diminished, fitfully, in the interests of speculation; at one time being abundant, at another scarce. The demands of trade are not met by such a currency.

The taxation of imports to the highest extent, within the limits of absolute prohibition, is what is meant by protection, with the tariff advocates of Mr. Cooper's school.

It would be well for all who so fluently propose remedies for commercial disease by tariff tinkering, to reflect that all taxation must, of necessity, be laid upon waste or consumption. Production cannot be taxed, because it can shift any burden of taxation to the shoulders of consumers. A single instance will suffice to illustrate. The present internal revenue tax on matches is added by the manufacturer to the cost of the article, and a profit on the whole is exacted from consumers, so that the manufacture is really improved by the impost. If the burden should be so great that the manufacturer could no longer sell, his stock on hand will begin to deteriorate. On this waste he will pay the tax.

This law of political economy is fundamental. It depends upon the very nature of the relation between buyer and seller. No attempt to change it can ever succeed. To equalize taxation among individuals, therefore, implies the equalization of waste, or consumption. Those who waste or consume most will be taxed most by any imposition levied upon the necessaries or luxuries of life. This being admitted, it is evident that it matters nothing whether imported articles be taxed, or whether domestic products support all the burden so far as expense of living is concerned. So long as the burden must be borne we may carry it as well on one shoulder as the other, notwithstanding the outcry that protection implies increased cost of the necessaries of life. But it matters very much indeed which is taxed, when one has to compete in the market with the other. In each case the consumer will pay the tax, but if importations are checked, he consumes home made goods, and thus encourages home production.

The encouragement of home production means the absence of the competition of labor living on one plane, with labor living on a lower plane of civilization, to which free trade would inevitably force down the laboring classes of this country. As "commercial war" exists, the operation of free trade would be simply to drive the manufacturing population into agriculture, at wages approximating those of the English farm laborer.

The mistake that production can be taxed leads to other fallacies, which we will not discuss in this article. The pamphlet of Mr. Cooper serves a certain purpose in the furtherance of the cause of protection, but its inherent weakness, will, we fear, furnish the opponents of the doctrine with a mark for the shafts of satire which will greatly neutralize its effect, even with those who follow the prestige of a name rather than convictions derived from sound premises and correct logic.

SCIENTIFIC INTELLIGENCE.

OLIVE OIL AS A PURIFIER OF CARBONIC ACID.

In the manufacture of carbonic acid for mineral waters and soda fountains, in consequence of impurities in the limestone employed for the evolution of the gas, certain disagreeable empyreumatic oils and offensively tasting gases are apt to go over; and, unless separated in some way, they will impart an unpleasant flavor to the mineral water. To obviate this difficulty, E. Pfeiffer suggests saturating pumice stone with olive oil, and passing the gases through it in the usual way. The oil absorbs the bad gases, and can be regenerated for subsequent use by heating it to expel the absorbed impurities. After becoming quite impure, it is still suitable for the manufacture of blacking or for application as a lubricator. It is said that Mallett employs this method to absorb the hydrocarbon products in his process of obtaining ammonia directly from coal tar. As much of our limestone contains organic matter, which gives a peculiar smell to carbonic acid made from it, this method of purifying the gas by passing it through olive oil is worthy of trial.

PRACTICAL USE OF THE CARBONIC ACID RESULTING FROM FERMENTATION.

The same ingenious inventor has devised a plan for economizing the waste carbonic acid resulting from the fermentation of wort, the manufacture of vinegar, from champagne vats, and the like. The fermenting vessels are covered, and, by means of exhausters, the air is drawn off and is found to contain from twenty to twenty-five per cent carbonic acid. This can serve for the manufacture of bicarbonates, and, if the gas were to be condensed, could be converted into a motive power, employed in the manufacture of soda water, or used for artificial refrigeration. At any rate, there would appear to be no reasonable excuse for wasting so much carbonic acid. If somebody would only devise a practicable plan by which the enormous amount of carbonic acid, produced by gas burners or exhaled from the lungs of large audiences in our churches, theatres, and public halls, could be drawn off, got out of the way, and devoted to some purpose more useful than suffocating and poisoning multitudes of people, he would confer a great boon on mankind, and would be cordially welcome to any remuneration he could make out of it. In other words, why cannot somebody devise a system of ventilation that will be accepted at once as feasible, and thus put a stop to complaints on this subject?

ACTION OF SULPHUROUS ACID ON PHOSPHATES.

B. W. Gerland has been making some important experiments on the action of aqueous sulphurous acid upon phosphates, which have developed some points of great practical importance, especially in their bearing on the manufacture of artificial composts and soluble phosphates. He finds that aqueous sulphurous acid does not, like the strong acids, wholly decompose the phosphates, but transforms them into soluble modifications. The ordinary bone phosphate, called tribasic, is easily soluble in sulphurous acid, and if the solution be hastily boiled and evaporated in open vessels, a crystalline double salt, a mixture of tribasic phosphate with a sulphite of lime, will separate. This new and remarkable body is said to be quite permanent, and, in reference to its use as a disinfectant and upon farm land, is certainly deserving of especial notice. If we can, by means of sulphurous acid, decompose the phosphates, we shall avoid the expense of sulphuric acid, which must first be made from sulphurous acid, and obtain a product not so difficult to handle, and capable of a greater variety of uses than the superphosphate made in the old way. The author has studied the behavior of sulphurous acid towards other phosphates, but, as the results are purely theoretical, we omit them.

PURE OXYGEN FOR INHALATION.

Eliot recommends for the preparation of oxygen gas, to be used in medicine, the employment of a mixture of equal parts of peroxide of barium and peroxide of lead. By pouring dilute nitric acid upon these salts, there is a violent effervescence and a copious evolution of pure oxygen gas. For greater security, the gas may be afterwards washed in water. As very little heat is necessary, the operation can be performed in any stout bottle, thus dispensing with the usual retorts.

A MEASURE FOR THE INTENSITY OF LIGHT.

Dr. Vogel proposes *nitroprussidiron* as a suitable salt for determining quantitatively the intensity of light. For the preparation of this reagent, dissolve chemically pure oxide of iron, best obtained from the oxalate, in hydrochloric acid, and evaporate nearly to dryness to expel the excess of acid; and after filtering, add an aqueous solution of nitroprussidnatrium in the proportion of three of the iron to two of the latter. There is usually a slight precipitate produced by this mixture, which can be collected on a filter; but this operation must be performed in a dark room. We have now a liquid excessively sensitive to the action of sunlight. By exposing a small quantity of a known specific gravity to the action of light, a precipitate of Prussian blue will instantly begin to fall; and, on redetermining the specific gravity in the dark chamber, its decrease will be found to be proportional to the precipitate; and we have thus the data for measuring the intensity of light. It was found by Dr. Vogel that that the liquid, exposed for forty-eight hours before a kerosene lamp, was not in the least affected, but a piece of magnesium wire, when burned, immediately produced a precipitate. By employing a long instrument graduated in millimeters, it would appear to be possible to measure the intensity of the light by the number of millimeters occupied by the precipitate. The invention has an important bearing upon photography.

OZONE ETHER.

A correspondent asks if there is any way by which ozone can be preserved dissolved in a liquid. Such a preparation is recommended by Dr. Richardson, which, however, is said by Böttger not to contain any ozone, but something equivalent to it, namely, binoxide of hydrogen. By agitating ether in a flask with binoxide of barium, adding gradually perfectly pure and very dilute hydrochloric acid, occasionally cooling and subsequently allowing the ether to settle, we obtain a liquid which has been recommended as a disinfecting, bleaching, and cleansing agent, and as a test for chromic acid, which it instantly turns indigo blue.

TIMELY SUGGESTIONS.

Every Employer should present his workmen and apprentices with a subscription to the SCIENTIFIC AMERICAN for the coming year.

Every Mechanic and Artisan whose employer does not take the SCIENTIFIC AMERICAN should solicit him to subscribe for 1872.

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If any mechanic whom you ask to subscribe says he cannot afford it, tell him he cannot afford not to.

If any one wishes specimens of the paper to examine before subscribing, tell him to write to the publishers and they will cheerfully mail them.

If any one wishes an illuminated Calendar for 1872, to hang in his office or shop, he can have it sent free on sending a request to this office.

If handsome illustrated posters and prospectuses are wanted to assist in obtaining subscribers, send to the publishers of this paper.

It is the intention of the publishers of the SCIENTIFIC AMERICAN to make the paper next year better and handsomer than any previous year during the last quarter century it has been published.

It is the intention of the publishers to illustrate, by superb engravings, all new and practical inventions and discoveries that may be developed during the year.

For Prospectus and terms to Clubs see last page.

AN ingenious Frenchman has invented a process for treating common woods, which makes them of a closer texture, harder grain, and greater density, and so enables the cheaper kinds of wood to take a polish. The mode is as follows: The surface is first planed perfectly smooth, and then rubbed with diluted nitrous acid. An ounce and a half of dragons blood, dissolved in half a pint of spirits of wine, and half an ounce of carbonate of soda are mixed together and filtered; and the liquid is then laid on the wood with a soft brush. The treatment should be repeated after a short interval, and the wood will then possess the outward appearance of mahogany. If the polish is not sufficiently brilliant, rubbing with cold drawn linseed oil will improve it.

MR. A. A. LOW, treasurer of the New York Chamber of Commerce Chicago fund, acknowledges the receipt thus far of $906,310.67—nearly a million dollars.

YOU cannot escape from anxiety and labor; they are the destiny of humanity.

NEW BOOKS AND PUBLICATIONS.

THE SCIOPTICON MANUAL. Explaining Marcy's New Magic Lantern, and Light; including Magic Lantern Optics, Experiments, Photographing and Coloring Slides, etc. By J. L. Marcy, Optician, No. 1340 Chestnut Street, Philadelphia, Pa.

This little work, which may be obtained of the author, is calculated to assist those who need instruction in the use of the sciopticon or magic lantern. This instrument, in its improved form, affords a means of much instruction and amusement; and the above work, while in itself interesting and instructive, will be found an invaluable guide to the use of the most entertaining apparatus yet invented by opticians.

ELEMENTARY PRINCIPLES OF CARPENTRY. By Thomas Tredgold. Revised from the original edition, and partly re-written by John Thomas Hurst. London: E. & F. N. Spon, 48 Charing Cross. New York: 446 Broome Street.

Mr. Tredgold lived to revise the second edition of his original work on *Carpentry;* but the time that has elapsed since his death has increased the general knowledge upon the strength of materials, and has also given birth to new inventions and appliances, which have made another revision imperative, in order to bring the work up to the improvements of the time. The large and increasing use of iron, in connection with wood in bridge building and in general architecture, is one of the advances made since the second edition was published. On this account, the editor of the present edition has entirely re-written the chapters on pillars, bridges, and timber, and has added sections to the chapters on coffer dams, scaffolds, etc., besides making such alterations, wherever needed, as will adapt the work to present needs. A very comprehensive work in its revised form, it supplies a want long felt, and will, we have no doubt, meet with a large sale. The carpenter will find a great variety of useful information in the chapters treating of the equality and distribution of forces, resistance of timber, construction of floors, roofs, domes or cupolas, partitions, scaffolds, staging, and gantries; construction of centers for bridges, coffer dams, shoring and strutting; wooden bridges and viaducts; joints, straps, and other fastenings, timber, etc. To these chapters are appended twenty-one useful tables, calculated to facilitate computation in all departments of carpentry, and a copious index, which renders every thing in the book available for easy reference. The work contains 517 printed pages, and 48 full page plates, besides numerous smaller engravings throughout the text. It is printed in excellent style, and is handsomely bound in cloth.

ANNALS OF THE DUDLEY OBSERVATORY. Vol. II. Albany: The Argus Company, Printers. 1871.

The most important and interesting feature of this volume is the record of the meteorological observations made during a period of five years, from 1862 to 1871, under the supervision of G. W. Hough, A. M., Director of the Dudley Observatory. Nothing like such a continuous and accurate series of observations for so long a period has ever before been published or made. In fact, they could not have been made with any less perfect and automatically registering and printing instrument than the "Automatic Registering and Printing Barometer," invented and perfected by Professor Hough, and used by him during the period named. This instrument not only traces a continuous curve of the varying hight of the barometric column, but so proportionally magnifies the fluctuations of the column that even the smallest variations become apparent. The importance of this will be appreciated when we state that frequent fluctuations of the column, though almost imperceptible, seem to always precede, for some time, the occurrence of violent disturbances in the atmosphere, and that this fact has been discovered by the use of Mr. Hough's instrument. In his remarks upon this point, Professor Hough says:

> Some years since, we pointed out the intimate relation existing between the barometric disturbance and the weather. We remarked that this element of disturbance was a better guide in prognosticating storms, than the mere change of barometric hight. An examination of the mean daily and mean monthly curves for barometric disturbance shows that this opinion is founded in nature.
>
> It will also be seen, by an inspection of the tables exhibiting the mean daily disturbance, that storms are invariably accompanied with excessive barometric fluctuation. In fact, a pretty correct history of the weather may be determined by an examination of this element alone; and when taken in connection with changes of pressure, it indicates, in a very marked manner, the atmospheric phenomena.
>
> Some hours previous to the arrival of a great storm, the "barometric disturbance" increases, amounting, in some cases, to seven times the change of pressure in a given interval of time. It is our opinion that the waves of pressure are propagated in the upper regions of the atmosphere, some hours before the storm reaches any given locality at the surface of the earth.

The record is made for each hour during the five years, and the curve of hourly disturbance, when compared with the weather record accompanying, clearly sustains the views expressed by Professor Hough. Diagrams are given, showing the mean hourly barometric disturbance, the mean monthly disturbance, simultaneous barometric curves at different points, mean hourly velocity of the wind, mean monthly temperature for nine years, etc. A most interesting part of the report is the account of observations at the time of the total eclipse of the sun in 1869. The book contains, also, much other important and interesting matter pertaining to the regular work of the observatory. It is, probably, the most important contribution to meteorological science yet published.

A REPORT OF SURGICAL CASES TREATED IN THE ARMY OF THE UNITED STATES, FROM 1865 TO 1871. Washington Government Printing Office. 1871.

This is a large quarto with illustrations, the character of which is set forth in its title. Its importance will, however, only be apparent to physicians and surgeons, who will find in it statistics of great value. The minute details given of operations which, a few years since, were scarcely known to surgery, are especially important as guides in the treatment of similar cases hereafter. The compiler and editor of the work, George A. Otis, Assistant Surgeon U. S. A., has done his work with scrupulous ability.

The Thanksgiving Number of HEARTH AND HOME, published by Orange Judd & Co., 245 Broadway, New York, is an evidence of the liberality and good taste which have secured for this journal a well deserved popularity and large circulation. As a family paper, for large and small, it has purity of tone, originality, and beauty, to recommend it, while it is edited with intelligent appreciation of what the masses of rural and city readers like to read. Its illustrations are excellent: in short, we shall have sufficiently described each of its features when we say they are all, of their kind, excellent. The more such papers are circulated, the better it will be for the mental and moral health of the rising generation.

THE ELEMENTARY MUSIC READER. A Progressive Series of Lessons, prepared expressly for use in Public Schools. Book First. By B. Jepson, Instructor of Vocal Music in the New Haven Pub ic Schools. New Haven, Conn.: Charles C. Chatfield & Co., 458 Chapel Street, opposite Yale College.

We have long been impressed with the importance of substituting the reading of music for the rote singing practiced very generally in public schools. The importance of a knowledge of musical notation, and the power of reading it with facility to satisfactory progress in music, needs no argument. The system of teaching this branch of the art, generally employed in this country, is, in our opinion, very defective, its chief fault being the transposition of the syllables used in solfeggio exercises, with the transposition of the scales, instead of maintaining them, without regard to key, in one position on the staff, as in the Italian method. We are sorry to see that, in Mr. Jepson's work, this error is retained—the more so, as it is in all other respects a capital book for the field it is intended to occupy, giving evidence that its author is a practical and thorough teacher.

HALF HOURS WITH MODERN SCIENTISTS. Huxley—Barker—Stirling—Tyndall. New Haven, Conn.: Charles C. Chatfield & Co.

This is one of, what the publishers style, the University Scientific Series of Publications, designed to place, in a cheap form, the advance thought in the scientific world. It contains the following essays: "On the Physical Basis of Life"—Professor T. H. Huxley. "Correlation of Physical and Vital Forces"—Professor G. F. Barker, M.D. "As Regards Protoplasm—Reply to Huxley"—James Hutchison Stirling. "On the Hypothesis of Evolution"—Professor E. D. Cope. Scientific Addresses, by Professor John Tyndall. "On the Methods and Tendencies of Physical Investigation. "On Haze and Dust," and "On the Scientific Use of the Imagination."

The names of these celebrated scientists and authors are so well known, and their popular style of discussion is so favorably appreciated, that it is hardly necessary to say this work possesses an interest and value, second to no other of its size ever issued from the American press. It is a medium octavo, plainly bound, but handsomely printed, and will meet with an extensive sale.

SERVING OUR GENERATION, and GOD'S GUIDANCE IN YOUTH. Two Sermons, preached in the College Chapel, Yale College, by President Woolsey. New Haven, Conn.: Charles C. Chatfield & Co.

This is a beautiful little volume, printed on tinted paper, and neatly bound in cloth. As the work of one of our most celebrated scholars and divines, it will be eagerly sought by those who delight in pulpit literature.

THE CIVIL ENGINEER'S POCKET BOOK OF MENSURATION Trigonometry, Surveying, Hydraulics, Hydrostatics, Instruments and their Adjustments, Strength of Materials, Masonry, Principles of Wooden and Iron Roof and Bridge Trusses, Stone Bridges and Culverts, Trestles, Pillars, Suspension Bridges, Dams, Railroads, Turnouts, Turning Platforms, Water Stations, Cost of Earthwork, Foundations, Retaining Walls, etc., etc., etc. In addition to which, the Elucidation of Certain Important Principles of Construction is Made in a More Simple Manner than heretofore. By John C. Trautwine, Civil Engineer. Philadelphia: Claxten, Remsen & Haffelfinger, 819 and 821 Market street.

The above comprehensive title relieves us of the necessity of an analysis of this work, and the name of its author is a sufficient guarantee of the value of its contents to any engineer and mechanic. The book is bound in morocco, with clasp, in the pocket book style, and is copiously indexed. It is in every way, in matter, style of publication, and binding, worthy of commendation, being in itself a complete compendium of engineering science, by the use of which much time and labor can be saved to any practical mechanic.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

DIMENSIONS OF BOILERS.—J. McC.
PROTECTION OF BUILDINGS FROM FIRE.—R. B. B
RAILROAD ACCIDENTS.—G. T. F.
SLIDE VALVES.—F. A.
SPIRITUALISM.—J. L. V.
ASTRONOMICAL DISCOVERY.—L. B. D.
BOILER EXPLOSIONS.—K. H.
DISEASE AND DIRT.—F. H. B.
MODERN SURGERY.—N. F. W.
WASTE OF WATER.—H. B. P.
ANSWERS TO CORRESPONDENTS.—F. D. C.—F. S. C.—R. V. P. W. J. W.
QUERIES.—L. D.—O. S.—R. V. P.—T. E. L.—W. H. G.

Business and Personal.

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Practical Hints to Inventors.

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How Can I Obtain a Patent?

s the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

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Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MOTH PROOF BOXES.—Raphael M. Seldis, of New York city, assignor to Jason Crane, of Bloomfield, N. J.—This invention provides boxes, packages, trunks, and similar receptacles with an inner lining, whereby moths will be effectually excluded, and the consequent destruction of the contents prevented. The invention consists in applying a coating of thin gutta percha to the inner side of every such receptacle. This not only makes the same practically airtight, to prevent dust and other impurities from entering, but is also injurious to moths, as, by its peculiar odor and exhalations, it is claimed to destroy them.

MACHINE FOR THREADING BOLTS.—Charles Schneider, of Newark, N. J.—This is a screwcutting chuck which can be conveniently opened apart after a screw thread has been cut, to enable the removal of the finished screw or bolt without necessitating the ordinary tedious process of unscrewing. The invention consists in making the chuck in sections, which are pivoted to sliding pins in such a manner that they can be moved forward, and swung apart conveniently after a screw has been cut; whereby considerable time in the cutting of bolts and screws is gained, and the expense of their manufacture consequently reduced.

BLACKING BOXES.—Thomas R. Sinclaire, of New York city.—This box may be stamped from a single piece of tin or other sheet metal, or made of pieces soldered together, as may be deemed advisable or convenient by the manufacturer. Instead of making the sides of the box perpendicular with the bottom, and thereby leaving a sharp corner to retain a large portion of the blacking, as is the case with the blacking boxes in common use, the sides are placed on a level, leaving an angle still, but an angle so obtuse that the brush readily reaches the last particle of blacking in the corners. This formation is claimed to not only save at least ten per cent of the blacking, but to save the brush from injury sustained in forcing it into a sharp corner and against the sharp edge of the box, besides a great deal of trouble and annoyance to the user.

PROPELLING POWER.—Nathaniel B. Baldwin, of Chicago, Ill.—This is an improved apparatus for drawing plows, wagons, reapers, mowers, and other machines, and for propelling thrashers and other stationary machinery. It is a four wheeled traction engine, the driving wheels of which are turned by pivoted levers actuating pawls which engage with ratchets.

APPARATUS FOR FORCING LIQUIDS.—Mancella E. Ogden, of New York city.—This invention has for its object to furnish a simple, convenient, and effective apparatus for forcing beer, ale, or other liquids out of their casks by atmospheric and hydraulic pressure. It consists in a combination of a tank with a slide and with pipes and valves, a pivoted lever, connecting rod, weighted lever, catch, bent arm, sliding rod, rod, pipe and stop cock provided with valve and stop cock, and an air tank provided with stop cocks, the whole being constructed in a peculiar manner, the nature of which precludes detailed description in this place.

TELEGRAPH INSULATORS.—George W. Kidwell, of Elwood, Ind.—The insulator is made of glass or other good non-conductor and is divided longitudinally into two or more parts, and is made tubular for receiving the telegraph wire. There is a groove around the insulator, by means of which the insulator is secured in the block by a pin. There is a hollow cavity in the flat side of one of the parts of the insulator, and a round projection on the other part which fits into the cavity. This is simply for holding the parts of the insulator in place, and to aid in adjusting it in the block. There is a slot in the block communicating with the insulator hole. This slot allows the telegraph wire to be slipped into the hole in the block; the parts of the insulator are then applied to the wire, thus enclosing it, and then slipped into the block on the pole, where the insulator is secured by a pin. By this mode of applying an insulator to the wire, it is claimed much valuable time is saved in putting up and repairing the wires, and the cost of the insulators is greatly reduced.

AIR REGISTERS.—Edward A. Tuttle, of Brooklyn, N. Y.—This invention relates to improvements in the registers used for regulating the passage of air; and it consists in a combination with the slats of a spring or springs in such a manner as to retain them in any position as may be required for controlling the passage of the air. By the employment of these springs, an elasticity is imparted to the support of the slats by which they are adapted to receive slats of different lengths, which is desirable, because they often vary in length, though made from the same pattern; but care will be taken to have the slats for each register as nearly the same length as possible. The said spring plates also afford a means for compensating for variations in the thickness of the sides of the frames commonly supporting the journals, which also often occur in casting, thereby obviating the necessity of fitting them, as they have had to be heretofore. The said arrangement is highly desirable over registers of railroad cars, to prevent them from rattling, as well as to hold them from turning.

DITCHING PLOW.—Henry D. Williams, Fairview, Iowa.—The construction of this plow enables the draw bar to be so adjusted as to draw the machine forward in a straight line, or to cause it to move to the right or left to pass obstructions, or change the direction of the ditch without its being necessary to change the position of the capstan for that purpose. While the nature of the invention precludes a more detailed description of parts, we may say something further relative to the merits of the invention. It appears to us to be well adapted to the purpose, in that it can be made as strong and durable as may be desired, there being no complications introduced likely to get out of repair. The draft strain upon the cutters is supported and the whole machine bound together by a metallic strap or band. The mold board is so elongated as to act with efficiency in throwing out the earth to the proper distance from the ditch. A shoe gages the depth of the cutting, the whole forming a very compact, solid and easily manipulated implement.

MECHANICAL MOVEMENT.—William F. Jones, of Easton, Kansas.—This invention relates to a new and useful improvemen. in a mechanical apparatus for imparting power and motion by means of horse or other motive power applied thereto for operating tools or machinery. A driving face wheel is made to revolve on a horizontal arm of a vertical stand. A spider, consisting of four, more or less, tubular arms, is attached to the stand. Pinion wheels, with which the driving gear wheel meshes, are employed, equidistant from each other on the face of the wheel. A shaft passes entirely through the spider. One of the pinions may be made fast on this shaft, so that the shaft will revolve, and the other pinion may be loose and revolve on the shaft. In the former case motion may be taken from the end of the shaft; but in case one or both of the pinions revolve on this shaft, they may have a socket hub, or center, so constructed as to couple and impart power and motion to other mechanism or tools for any purpose which may be required. Motions in reverse directions may be obtained either for conveying power and motion, or turning augers, drills, or other tools. The pinions, one or more, may have socket hubs for the introduction of coupling-bars or tools, as may be desired.

BEE HIVE.—Sandy S. Collins and Hiram Senseman, of Tremont, Ohio.—This improvement provides a double bottom to hives for the reception of the droppings of the bees, and, by a peculiar device, to serve as a moth trap. Other features are the strengthening of the comb frames, provision for the ventilation of the hive, for the protection to the bees while inserting the comb frames, for the convenient inspection of the honey boxes, prevention of damp in the hives, etc., etc.

ANIMAL TRAP.—Nathan S. Howell, of Tualatin, Oregon.—This invention consists in the arrangement of a trap having two pivoted toothed jaws, which catch and hold the animals by their bodies, the jaws being actuated like the jaws of the ordinary double steel trap.

ELECTRIC LINING FOR SAFES.—Edwin Holmes, of Brooklyn, N. Y. and Henry C. Roome, of Jersey City, N. J.—This invention relates to an improved method of applying electric alarm apparatus to safes, vaults, and other structures, with the view to greater efficiency of action and simpler mode of application. The method heretofore employed has been to apply a lining connected with the electric apparatus directly to the inside of the safe or vaults. Whenever such a safe or vault is attacked by burglars; it is injured or destroyed before the lining is reached and the alarm given. To remedy this defect the inventor builds, around the structure to be guarded, an exterior case, to which a lining, which may consist either of metallic sheets or a network of wires, is applied, and which constitutes an exterior electrical burglar proof safe of itself, so that if any attempt be made to enter by cutting, drilling, or breaking through, an alarm will be sounded before the structure guarded is itself reached.

APPARATUS FOR FILTERING LIQUIDS.—Thomas R. Sinclaire, of New York city.—The object of this invention is to overcome some difficulties which have been met with in the use of the filtering apparatus for which letters patent of the United States were granted to the same inventor, dated April 27, 1869, and July 6, 1869. It consists in a perforated tube or receiver within the filtering vessel, of conical or other form, connected with the bottom of the vessel and extending upward therefrom, consisting of perforated metal, wire gauze, and textile or fibrous material, or their equivalents, the same being surrounded by the charcoal or filtering material. The filtering vessel may be of any suitable size and form, provided with a conical or oval top or cover, with a ring or eye for lifting and handling the same. A flange is formed around the rim of the vessel. The cover is so securely confined to the vessel by bolts, that the connection will allow liquids to be filtered under pressure. The filtering vessel is filled, or nearly filled, with charcoal or other filtering material for clarifying and purifying liquids. Charcoal is usually employed. In filtering under pressure on the old plan, or without an interior perforated receiving tube or its equivalent, more or less of the liquid, it has been found, will force its way between the charcoal and the side of the vessel, or through channels in the coal itself, and will consequently be but partially filtered or clarified, thus rendering the whole operation imperfect and unsatisfactory. By the introduction of the receiving tube all the liquid is compelled to pass and to be regularly distributed through the body of the filtering material and into the perforated tube through the coverings thereof, by which operation all the liquid is thoroughly filtered and purified.

HONEY BOXES FOR BEE HIVES.—Ellery Channing Lewis, of Glasgow, Mo.—This invention has for its object to improve the construction of honey boxes so as better to adapt them for use, both in connection with the hives and in sending the honey to market; and it consists in a construction of the boxes whereby any box of the series may be removed without disturbing the other boxes, and replaced by a new box; or the honey may be removed and the same box put back in its place. Hexagonal honey boxes are made with slots in their lower sides and with slots in their upper sides to adapt them for use in connection with each other and with a bee hive. The hexagonal boxes are made with their lower sides movable and secured to the ends of said boxes. The boxes are provided with cross slots formed in the upper angle.

BRIDLE BITS.—Albert Vanauken, of Ludlowville, N. Y.—This invention relates to hollow bridle bits, perforated to allow a melted substance to exude therethrough. The mouth piece is made hollow to receive the medicine, and has a number of small perforations formed through its side through which the dissolved medicine or the vapor of the medicine may escape into the horse's mouth. The mouth piece is plugged by metallic screw plugs which carry the rings.

LINK JOINTS FOR WATCH CHAINS.—Charles B. Charpenter, of North Brattleborough, Mass.—This invention has for its object to furnish an improved joint for connecting the links of watch chains, watch guards, etc. It consists in a joint formed by combining two rings with each other and with the end of the adjacent links, which construction gives the necessary flexibility to the chain and produces a chain strong, durable, and substantial, and, at the same time, neat and elegant in appearance.

AGRICULTURAL BOILER.—John Murdock, of South Carver, Mass.—This improvement in boiler furnaces consists in combining therewith a damper for direct draught, wherein the heat is carried completely around the kettle in one united flue. The advantage of the improvement is that the damper is enabled to give a much larger opening where the upper portion of th kettle becomes heated, while opening directly into the smoke pipe; and closing the flue around the kettle, all circulation is effectually arrested. By the arrangement of discharge orifice and damper a direct draught is given to the furnace in starting a fire. The heat may be regulated as may be required by the contents of the boiler, as damage is frequently caused by allowing the full heat of the furnace to pass up around the boiler when the boiling is nearly or quite completed.

APPLE CORER.—Stephen C. Collins, of Oregon, Mo.—This invention relates to a new, simple tool for coring apples, consisting only of a handle and a trough shaped conical cutting blade, which is adapted to core apples of larger or smaller size.

BEDSTEAD FASTENINGS.—Thomas W. Moore, of New York city, assignor to Frances N. Moore, of same place.—The object of this invention is to furnish a cheap, strong, and durable bed fastening. It consists in a flanged metallic angular tenon attached to the bed rail in combination with an angular mortise in the bedpost, the construction and arrangement of the tenon, the holding flanges entirely upon one side of the tenon, and the bearing surface of the wood entirely on one side of the mortise, thus making the fastening secure and durable. The mortise in the post is made by boring a round hole, inclining inward, and then cutting a slot to it from the outside to fit the plate of the tenon so as to leave the bearing surface all on one side of the slot.

MUSIC STAND.—Willard C. James, of Fishersville, N. H.—This invention relates to improvements in music stands; and it consists in a novel arrangement of the rack and legs for being inclosed in a tubular support, adapted to be used as a walking cane, so that it may be more easily carried from place to place than the ordinary racks.

STEAM GOVERNOR.—George W. Clark, of Council Bluffs, Iowa.—This invention consists in the application to the ordinary governor of a weight, to be moved towards or from the fulcrum as a reinforcement to the balls to assist in moving the valve, and apparatus for shifting the weight, said apparatus being actuated in one direction by the steam and in the other by gravity or a spring, to move the ball one way as the pressure increases, and the other way as it falls. We would be glad to describe more at length this ingenious device, but we could not make its action clear without the aid of engravings. We judge it constitutes a very sensitive governor without much complication.

WATER METER.—Camille Campeaux, New York city.—This invention relates to a new instrument for measuring the quantity of water or other fluid passing through it and recording the measurement thus taken. The invention consists in a new arrangement of parts, whereby a float is caused to alternately open and shut a valve and impart intermittent rotation to a recording gear. The nature of the device precludes detailed description in this place.

CORN PLANTER.—Bendix Ingebrigtson, of Cambridge, Wis.—This invention relates solely to certain improvements in the dropping gear of corn planters, whereby the seed is deposited in the drills or hill formed by markers in an accurate and uniform manner.

REFRIGERATOR.—James W. Fisher, of Islip, N. Y.—This invention has for its object to furnish an improved refrigerator which shall be simple in construction, convenient in use, and at the same time strong, durable, and not liable to get out of order; and it consists in the construction and arrangement of various parts which cannot be described without diagrams, but which together form a very convenient and neat design for the purpose intended.

FASTENING FOR WINDOW BLINDS.—Isaac Amos, Belair, Md.—This invention consists in a peculiar construction of pintle for the lower hinge of a blind, whereby the blind is locked and unlocked by sliding the said pintle up and down. The blinds may also be swung open or closed by aid of the device.

BALANCED VALVE FOR STEAM ENGINE.—David W. Huntington and William A. Hempstead, South Coventry, Conn.—This invention consists in a plate covering a slide valve having a vertical exhaust discharge opening through it, which plate, also having an opening for the exhaust, is provided with a hollow cylinder extending up into another cylinder in the top of the steam chest, in which it fits steam tight, which cylinder prevents the action of the down pressure upon a portion of the plate nearly as large as that under the plate open to the atmosphere, so that there is only a slight preponderating downward pressure, merely sufficient to keep the joint of said plate with the top of the valve tight. As this cylinder on the said plate is liable to bind in the cylinder of the steam chest, in which it must fit steam tight, and thus not always rest on the valve with sufficient pressure, a bar or rod is applied to it, having a slight forward and backward motion to oscillate said plate and prevent it from sticking in the cylinder of the valve chest.

BEE HIVE.—Martin R. Sanders, Cambria Township, Pa.—This hive is of a rectangular form, and provided with a hinged bottom having supports or feet and a side door, with a removable glass panel, to permit easy and safe inspection of the operations of the bees at all times. Ventilating apertures are formed in the bottom and side of the hive, respectively, and closed by pivoted buttons, which are imperforate at one end and provided with wire gauze in the perforation of the other. The gauze affords ventilation, while preventing entrance of vermin into the hive. The door for closing the main bee entrance is attached to the side of the hive by screws working in slots, and notches are formed in the side of the slots to adapt the door to be supported on the screws. The lower edge of the hive is beveled, to allow the bees to work all around the edge, and leave no space for worms or other vermin to find a lodgment. The door is provided with vertical grooves in its side edges corresponding to beads on the hive. Thus a perfectly vermin proof joint is formed, as well as one calculated to keep out moisture, etc. The comb frames have a bottom bar and transverse middle bar, to form supports for the comb, so that it will not be liable to break down when being removed or transported from place to place. They are supported at the back of the hive on fixed cleats or bars, fitting in notches, and at the front by wire hooks. Drawers for surplus honey are arranged to slide into the upper compartments of the hive, and provided with removable glass fronts. When it is desired to remove one of the boxes, it is only necessary to open the glass front, and thus allow the cold air to pass in, which has the effect of immediately driving the bees into the lower part of the hive. Similarly, by removing the glass panel of the door, the bees will be forced into the boxes, and the comb frames may be manipulated with safety. The door is made in two parts—the upper to close the box, and the lower to close the comb frame compartment.

BOTTLE STOPPER.—Wendell Wright, of Phœnicia, New York.—The object of this invention is to provide a stopper for bottles, jars, jugs, etc., which may be inserted and withdrawn an indefinite number of times without injury, and which shall be homogeneous in its texture, and uniform as regards its elasticity. It consists in making the stopper of a block of wood, provided with a deep annular groove, by which the outer bearing surface of the stopper forms a ring, more or less elastic and flexible, according to its thickness and the nature of the wood. These stoppers are very cheaply made, and it is claimed, may be used over and over again without the least injury, besides being superior as stoppers to the ordinary corks used for that purpose.

PISTON PACKING.—Herschel P. McCarroll, of Pittsburgh, Pa.—This invention relates to the use of a continuously self acting expansion spring within the ordinary packing spring of a steam engine or pump piston, and to a new arrangement of interior steady pins. One of the heads has a projecting ring, against which the other head rests. Between this ring and the packing spring is interposed a coiled spring, which bears with constant pressure against the packing spring, and counteracts the contracting efforts of the same. The power of the springs will always be balanced, for the latter becomes weaker as the former is enlarged, and consequently also weakened. In this manner an equal pressure on all points of the packing spring is sustained. To the inner side of the ring is secured a series of springs, which are by jointed links connected with radial steady pins. These pins fit through the ring, and bear, by the power of the springs, against the inner face of the coiled spring. The pins serve to steady the coiled spring and make it act uniformly against the packing spring.

BELL PULL.—Amos L. Swan, of Cherry Valley, N. Y.—This invention relates to a new arrangement of levers constituting a bell pull; and has for its object, by the improved combination, to insure reliable action under a short motion of the pull. By pulling on the knob, levers will be swung so as to carry another lever down, and cause it to pull on the wire that leads to the bell. A short motion of the knob will suffice to produce a complete swing of the latter lever, and insure the desired disturbance of bell or stroke of clapper. On being let go, the knob will, by the power of a spring, be drawn in again and all parts brought back to their normal position.

CONSTRUCTION OF ARCHES.—Frank Alsip, of North McGregor, Iowa.—This invention relates to an important improvement in brick arches, whereby such articles are made to sustain a greater weight, and are more durable than when built in the ordinary manner. It consists in a bearer of metal or other suitable material, supported on the cap piece of the column, and in a cross piece, by which arrangement the wall is sustained by the bearer and column, and the arches are relieved of the greater portion of its weight. The caps may be made in proportion to the size of the column, as the arches may be made much lighter, while the thrust of the arches is much diminished.

CHURN DASHER.—William C. Broyhill and William D. Sperry, of Tremont, Ill.—This invention has for its object to provide farmers and dairymen with an improved churn dasher, which shall be capable of completing the operation of churning more quickly, and also better adapted for use in gathering the butter than others of its class. To this end the under side of the radial dasher blades are grooved, made of wedge form in cross section, and set at an inclination of about thirty degrees to a vertical rotating shaft. The agitation produced by the revolving of the shaft, thus bladed, in the cream soon breaks the globules of butter and completes the process of churning. In churning the dasher is turned so as to raise the cream. In gathering the butter, after the process of churning is completed, the dash is turned in the opposite direction.

PIPE TONGS.—James Stratton, of New Haven, Connecticut.—The griping levers of the pipe tongs, instead of having a steel face made fast to the short jaw, as now practiced, has a circular plate or disk, (preferably of steel) attached to the bottom of jaw, so that it cannot escape therefrom or change its relative position to the upper jaw; but, also, so that it can move on its axial center, and thus continually present a varying surface for wear. In this manner the whole of the belt of contact surface near the edge will wear down together. The top surface is then simply ground down to a plane face, and this is performed again and again until the whole circular plate or disk is worn out and utilized.

MACHINE FOR CUTTING BOOT AND SHOE COUNTERS.—Sylvanus C. Phinney, of Stoughton, Mass., assignor to S. C. Phinney and J. C. Phinney, of same place.—The object of this invention is to furnish a machine for dividing leather, or for cutting it into counters for boots and shoes without waste. It consists in the mode of adjusting a knife, feed rolls, and gage, and in the arrangement of the same in relation to each other; through which a machine is produced, which, it is claimed, divides leather into counters in a most perfect and satisfactory manner, effecting a very great saving in material as well as in time.

FOUNTAIN.—Henry H. Sawwell, of Randolph, N. Y.—This consists of two inclosed chambers and two open pans so connected together by pipes that, when one of the chambers is filled with water, the transfer of the water from the one to the other causes a jet to be projected upwards which will be continued until all the water is thus transferred. The fountain thus constructed is portable and suitable for conservatories, etc.

LIFTING JACK.—Arthur A. Davis, of Clark's Green, Pa.—This invention relates to a new and useful improvement in jacks for lifting carriages, wagons, and other vehicles and articles. When it is desired to drop or lower the lifting bar quickly, a lever is raised higher than is required in lifting, when the end of the lever between cams strikes a lug on an upper catch, and releases the catch from the friction with the bar, and at the same time the toes of the cams strike the outer end of the lower catch plate and release that catch from the bar, when the bar drops by its own gravity.

LAYING TILES.—Manly A. Burnham, of New York city, assignor to himself and Tobias New, of same place, has patented a new and useful improvement in laying tile. This improvement, in laying tile in vestibules, halls, and other apartments, consists in the use of a continuous stone bed or floor above the foundation and "gage mortar," which prevents the tile from being affected by the shrinking, swelling, and warping of the wood foundation beneath. This tile flooring is supported, first, by the foundation timbers or joists, which rest in the walls of the building. On these timbers a flooring of boards or planks is placed. To prevent warping the wood floor is made of narrow pieces, placed so that they may swell without crowding each other. A layer of gaged mortar rests upon the floor, upon which the tile floor is usually placed. This layer of mortar (as tile floors are ordinarily laid) is more or less disturbed by the swelling and warping of the wood floor beneath, and, as a natural consequence, the tile becomes loosened and uneven, and frequent repairs are necessary. As a remedy for these very serious evils, a continuous floor, composed of marble slabs or of stone (either natural or artificial) is embedded in the gaged mortar. Upon this stone floor a layer of plaster of Paris or other suitable cement is spread sufficiently thick to form a level surface. Upon this the tile floor is laid, the tile being bedded down so that the upper surface will present a perfectly level plane. The tile floor supported in this manner will not be affected by the swelling, shrinking, or warping of the wood beneath. The pieces of tile are cemented to the stone floor; and the adhesion of the stone floor to the gaged mortar in which it is embedded being perfect, it is claimed all objection to the floors laid above wood supports is obviated. By the use of the stone floor, a permanent sidewalk or an area may be laid out of doors as well as indoors.

HARROW.—Elial S. Herrington, of Emmett, Ohio.—This invention has for its object to furnish an improved machine for harrowing the ground, breaking up the lumps and clods and leveling off the ground, leaving it light, smooth, and level; the harrow frame is made triangular in form and in two equal parts, which are hinged to each other at the forward and rear parts of the central short longitudinal or line bars by double jointed hinges. This construction enables the two parts of the frame to be turned into a vertical position, so that it may be drawn upon the central bars when passing from place to place, or whenever it is desired that the harrow should not operate upon the ground. The harrow teeth are attached to the frame in the ordinary manner, except that the two teeth attached to the rear parts of the central or line bars are made longer than the other teeth, to take a firmer hold upon the ground. A box, open upon its upper side, has its ends inclined, so that it may fit into the space between the rear parts of the inclined or outer side bars of the triangular frame. To the forward parts of the ends of this box are pivoted the ends of a bail, the middle part of which is connected with the rear hinge, or with the rear part of the said frame by a short rod or chain. Two boxes placed in the rear of this box, the ends of the forward one being connected with the ends of the first box by short rods or chains, and the ends of the rear one of which are connected with the ends of the other one by short rods. To one of the boxes, preferably the middle one, is attached a seat for the driver. If desired, the boxes may be weighted with stones or other heavy material when additional weight may be required for breaking the clods and leveling the ground.

REIN AND SHAFT SUPPORT.—James P. Crutcher and Thomas Y. Vancleave, of Connersville, Tenn.—This invention consists in a new line supporter applied to buggy shafts or carriage poles, so that it will also serve to support the rear ends of such shafts or poles, when detached from their vehicles, on the animals' backs and preserve them from injury.

COMBINED CLOTHES DRYER AND AWNING.—Charles E. Hyde, Oswego, N. Y.—This invention consists in the combination of a frame with an awning which latter can be used either in connection with cords stretched on the frame for the purpose of forming a clothes dryer, protected by the awning from rain, or may be used without the cords, simply as a tent.

FASTENING FOR CORRUGATED ROOFING.—John C. Wands, Nashville, Tenn.—This invention relates to a device for fastening together sheets of corrugated roofing by means of a Z shaped clamp into whose angles the edges of the upper and lower sheets are passed, the same being thereby prevented from springing apart.

CARRIAGE SEAT JOINT.—John A. Hanna, Belair, Md.—The invention consists in forming swells or extensions on each side of the joint so as to produce large planes for bearing surfaces and thus secure the shoulders from being staved up; also in a flap that automatically removes the dress and prevents it from being caught.

CLOTHES WASHER.—David P. Sulouff, Milton, Pa.—This invention relates to a washer intended to go inside a wash boiler and to support the clothes to be washed, holding them above the water, and provided with a pipe having a rose head through which water is forced by the steam pressure, falling from the rose heads in jets on all parts of the clothes.

CLOTHES WASHER.—David B. Sulouff, Milton, Pa.—This invention relates to a washer intended to go inside a wash boiler and to support the clothes to be washed, holding them above the water, and provided with pipes, one at each end, having rose heads through which water is forced by steam pressure, falling from the rose head in jets on all parts of the clothes.

SASH FASTENER.—John C. Hanna, Rossville, Iowa.—This invention consists of a device formed of two plates pointed together like a butt hinge, one of which plates is to be let into the side of a window sash, the hinge being placed next to the casing; the other plate being free and provided with a right angle flange at its upper or lower end, which flange, when the free plate is turned back against the casing, enters one of several slots, and thus fastens the window.

COTTON PRESS.—Charles J. Beasley, Petersburg, Va.—This invention relates to that class of presses which employ two followers, one moving upwards and the other downwards. The invention consists in the combination of two such followers, in such a manner that the lower one in rising draws down the upper one part of the way, and when descending raises the upper one. It also consists in the construction and arrangement of a lever for operating the shaft on which are mounted the cords for adjusting the followers. And it finally consists in the combination with said shaft of a horse power for drawing the followers together when it is preferable that the other apparatus for doing the same thing should not be used.

STEAM AND WATER INJECTOR.—Samuel S. Jamison, Jr., Saltsburg, Pa.—This invention relates to the steam injector used for filling boilers with water, and it consists in a double conical piece of metal placed within and lengthwise of the conducting pipe of the instrument, in front of the steam and water supply pipes, an annular space being left between said conical piece and its inclosing pipe for the passage of water to the boiler, the object of the conical piece being to more thoroughly commingle the steam and water than would otherwise be done, and, consequently to more rapidly and completely condense the steam.

BUGGY REACH.—John Clinton Hillsabeck, of Montovallo, Mo.—This invention consists in the provision of certain attachments to buggy reaches whereby a degree of flexibility is given to the vehicle which preserves it from damage, and by which the sudden jerks given to the body by rigid running gear are avoided. The improvement allows either wheel to pass through a hole or over an obstruction without, it is claimed, straining either the axle or any other part of the running gear.

APPLICATIONS FOR EXTENSION OF PATENTS.

SPLICE FOR JOINTS FOR RAIL ROAD RAILS.—John H. Norris and Edward W. Scudder, Trenton, N. J., executors of Mark Fisher, deceased, have petitioned for an extension of the above patent. Day of hearing, Feb. 21, 1872.

CONTINUOUS METALLIC LATHING.—Birdsall Cornell, New York city, has petitioned for an extension of the above patent. Day of hearing, Feb. 14, 1872.

COTTON GIN.—Benjamin David Gullett, Amite, La., has petitioned for an extension of the above patent. Day of hearing, Feb. 7, 1872.

SHOVEL PLOW AND CULTIVATOR.—Paul Dennis, Schuylersville, N. Y., has petitioned for an extension of the above patent. Day of hearing, Feb. 7, 1872.

SHOE PEG MACHINE.—Abijah Woodward, Keene, N. H., has petitioned for an extension of the above patent. Day of hearing, February 7, 1872.

SEWING MACHINE.—Charles F. Bosworth, Milford, Conn., has petitioned for an extension of the above patent. Day of hearing, April 4, 1872.

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121,226.—IRON.—C. Adams, Phila., Pa.
121,227.—OYSTER DREDGE.—W. C. Baker, Baltimore, Md.
121,228.—CULTIVATOR, ETC.—J. W. Blake, Jefferson, Wis.
121,229.—PIPE ELBOW.—J. P. Brace, Springfield, Ohio.
121,230.—PLANER.L.C.Brastow,A.M.Zwiebel,Wilkesbarre,Pa.
121,231.—STUD.—E. Bredt, New York city.
121,232.—CLAMP.—I. Buckman, Jr., Williamsburgh, N. Y.
121,233.—CUP.—S. C. Catlin, Cleveland, Ohio.
121,234.—BURNER.—G. Cuppers, Brooklyn, E. D., N. Y.
121,235.—FLUTER.—E. M. Deey, New York city.
121,236.—GRATE.—W. Doyle, Albany, N. Y.
121,237.—SEWING MACHINE.—W. Duchemin, Boston, Mass.
121,238.—COVER.—A. S. Dyckman, South Haven, Mich.
121,239.—PAPER CUTTER.—F. A. Fletcher, Newark, Del.
121,240.—EASEL.—J. C. Forbes, Toronto, Can.
121,241.—LANTERN.—A. French, Phila., Pa.
121,242.—CURTAIN FIXTURE.—J. Gray, Medford, Mass.
121,243.—FLOOR.—F. E. Hall, Bridgewater, Mass.
121,244.—HAY PRESS.—F. F. Hamilton, Green Bay, Wis.
121,245.—MELTING CHIPS.—E.C. Haserick, Lake Village, N.H.
121,246.—ORGAN.—A. K. Hebard, Boston, Mass.
121,247.—RAKE.—J. Heuerman, W. Sternberg, J. Stuhr, Davenport, Iowa.
121,248.—PLANER.—A. S. Hewlett, Sebastopol, Cal.
121,249.—DREDGE.—E. B. Lake, Mauricetown, N. J.
121,250.—DRAWERS.—K. V. R. Lansingh, Jr., Albany, N. Y.
121,251.—SLEIGH.—W. Leslie, Gray, Me.
121,252.—COUPLING. H.H.Morgan, A.Gerry, San Francisco, Cal.
121,253.—LATCH, ETC.—J. H. Morse, Peoria, Ill.
121,254.—CRUTCH.—E. T. Pearl, Milwaukee, Wis.
121,255.—CAR SEAT.—A. Prier, Milwaukee, Wis.
121,256.—PRINTING PRESS.—G.W.Prouty, Charlestown, Mass.
121,257.—RENOVATOR.—S. B. Shoemaker, Willoughby, Ohio.
121,258.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.
121,259.—HINGE.—W. A. Slaymaker, Atlanta, Ga.
121,260.—WATCH.—H. R. Smith, R. Folsom, Cincinnati, Ohio.
121,261.—GUARD.—J. Edson Sweet, Syracuse, N. Y.
121,262.—SHUTTLE.—F. O. Tucker, Stonington, Conn.
121,263.—CONVERTING IRON.—L. La B. Vigor, Montreal, Can.
121,264.—CUTTING WEDGES.—N. Warner, Jasper, Ind.
121,265.—NOZZLE.—T. Watson, Nevada, Cal.
121,266.—SCREWS.—W. D. Alford, Cuyahoga Falls, Ohio.
121,267.—CULTIVATOR.—J. A., G. W. Ansley, Marengo, Mich.
121,268.—GIRTH.—S. W. Baker, Providence, R. I.
121,269.—BLOWER.—J. F. Barker, Springfield, Mass.
121,270.—WHEEL, ETC.—J. W. Beal, South Scituate, Mass.
121,271.—BUTTON.—G. F. Beardsley, Binghampton, N. Y.
121,272.—DESTROYER.—J. M. Bennett, Jaynesville, Iowa.
121,273.—HOLDER.—F. Bruns, Cleveland Ohio.
121,274.—HANDLE.—H. R. Butterfield, Vassalborough, Me.
121,275.—LIFE RAFT.—H. C. Calkin, New York city.
121,276.—STAND PIPE.—M. Coombs, Jr., Youngstown, Ohio.
121,277.—GUN.—L. Christophe, J. Montigny, Brussels, Belgium
121,278.—DOVETAIL.—A. Davis, Lowell, Mass.
121,279.—BED.—L. L. and A. J. Deming, R. Alden, Erie, Pa.
121,280.—REFRIGERATOR.—J. F. Dick, New Orleans, La.
121,281.—HORSE POWER.—H. C. Drew, Jamestown, Mich.
121,282.—SADDLE TREE.—E. H. Dunn, Portland, Me.
121,283.—LOCOMOTIVE.—R. S. Gillespie, New York city.
121,284.—PAVEMENT, ETC.—C. C. Hallock, Brooklyn, N. Y.
121,285.—WASH BOILER.—A. S. Herr, Bainbridge, Pa.
121,286.—HAND STAMP.—B. B. Hill, Springfield, Mass.
121,287.—DESK, ETC.—W. P. Hood, Winona, Minn.
121,288.—BUCKET.—F.D.Kellogg, G.N.Ives, New Haven, Conn.
121,289.—DEVELOPER.—H. P. De B. Kops, New York city.
121,290.—GRAIN BINDER.—S. D. Locke, Janesville, Wis.
121,291.—COPY HOLDER.—A. B. Manard, Rockford, Ill.
121,292.—COFFEE ROASTER.—D. D. Martin, Cincinnati, Ohio.
121,293.—SEWING MACHINE.—S. O. Matteson, Chicago, Ill.
121,294.—PAVEMENT.—G. H. Moore, Norwich, Conn.
121,295.—CARRIAGE.—E. C. Newton, Batavia, Ill.

121,296.—Amalgamator.—T. A. Pratt, Marysville, Cal.
121,297.—Tramway Saddle.—J. C. Robinson, Hamilton, Nev.
121,298.—Cigar Machine.—S. Scholfield, Providence, R. I.
121,299.—Handling Logs.—E. H. Stearns, Erie, Pa.
121,300.—Track Clearer.—J. Timms, Malta, Ohio.
121,301.—Lighting Gas.—J. P. Tirrell, Charlestown, Mass.
121,302.—Lighting Gas.—J. P. Tirrell, Charleston, Mass.
121,303.—Clothes Pin.—H. J. Wattles, Rockford, Ill.
121,304.—Splint.—I. F. Wilcox, Streetsborough, Ohio.
121,305.—Nail.—W. E. Worthen, New York city.
121,306.—Engine.—W. E. Worthen, New York city.
121,307.—Washer.—J. Abbot, Fitchburg, Mass.
121,308.—Gas Lighter. A. N. Allen, R. H. Dewey, Pittsfield, Ms.
121,309.—Fastening.—I. Amos, Bel Air, Md.
121,310.—Bin.—F. W. Aufderheide, St. Louis, Mo.
121,311.—Filling.—D. R. Averill, New Centerville, N. Y.
121,312.—Shoe Quarter, etc.—S. Babbitt, Brazil, Ind.
121,313.—Street Washer.—G. C. Bailey, Pittsburg, Pa.
121,314.—Cheese Cutter.—J. G. Baker, Philadelphia, Pa.
121,315.—Drill.—N. Ball, East Palestine, J. A. Stansbury, Salem, Ohio.
121,316.—Power, etc.—J. Bayma, San Francisco, Cal.
121,317.—Press.—C. J. Beasley, Petersburg, Va.
121,318.—Column.—C. Bender, Phœnixville, Pa.
121,319.—Shears.—G. Bergner, Washington, Mo.
121,320.—Valve.—G. F. Blake, Boston, Mass.
121,321.—Restoring Paper.—J. V. Z. Blaney, Chicago, Ill.
121,322.—Washer.—J. A. Boyce, Altoona, Pa.
121,323.—Washer. D. Bradley, A. Doney, Saratoga Springs, N. Y.
121,324.—Trap.—M. D. Brown, Newburg, Tenn.
121,325.—Buckle.—J. Buche, Apple River, Ill.
121,326.—Tea Pot, etc.—E. M. Burchard, Washington, D. C.
121,327.—Lantern.—A. Burger, New York city.
121,328.—Sewing Machine.—W. Burnam, Pana, Ill.
121,329.—Stove Pipe.—C. A. Buttles, Milwaukee, Wis.
121,330.—Paint.—W. J. Byrne, Russellville, Ky.
121,331.—Shovel.—R. Calhoun, Allegheny City, Pa.
121,332.—Sewing Machine.—W. Carpenter, Lawrence, Kan.
121,333.—Swinging Railway. J. L. Cheeseman, Gardiner, Me.
121,334.—Piano.—C. F. Chickering, New York city.
121,335.—Fly Brush.—W. H. Chipley, Libertytown, Md.
121,336.—Cake Stirrer.—S. M. Clark, Beaver Dam, Wis.
121,337.—Escapement.—A. Coombs, Burlingame, Kan.
121,338.—Compound.—J. L. A. Creuse, Brooklyn, N. Y.
121,339.—Knife Polisher.—W. H. Cummings, Oxford, Mass.
121,340.—Chuck.—C. Deavs, New York city.
121,341.—Stove Pipe.—F. Dieckmann, Cincinnati, Ohio.
121,342.—Curtain Fixture.—C. Eaton, New York city.
121,343.—Blacking Boots.—N. Eisenmann, New York city.
121,344.—Commode.—R. G. Elder, New York city.
121,345.—Step, etc.—R. G. Elder, New York city.
121,346.—Canal Boat.—J. English, Syracuse, N. Y.
121,347.—Bulletin Board.—A. M. Ernsberger, Danville, Ill.
121,348.—Nut Lock.—J. L. Estill, Salem, Ohio.
121,349.—Dryer.—J. B. Fellows, Augusta, Me.
121,350.—Coupling.—J. R. Finley, Delphi, Ind.
121,351.—Concrete, etc.—H. Franke, Brooklyn, N. Y.
121,352.—Harness.—C. Gahr, Newark, N. J.
121,353.—Cutter.—T. A. Galt, G. S. Tracy, Sterling, Ill.
121,354.—Converting Motion. G. L. Gavett, Sandstone, Mich.
121,355.—Engine.—T. W. Godwin, Norfolk, Va.
121,356.—Binder.—B. Goldsmith, Newark, N. J.
121,357.—Corn Planter.—H. Gortner, Nashport, Ohio.
121,358.—Steam Valve.—W. F. Gould, Davenport, Iowa.
121,359.—Loom Pick.—E. D. Gove, Holyoke, Mass.
121,360.—Solder.—J. Gracie, Pittsburgh, Pa.
121,361.—Stove.—C. B. Gregory, Beverly, N. J.
121,362.—Seat Joint.—J. A. Hanna, Bel Air, Md.
121,363.—Stove.—T. Hartley, Bridgeport, Ohio.
121,364.—Engine.—A. A. Heath, Mercer, Pa.
121,365.—Gin.—W. L. Henderson, Comrawatte, Western India.
121,366.—Sewing Machine.—A. H. Hewitt, Batavia, N. Y.
121,367.—Gaiter.—S. Hodgins, St. Louis, Mo.
121,368.—Insulator.—M. Y. Holley, Washington, D. C.
121,369.—Sewing Machine.—J. O. Hough, De Witt Co., Ill.
121,370.—Wash Boiler.—M. C. Hubbard, Troy, N. Y.
121,371.—Drier, etc.—C. E. Hyde, Oswego, N. Y.
121,372.—Pipe Wrench.—H. A. Hyle, Shamburg, Pa.
121,373.—Guide.—S. Ide, Medina, N. Y.
121,374.—Iron Girder.—P. H. Jackson, New York city.
121,375.—Compound.—G. Jäger, Indianapolis, Ind.
121,376.—Injector.—S. S. Jamison, Jr., Saltsburg, Pa.
121,377.—Thrasher.—F. P. Jaquith, Hoosick Falls, N. Y.
121,378.—Wagon.—J. Jenkins, Sligo, Md.
121,379.—Digger.—M. Johnson, Three Rivers, Mich.
121,380.—Monument.—F. M. Jones, Independence, Mich.
121,381.—Cultivator.—W. T. Jordan, Newman, Ga.
121,382.—Plow.—H. M. Keith, Commerce, Mich.
121,383.—Plating.—N. S. Keith, New York city.
121,384.—Corn Picker, etc.—S. R. Kenyon, Greenville, R. I.
121,385.—Furnace.—W. S. Keys, A. Arents, Eureka, Nev.
121,386.—Hoist.—T. Krausch, New York city.
121,387.—Malt House.—T. Krausch, New York city.
121,388.—Engine, etc.—O. P. Lewis, Cincinnati, Ohio.
121,389.—Rolling Leather.—N. Linsley, Lena, Ill.
121,390.—Motor.—J. R. Lomas, New Haven, Conn.
121,391.—Head Dress.—L. E. Love, New York city.
121,392.—Wind Wheel.—G. Mabie, Dixon, Ill.
121,393.—Whiffletree.—W. J. McMaster, Dixmont, Pa.
121,394.—Burner.—R. S. Merrill, Boston, Mass.
121,395.—Boiler.—J. H. Mills, Boston, Mass.
121,396.—Sawer.—J. K. Milnor, Baltimore, Md.
121,397.—Pavement, etc.—G. H. Moore, Norwich, Conn.
121,398.—Furnace.—T. H. Moore, Alexandria, Va.
121,399.—Spice Box, etc.—B. Morahan, Brooklyn, N. Y.
121,400.—Shoe Binding.—C. E. Morrill, Deering, Me.
121,401.—Escapement.—D. J. Mozart, New York city.
121,402.—Ice.—A. Muhl, San Antonia, Texas.
121,403.—Wagon.—W. A. Nichols, Zionsville, Ind.
121,404.—Dryer.—R. L. Normando, Higginville, N. Y.
121,405.—Belt.—M. Olmstead, Alum Creek, Tex.
121,406.—Plane.—S. W. Palmer, E. G. Storke, Auburn, N, Y.
121,407.—Capsuling.—J. Paterson, Edinburgh, N. B.
121,408.—Press.—W. H. H. Peairs, Olathe, Kan.
121,409.—Wagon.—J. D. Pettit, Rochester, Ind.
121,410.—Gilding.—H. Petrie, Chicago, Ill.
121,411.—Pulley.—E. W. Phelps, Elizabeth, N. J.
121,412.—Fruit Box.—S. W. Phelps, Sandusky, Ohio.
121,413.—Chute.—W. E. Phelps, Elmwood, Ill.
121,414.—Hemp Drawer.—G. W. Pittman, Dartmouth, Can.
121,415.—Flock Cutter.—J. Pitts, Millville, Mass., R. Aldrich, Slatersville, R. I., E. T. Marble, Worcester, Mass.
121,416.—White Lead, etc. J. B. Pollock, Port Richmond, N. Y.
121,417.—Lathe.—A. Pries, H. Arnd, St. Louis, Mo.
121,418.—Gage.—W. Race, S. D. Hooper, Lockport, N. Y.
121,419.—Switch Stand.—E. F. Reynolds, St. Joseph, Mo.
121,420.—Scale Beam.—W. W. Reynolds, Brandon, Vt.
121,421.—Shield.—H. Rieger, Beaufort, N. C.
121,422.—Furnace.—J. M. Roberts, Burlington, N. J.
121,423.—Fair Leader.—A. W. Robinson, Providence, R. I.
121,424.—Field Roller.—A. Rogers, Freeport, Ill.
121,425.—Not issued.
121,426.—Boiler.—J. Shand, London, England.
121,427.—Engine.—L. D. B. Shaw, Boston, Mass.
121,428.—Tongs.—E. R. Shepard, Binghamton, N. Y.
121,429.—Hydrant.—J. Small, Washington, D. C.
121,430.—Faucet.—A. D. Smith, Grafton, O.
121,431.—Stair Rod.—E. J. Smith, Washington, D. C.
121,432.—Column.—F. H. Smith, Baltimore, Md.
121,433.—Stove.—A. Spitzmiller, Buffalo, N. Y.
121,434.—Masher, etc.—H. P. Stichter, Pottsville, Pa.
121,435.—Screw Cap, etc.—J. H. Stone, Hamilton, C. W.
121,436.—Stump Extractor.—J. D. Troyer, Goshen, Ind.
121,437.—Bed.—J. C. Walker, Wm. Lapish, Burlington, Iowa.
121,438.—Roofing.—J. C. Wands, Nashville, Tenn.
121,439.—Cultivator.—W. M. Watkins, Talcott, Va.
121,440.—Breast Pin.—A. Weiller, New York city.
121,441.—Motor.—J. H. and R. W. Welch, Georgetown, D.C.
121,442.—Gate.—J. A. Wood, Crosswicks, N. J.
121,443.—Rolls.—J. V. Woodhouse, Mine La Motte, Mo.
121,444.—Holder.—J. T. Woods, E. H. Leseman, Toledo, O.
121,445.—Sediment Collector.—A. Zipser, Biala, Austria.
121,446.—Overshoe.—A. O. Bourn, Providence, R. I.

REISSUES.

4,645.—Refrigerator.—A. Fuller, L. P. Reichert, Buffalo, N. Y.—Patent No. 74,813, dated February 25, 1868.
4,646.—Printing Press.—M. Gally, Rochester, N. Y.—Patent No. 97,185, dated November 23, 1869.
4,647.—Whiffletree.—G. and W. Gibbs, Canton, O.—Patent No. 75,408, dated March 10, 1868.
4,648.—Fare Box.—J. B. Slawson, New York city.—Patent No. 105,005, dated July 5, 1870.
4,649.—Cords.—J. Turner, Norwich, I. E. Palmer, Montville, Conn.—Patent No. 38,190, dated April 14, 1863; reissue No. 3,345, dated March 30, 1869.
4,650.—Can.—O. S. Camp, Grand Rapids, Mich.—Patent No. 118,904, dated September 12, 1871.
4,651.—Division A.—Broiler.—D. E. Roe, Elmira, N. Y.—Patent No. 106,210, dated August 9, 1870.
4,652.—Division B.—Broiler.—D. E. Roe, Elmira, N. Y.—Patent No. 106,210, dated August 9, 1870.
4,653.—Fluter.—S. G. Cabell, Quincy, Ill.—Patent No. 83,924, dated November 10, 1868.

DESIGNS.

5,379.—Carpet.—J. Barrett, New York city.
5,380.—Carpet.—A. Beck, Phila., Pa.
5,381 to 5,389.—Carpets.—R. R. Campbell, Lowell, Mass.
5,390 & 5,391.—Carpets.—A. Heald, Phila., Pa.
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TRADE MARKS.

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557.—Hydrocarbon Oil.—R. S., W. B., J. Merrill, Boston, Mass.
558 & 559.—Tobacco.—C. R. Messinger, Toledo, O.
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562 & 563.—Scythes.—The Dunn Edge Tool Company, West Waterville, Me.
564.—Sheet Iron, etc.—A. Wood & Co., Phila., Pa.

EXTENSIONS.

Seeding Machine.—A. Franklin, of Genoa Cross Roads, O.—Patent No. 18,579, dated November 10, 1857; reissue No. 3,310, dated February 23, 1869.
Operating Fly Frame.—R. M. Hoe, of West Farms, N. Y.—Letters Patent No. 18,640, dated November 17, 1857.
Turning Wooden Boxes.—A. S. Newton, of Brandon, Vt.—Letters Patent No. 18,646, dated November 17, 1857.
Turning Pillars for Clock Movements.—W. H. Nettleton of Bristol, Conn., C. Raymond, of Guelph, Canada, and A. Hatch, of New Haven, Conn.—Letters Patent No. 18,661, dated November 17, 1857; reissue No. 3,489, dated June 8, 1869.
Snuffers.—O. W. Stow, of Plantsville, and A. Barnes, of Southington, Conn.—Letters Patent No. 18,712, dated November 24, 1857.
Safety Lamp.—W. Pratt, of New York city.—Letters Patent No. 18,704, dated November 24, 1857.
Truss.—J. W. Riggs, of Brooklyn, N. Y.—Letters Patent No. 18,708, dated November 24, 1857.
Spreading Fertilizers.—P. Seymour, of East Bloomfield, N. Y.—Letters Patent No. 18,774, dated December 1, 1857.
Rolling Beams.—J. Griffin, of Phœnixville, Pa.—Letters Patent No. 18,738, dated December 1, 1857.
Threading Bolts.—W. Sellers, of Phila., Pa.—Letters Patent No. 18,775, dated December 1, 1857; reissue No. 656, dated February 8, 1859.

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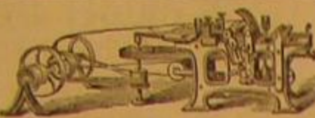

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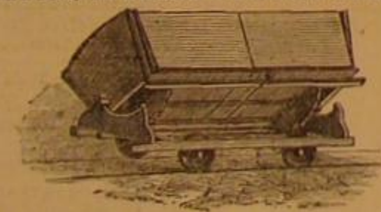

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A Letter from Mrs. Henry Ward Beecher.

While overhauling our papers, after the recent removal to our new quarters, we came across the following letter, which so appropriately expresses the general sentiments of those who read our Magazine, that we have concluded to publish it.

BROOKLYN, February 11th, 1871.

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DEAR SIR,—In '69, while I was editing "The Mother at Home," I was much interested in a few copies of your "Household Magazine," which found their way into my house, whether to me or my husband, I do not know, nor does it matter. I was so much pleased that I wrote, asking for an exchange, but receiving no answer, I let the matter drop. I write now, enclosing two dollars, with the request that if you can furnish me the whole set of 1870, you will do so, and also put me down as a subscriber for 1871. If you have not a set of 1870, please, for the extra dollar, put my daughter down for 1871, directing to Rev. Mrs. Samuel Scoville, Norwich, Chenango Co., N. Y.

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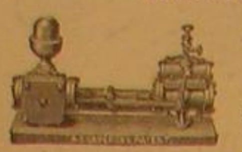

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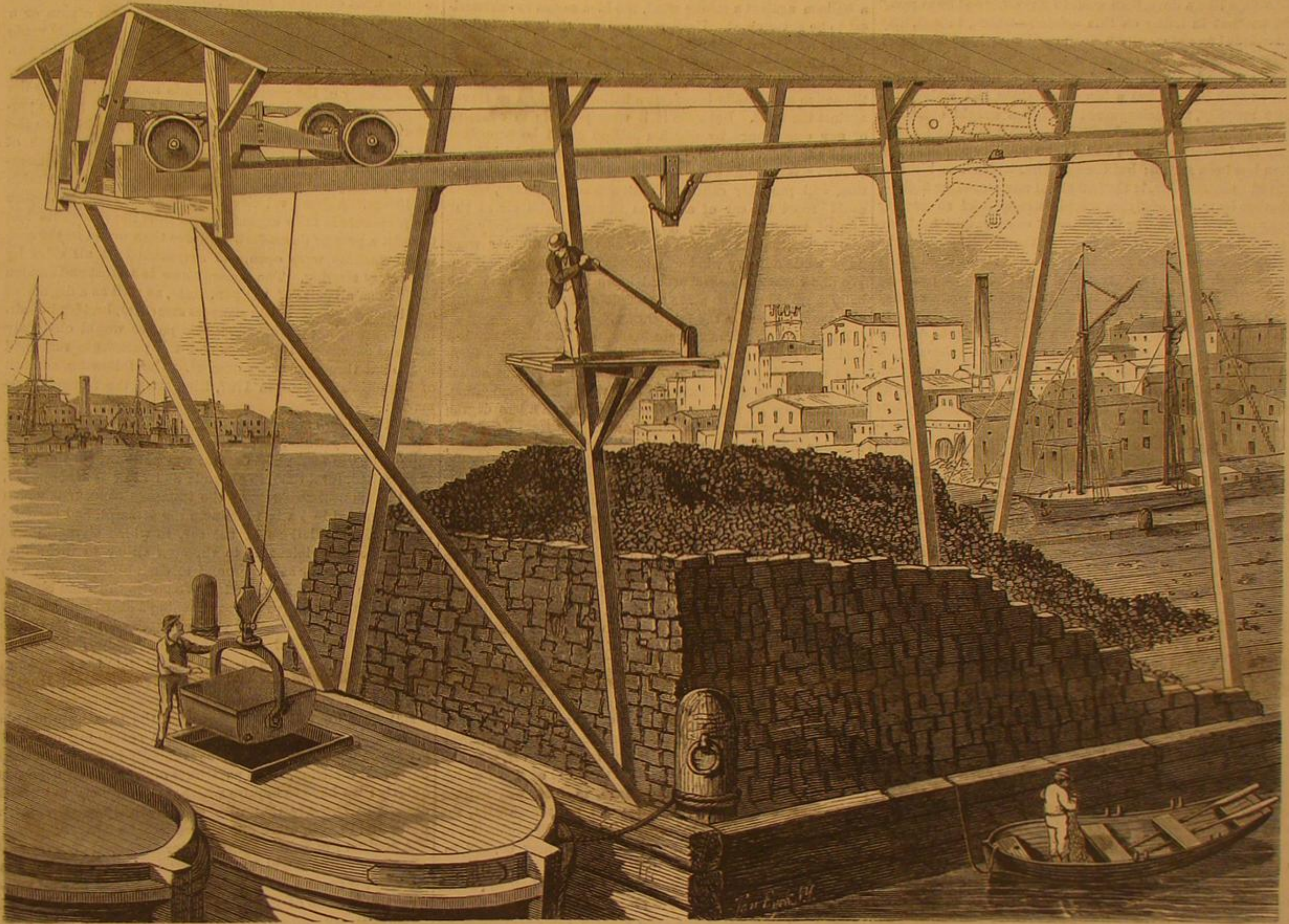
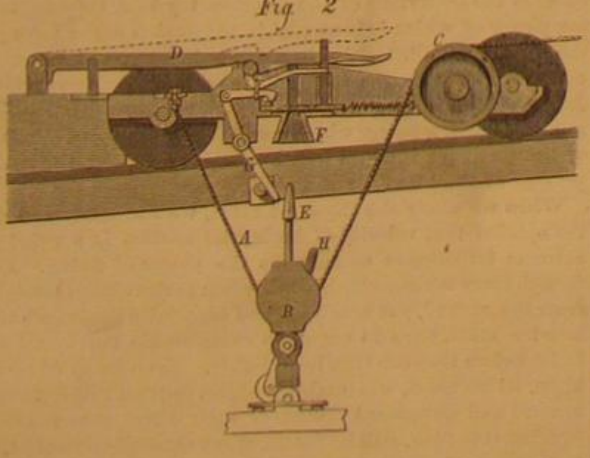
Vol. XXV.--No. 25. [NEW SERIES.] | NEW YORK, DECEMBER 16, 1871. | $3 per Annum. [IN ADVANCE.]



GREEN AND STANCLIFF'S APPARATUS FOR HOISTING AND CONVEYING COAL.

The accompanying engravings illustrate an improved apparatus for hoisting and conveying coal, patented August 1, 1871, through the Scientific American Patent Agency, by Joseph Green, of New York city, assignor to himself and George Stancliff, also of this city, and which is undoubtedly one of the most complete devices, for the work intended, yet produced.

Fig 2



The principal engraving shows the apparatus as discharging a cargo of coal at a dock, and is an excellent representation of the general appearance and application of the invention.

Figs. 2 and 3 are details showing the main features of the invention, which are simple and not liable to get out of order.

The elevator bucket is raised by a rope, A, Fig. 2, which passes under the sheave, B, Fig. 2, and over the pulley, C, Fig. 2, attached to the frame of a car which runs on an elevated inclined railway, as shown in Fig. 1. The car is held from moving, while the bucket ascends, by the hook lever, D, Fig. 2, which engages a round cross-bar of the car frame.

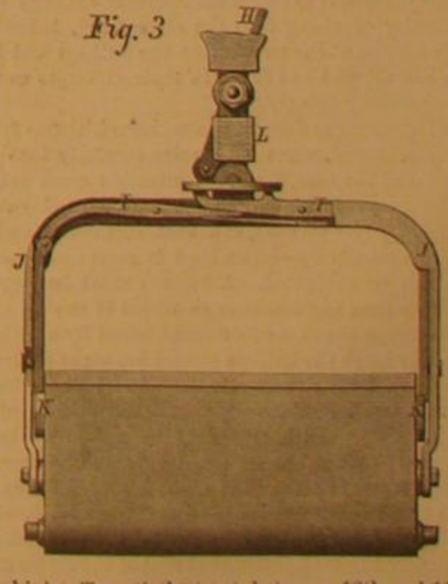
As the bucket reaches the car, the spear head, E, Fig. 2, enters the funnel shaped guideway, F, which directs the point of the spear head up against the hook lever, D, thus releasing the latter from its engagement with the bar which holds the car. The continued traction of the rope then draws both car and bucket to the point at which it is to be dumped. During this part of the movement, the bucket is sustained by the spear head, held by a spring catch plate which is caused, by suitable tripping mechanism, to pass under the lower shoulders of the spear head, and which is released from its engagement from the spear head, and reset on the return of the car, by the action of the tripping lever and hook, G, Fig. 2, attached to the frame of the car.

The bucket is dumped, when it arrives at the proper point, through the agency of the tripping lever, H, Figs. 2 and 3, which operates bent levers or latches, I, that pass down through the interior of the bale, J, and enter catches, K, attached to the pivots of the bucket.

The tripping is effected by an adjustable stud clamped to the lower side of one of the rails. A sleeve on the shank of the spear head allows the bucket to be turned and locked so as to be dumped forward or backward, or to either side, as required.

The facility with which coal can be handled by this apparatus is very great, and we expect to see its universal adoption. The inventor states that one tun per minute may be raised to the ordinary hight, and delivered one hundred feet back, as an average rate of working. The apparatus requires the attention of only two men, and is adapted not only for hoisting coal in yards and gasworks, and for discharging cargoes of coal, but also for use in the elevation of ores and broken crude materials of every sort. The Manhattan Gas Company has already adopted this machine for their coal sheds, (ten of these machines being now in operation and building for this company), at their works on North river, at the foot of Eighteenth street, where they may be seen in operation. For further particulars, address Joseph Crampton, machinist, Twentieth street, between 10th and 11th avenues, New York city.

Fig. 3



ASBESTOS is a silicate of magnesia, containing also about 15 per cent of lime. It has long been known, as its name indicates. The ancients used it for the wicking of their lamps and also for napkins. The Greek word *asbestos*, meaning unextinguished, was appliedto the wicking, as the wick never burnt out and the votive lamps were kept constantly burning. When made into napkins, it was called *amianthos*, meaning undefiled, as the napkins were cleaned by throwing them into the fire. The French have adopted the name of *amianthe*, instead of asbestos, from this latter word.

NOTES ON FLYING AND FLYING MACHINES.

(From the Cornhill Magazine.)

NUMBER I.

It would be difficult to say how many centuries have elapsed since the first attempt was made to solve the problem whether man can fly. Ages before the "philosopher's stone" was ever sought for, or before the problem of perpetual motion had attracted the attention of mechanists, men had attempted to wing their way through the too unresisting air,-by means of more or less ingenious imitations of the pinions of birds or insects. It has even been suggested (see Hatton Turnor's *Astra Castra*), that King David referred to successful attempts of this sort, when he cried, "O that I had wings like a dove, then would I flee away and be at rest." But without insisting on this opinion—which, indeed, may be regarded as not wholly beyond cavil—we have abundant evidence that, in the earliest ages, the same problem has been attacked which the Aëronautical Society of Great Britian took in hand but a few years since, and which, still more recently, the beleaguered Parisians sought earnestly, but in vain, to solve.

By the invention of the balloon the problem of aërial flotation has been solved; but the problem, which has hitherto proved so intractable, is that of aërial navigation or flight—whether by means of flying machines capable of supporting many persons at once, or by means of contrivances enabling a man to urge his way alone through the air. There can be little question that this problem is one of great difficulty. It has, indeed, been long regarded by nearly all practical mechanicians as really insoluble. But of late years careful researches have led competent men to entertain doubts as to the validity of the objections which have been urged against the theory that it is possible for men to fly. Facts have come to light which seem, to say the least, highly promising. In fine, there are not a few who share the convictions of the learned President of the Aëronautical Society, that before many years have passed men will have learned how to navigate the air. The time may not be at hand, indeed, when Bishop Wilkins' prophecy will be fulfilled and men will call as commonly for their wings as they now do for their boots; but it does not seem improbable that before long the first aërial voyage (as distinguished from aërial drifting in balloons), will be successfully accomplished.

It may be interesting to inquire, what are the principal facts on which this hopeful view of the long vexed problem has been founded. In so doing, we shall have occasion to touch incidentally on the history of past attempts at flight; and this history is, indeed, so attractive, that the reader may be disposed to wish that it were entered upon more at length. But our subject is such a wide one, that it will be necessary to avoid discussing, at any length, those strange and sometimes apocryphal narratives, which are to be found in the records of aëronautics. For this reason we propose to consider only such accounts of past attempts as appear to bear on the subject of the actual feasibility of flying.

In the problem of aërial navigation, four chief points have to be considered—buoyancy, extent of supporting surface, propulsive power, and elevating power. At first sight, buoyancy may seem to include elevating power and supporting power, but it will be seen, as we proceed, that the term is used in a more restricted sense.

In the balloon, we have the perfect solution of the problem of securing buoyancy. The success with which men have overcome the difficulty of rising into the air is complete; and this being their first and, seemingly, a most important success, we can, perhaps, hardly wonder that further success should long have been looked for in the same direction. The balloon had enabled men to float in the air; why should it not enable them also to direct their course through the air? The difficulty of rising into the air seemed, indeed, much the more serious of the two before the balloon had been invented; and all who had failed in their attempts to fly, had failed in precisely this point.

Yet all attempts to direct balloons have hitherto failed. It seems clear, indeed, when we inquire carefully into the circumstances of the case, that such attempts must necessarily fail. The buoyancy of balloons is secured, and can be secured, only by one method, and that method is such as to preclude all possibility—so at least it seems to us—that the balloon can be navigated. A balloon must be large, many times larger than any machine to which it can be attached. If we take even the case of one man raised by a balloon, and inquire how large the balloon should be, we at once see how disproportioned the size of a balloon must needs be to the bodies of a heavier nature which it is intended to raise. We know that a man can barely float in water; so that he is about equal in weight to an equal volume of water. But a volume of water is more than eight hundred times heavier than an equal volume of air, even at the sea level, where the air is densest. So that the weight of a man is more than eight hundred times heavier than that of the air he displaces. It follows that if a very light hollow vessel could be made, which should be more than eight hundred times as large as a man, and which could be perfectly exhausted of air without collapsing (a thing wholly impossible), the buoyancy of that vessel would barely enable it to support the weight of a man. But the balloonist is unable to obtain any vessel of this sort. He cannot employ the buoyancy of a perfect vacuum to raise him. What he has to do is, to fill a silken bag with a gas lighter than air, but still not weightless, and to trust to the difference, between the weight of this gas and that of the air the balloon displaces, to raise him from the ground. So that such a balloon, in order to raise a man, must be considerably larger than the hollow vessel just referred to. But further, the balloon must rise above the denser parts of the air; it must carry its own weight as well as that of the man; the balloonist must take a supply of ballast; and other like considerations have to be attended to, all of which render it necessary that the balloon should be larger than we have hitherto supposed. Apart, however, from all such considerations, we find the very least proportion, between the size of the balloon intended to carry one person and the size of the human body, to be about as one thousand to one. Buoyant vessels constructed on such a scale must needs present an enormous surface; and therefore not only must they strongly resist all attempts made to propel them in any direction, but the lightest wind must have more effect upon them than any efforts made by those they carry. As for any power which should avail to propel a balloon against a strong wind, the idea seems too chimerical to be entertained. Until men can see their way to propelling a buoyant body (one thousand times larger than the weight it supports), at the rate of fifteen or twenty miles an hour through the calm air, they cannot expect even to resist the action of a steady breeze on a balloon, far less to travel against the wind. But even if it were possible to conceive of any contrivance by which a balloon could be propelled rapidly through calm air, yet the mere motion of the balloon at such a rate would sway the balloon from its proper position, and probably cause its destruction. A power, which could propel the car of a balloon through calm air at the rate of twenty miles an hour, would cause precisely the same effect, on the balloon itself, as though the car were fixed while a heavy wind was blowing against the balloon. We know what the effect would be in this latter case; the balloon would soon be made a complete wreck; and nothing else could happen in the former case.

But it may be seriously questioned, whether buoyancy is a desirable feature in any form of flying machine. We have seen that a degree of buoyancy sufficient to secure actual flotation in the air is incompatible with aërial navigation. We may now go further, and urge that even a less degree of buoyancy would be a mischievous feature in a flying machine. M. Nadar, the balloonist, makes a significant, though not strictly accurate observation on this point, in his little book on flying. Passing through the streets of Paris, during the ædileship of Haussmann, he heard a workman call, from the roof of a house to a fellow workman below, to throw a sponge up. "Now," says Nadar, "what did the cunning workman, who was to throw the sponge, do? The sponge was dry, and therefore light and buoyant. Was it in this condition that he threw it up to his fellow? No; for it would not have been possible to send it above the first floor. But he first wets the sponge, and so makes it heavy; and then, when it has been deprived of the lightness which is fatal to its flight, he throws it easily to his fellow on the house roof." M. Nadar infers that the first essential in a flying machine is weight!

Now, what is true in the above reasoning is, that buoyancy renders flight—as distinguished from aërial floating—impossible, or, at least, difficult. It is not true, however, that the flight of the wet sponge exemplifies the kind of flight which the aëronaut requires. The sponge, in fact, was neither more nor less than a projectile; and most assuredly, the problem of flight is not to be solved by making projectiles of our flying machines, or of our bodies. It may be, and, indeed, we shall presently see that it probably will be necessary that some form of propulsion from a fixed stand should have to be applied to the flying machines of the future. But after such propulsion has been applied, the flying machine must be supported in some way, not left, as an ordinary projectile is left, to the action of unresisted gravity. M. Nadar's wet sponge is no analogue, then, of the flying machines we require.

Before leaving the subject of buoyancy, however, it will be desirable to inquire whether buoyancy is, in any marked degree, an attribute of the flying creatures we are acquainted with—birds, bats, and insects. The structure of such creatures has been supposed by some to be such as to secure actual buoyancy, to a greater or less degree; and many would be disposed, at a first view of the matter, to regard the hollow bones and the quill feathers of birds as evidences that buoyancy is essential to flight. We have even seen the strange theory put forward, that during life, the quills of birds, as well as their hollow bones, are filled with hydrogen. "Flying animals," says a writer, in *All the Year Round* for March 7, 1868, "are built to hold gases everywhere—in their bones, their bodies, their skins; and as their blood is several degrees warmer than the blood of walking or running animals, their gases are probably several degrees lighter. Azote, or hydrogen, or whatever the gas held in the gaseous structures may be, is proportionately warmer, and, therefore, proportionately lighter than air."

But it appears to us that on a careful consideration of the structure of flying creatures, the hollow portions of their bodies will be found to fulfil a purpose quite distinct from that of imparting buoyancy. If we examine a quill we find that the most remarkable feature, which it presents to us, is the proportion which its strength, especially as respects resistance to flexure, bears to its weight. It would be difficult indeed, to construct any bar, or rod, or tube, of the same length and weight as a portion of a bird's quill, which would bear the same pressure without perceptible flexure; and it is scarcely conceivable that any structure, appertaining to a living creature, could possess greater strength with an equal degree of lightness. In the hollow bones, again, we see the same association of strength and lightness. Precisely as a tubular bridge, like that which spans the Menai Straits, is capable of bearing far greater strain than a solid metal bar of equal weight and length, so the hollow bones of birds are far stronger than solid bones of equal weight would be. We see then, that lightness is secured in these parts of a bird's structure. But lightness and buoyancy are different matters. We can understand that it is absolutely essential that the weight of a machine intended for flight should be as small as may be, due regard being had to strength and completeness. But there is little, we conceive, in the structure of flying creatures, which points to buoyancy as a desirable feature in a flying machine.

We come next to a much more important point, namely, extent of supporting surface. We are to consider the air now, not with regard to its density, the quality which enables a balloon, filled with rarer gas, to float in air, but with reference to its power of resisting downward motion through it; that is, of resisting the effects of gravity. We have to inquire what extent of surface, spread either in the form of wings or as in parachutes, will suffice to support a man or a flying machine. It is here that the researches recently made seem to bear most significantly upon the question of the possibility of flight.

The history of the parachute affords some insight into the supporting power of the air—some, but not much. The parachute has been commonly suffered to fall from beneath the car of a balloon. Suspended thus, in the lee, so to speak, of the balloon's mass, and with its supporting surface unexpanded, the parachute descends under highly unfavorable conditions. A great velocity of descent is acquired before the parachute is fully expanded, and thus the parachute has to resist a greater down-drawing force than would be the case if the machine were open, and surrounded on all sides by free air, at starting. The consequence is a great and sudden strain upon all parts of the parachute, as well as a degree of oscillation which seriously risks its structure, besides impairing its supporting power—since this power would obviously act most effectively if the span of the parachute remained horizontal throughout the descent. The following account of Garnerin's descent, in 1797, illustrates the foregoing remarks:

"In 1797," says Mr. Manley Hopkins, "Garnerin constructed a parachute by which he descended from a balloon at an elevation of 2,000 feet. The descent was perilous, for the parachute failed, for a time, to expand; and after it had opened, and the immediate fears, of the immense concourse which had assembled in Paris to witness the attempt, had been removed, the oscillations of the car, in which Garnerin was seated, were so violent as to threaten either to throw him out, or, on arriving at the ground to dash him out with violence. He escaped, however!" We notice the same circumstances in the narrative of poor Cocking's disastrous attempt in 1837. "When the cords which sustained the parachute were cut, it descended with dangerous rapidity, oscillating fearfully, and at last the car broke away from the parachute, and Mr. Cocking was precipitated to the ground, from a hight of about one hundred feet."

But apart from these considerations, the parachute affords no evidence whatever of the increased sustaining power of the air on bodies which traverse it rapidly in a more or less horizontal direction. The parachute descends, and descends quickly: we have to inquire whether the air may not resist descent so strongly that, with comparatively small effort, a horizontal or even ascending motion may be effected.

A familiar illustration of this supporting power of the atmosphere is given in the flight of an oyster shell or piece of thin slate, deftly thrown from a schoolboy's practised hand. Such a missile, instead of following the parabolic path traversed by an ordinary projectile, is seen to skim along almost like a bird on resting pinions. It will sometimes even ascend (after the projectile force has ceased to act in raising it), as though in utter disobedience to the laws of gravitation.

The fact appears to be that, when a horizontal plane traverses the air in a horizontal direction, the supporting power of the air is increased in proportion as the plane moves more quickly, or in proportion to the actual quantity of air it glides over, so to speak. Indeed we have clear evidence to this effect in the behaviour of the common toy kite, the supporting power of which is increased in proportion to the force of the wind. For a kite, held by a string in a strong horizontal current of air, corresponds exactly to an inclined plane surface drawn swiftly in a horizontal direction during a calm. The same supporting power which results from the rapid passage of the air under the kite will be obtained during the rapid passage of the kite over still air.

When we study the flight of birds, we are confirmed in the opinion that velocity of horizontal motion is a point of extreme importance as respects the power of flying. For though there are some birds which seem to rise almost straight from the ground, yet nearly all, and especially the larger and heavier birds, have to acquire a considerable horizontal velocity before they can take long flights. Even many of those birds, which seem, when taking flight, to trust rather to the upward and downward motion of their wings than to swift horizontal motion, will be found, when carefully observed, to move their wings up and down in such sort as to secure a rapid forward motion. The present writer has been much struck by the singularly rapid forward motion which pigeons acquire by what appears like a simple beating of their wings. A pigeon which is about to fly from level ground may be seen to beat its wings quickly and with great power; and yet instead of rising with each downward stroke, the bird is seen to move quite horizontally, as though the wings acted like screw propellers. We believe, in fact, that the wings during this action do really act, both in the upward and downward motion, in a manner resembling either screw propulsion or the action by which seamen urge a boat forward by means of a single oar over the stern. (Sailors call this *sculling*, a term more commonly applied to the propulsion of a boat by a single oarsman using a pair of oars, or sculls.) The action of a fish's tail is not dissimilar; and as the fish, by what seems like a simple beating of its tail from side to side, is able to dart swiftly forwards, so the bird, by what seems like a beating of its wings up and down, is able—when occasion requires—to acquire a swift forward motion. At the same time it must be understood that we are not questioning the undoubted fact that the downward beat of a bird's wing is also capable of giving an upward motion to the bird's body. The point to be specially noticed is that when a bird is taking flight from level ground, the wings are so used that the downward stroke gives no perceptible motion.

But since a horizontal velocity is thus effective, we might be led to infer that the larger flying creatures, which, *cœteris paribus*, travel more swiftly through the air than the smaller, would require a smaller relative extent of supporting surface. We are thus led to the consideration of that point which has always been regarded as the great, or rather the insuperable difficulty, in the way of man's attempts at flight—his capacity or incapacity to carry the requisite extent of supporting surface. We are led to inquire whether a smaller extent of supporting surface than has hitherto been deemed necessary may not suffice in the case of a man, and *à fortiori* in the case of a large and powerful flying machine.

The inference to which we have thus been led is found to accord perfectly with the observations which have been made upon flying creatures of different dimensions. It has been found that the supporting surface of these creatures—whether insects, birds, or bats—by no means varies in proportion to their weight. This is one of the most important results to which the recent inquiries into the problem of flight have led; and we believe that our readers cannot fail to be interested by an account of the relations which have been observed to hold between the weight and the supporting surface of different winged creatures.

[Concluded next week.]

The Finish and Preservation of Metallic Surfaces.

The following excellent remarks upon the above subject are extracted from the *Technologist*:

All metals in common use are liable to corrosion; and it has always been an object with mechanics to find out the best means of preventing this, since such corrosion is not only unsightly, but tends to weaken the metal and to add greatly to the friction when it occurs on moving surfaces. In general, the greatest safety has been found in surfaces which have been either well painted or highly polished. When a piece of metal has been highly polished, it no longer presents to the air the same extent of surface that is presented by the same piece in a rough state. The reader will readily appreciate this statement if he will consider the difference between the surfaces presented by a smooth lawn, and by the same field after it has been thrown up into ridges and furrows by the plow. Of course, the greater the extent of surface presented by any given piece of metal, the more powerfully will air and moisture act upon it to corrode it. Besides this, it has been found that the condition of the surface has a great deal to do with the force with which water adheres to it. It is almost impossible to wet the blade of a well polished razor; and a highly polished needle, if carefully laid on the surface of water, will float, because the water will not wet it easily. These facts explain why it is that highly polished surfaces do not corrode easily, as is seen in the case of fine cutlery and instruments made of steel; and they enforce the importance of carrying the polishing process to the last degree of perfection.

It is undoubtedly true, however, that we are apt to put too much polished work upon our machinery, and especially upon our engines; and we thereby not only incur a greatly increased expense in the first instance, but the subsequent cost of maintaining this high polish is a serious item. It was therefore with a good deal of pleasure that mechanics saw the new mode of finishing by plating with nickel introduced. This process has already been applied with the very best results to tools of various kinds, and even to machines of considerable size. We have seen an engine which had all the exposed and polished parts nickel plated. The appearance was very fine, and the labor involved in keeping the engine bright was reduced to a minimum. Nickel does not corrode by exposure to ordinary vapors and gases; and consequently a mere wipe with an oiled rag or cotton waste is all that is needed to keep it bright.

Unquestionably, the cheapest and most effective method of protecting metallic surfaces is to paint them. For very coarse articles coal tar is frequently employed; and we have often seen great mistakes made in the methods employed in its application. Coal tar, if simply applied to any surface as a paint, takes a very long time to dry. Indeed, we have seen it remain for years in a sticky, semi-solid condition. To avoid this, the tar ought to be boiled until reduced to pitch, and then, if necessary, thinned by the addition of naphtha, or applied while hot to a hot metallic surface. Tar treated in this way dries rapidly, and forms a hard paint or varnish that does not soil other objects. In using tar, however, we are prevented from obtaining any other color than black—an objection which does not apply to many objects, such as the coarser articles of agricultural implements, boilers, etc. For such purposes, a cheap varnish made from coal tar has come into very extensive use. A very fine black varnish may be applied to any coarse iron surface that will bear the operation, by simply heating it to such a point as will cause it to decompose linseed oil, and then brushing it over with this liquid. When it gets cold, the iron will be found to be covered with a fine, smooth, black varnish which adheres very closely to the metal.

One of the greatest difficulties in the way of protecting iron surfaces by means of paint is the difficulty of producing a firm adhesion between the paint and the metal. When applied to surfaces that have been polished, the difficulty is not so great; though, even in this case, anything that will cause a more perfect adhesion is to be welcomed. It is when paint is applied to the rough surfaces of iron castings, and especially to those that have been scaled by the action of vitriol, that the difficulty of producing a perfect and permanent adhesion is found. In order to secure the best results, iron that has been vitrioled ought to be well washed and carefully dried before the paint is applied. If the articles are small and will bear the application of a strong heat, they should be heated until oil applied to them smokes. They may then be brushed over with a thin coating of boiled linseed oil; and, when this has become thoroughly dry, they may be painted. When the articles are too large, or when, from other reasons, it is impossible or inconvenient to heat them, the oil may be warmed before it is applied. A thin coat of hot oil will penetrate every pore, displace all adhering dampness, and stick to the metal so closely that no exposure to air or moisture will ever cause it to separate. To such an oiled surface paint adheres well; and when this process is adopted, we never find the paint falling off, in large flakes, owing to moisture having crept into some crack and gradually producing a thin layer of rust between the paint and the metal.

These remarks of course apply to metal that is exposed to the open air and subjected to the action of frost, moisture, and air. It is easy enough to protect metal that is kept within doors, in a dry place, and consequently needs no protection; but iron exposed to the elements is a different affair. And here we may perhaps be allowed to remark that these directions, in regard to hot oil, apply to wood quite as well as they do to metal. A coat of oil applied hot and allowed to become thoroughly dry is a powerful preservative, and makes an excellent groundwork for a subsequent coat of paint.

Patents.

[From the Report of the Secretary of Interior.]

There were filed in the Patent Office during the year ending September 30, 1871, 19,429 applications for patents, including reissues and designs; 3,337 caveats, and 181 applications for the extension of patents. Twelve thousand nine hundred and fifty patents, including reissues and designs, were issued, and 147 extended; 514 applications for trade marks were received, and 457 trade marks issued. The fees received during said year amount to $671,583·81, and the expenditures for the same period were $560,041·67, leaving a surplus of $111,542·14 of receipts over expenditures. The appropriation asked for the next fiscal year is $606,400.

The number of applications for patents, including reissues and designs, received during said year, is a small increase over the number received the preceding year, while the number of patents issued is not quite so great. It is worthy of remark, however, that the labors of the clerical force of the office are increased proportionally more than the number of applications would seem to indicate, inasmuch as each year's operations add about 20,000 to the number of patented and rejected applications, with which the examining corps must become familiar, in addition to those previously filed. The examiners are, generally, men of distinguished ability and untiring industry, but their number is inadequate to properly and promptly discharge the increasing duties demanded of them.

The act of January 11, 1871, abolished the old form of annual report of the Patent Office, and authorizes the Commissioner to substitute therefor full copies of the specifications and drawings of all patents issued, these to be deposited in the clerk's office of each United States District Court, and in certain libraries. This law was passed in the belief that there was very little public demand for, or interest in, the annual reports of the Patent Office, which belief the Commissioner thinks was not well founded, although approving of the law, and regarding it as a means of placing fuller information before those interested, and at a much less cost than before. Beside copies of the specifications and drawings for disposition under the law, other copies are printed for subscribers. These publications are rapidly becoming popular among those interested in patents, and will be of great benefit to the office in various ways. For the convenience of subscribers, the publication of the specifications and drawings has been arranged into 176 different classes, according to their subject matter, so that subscribers need not necessarily pay for the entire issue, but only for the particular class or classes in which they may be interested.

The rapidly extending business of the office requires more room; and although additional room has been provided during the year by the transfer of the Pension Office clerks to another building, the Patent Office is still without sufficient room for the transaction of its business in a satisfactory manner. The general business of the office has been promptly and satisfactorily administered during the term of the present Commissioner, and his efficiency and capability for its delicate duties is cheerfully attested.

Science in Prussia.

Sir William Thomson stated in his recent address before the British Association, that in Prussia every university, every polytechnic academy, every industrial school, most of the grammar schools, in a word nearly all the schools superior in rank to the elementary schools of the common people, are supplied with chemical laboratories and a collection of philosophical instruments and apparatus, access to which is most liberally granted by the directors of these schools to any person qualified for scientific experiments. In consequence there will scarcely be found a town exceeding 5,000 inhabitants that does not offer facilities for scientific investigations at no other cost than that of the materials wasted in the experiments. And further, professors, preceptors, and teachers of secondary schools are engaged on account of their skillfulness in teaching; but professors of universities are never engaged unless they have already proved by their own investigations that they are to be relied upon for the advancement of science.

Fireproof Materials.

Mr. H. J. Ramsdell, in a Washington letter to the *Cincinnati Commercial*, giving an account of an interview with Mr. Mullett, the supervising architect of the Treasury Department, elicits some interesting opinions as to the lessons from Chicago, especially the following, relating to fireproof materials:

"Iron," said Mr. Mullett, "I mean cast iron, absurd as the statement may appear, will not resist as much heat as good sound oak timber of the same dimensions. Fire expands the iron and warps it, and it breaks very easily. Indeed, if oak timber should be treated by any of the processes of liquid silicate, it may be considered almost a fireproof material compared with cast iron. As for stones suitable for building purposes, as I told you before, there are few that are fireproof, though some approximate the necessary conditions, and, except in severe conflagrations, may be generally depended upon. Granite, marble, and sandstone are not to be trusted, as they soon perish by exposure to the heat, as has been shown a thousand times. But I am strongly in favor of liquid silicate as a preparation for wood to be used for building purposes. My attention was directed to this material some years since, but I have not had an opportunity to investigate the subject fully. I believe, however, that it merits more attention than any other suggestion that has been made public, and may yet prove one of the most practical solutions of the question of non-combustible construction that has yet been offered. Whether this or some other process for making wood non-combustible is the more desirable, I am not prepared to say. I am, however, decidedly of the opinion that any process by which wood can be rendered non-inflammable at a reasonable cost would not only be an inestimable blessing to the public, but its use should be rendered imperative by law."

"Well, Mr. Mullett, do you still think that brick is the only fireproof material?" "I looked into that subject at Chicago with much interest. Now, it is very hard to make an absolutely fireproof building; but I believe that a building, properly constructed of bricks that are well made, and of iron or non-combustible timber, protected by fireproof shutters and door, will resist the fiercest conflagration. Remember, I say fireproof doors and shutters, not iron. To make an absolutely fireproof structure, however, well burned and homogeneous brick must be used. The walls must be of sufficient thickness, and should be built with an air space to prevent the transmission of heat. The joists should in no case be carried into the walls, but should be supported on corbel courses of brick, and connected with the walls themselves only by wrought iron anchors. The windows and doors to be protected, as I have said, with fireproof shutters, and the roof to be of slate or metal. The use of roofs composed of coal tar, or other similar substances, should be prohibited by law in cities. Ordinary iron shutters are scarcely more fireproof than those of wood. They heat rapidly, warp from their fastenings, and admit the fire to the interior, and are in fact a means of facilitating the conflagration by obstructing the efforts of the fire department. I see no reason, however, why fireproof shutters should not be produced at a price that would place them within the reach of all."

"What do you think of dry pressed bricks?" "I never had much experience with them, and I don't believe in them. They are certainly not so good as the ordinary kind. A very little experience with brick will show that the more thoroughly the clay is tempered the better the bricks are. One great trouble in obtaining good brick is in the indisposition of brick makers to temper their clay enough." "What do you think of terra cotta?" "Terra cotta is a material to which I do not think sufficient attention has been given in this country, though in Europe many beautiful and durable specimens have been produced. I feel confident that it will be found, if properly made, one of the most desirable articles for the use of an architect in the erection of fireproof buildings. It should be used in a legitimate manner, and not as an imitation of cut stone."

For the Benefit of Chicago.

An esteemed correspondent, R. B. S., calls our attention to the following: "The theatres of the Romans were fitted up with numerous concealed pipes, that passed in every direction along the walls, and were connected to cisterns of water or to machines for raising the latter. Certain parts of the pipes were very minutely perforated, and were so arranged that, by turning one or more cocks, the liquid escaped from them, and descended upon the audience in the form of dew or extremely fine rain. This effectually cooled the heated air, and must have been exceedingly refreshing to the immense multitudes, especially in such a climate as Italy.

The dining rooms of Nero's golden house were ceiled in such a manner that the attendants could make it rain either flowers or liquid perfumes. At one feast 100,000 crowns were expended in perfumed waters." *Ewbank's Hydraulics*, p. 539.

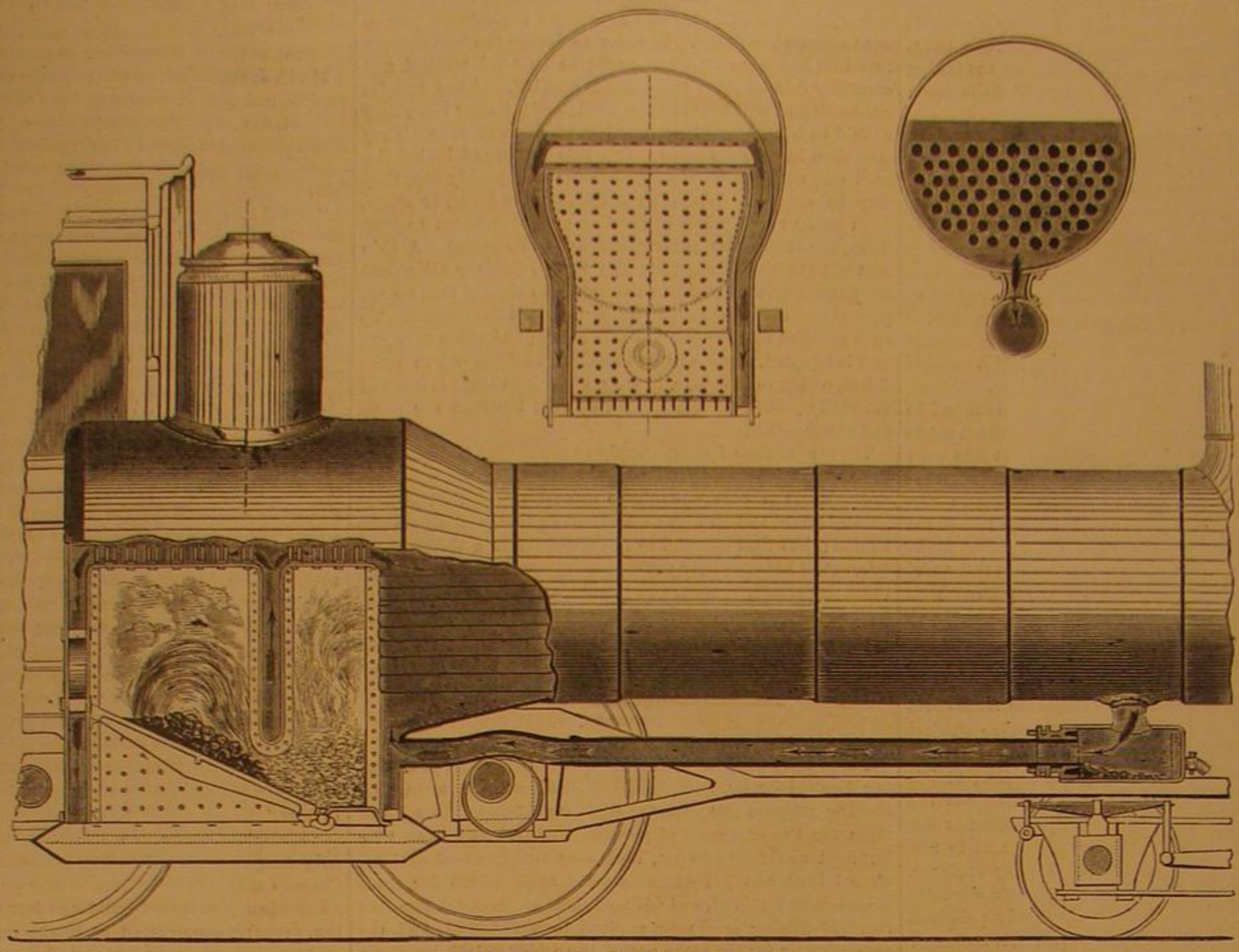
And it is reasonable to suppose that the Romans extinguished flames in like manner.

"TIME IS MONEY;" do not throw it away, but make every day and every hour tell either for your growth, health, or profit.

Improved Steam Boiler.

The accompanying engravings illustrate a boiler invented by F. A. Woodson, and patented in the United States and England, and for which applications for patents are now pending in Russia, Prussia, Austria, France, Belgium, and Italy.

To explain the principles which govern the construction of this boiler, it will be necessary to refer, as concisely as possible, to the laws which control the generation of steam in boilers. When steam is making in a boiler, and, as it is made, is passed off constantly to an engine, the demand being equal to the supply, there is constant motion in the water, arising, first, from the difference in the specific gravity of different portions of the water and the difference in the specific gravity of water and steam; and second, from the expansive force of the steam. The ebullition of water, under these circumstances, is principally due to the expansive force of the steam, generated more rapidly than it can quietly escape by virtue of its less specific gravity. If, under these circumstances, the throttle valve be closed, and the safety valve be kept shut, no ebullition, in the strict sense of the term, can take place; the circulation will then be decreased to that which takes place in water before it is heated to the boiling point. The expansive force of the steam being resisted, it permeates the water like carbonic acid gas in a soda fountain, until the water, becoming saturated, can hold no more. If now the fires be kept up, it is evident that, while the plates in contact with the water and steam continue to receive heat, the power to convey away the heat is greatly decreased, on account of the now almost checked circulation. The consequence is that a thin stratum of steam accumulates next the plates, and separates them from the water. This state of things has been styled *repulsion*, and is assigned as the cause of many destructive explosions. For as soon as this condition takes place, the plates get very hot, and the partial escape of the separating film of steam at once begins, with eruptive force through the stratum of water, the water descending with power enough to force it into contact with the over-heated plates, when the sudden production of steam causes another jump of the liquid, throwing it upward with great force, and, if not exploding the boiler, trying its strength far beyond the limit of safety, and producing symptoms of internal disturbance which are externally perceptible, and often alarming even to experienced engineers.



WOODSON'S STEAM BOILER.

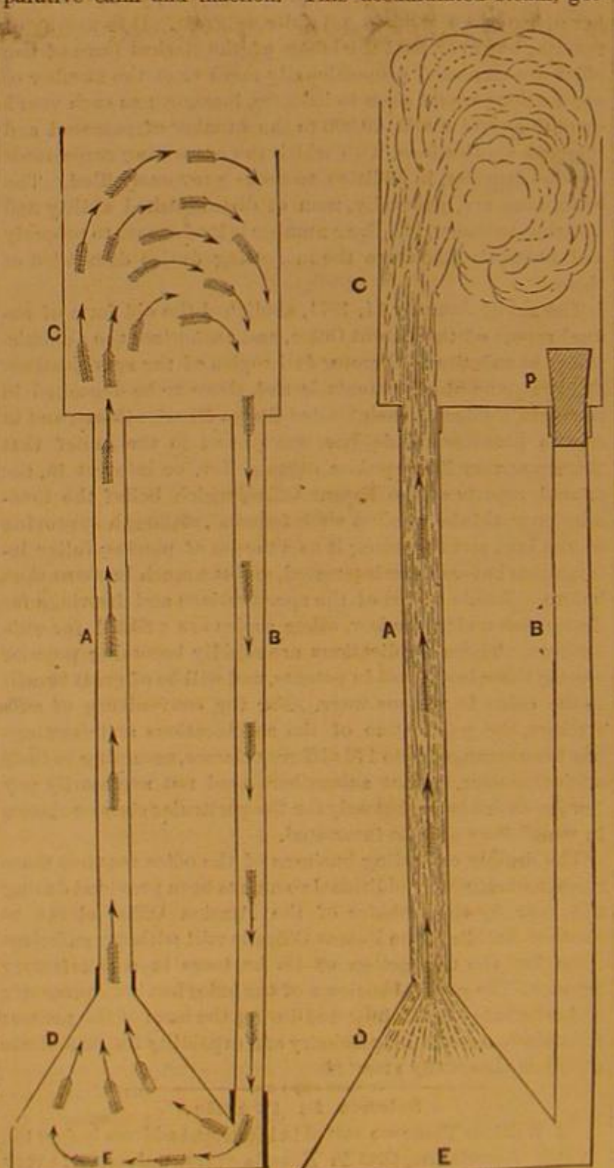
Again, when the circulation in a boiler is diametrical, it is common to find different parts of the boiler very unequally heated. Engineers are aware that it is often possible to draw water in which the hands may be washed from a boiler which is generating steam. Unequal heating causes unequal expansion, and this alone may often strain boilers so near to the point of rupture that the addition of a comparatively moderate steam pressure may complete their destruction.

The separation of the water from the plates, by a film of steam, may take place in a boiler which is delivering steam, whenever the boiler is so constructed that the heating surface makes steam faster that the latter can escape through and by the obstructions above it. The stratum of water may be too deep in proportion to its other dimensions, or the space may be obstructed by flues, diaphragms, or tubes, etc. It matters not what interferes with the circulation; without this we cannot have a quiet and safe generation of steam; and without uniform circulation throughout the boiler, we must have unequal expansion and the dangers that follow it.

This lifting of water, by the effort of steam to escape, is illustrated in the accompanying engraving, Fig. 2, of an apparatus described by C. Wye Williams, in his treatise on the "Combustion of Coal," page 142, from which we make the following quotation:

"The violence and intermittent action which ensues when separate channels or sufficient space is not available (in steam boilers) will be well illustrated in the following experiment: Fig. 84 represents two long glasses, each two inches wide by eighteen inches long, A and B, connected by means of a tin apparatus, C and D, at top and bottom, leaving the communication open above and below, the whole being suspended over a fire. On the heat being applied, a current of mixed steam and water will be seen ascending in one glass and descending in the other, as indicated by the arrows. There being here no confusion or collision, a state of things will be produced highly favorable to the generation of steam, the colder water finding easy and continued access to the heated bottom of the vessel at E.

"If the communication between the two glasses be cut off by inserting a plug in one of them, as seen at P, in Fig. 85, the circulation in the glass, B, will be suspended, and the previous uniform generation of steam will then be succeeded by an intermittent action—explosive violence alternating with comparative calm and inaction. This accumulated steam, getting sudden vent, is discharged with great violence, literally emptying both the glasses and lower chamber.



"Here we see the true source of priming in boilers and a practical exemplification of at least one of the causes of explosions, which have lately become so frequent."

Unequal expansion is, without doubt, one of the causes of the rapid deterioration of boilers, which, upon inspection, have been passed as sound, and which explode subsequently, under circumstances which lead us to doubt the thoroughness of the inspection.

The Woodsen boiler is based upon the principle of uniform *longitudinal* circulation, whereby the steam is easily and constantly brought to the surface of the water with gradually and uniformly accumulating pressure, and the boiler is kept at nearly the same temperature throughout, thus avoiding the evils of unequal expansion, and securing the economy that results from quiet yet rapid circulation. The principle is applicable to all sorts of boilers, but the improvement is shown in our engraving as attached to a locomotive boiler. It consists, principally, in the attachment of a longitudinal pipe, six inches in diameter (more or less) below the boiler proper, and a mud drum, in which an eddy is formed which deposits all the sediment. The water passes from the end of the boiler remote from the furnace downward into the mud drum, thence onward to the water leg at the rear of the furnace, thence upward into the boiler, where it immediately commences to pass back from the furnace over the surface of the tubes, delivering its steam quietly along the route.

The passage of the water, through the pipe or "circulator," is more or less rapid, according to the heat which is generated in the furnace, but in all cases is rapid enough to change the entire body of water in a very short time.

The conflict between ascending and descending currents of water is thus avoided, the back end of the boiler is kept within a degree or two as hot as the end nearest the fire, and the impurities are all entrapped in the mud drum, from which they may at any time be conveniently removed.

From personal observation of one of these boilers, we can vouch for the rapidity and uniformity of the circulation, and the perfect separation of sediment. As to the economy, we have only the testimony of engineers and the statement of the inventor that he will guarantee the boilers to produce 12½ lbs. dry steam at 60 lbs. pressure, by the consumption of one pound of good bituminous coal. That it must be a very economical boiler we judge from general principles; but this amount of evaporation is so large that it is one of the things engineers must see to believe.

The inventor refers this large evaporative power partly to the improved circulation and partly to the construction of the furnace, by which he claims not only to coke the coal when it is first put in, but to wholly consume the combustible gases given off while coking, avoiding loss of fuel and of the heat which the unconsumed gases would otherwise carry away through the uptake.

It will be seen that the grate is inclined, the highest part being in front. The coal thus feeds backward automatically by its own gravity. A descending bridge wall, into the hollow interior of which water constantly flows, intercepts the gases and forms a sort of reverberatory furnace to which air is admitted in sufficient quantity to create perfect combustion.

The plates being thus more highly heated and being brought by the more perfect circulation into constant contact with the coolest water in the boiler, they impart their heat much more perfectly and rapidly, the rate of conduction being, according to Rankin (see page 263 of his work on "The Steam Engine"), "nearly proportional to the square of the difference of temperature, of the heated gases on one side of the plates and the water on the other. This the inventor claims as the principal source of the large evaporative power of the boiler.

In conclusion, we will say that we have formed a very favorable impression of this boiler from inspection of its working, and that it seems to give very much more control, over the uniform generation of steam and gradual accumulation of pressure in steam boilers, than is the case with most other kinds of boilers.

The Woodson Steam Boiler Company, Selma, Ala., or 243 Broadway, New York, may be addressed for rights to use or manufacture.

A Vermont man has established a steam toy factory at Nuremburg, Bavaria.

THE THAMES EMBANKMENT.

This celebrated structure, of which we this week present an excellent engraving, has many points of interest both to the engineer and the general reader. One result of its construction was the reclamation of the land lying between the present beautiful water front and the rear of the houses in Whitehall Place and Whitehall Gardens, London, including all that shown in the engraving between the buildings and the water front formed by the embankment, and which now forms a beautiful park.

The ground between the wall of masonry, that forms the frontage on the river and the buildings, is all made ground. Along the front, parallel to the wall, runs the Metropolitan Railway (underground), one depot being in the extreme background, facing the clock tower of the Houses of Parliament.

The statue in the center of the Park is that of General Sir James Outram, a distinguished soldier and statesman. The Nelson Monument in Trafalgar Square is seen at the extreme right of the picture.

A difficulty as to the title of the ground thus reclaimed arose between the general government and the Metropolitan Board of Works, the former claiming that the title should be vested in the Crown, and the latter that it should belong to the Board. The difficulty was adjusted by a compromise, in which the Board of Works leases the land from the Crown for the purposes of a public garden; so that the Crown derives a rental, and the public get the benefit of the park, as originally intended.

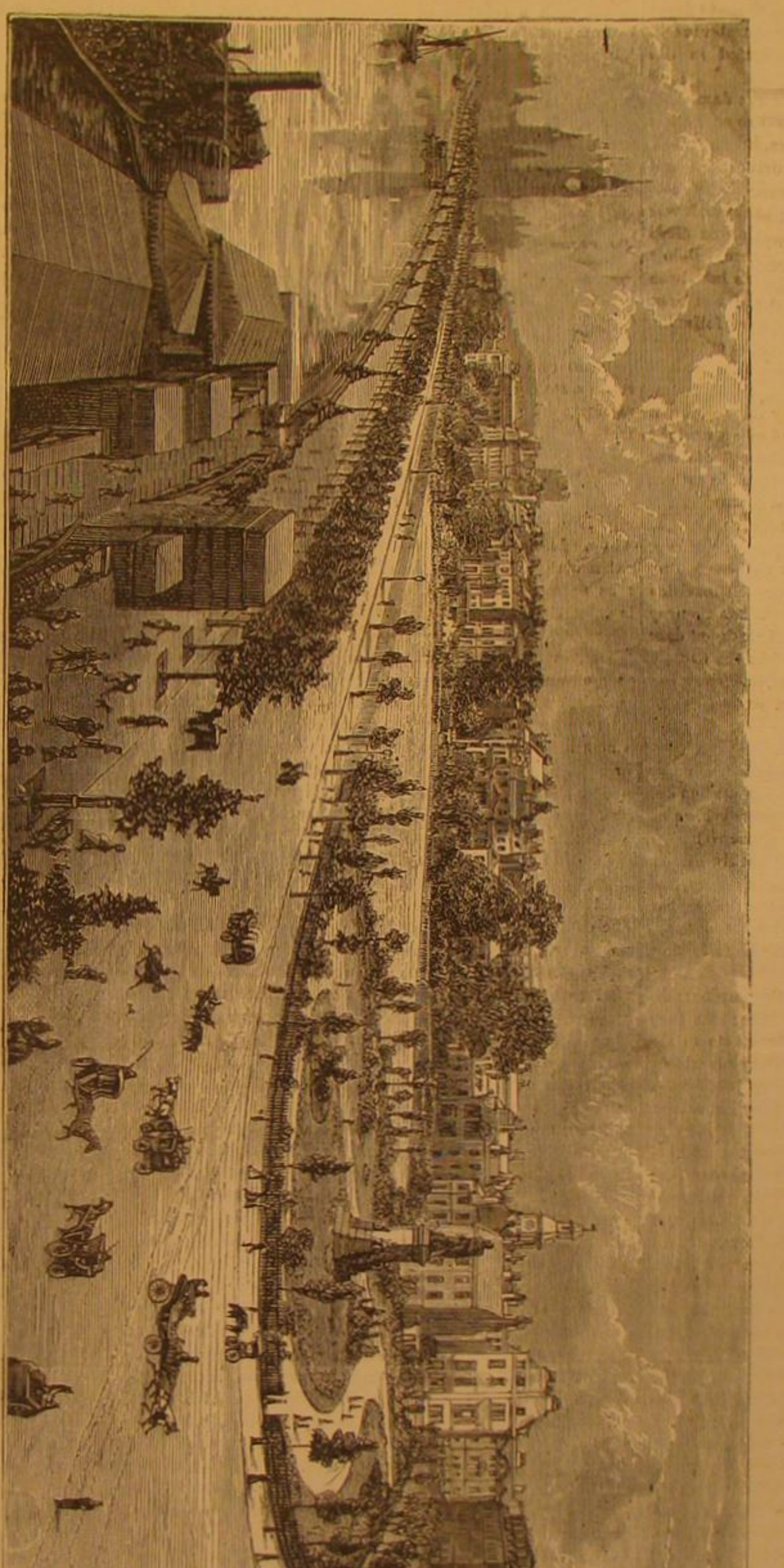
The work exacted some nice engineering skill for its performance. We cannot give our readers a better idea of its general character than by the abstract of a paper read, before the Institution of Civil Engineers at their first meeting of 1870, by Mr. Thomas Dawson Ridley, which follows. The paper read was a "Description of the Cofferdams used in the execution of No. 2 Contract of the Thames Embankment."

This contract extended from the landing pier at Waterloo Bridge to the eastern end of the Temple Gardens, a length of 1,970 feet. Mr. J. W. Bazalgette (M. Inst. C.E.), was the engineer-in-chief, and Mr. Edmund Cooper (M. Inst. C.E.), was the engineer; the author of this paper having charge of the works for the contractor.

The breadth reclaimed from the river by this portion of the embankment varied from 110 feet to 270 feet; the depth of water, when the tide was low in front of the wall, averaged 2 feet; and the rise of tide was 18 feet 6 inches. The borings showed the bed of the river to consist of sand and gravel, resting upon the London clay, at depths varying from 21·58 feet to 27·10 feet under low water mark, while the foundation of the wall was, in all cases, designed to be carried down to a depth of 14 feet under low water mark.

It devolved upon the contractor to design dams to the satisfaction of the engineer, who reserved to himself the power to adopt either caissons or cofferdams. The author considered that dams of timber and puddle would not only be cheaper, but could also be more expeditiously constructed, than iron caissons; and having succeeded in obtaining the engineer's sanction to one of the plans which he submitted, the work was begun.

The Temple Pier was the most important work in the contract, and it was therefore requisite to lay its foundation dry as soon as possible. To effect this, two short dams, one at each end of the pier, completely inclosing a short length of the river wall, were first begun. No. 1 was 111 feet 6 inches long by 25 feet broad, inside measure, and No. 2 was of similar breadth, but a few feet longer. These dams consisted of two rows of piles of whole timbers, averaging 13 inches square, with a clear space of 6 feet for puddle. The piles were from 40 feet to 46 feet in length, having cast iron shoes 70 lbs. in weight, and were driven 40 feet into the clay. Cast iron was used in preference to wrought iron for the shoes, as giving, at an equal cost, a much larger base for the timber to rest upon. Where the driving was difficult, shoes having cast iron bases and wrought iron straps were employed. The piles were secured by three rows of walings of whole timbers, 13 inches to 14 inches square, through which and passing through the puddle space, at distances of 6 feet 6 inches horizontally, were bolts, 2¼ inches in diameter in the lower waling and 2 inches in diameter in the middle and upper walings. Cast iron washers, 9 inches in diameter and 2¼ inches thick, were used to distribute the pressure over a large surface of the walings. To avoid the difficulty of having to procure a number of long timbers, the piles were in a few cases only of the full length required, and the others, after being driven, had lengthened pieces fixed to them, so as to raise the dam to a hight of 4 feet above the high water line. Before proceeding with the construction of these two dams, the ground was not dredged, but in all the dams subsequently constructed, the sand and gravel were cleared off to the level of the clay before the piles were driven. Where the ground had not been dredged, great difficulty was experienced in driving the piles, and in the two dams in question one sixth of the whole number pitched, having shown symptoms of failure, were drawn. In all cases the piles so drawn were observed to have cast their shoes, and their lower extremities were usually bruised into a mass of tangled shreds. The failure generally occurred when the piles were passing through a bed of compact sand, resting upon coarse open gravel. Beneath the gravel, and resting upon the clay, was a layer of septaria, which offered a serious impediment to the passage of the piles; but when once the clay was reached, the driving was comparatively easy. The space between the piles was dredged to the level of the clay and filled with well tempered puddle. The transverse struts, of which there was a tier to each waling, were of whole timbers, 8 feet apart in the length of the dam.



THE THAMES RIVER EMBANKMENT, LONDON, ENGLAND.

Simultaneously with the construction of these dams, the filling in of the space behind the Temple Pier was going on, the line of the dam was being dredged, and the driving of the piles begun. The Temple Pier, 470 feet in length, was irregular in outline, projecting in some parts upwards of 30 feet in advance of the river wall, and the breadth across the foundation trench in the center part was 57 feet. To avoid the necessity of having to use a large number of struts of such great length, this dam was strengthened by means of buttresses of piles, somewhat similar to those used in the cofferdams constructed for the Grimsby Docks. These buttresses were placed at intervals of 26 feet, and were backed up by struts extending across the foundation of the pier. The scantlings of the timber and the sizes of the bolts in this dam were similar to those in dams Nos. 1 and 2, the walings only being a little stouter, averaging 14 inches square.

Before No. 3 dam was completed, No. 4 dam was begun, and was followed by dams Nos. 5 and 6. In these and in all the dams, except No. 3, the inner row of piles was placed so as to coincide with the riverward face of the concrete in the foundation trench. The piles, walings, and bolts of these dams were similar to those in dams Nos. 1, 2, and 3; but the shoring was of a different character. Across the breadth of the wall the struts were all horizontal, and abutted against walings of whole timbers, bolted to pairs of piles, driven into the solid ground behind the foundation of the wall. These coupled piles were placed at distances of 18 feet apart from center to center, and were further supported by three back struts to each pair, two of which were horizontal and one raking. These struts abutted against piles driven into the slope of the filling material, and backed up with rubble stones. From the lower waling to the bottom of the trench, or to the solid ground, the space in all the dams was filled up with clay, or with a mixture of clay and gravel, to give further stability to the dam, and to assist the lower bolts to resist the pressure of the puddle. Sluices of 4½ inches elm plank, and having hinged flaps, were inserted in each dam through the piles and puddle at the level of the lower waling. For dams Nos 1 and 2 these sluices were 8x8 inches, internal cross section. In the Temple Pier dam, there were two sluices, 3 feet high and 1 foot wide, and for each of the other dams there was one sluice of similar section. In the Temple Pier dam, two iron cylinders, 8 feet in diameter, were sunk to a depth of 4 feet below the lowest level of the foundation for pump wells, and in each of the other dams one such cylinder was sunk. The volume of water, filled out of the Temple Pier dam, varied from 620 gallons to 1200 gallons a minute, according as a less or a greater area of the foundation was exposed; but in all the other dams there was much less water to be pumped. As soon as the walls in any of the dams had been raised 6 feet above low water mark, no further pumping was needed, as the water which gathered when the tide was high was passed through sluices at low water. Murray's chain pumps were used in all cases, and were found to be very efficacious.

In the cofferdams there was usually a frequent settlement of the puddle, producing channels underneath the bolts, and a consequent leakage. In such cases holes were bored, with a 3 inch auger, through the inner row of piles, immediately below the tie bolts, and pellets of clay were driven through these into the puddle until the leakage was subdued.

When the dams had served their purpose, it became necessary to clear them away, and before the completion of the whole series, the removal of those first constructed had been begun. The piles in front of the ordinary wall were cut off at a level of 3 feet under low water mark, and those in front of the Temple Pier at a level of 7 feet under low water mark. The removal of the piles and puddle was effected in the following manner:

Upon the tops of the piles of each side of the dam half beams were fixed, and upon these rails were laid so as to form a road, upon which the steam cranes and dredging machines, to be used in the removal of the puddle, could travel, and upon which the pile cutter could also be moved. These machines were successively placed in position, and the work was begun. For the first 15 feet in depth, the puddle was filled into skips and hoisted by means of steam cranes. Below that depth, it was dredged by the machines which had been used for excavating the trench. When the puddle had been cleared away to the requisite depth, the pile cutter followed and performed its part of the work. This machine consisted of a platform upon a stout frame, resting upon four wheels which traveled upon the rails before mentioned, and carrying a steam engine with the requisite machinery for driving a circular saw, which was fixed at the lower end of an upright spindle, and adjusted to the proper level. The spindle was placed between the two rows of piles, and revolved in guides at the end of movable arms, so arranged that it would shift to either side of the dam by turning a handle, and by the same motion it could be pressed towards the pile, which was being operated upon, until it was severed by the saw. Two piles were usually cut off on each side before the machine required to be moved backward on the rails. When the way was clear for the piie cutter, and a sufficient length of dam dredged, sixty piles could be cut off in a day; but the excavators could not keep pace with the pile cutter, and the average number of piles actually cut off did not exceed thirty.

A Chance for an Inventor.

The *American Builder* for December, published by Charles D. Lakey, 190 South Sangamon Street, Chicago, appears on our table as fresh and beautiful as though there had been no fire and no wholesale destruction of the appliances by the aid of which it was formerly issued. This monthly has always been one of the most welcome of our exchanges, and we congratulate its editors upon the vitality of an enterprise that could sustain such a shock and still survive. As a specimen of the many good things in it, we extract the following, under the title given above:

"Our inventors seem always happy in getting up new devices for churns, washing machines, and the like; but they seldom trouble their heads about any improvements in the art of building. Architects never invent. They invariably follow in the path of precedent, and are happy just in the ratio that they succeed in doing things as they have been done by others.

"If inventors would examine into our present system of building, with a view to making needful improvements, they would put money in their purses. Just now, we need some method for protecting warehouse windows; a system, too, which shall guarantee the closing of iron shutters, and not the leaving of them open one night in the year, and that night the one when the fire comes. Then, too, we want the street fronts protected by these iron shutters; and they are so unsightly that it can be done by no ordinary method. Here, then, is a plan; and the first man who gets ready the papers can secure the patent:

"Let plain iron shutters (cast iron of sufficient thickness will answer) be constructed and placed in the brick work, which is to be so laid that the shutters shall slide laterally. Arrange for the construction of a series of shafting while the building is going up, which shall be worked from the engine that is used for hoisting. When the store is closed for the night, the engineer, by the simple action of a lever, draws a solid sheet of iron over every outside window and doorway, save the one by which he leaves the building. Such a building, with a roof of stone, concrete or iron—providing the architect has not loaded the cornices with wood—might be considered nearly proof against fire from the outside.'.

A Fireproof Man.

About the year 1869, one Lionetto, a Spaniard, (writes a French chemist,) astonished not only the ignorant, but chemists and other men of science, in France, Germany, Italy, and England, by the impunity with which he handled red hot iron and molten lead, drank boiling oil, and performed other feats equally miraculous. While he was at Naples, he attracted the notice of Professor Sementeni, who narrowly watched all his operations, and endeavored to discover his secret He observed, in the first place, that, when Lionetto applied a piece of red hot iron to his hair, dense fumes immediately rose from it, and the same occurred when he touched his foot with the iron. He also saw him place a rod of iron, nearly red hot, between his teeth, without burning himself, drink the third of a teaspoonful of boiling oil, and, taking up molten lead with his fingers, place it on his tongue without apparent inconvenience. Sementeni's efforts, after performing several experiments upon himself, were finally crowned with success. He found that by friction with sulphuric acid diluted with water, the skin might be made insensible to the action of the heat of red hot iron; a solution of alum, evaporated until it became spongy, appeared to be more effectual in these frictions. After having rubbed the parts which were thus rendered, in some degree, insensible, with hard soap, he discovered, on the application of hot iron, that their insensibility was increased. He then determined on again rubbing the parts with soap, and after this found that the hot iron not only occasioned no pain, but that it actually did not burn the hair. Being thus far satisfied, the Professor applied hard soap to his tongue until it became insensible to the heat of the iron; and having placed an ointment, composed of soap mixed with a solution of alum, upon it, boiling oil did not burn it; while the oil remained on the tongue, a slight hissing was heard, similar to that of hot iron when thrust into water; the oil soon cooled, and might then be swallowed without danger. Several scientific men have since, it is said, successfully repeated the experiments of Professor Sementeni, but we would not recommend any but professionals to try the experiments.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

To Smoke or not to Smoke.

To the Editor of the Scientific American:

The problem: if one drop of nicotin kills a rabbit in three minutes and a half, how many cigars must a man smoke to reach a state of locomotorataxy, reminds me of another arithmetical query no less profound, to wit: If eight shillings make one dollar, how much milk does it require to make a pair of stockings for an elephant?

The mere fact that nicotin is a poison for one species of animals is no proof of its similar effect on all others. I could quote an endless line of examples in favor of this assertion. Thus, *phellandrium aquaticum* is fatal to horses, but may be eaten with impunity by oxen; *doronicum* kills dogs, but fattens antelopes, thrushes, and swallows; the *cocculus indicus* is deleterious to fish and lice, but a salutary ingredient in the best London porter.

But, even granted that tobacco contains matter poisonous to the human system, let me ask what does not? Pôtatoes, cereals, and, in fact, nearly all vegetables, contain alcohol or other matter, which, if taken alone or in overdose, may kill a man in two minutes and a quarter. Even the very air we breathe is replete with nitrogen and other deadly gases which the anti-smoker would do well to avoid. The mere proof, therefore, that the extract of tobacco is a poison should not suffice as a conclusive argument against its use. It is stated that tobacco reduces the vital energy of the system. It may as well be said that nothing draws so much on the vital powers as the hewing of trees or plowing of fields. Such labor virtually tends to exhaust the system; but does not nature, when properly sustained by food and rest, amply repay the outlay? Does not just this exhaustive practice tend to build up a stock of iron nerve and muscle? The same with mental labor. Nothing so draws on the brain as the continuous and active production of ideas; still nothing will make a more powerful mind than just such exhaustive production, if sustained by food and rest. Therefore tobacco can safely be considered a benefactor in the same line as muscular or mental activity. It partially reduces the system only to give nature an opportunity to replenish with opulence. This argument is of course only applicable to healthy persons. Invalids should apply to their medical advisers, even such invalids whose disease consists in lack of courage to withdraw their minds from the molds wherein they were originally cast.

Now let us observe the practical application of the weed: Germans are said to be the greatest smokers; cigars are drawn among the regular rations by their soldiers. And where do you find more powerful men, both mentally and bodily, than in the land of Humboldt and Bismarck? While, on the other hand, the fact that the Chinese and Shakers do not smoke does not speak much in favor of total abstinence.

Nevertheless I would advocate the discharge of that inverted distilling apparatus, the pipe, which, unless kept scrupulously clean, that is, used just for one smoke, appears the filthiest thing on record, the chewer's palate always excepted.

Your statement, Mr. Editor, that you are always willing to give room to both views of a question, makes me bold in submitting mine to your consideration. I would earnestly warn against a too narrow view of any subject. This is no longer the day for the supremacy of any one abstract science. All the exploits of thought should be used in determining our difficult problems. We only heard the doctors thus far. Let us know what the laymen have to say. At any rate, I must personally protest against your concluding sentence, for should I ever see fit to smoke, I will do so deliberately, neither thinking myself a hypocrite, a corrupt man, nor a fool.

V. B.

Influence of the Moon on Timber.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of September 3, 1870, on page 148, I wrote an article on "Moon Fallacies," and asserted that if hickory timber be cut, say three or four days after a full moon, that the worms would devour it; and that if the same kind of wood be cut, say three or four days after a new moon, the worms would not touch it; and I invited some of your country correspondents to give the matter a trial, and report the result. D. E. S., of Oneida, N. Y., claims to have tried it, and in the SCIENTIFIC AMERICAN of April 15, 1871, on page 244, his report is that "the piece of hickory cut in the full of the moon shows no indication of being worm eaten." He says: "at the end of another six months, I will again report."

On page 228 of the SCIENTIFIC AMERICAN, October 7, 1871, D. E. S., writing from Wallingford, Conn., makes another report on the sticks cut by him. He says: "It is now over a year since I cut two hickory sticks, three days after a full moon, marked them, and placed one in the ground out of doors, and the other in an old garret. Three days after the next new moon, I cut two more sticks, similar to the first, marked them, and placed them beside the first. I send you a section of each, properly marked, by which you will see there is no perceptible difference between those cut in the old, and those cut in the new, of the moon." You add: "the specimens show no difference, and we regard the experiment as conclusive."

After reading the article written by D. E. S. last April, I concluded to give the matter a trial myself; accordingly, on the 9th of May, 1871, four days after a full moon, I cut two sticks of white hickory, marked them, and laid them up in a dry loft; and on the 24th of May, 1871, four days after the next new moon, I cut two sticks of white hickory, similar to the first, marked them, and placed them with the two cut on the 9th. It is now six months since the sticks alluded to were cut, and I send you a section of each. You will find that those cut in the old of the moon, or four days after the full, are so badly worm eaten as to render them almost useless for anything but fuel; whilst those cut in the new of the moon, or four days after a new moon, are sound, hard and dry.

As I stated in my first article; I do not know, or pretend to argue, that the moon exerts this influence, yet it is quite evident that there is a right and a wrong time to cut timber; and so far as I know, we can only be governed by the phases of the moon as to the proper time.

In cutting hickory in the old and new of the moon, the differences, of which I speak, will be perceptible in a shorter time where the wood is cut while full of sap, or while the leaves are on the trees. I feel satisfied that the sticks cut by D. E. S. will show a perceptible difference in the course of time.

This question, of a proper time to cut timber, is a matter of great importance to all who work in timber, either in manufacturing, or using it for posts or building material.

In volume XXV, No. 22, November 25, page 346, in query No. 6, S. F. says he is engaged in a business where he uses hickory, and wants a "simple preventive for worms in hickory." If he will observe the rule I have given about cutting his timber, he will have no trouble, namely: commence cutting white hickory about three days after a new moon, and cut to within about four days before the next full moon. I have never tried this test on "red hickory," (which may be the kind D. E. S. experimented on).

The whole subject is worthy the attention of scientific men; perhaps by further experiments and observation, the true solution may be arrived at; and if the moon *does not* exert this influence on the durability of timber, the true cause may be ascertained.

Cincinnati, O., November 28, 1871. D. A. M.

[The samples sent are as described by our correspondent. The two sticks cut four days after the full of the moon are very badly worm eaten, while the others show no signs of attack. The experiment of our former correspondent, D. E. S., showed no difference in this respect between timber cut shortly after the new and the full of the moon. That this proves the moon has nothing to do with the worms, seems still conclusive to us. If further experiments are to be performed, we advise that many specimens be subjected to trial, instead of making the comparison between two or four. The average result of such an experiment would be a far more reliable indication than can be obtained from so small a number of specimens.—EDS.

Curious Freak of Twin Steam Boilers.

To the Editor of the Scientific American:

I notice the communication of H. P. S. on page 356, current volume of your paper, and now submit the following:

Judging from the description given by him of his boilers, and the manner of setting them, also their feed water and steam connections, I assure him he has a most dangerous arrangement.

In his description, he asserts that even firing is maintained under both boilers at all times, and yet the same water level cannot be maintained in them—that the water level will rise and fall two and even three gages at regular intervals, first in one and then in the other boiler.

Now in regard to uniform firing, it is a feat impossible, even where both boilers are set in one arch and over the same fire, and it must become more difficult when set in separate arches, as in his case. The opening of the fire or furnace doors and the addition of fresh fuel cause a temporary change of the steam generating power of the fires—which change alone would be sufficient to produce the results mentioned, when considered in connection with his descriptions and surrounding circumstances.

The steam pipes leading from his boilers are too small in capacity by fully one half; and the two opposite currents of steam, meeting at the T, and the right angular turn of these united currents with no larger pipes, produce a great reaction and resistance to the steam, which would be avoided by using a steam drum of considerable capacity in place of the T, and taking it thence to the engine by a pipe of double capacity.

As his water supply is admitted to the boilers through the same sized pipes as are used for the outlet of steam from them, and as the water in passing into or from the boilers has neither counter currents, contractions or short angles to overcome, it follows that the water in each boiler will more readily pass from one boiler to the other than the steam through its several obstructions; and consequently any increased pressure, caused by the temporary variation of the energy of the fire under such boiler, will cause the water in said boiler to pass with great rapidity to the other boiler, as described by him. As to any regular intervals between such changes, I think his remedy, of opening the furnace and connecting doors of the empty boiler to lessen the generation of steam and pressure therein, indicates the cause and cure, and is the direct result of uneven firing or generation of steam; and consequently regular intervals between the changes could not well occur.

The small steam space in his boilers, together with the too small, interrupted, and contracted steam outlets, would cause the pressure within either boiler to rise or fall several pounds to the square inch almost instantly, with even slight changes in the generation of steam.

As the pressure of a column of water one foot in hight is only half a pound to the square inch, it follows that an excess, of so little as half a pound in pressure to the square inch of steam in one boiler over the other, would be sufficient to force the water from it to the other until the water level would stand one foot lower in the hotter boiler than in the other; while an excess of one pound pressure would make a difference of two feet in the water level in the two boilers.

REMEDY.—All water feed pipes to boilers should have a check valve as near the entrance to the boiler as possible.

When two or more boilers are to be fed from one source or pump and from the same pipe leading therefrom, each boiler should have its branch from such pipe, and a stop cock, in addition to the check valve in such branch. This effectually controls the flow of the water to each separate boiler and prevents the return from it.

The steam connections from the boilers should be of at least double the capacity for such sized boilers. When two or more such boilers are used together, their steam pipes should conduct the steam to a drum at least equivalent to three or four cubic feet capacity for each such boiler. The steam to be taken from the upper side of such drum to the engine, etc., by a pipe larger than or of a capacity equal to that of all the pipes leading to the said drum combined.

Safety valves as well as pressure gages should be attached directly to each separate boiler, and never to the steam drum nor to pipes conveying steam from the boilers.

With these precautions and directions adopted by your correspondent, all further trouble will be avoided in his own case as well with the other houses alluded to by him.

Albany, N. Y. HORACE L. EMERY.

Ants in Sugar.

To the Editor of the Scientific American:

More than the usual quantity of sugar was recently purchased for my family; and the surplus, above what the wooden box used to keep it in would hold, was put into a paper one, and placed by its side on the same shelf. Black and brown ants had always troubled us, but none of them entered the paper box, which they could have done if so disposed. I sought for but found no reason. Finally, I tried the experiment of keeping it all in paper boxes or bags, and for three years have had no trouble, as formerly, with ants in the sugar boxes. I do not claim to give or know any reason; but such are the facts.

Northampton, Mass. M. L. KIDDER.

[For the Scientific American.]

REMARKABLE RELATION BETWEEN THE SPECIFIC HEAT AND THE ATOMIC WEIGHT.

BY P. H. VANDER WEYDE.

Dulong and Petit were the first who, in 1819, pointed out the curious fact that, when the numbers representing the specific heat of elementary substances were multiplied with those representing their atomic weights or chemical equivalents, products are obtained, which are equal to within a small fraction. So taking the specific heat of the substances mentioned, and multiplying it with their atomic weights, we obtain the following table:

Elementary substance.	Specific heat.	Atomic weight.	Product of number of the two former columns.
Mercury	0·033	100	3·3
Gold	0·032	98	3·13
Silver	0·057	54	3·07
Copper	0·095	32	3·04
Iron	0·11	28	3·08
Sulphur	0·2	16	3·2

If the value of atomic weights of many substances are doubled, as for good reasons is done at the present day, the products are of course also double that given in this table and all approximately =6, in place of nearly =3, as is here found to be the case.

A similar relation to that which Dulong and Petit discovered for the elementary substances was found by Neuman in 1831 for compounds; for instance, in case of sulphates and carbonates, he found for the following minerals:

Mineralogical name.	Chemical name.	Specific heat.	Atomic weight.	Product.
Anhydrite	Sulphate of Lime	0·185	68	12·6
Celestin	" Strontia	0·135	92	12·4
Heavy spar	" Baryta	0·108	116	12·5
Lead vitriol	" Lead	0·085	151	12·8
Iceland Spar	Carbonate of Lime	0·204	50	10·2
Iron spar	" Iron	0·182	58	10·5
Zinc spar	" Zinc	0·171	62·6	10·7
Witherite	" Baryta	0·107	98·5	10·5
White lead ore	" Lead	0·081	133·5	10·8
Strontianite	" Strontia	0·144	73·8	10·6

Two questions suggest themselves from the above details in every philosophically inclined mind. First: Are these coincidences merely accidental? Secondly: If not accidental, what do they mean? Is there some natural law at the bottom of these remarkable relations?

In regard to the first question, it must be remarked that the law appears quite general, and the exceptions very few, therefore accident is out of the question; besides, the small differences in the products are easily accounted for by the fact that the specific heats differ at different temperatures, and for different physical conditions of the substances under investigation; while it is very significant that, in proportion as the experiments were made more carefully, the numbers calculated became more and more equal, as Regnault has pointed out.

In regard to the second question, as to the cause of this peculiarity, we have only to recall the numbers given on page 372, which show that 30 lb. mercury, 17 silver, 10·5 copper, 8·75 iron and 5 sulphur possess at the same temperature the same amounts of heat; and to remark that these numbers are very nearly in proportion to one another as the respective atomic weights of the substances, 100, 54, 32, 28, and 16. As now these numbers express the combining equivalents, so that, for instance, 100 lb. of mercury will combine with 16 of sulphur and form vermillion, and as we have reason to suppose that, in this case, like in others, each atom of mercury combines with an atom of sulphur, it is more than probable that 100 lb. of mercury contains as many atoms as 16 lb. of sulphur. If the number of atoms in these two quantities of mercury and sulphur is the same, and the amounts of specific heat the same, it is clear *that all atoms must possess the same specific heat.* This, now, is the law which lies at the foundation of the remarkable property explained.

When applying the modern theory, that heat is only a mode of motion, to the fact that all single atoms possess the same specific heat, it follows that it takes the same motion producing force, to increase the atomic oscillation (that means, raise the temperature) of every atom, be it mercury, sulphur, iron or any other substance of this series of elementary substances; and that it takes a greater force (more heat) to increase the oscillation of the compound atom of a carbonate, and still more of a sulphate, etc.

"When these bodies lose their heat," means, in the modern language of the conservation of force, nothing but that they communicate their atomic motion (oscillating or otherwise) to the atoms of the surrounding bodies, and put them in the same motion as they possess themselves, losing an equal amount of their own motion. Or conditions may be so arranged that this atomic motion (heat) is changed into motion of masses, commonly called force; of this arrangement, the steam engine is the great type and example for further development.

Compound Engines in the Navy.

Mr. J. W. King, Chief of the Bureau of Steam Engineering United States Navy, recommends in his report that "all naval engines now in store be sold, and that all our naval vessels be supplied with compound engines." Almost every engineer has his preferences in favor of some particular engine. Isherwood had his, and so had Dickerson and Ericsson. Of course, the hobby each one happens to be riding is considered the best horse, and so a series of costly experiments and changes and repairs are undertaken, for which the country pay and the service is but little, if any better off. Our navy wants the best engines and also the most economical, since frigates cannot tow a coal yard around with them. But changes should only be made after a series of successful experiments demonstrates the fallacy of the rule that "the old way is the safest." Commenting on Mr. King's remarks, the *National Gazette* says: "Until something more definite and satisfactory is known in relation to this type of engine, we think it would be a false economy to introduce them by wholesale into our naval vessels. We see no objection to having one or two experimental sets of compound engines built for the navy, but to make such a sweeping change as recommended by Mr. King is impolitic and unwise. The truth is that compound engines are by no means as economical as their admirers would have us believe. An engineer who is running one of them at the present time, in a large transatlantic steamer, informs us that he would like to have the difference of the price of coal said to be consumed each voyage and what is actually paid for and consumed. Compound engines were given a fair test on our lakes and rivers a quarter of a century ago, and did not prove a success."

Heath's Improved Steam Engines.

This invention relates to an improved arrangement of steam chests, ports, and valves, having for its object to balance the valve as evenly as possible, shorten the steam passages, enlarge the area of the ports without correspondingly enlarging the waste of steam in the ports, and to provide for jacketing the cylinder more readily than can now be done. The steam chest surrounds the cylinder, and annular valves work, between the cylinder and the steam chest, on ports at each end of the cylinder, admitting the steam from the space between the rings or valves, and exhausting into the jacket behind the rings or between the rings and the end of the jacket.

The outer surface of the steam cylinder and the inner surface of the steam chest are turned up truly for the pistons to fit between them steam tight, and the pistons are fitted with metal packing rings. The pistons are composed of a solid ring, preferably made in two parts, and bolted together tightly, so that steam cannot pass from one face to another, both the outer and the inner faces being recessed to provide space for the packing rings. As the steam might force the packing rings in the inner face of the piston backward to the bottom of the recess when passing over the ports, at which time there is a direct pressure on the rings, holes are made in the rings to admit steam behind them and balance their pressure. This arrangement of the engine admits of the application of a jacket more easily and better than when a square steam jacket is arranged on the side of the cylinder, which greatly interferes with the fitting of the jacket. The steam chest cylinder and the steam cylinder may be formed in one casting, proper stays being formed to connect them together between the parts where the valves work; or they may be cast separately and connected by the heads, if preferred.

But little steam is lost by the amount contained in the ports so as not be effective, for the steam cylinder ports are very short, being only equal to the thickness of the cylinder, which need not be thick, as it is constantly exposed to steam pressure at the outside.

Arden A. Heath, of Mercer, Pa., is the inventor of this improvement.

Ice Houses.

This being the season for storing ice, we would call attention to what is known as the "Stevens plan" for erecting a cheap house and storing ice, from *Hall's Journal of Health* for December:

"For one family, make a house twelve feet each way, by setting twelve posts in the ground, three on a side; board it up, eight feet high, on the inside, so that the weight of the ice shall not press the boards outward; dig out the dirt inside, six inches deep, and lay down twelve inches of sawdust; pack the ice in a pile nine feet each way, filling the space of eighteen inches between the ice and the boards with sawdust or tan bark, with the same thickness on top; make an old fashioned board roof, leaving the space above the ice open for ventilation. Have a small entrance on the north side of the roof.

"If the ice house can be located on the north side of a hill, and a small stream of water introduced slowly through the roof, on a very cold day, so as to make its way between the pieces of ice, the whole mass will freeze solid; or a pile of snow could thus be made into solid ice, and would last from one winter to another."

The Effect of a Grain of Strychnine.

A man in Harrisburgh recently attempted to commit suicide by taking a grain of strychnine. The skill of his physician having saved his life, he narrates his experience for the benefit of science. He says:

"In the course of five minutes I began to feel slight cramps in the calves of my legs. The cramps increased in intensity and extended to the feet and thighs, causing the most intense pain. I attempted to rise from the chair, but fell to the floor with convulsions in the lower extremities. Unsuccessful attempts were made to bathe my feet in hot water, each effort to raise me bringing on violent paroxysms, in the last one of which I thought my jaws had become unhinged. I was now perfectly paralyzed from the hips down, and suffering the most excruciating pains, which began to extend upwards; the muscles of the shoulders and neck were soon considerably convulsed, the forearms still being free from pain.

"I now prepared for the final struggle, which I knew must be near at hand, as I had become rigid from the neck down, save the forearms. The convulsions of the muscles were becoming fearful, and the torture awful to endure. My hands were drawn in to my sides, with the fingers drawn apart, and slightly bowed, and the jaws became rigid. I felt myself raised as if by some mighty power, and fixed immovably, with only my feet and head touching anything. I became unconscious of everything except my own agony, which was now beyond all description. I could feel my heart fluttering, and my brain beating and throbbing with an irregular motion, as though at every beat it would burst from its confinement. Every joint was locked, and every drop of blood seemed stagnated. I remember thinking it could not long be thus, when I must have lost consciousness.

"I remember nothing more until I felt a sensation of relief, as though the garments of death, which had been drawn over me, were being drawn back. Those terrible cramps seemed to be descending towards my lower limbs. A feeling of relief stole over me, and I began to be again conscious.

"From that time I resumed consciousness, when I was entirely free from cramps, with the exception of a little in the feet. I had but one attack of cramps afterwards, which was immediately relieved by a dose administered by my wife—the doctor having left for a short time—and when he returned, I felt that the poison was completely neutralized."

Snakes and Tigers in India.

We need not wonder at the eagerness, says the *Chemist and Druggist*, with which physicians and authorities in India examine every new remedy put forth as an antidote to the poison of a snake bite, when we learn that in British India, including British Burmah, the deaths from snake bite during the past three years amount to 25,664. This statement appears in an official report published in the *Gazette of India.* From that report, we also learn that during the same period the deaths resulting from the attacks of all kinds of wild beasts in the same area numbered 12,554. The snakes killed more than twice as many as were slain by the tigers and all the other fierce forest rangers put together. Truly the serpent is still "more subtle than the beasts of the field."

WHAT sunshine is to flowers, smiles are to humanity. They are but trifles, to be sure, but, scattered along life's pathway, the good they do is inconceivable. A smile, accompanied by a kind word, has been known to reclaim a poor outcast, and change the whole current of a human life. Of all life's blessings none are cheaper, or more easily dispensed, than smiles. Then let us not be too chary of them, but scatter them freely as we go; for life is too short to be frowned away.

Improved Steam Heating Apparatus.

The accompanying engraving represents the steam heating apparatus, patented July 18, 1871, by F. H. Pulsifer and Wm. C. Wheeler, of Baltimore, Md.

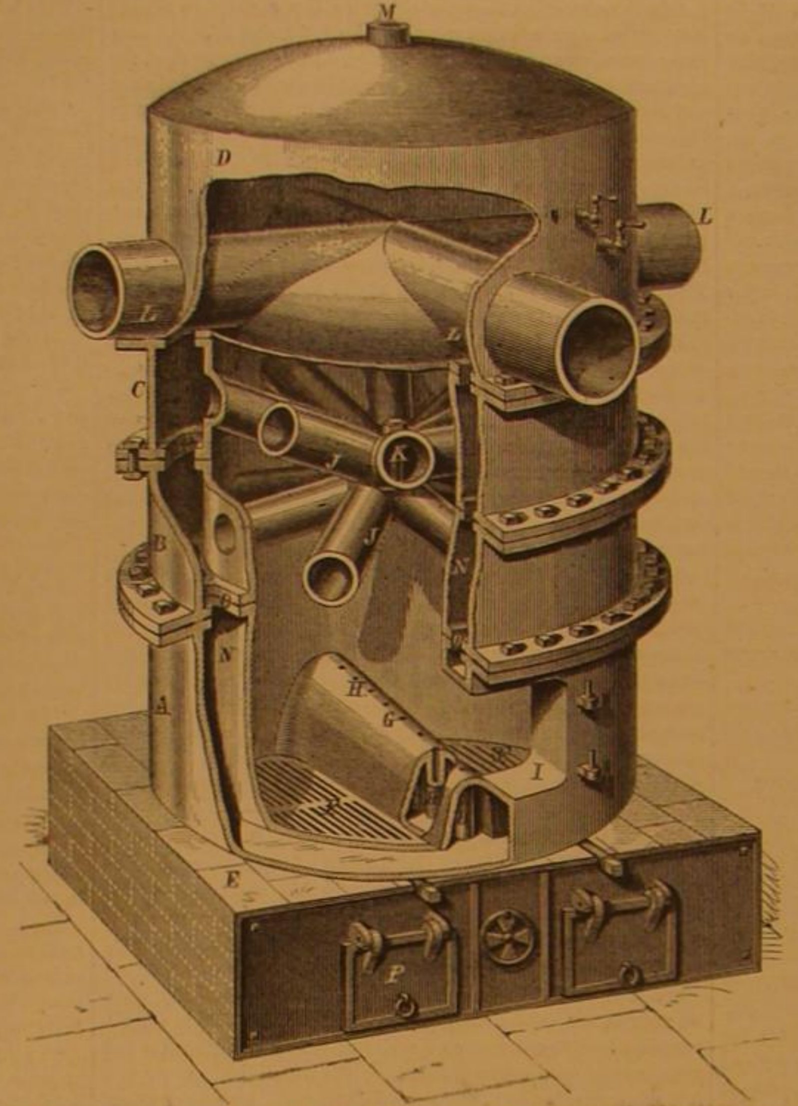
A B C D represents the outer shell, made in four sections and bolted together. The lower section, A, rests upon the brick ash pit, E, and is provided with a grate, F, separated by the hollow partition, G, inclined as shown. Through this partition is cast a number of tubes, H, for the passage of air to the fires, thereby producing a more perfect combustion of the fuel. By means of this partition two separate fires may be made, and, if preferred, only one grate or side may be used, thereby saving one half the amount of fuel. In this section is arranged the furnace door, I, which is of the ordinary construction. The sections, B and C, are provided with eight pipes or tubes, J (through which the water circulates), inclining and joining in the center, and bolted together through the center by the bolt, K. A water space is thus left all around the tubes.

In the engraving two of the sections, with flues or tubes, are shown; but for a larger boiler, as many sections as desired can be used. The pipes, J, in each section, may be set around or advanced, as shown in the engraving, thereby obtaining a greater heating surface.

In the top section, D, forming the dome or steam drum, are arranged four flues or pipes, L, running at right angles to each other, thereby obviating the necessity of elbows as heretofore used. M is the steam pipe connection. The sections are all connected between the inner and outer shell, forming the water space, N, by the openings, O. The front of the ash pit is of cast iron, and is fitted with ash pit doors, P. The advantages claimed for this apparatus over others heretofore used are, that a better circulation of the water is obtained, as well as a greater amount of heating surface; the water, being in the hollow partition in close proximity with the fire, is sooner heated, and, if desired, only one of the fires may be lighted, thereby saving one half of the fuel. A more perfect combustion of the fuel is also claimed; the outlets or escape flues having no elbows, the smoke is sooner got rid of; by bolting the pipes together in the center, greater strength is given the boiler. And it is claimed that, by including the tubes, they are not so liable to be cracked or broken in contraction or expansion, nor to hold the sediment contained in the water. And by arranging the tubes or pipes, as shown in the engraving, all the heat passing from the furnace or fire must come in contact with some portion of the heating surface, before passing out to the chimney.

The boiler is designed not only for heating but for other purposes.

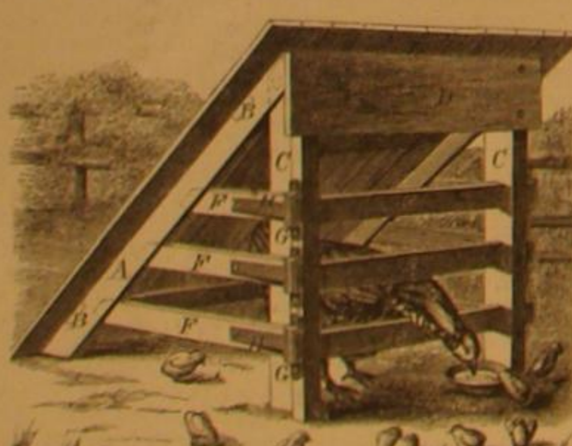
For further information or for purchase of State rights, address Frank H. Pulsifer, Milwaukee, Wis., or Wm. C. Wheeler, 679 Lexington street, Baltimore, Md.



PULSIFER & WHEELER'S STEAM HEATING APPARATUS.

WILCOX'S FOLDING HENCOOP.

To raisers of poultry and farmers in general, the invention we herewith illustrate will possess interest. It is a folding chicken coop, which may be closed together in small space for storage or transportation, and is constructed as follows:



The inclined bars, A, are held parallel to each other by crossbars, B, which, with the inclined bars, support the roof. To the upper ends of the bars, A, are pivoted the uprights, C. The latter are rabbeted on the outside, so that when the coop is folded they partly overlap the bars, A, as shown in detail at the bottom of the engraving. To the outer sides of the upper ends of the bars, C, is attached a board, D, the ends of which project and rest against the ends of the bars, A, as shown.

The edge of the board, E, and the ends of the bars, C, as also the edges of the shoulders of the bars, C, are beveled off so that the coop may stand firmly when set up.

To the bars, C, and at a proper distance from each other, are attached crossbars, E. The side bars, F, are slid in through keepers, G, and are held in place by spring catches, I, which engage the keepers, as shown. The inner ends of the bars, G, enter mortices in A, as shown in dotted outline.

When taken down and folded, the parts assume the position shown in detail at the bottom of the engraving.

The invention was patented through the Scientific American Patent Agency, Nov. 14, 1871, by Edward J. Wilcox, of Ivy Mills, Pa., who may be addressed for further information.

Ants as Engineers.—It appears that the ants in Panama are not merely mining engineers—they build tubular bridges. A corresponding member of the Glasgow Natural History Society, who has been lately in that country, describes the curious covered ways constructed by these ingenious insects. In tracing one of these covered ways, he found it led over a pretty wide fracture in the rocks and was carried across in the air in the form of a tubular bridge of half an inch in diameter. It was a scene of busy traffic. There was nearly a foot of unsupported tube from one edge of the cliff to the other.

Toothache, Earache, Etc.

The little work noticed in another column, entitled "First Help in Accidents," speaks of these complaints, so prevalent at this season of the year, as follows:

"It is a bad practice to put cotton wool, soaked in laudanum or chloroform, into the ear for the relief of toothache. It is true that it may sometimes prove effectual, and procure a night's rest, for the connection between the teeth and the ear is very close. But let it be borne in mind that the ear is far too delicate and valuable an organ to be used as a medium for the application of strong remedies for disorders of the teeth, and that both laudanum and chloroform, more especially the latter, are powerful irritants, and that such applications are always accompanied with risk. The teeth should be looked after for themselves, by some competent dentist; and if toothache spreads to the ear, this is another reason why they should be attended to at once; for prolonged pain in the head, arising from the teeth, may itself injure the hearing. In earache everything should be done to soothe it, and all strong irritating applications should be avoided. Pieces of hot fig or onion should on no account be put in; but warm flannels should be applied, with poppy fomentation externally, if the pain does not soon subside."

Clark's Locomotive Engine.

John Clark, M. E., of 44 Finsbury Circus, in the city of London, England, has recently patented, through the Scientific American Patent Agency, an improvement in locomotive engines, the object of which is to radiate the leading and trailing axles of locomotive engines, or of engine and tender comb'ned, to enable them to pass round sharp curves more freely.

He constructs the leading and trailing axles hollow, inside of which he fits a central spindle, to which are fitted, at each end, cranks in connection with the driving gear. The hollow axles may be called the carrying axles, and the central spindles, the driving axles. The centre part of the spindles may be square or hexagonal, to fit freely a bush fixed at the center of the hollow axle, so that it may slide therein. Thus, when the spindle is driven, the carrying or hollow axle will be driven with it.

The radial movement of the hollow axles is effected by links fixed to the framing. The spindles are carried in bearings in the framing, and are held in a parallel plane with the other axles of the engine by horizontal rocking shafts. The engine may have eight, ten, or even twelve wheels coupled and propelled by one pair of cylinders, either outside or inside.

One purpose effected in the design is to make the load moderate on all the wheels—say not to exceed nine tuns per pair—and to include all the weight for adhesion. In the eight wheeled engine, the four wheels in the centre form a fixed or parallel wheel base from seven to ten feet centers.

The leading and trailing axles radiate freely to pass curves of three chains radius. In the ten wheeled engine the six wheels in the centre form a fixed or parallel wheel base, the middle pair being without the flange. In the twelve wheeled engine the six wheels, situated immediately behind the leading axle, form a fixed or parallel wheel base from nine to twelve feet centres, and the leading and two trailing axles are fitted with the radial arrangement.

The load carried by the radial axle is entirely borne by a transverse spring or springs from a pin in the center buckle, supporting slings from a bracket fixed to the framing or boiler. Either wheel of the leading and trailing axles is free to rise or fall about an inch and a half, to suit the "cant" or inequalities of the rail, without imparting any cross twist to the framing, thereby securing the advantages of the American bogie as applied to engines. The said supporting slings have a double fulcrum pin, where they are joined to the supporting brackets, to secure a certain amount of righting to make the engine run smooth and steady on a straight road.

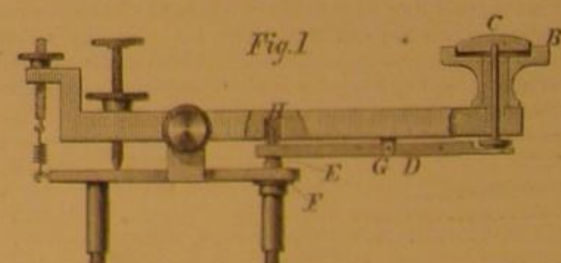
The details of Mr. Clark's invention cannot well be explained without drawings, but the general description given will enable engineers to comprehend in some measure the nature of the improvement.

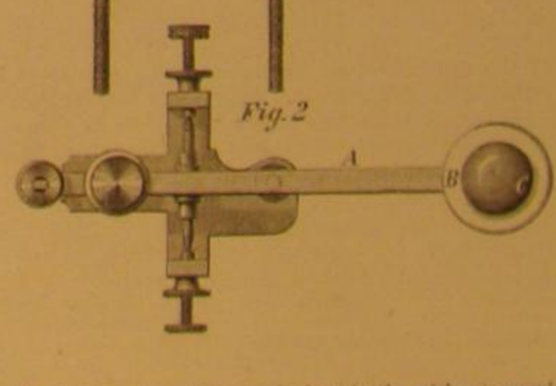
SELF-CLOSING TELEGRAPH KEY.

This telegraph key, which was patented through the Scientific American Patent Agency, Nov. 7, 1871, by Jeremiah F. O'Sullivan and Philip W. O'Sullivan, of Jackson, Miss., is so constructed as to hold the circuit constantly closed, in order that it may not be accidentally left open by careless and inexperienced operators.

To this end there is applied to the ordinary key bar, A (see engraving), a secondary button, C, in addition to the ordinary one, B, in connection with the lever, D, and spring, H, the latter holding the lever in constant contact with the conductor, unless it is lifted off by pressure on the secondary button.

The second button, C, is fitted upon a pin or shank, which passes through the button, B. The lever, D, is pivoted to the under side of the bar, A, at G. The spiral spring, H, holds the pin or hammer, E, in contact with the anvil, F, thereby closing the circuit.





The instrument can be worked perfectly, without grasping the button with thumb and fingers, by operators who do not use the thumb in writing. The improvement can be adapted to all keys at very little expense, and new keys can be made as cheap as the old.

The key is very convenient to inexperienced operators. Accidents that would open a common key will have no effect on this. The spring, so sensitive to the touch which closes the circuit, would require a nicely balanced weight to keep it open without bearing down the key bar and connecting the platina points on the hammer and anvil.

For further particulars, address O'Sullivan & Brother, Jackson, Miss.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE NEW YORK GAS MONOPOLIES.

New York has, like most large cities in the United States, suffered from the extortions of gas companies until the public at last revolts against their impositions. The chartered privileges of these companies, the large capital necessary to the establishment of an extensive system of illumination by gas, and the enormous profits realized in a few years, have made the monopolies so powerful that they have, as yet, defied competition. And although numerous companies have been projected, and some have been organized, the wealth of the older companies has been able to buy them up, or to effect coalitions, so that the monopolists have had their own way so far.

These companies have sustained prices far above that for which good gas can be made and furnished; but not content with this extortion, they have persistently furnished inferior gas without decreasing the price. They have been exceedingly arbitrary in their treatment of complaints, have treated with indifference those who questioned the accuracy of their bills, and have altogether made themselves so obnoxious to the public at large that every gas consumer will hail with delight any attempt to break their power.

For a period of about fifteen years, inventors have grappled with the problem of how to make illuminating gas from the light products of petroleum distillation. The task was not an easy one, and only through many failures has a fair measure of success been reached. There are now portable machines, for this purpose, in market that work very satisfactorily.

In Memphis, Tenn., there have been put into operation, on a large scale, works which manufacture gas from naphtha, and which are, according to the accounts that reach us, furnishing gas of far better quality than the ordinary coal gas, at a cheaper rate than the latter has yet been furnished to American consumers. We published last week an article referring to the quality of New York City gas, and need not enlarge further upon this head.

We are glad to learn that an organized effort to introduce here the system in use at Memphis is in progress, and that a company, composed of citizens among our heaviest capitalists, has purchased a site, and is erecting works on Avenue D, between 11th and 12th streets.

The company have a charter, granted at the last session of the State Legislature, which permits them to lay mains, to open streets, etc., and they are now vigorously engaged laying their main pipes in various parts of the city. It is further stated that at the ending session of the Legislature, strenuous attempts will be made to annul the charters of the old gas companies; but of this result we have not much hope.

The process used at Memphis, and which is to be adopted by the new mutual company here, is, so far as we have been able to ascertain its character, extremely simple, consisting in the conversion of the naphtha into gas by heat in retorts, and diluting it with atmospheric air to the proper degree for burning without smoking. Were it not that the process is stated to be a practical success, we should anticipate trouble in the distribution of such gas from condensation in pipes, which has been a difficulty experienced in the previous use of this material; but as a committee sent from this city to examine the process reports no such difficulty, we are constrained to hope it is in some way obviated. The committee report that the process is simple and safe; that the gas had a high illuminating power in all parts of the city, and that consumers state this power to average three times that of coal gas. It is expected that the new Mutual Company will have their works finished, and pipes laid so as to supply consumers early next season.

THE REPETITION OF EXPERIMENTS.

The importance of experimental investigation, so strongly insisted upon by Bacon and practiced since by scientists as the basis of the true scientific method in physical researches, is now so generally admitted as to need no argument. The importance, of not accepting results as final determinations of physical laws until repeated experiments leave no room to doubt their accuracy, is not so generally appreciated. The really scientific investigator always retains some reservation in his acceptance of results attained by others, unless, through the most careful scrutiny, he can find no error in their method of experimentation, and can devise nothing which appears a more sure way of arriving at truth.

The prestige of name and attainments goes far to influence belief, but those who think for themselves need a surer foundation than this in matters where accuracy is essential.

Libraries of reference contain tables which are relied upon by engineers and constructors in making their computations, and in the use of which they cannot go far astray; yet many of them have been found in practice to be inaccurate. At least, recent experiments have given results differing more or less from those formerly obtained, and from which the tables were framed. As long as differences exist greater than may be accounted for by inaccuracies in manipulation, there must remain doubt as to the correctness of our knowledge. Experiments upon any subject should then never cease until a certain degree of uniformity is attained through the employment of different methods.

There are not wanting recent illustrations of the truth of this proposition. Among these may be cited the remarkable experiments, of Professor Ogden W. Rood, of Columbia College, New York, on the amount of time necessary for vision, in which Wheatstone's conclusions from his experiments on the duration of the discharge of a Leyden jar, are found to be immensely far from the truth. He affirmed that the time necessary to produce distinct vision was within one millionth of a second. Prof. Rood now shows, by a most ingenious method, that in a space of time less than forty billionths of a second, the retina can receive and combine a whole series of impressions; and he feels confident that the eye could distinctly see an object illuminated during a period so inconceivably minute as four billionths of a second. In the conclusion of his paper on this subject, published in the *American Journal of Science* for September, 1871, he quietly remarks: "All this is not so wonderful, if we accept the doctrine of undulatory light, for according to it, in four billionths of a second, nearly two and one half millions of the mean undulations of light reach and act on the eye."

Professor Rood also has determined the possible duration, of the discharge from a Leyden jar, to be as short as nineteen hundred-millionths of a second.

Even the experiments of Regnault have been recently revised by Mr. Alexander Morton, with results from which he deduces formulae that show the relation between the temperature, pressure, and density of steam.

Recent experiments have shown room for doubt as to the full reliability of the tables in common use for computing the strength of beams and girders.

Boiler explosions are now being brought under systematic experiment, at Sandy Hook, which will doubtless throw much light on this important subject.

In short, there yet remain many things in science and mechanics to be definitely determined. The experiments of General Morin on friction might be revised, we think, with profit, and carried further than he went with them, to show how the compounding of motion on cylindrical surfaces modifies friction, and what part of the power is absorbed by friction in each of the components of the resultant.

The use of air compressors has shown that we are far from knowing the real laws of the friction of gases in tubes; and herein is a most important and profitable field of investigation, as the use of air as a motive power in mines and tunnels is only in its infancy. But we have said enough to show that, notwithstanding the labors of those that have gone before, there is yet enough scientific work to be done.

THE CONDEMNATION OF THE HALL OF PUBLIC RECORDS FOR THE CITY AND COUNTY OF NEW YORK.

In the Court of General Sessions, December 5th, Judge Bedford presiding, the Grand Jury made a formal presentment relating to the unsafe and filthy condition of the above building, a condition which, we believe, we were the first of the New York press to notice publicly.

In view of this decided action, it will probably interest our readers to know in what way important records of untold millions are kept (or rather not kept), as ascertained by a personal inspection of all parts of the building.

The building stands by itself in the northeast part of the City Hall Park, but not so far removed from other buildings as to be protected from fire by its isolation, unless it were thoroughly fireproof. Sparks would find easy access through numerous broken panes, only a portion of which were, at the time of our visit, stopped with books labeled "conveyances," newspapers, or whatever other makeshift could be extemporized by the clerks to keep out wind and rain.

Entering thus, the sparks would find sport ready to hand in loosely folded and dusty, cobwebby papers, which crowned the tops of nearly all of the cases, and in bundles of paper, loose shavings, small pieces of lath, etc., etc., which, dried by long protection from weather, are profusely scattered in the upper unoccupied rooms left in an unfinished state by the carpenters and masons.

The cases for containing the books of conveyance and records of mortgages are most perfectly designed fire traps. They are double, so that books are placed in them from both sides, the partitions which separate the books being boarded on their inner edges, leaving a wooden flue the whole length of each case, and about six inches wide, running from bottom to top, and open above and below.

No walls of any railway round house can exceed in grimy squalor the walls and ceilings of the Hall of Records. They look like chimney flues. One of the clerks told us that, during a term of fourteen years service, he had never seen a whitewash brush in the building. Leaky soil pipes and fetid sinks lend odors to the air, which is so sickening in some parts of the building that, we were told, some of the clerks have been made ill by it.

The numerous paper stuffed holes and crannies form a favorite haunt for troops of mice that, in the absence of other food, gnaw at the leather of the bindings to get at the paste and gum, and destroy the papers and maps without let or hindrance. We did see one or two tin boxes designed to spoil the literary recreations of these rodents, but the great mass of documents are entirely open to their ravages. In one place we were shown a great pile of what once were maps, thrown in a confused heap together, the mice having so disfigured and torn them that they are rendered illegible. In other places ledgers were reduced to mere bundles of unbound and displaced pages by the same destructive vermin. Everything spoke of ruin and rottenness. But sadder than all, the destruction and decay visible in the records and in the building were the evidences of the moral decay and the misrule which has so long corrupted our city government, and which has thus carelessly and criminally neglected public interests, and failed to provide for the security of the public records. We trust that, as we are now emancipated from this reign of disorder, the action of the grand jury will lead to measures that will so place public documents that they will no longer be food for mice, nor remain likely to become a prey to the first severe fire that shall take place within a hundred yards of the building where they are kept.

A MARE'S NEST----MORE ABOUT THE GAS QUESTION.

In another column will be found an editorial containing the announcement that gas works are in process of erection on Avenue D, between 11th and 12th streets, by the Mutual Gas Light Company, to supply gas made from naphtha. A correspondent in the New York *Herald*, of Dec. 4, states that the gas to be supplied will be compounded of naphtha vapor, common illuminating gas, and atmospheric air. He sounds, (to the uninitiated), a fearful warning that a gas thus composed is "as explosive as gunpowder or nitro-glycerin, and far more terrible in its effects." He further says:

The dreadful disaster of the *Westfield* excited the just indignation of the public, but this calamity was only a faint intimation of what may be expected if this compound is allowed to be made. The oxygen necessary for its combustion is mingled with the gas not only in the holders, but also in the supply pipes; and if an explosion should occur it would take place instantaneously, throughout the entire body of the gas not only in the holders but also in the pipes in all parts of the city wherever they are laid, and every building in the vicinity of these pipes would be blown into atoms instantly, and every human being therein or near by would suddenly perish.

The destruction would be more terrible than an earthquake or the explosion of a powder magazine.

Now, mark, it will be claimed by those interested in this death process that it has been in successful operation in Saratoga and other places, and that no accidents have occurred from its use. Well, the Saratogians have been truly fortunate in escaping a terrible calamity, but let this compound be ignited by the breakage of a street main, or in any other of the thousand ways that may happen any moment, and if the result is not more terrible than here indicated, then it will be because Providence interposes a miracle to save the people.

A year or two since a new gas burner was invented for burning a mixture of coal gas and oxygen gas. This burner was denominated the "safety burner." It was tried and worked well for months. No accident occurred until a defective burner was used, when an explosion took place. There was not more than one cubic foot of the mixed gases in a small holder, when the accident occurred which sent part of the holder down through two ceilings and the other part upwards through one ceiling and the roof of a building in Broadway, producing a frightful noise and great consternation among the people in the block. Thousands were attracted to the scene of the accident in a few moments. Now, this mixture, so far as its explosive properties are concerned, was precisely the same as that proposed to be made by the Mutual Gaslight Company and supplied to consumers.

All of this terribly sensational statement is pure, unmitigated bosh, having no more foundation in fact than the stories of Munchausen or Gulliver. It is calculated to frighten those ignorant of the subject, and to injure the Mutual Gas Light Company. The statement, that the naphtha gas is the same mixture as that which exploded on Broadway, is without truth. Any kind of combustible gas will explode when mixed with enough air or oxygen to entirely consume it. The explosion, cited by the *Herald* correspondent, was with coal gas and oxygen so mixed, as is always the case when coal gas and oxygen are used in the so called magnesia, or lime light. The mixture is ordinarily made with minute quantities of the gases, just before they reach the pencil of lime, or magnesia, which in their combustion they heat, and render luminous. It has long been known that common illuminating gas, mixed with common air in the proper proportions, will explode, yet when conveyed in pipes it is so impossible that such a mixture can occur in the conduits, that gas is acknowledged the safest illuminating agent in use. The explosions that have occurred with it have been caused by its escape into closed apartments where, after a time, the proper proportions of gas and air have been mingled, and subsequently ignited by contact with flame, through carelessness.

When any illuminating gas is mixed with air in sufficient quantity to render the mixture explosive, it loses its illuminating power, and burns with a pale blue flame. A gas, that will give a light from any ordinary sized burner sufficient to read by, is never explosive. The Mutual Gas Light Company propose to furnish *illuminating gas*, and if they do this, they will furnish a material as safe as any ever employed for lighting; for the same general principles apply to all kinds of gas from which light is obtained.

But it may be asked, why has the SCIENTIFIC AMERICAN made such a persistent protest against the use of naphtha in naphtha stoves and in lamps, if the material can be used as is proposed by the Mutual Gas Light Company? We answer that naphtha, so long as it is in a liquid state, can never explode. So long as it is confined in close pipes, it can never burn, whether it be in a liquid state or in a gaseous form. When not controlled as it can be in metal pipes, it may and does often generate vapors that, mixed with air, are explosive. When lamps are broken or overturned, a highly inflammable liqud is scattered about, which endangers life and property. The dangers arise from the careless and wrong methods of using this material. A lamp is no more a fit instrument for burning naphtha than is a man's watch pocket for the burning of gunpowder. Experience has shown that inflammable gases may be conveyed in pipes with very great economy and safety; and when the false prophet of the *Herald* cites, as an example of danger, an instance where coal gas exploded when mixed with oxygen, he, like other over eager witnesses, proves too much. He proves that gas, (which, rightly mixed with a supporter of combustion, will explode), can be and has been used for years with less damage than has arisen from any other mode of illumination. The same can be done with the naphtha gas, the safety arising in both cases from the manner of distribution through pipes.

The article in the *Herald* is evidently written by a person not ignorant of the facts and principles we have stated, but one who, out of his knowledge of the subject and his acquaintance with the general ignorance of the public in such matters, has seen his opportunity to frighten the people, and retard the new enterprise which is likely to become a strong competitor with the old gas companies.

EDUCATION OF THE EYE.

How few there are that appreciate that optical marvel, the eye! How few understand its mechanism, the principles on which it acts, and the wonders it accomplishes! As an avenue by which external impressions find their way to the mind, it is worth all the others man possesses. So gradually is its skill acquired, that we hardly recognize it as acquired skill. We educate, through long and systematic practice, hands, feet, and muscles; but in the main the eye is left to itself, to acquire as it may its power of estimating distance and size, color and the definition of form.

In this desultory way it acquires a skill beyond expression wonderful, yet we believe that with most the power of vision is only imperfectly developed. What is to hinder systematic discipline of the eye any more than that of any other organ? To be able to see correctly is of as much importance to the mechanic as to the artist. Mr. Ruskin in his admirable treatise on the "Elements of Drawing" lays particular stress upon teaching the eye to see correctly, and shows that the hand will have but little difficulty in learning to represent what is accurately seen.

The mechanic is often called upon to make forms for which his unaided eye must be the principal guide. The wagon maker may lay out his work by patterns, but the ornamental finish principally depends upon the nicety with which his eye can trace lines of grace and beauty. Even in shaping a boot sole there is required great skill of eye. If any one doubts this, let him try to shape a sole to the outlines of his own foot, and see what an uncouth, ungainly form he will make. None but novices will try the experiment, for any one who has tried it, knows the difficulty of combining comfort and beauty in a boot sole. Shoemakers have been much denounced for their failures in this respect, but the reader may rest assured that their art is a difficult one. They can not go by plumb line, square, and level, like the mason or the carpenter, and no one who has never tried to draw a sole pattern knows how slight variations will affect, favorably or unfavorably, its appearance. The cabinet maker, the carver, the sign painter, the decorator, all of these attain skill principally through the education of the eye.

An analysis of what the eye can perceive will give a clue to the proper method of educating it. The impressions gained through this organ may be classed under the categories of distance, size, light and shade, form, and color. It appears to us that, in the order in which these categories are named, the education of the eye should proceed, since that is probably the order in which we first learn to perceive. It is through the power to appreciate distance that we form our first estimates of size; then we begin to distinguish light and shade, and thus to gain power to define form, and lastly we distinguish, more or less perfectly, colors and tints.

We think a most profitable system of exercises might be devised by an ingenious teacher, calculated to train the eye in the exercise of its various functions in early youth, and to form correct habits of vision; for he who supposes the eye is not influenced by habit as well as any other organ makes a serious mistake.

The worst habit of all is the habit of partial sight. Instead of closely scrutinizing everything they see, the majority of men only superficially look at objects as they pass before them. They thus become inaccurate witnesses in courts, inaccurate in their impressions of material objects in general, and fail when they attempt to imitate, because the images they strive to reproduce are imperfect.

If in early youth, children were taught to look carefully at everything, and to constantly test the accuracy of the perceptions thus obtained, we believe the habits of close observation thus acquired would be of greater advantage than the result of any other mode of discipline now practiced in elementary schools.

THE ST. GOTHARD TUNNEL---ANOTHER GRAND ENGINEERING WORK.

The pass of St. Gothard was the most frequented of all the routes across the Alps until the commencement of the present century; but as it was not practicable for vehicles, it was gradually deserted after the construction, by Napoleon I., of the road over the Simplon. The loss of traffic induced the cantons through which the route passed to construct a carriage road quite as good as that on the Simplon. The work was commenced in 1820, and finished in 1832, and it is one of the greatest monuments of engineering skill to be found in Europe. In magnificence of scenery, the St. Gothard is superior to all of the passes, unless we except the Stelvio. To the mere pleasure seeker, it will, therefore, be a matter of regret to see this superb road deserted for a hole through the mountain. Ever since the Mont Cenis tunnel was projected, the Swiss and Germans have felt that a large share of traffic would be diverted to France. For military and strategic reasons, it was, also, felt that equally good facilities ought to be provided on the other side of Switzerland, and all of the necessary surveys were made many years since; but the jealousy of the French, and the fear of that nation, has prevented the commencement of the work. The moment, however, that France was powerless to prevent, the project was revived, and we now hear that a contract for the construction of the tunnel has been concluded between the Swiss government and a syndicate of German bankers under the protection of the imperial government of Germany. The work will be about twice as long as the Mont Cenis tunnel, and it will be considerably more difficult, as it must pass under several rivers and lakes, and encounter the hardest rocks of the Alps. The summit of the present carriage road is 6,507 feet, but the railroad will pass under peaks varying from 8,750 to 10,900 feet. There is no distinct peak of St. Gothard, but an extensive ridge of elevated ground which bears that name.

Geologists will be greatly interested in the work, as this part of Switzerland abounds in a large variety of choice minerals, and some important questions may be solved by the projected work. The total cost is estimated at $37,000,000. Of this amount, the company will raise $20,000,000, leaving the balance to be raised by assessment upon the cantons and countries immediately interested in the project. There is a general belief among engineers that the work will cost much more money than the above estimate, but, as rich governments stand as security, there seems to be little doubt that the undertaking will be pushed to final completion. The new road will bring Germany and Italy into closer political union, and, in the event of war, give these powers a decided military advantage; but this feature of the undertaking is of small importance in comparison with the enormous traffic that will flow through the tunnel between the nations of the North and the remote inhabitants of Asia. Its principal utility will consist in facilitating trade and travel between Europe and Asia, by way of Italy. The extreme Eastern points within its circle of traffic will touch the outstretched hand of our Pacific railroad, and the commerce of the whole world will be benefitted by the completion of the gigantic scheme. It is not many years since the river Danube was the highway for the commerce of the world. The boats, moored at the bridge of Ratisbon, far up in the interior of the Continent, were manned by sailors who were the boast of that period, when suddenly, by the discovery of the passage around the Cape of Good Hope, commerce was diverted to new routes, and we have nothing but the ancient bridge and the quaint old storehouses to tell us of the magnificence of the past. The completion of such works as the Suez Canal and the tunnels through the Alps are great illustrations of the triumph of science over all obstacles.

The trade, which, for a time, was diverted to new routes, appears likely to return to its former channels. The Austrian government already have a railroad over the lower Alps, connecting with Trieste and Venice, so that they will profit by the revival of trade in this direction.

It is difficult to anticipate how long it will require to complete the St. Gothard tunnel, but, with improved machinery and aided by the experience of Mont Cenis, it can hardly endure twice as long as the last famous undertaking. It is a bold enterprise, well worthy of the age in which we live.

A MOST INGENIOUS MACHINE.

There is on exhibition at the Progress Iron Works, 59 Lewis St., this city, a machine, for bunching, wiring and inserting and fastening bristles in brush backs, that is a marvel of ingenuity. In the accuracy, beauty and rapidity of its operation, it has scarcely been excelled in the history of invention. The machine was entered at the Fair of the American Institute only just before the closing, and it escaped notice from us at the time on that account. We shall, however, shortly give an illustrated description, which will be more satisfactory to our readers. The machine is, we believe, the joint invention of Messrs. O. D. and D. C. Woodbury, of the above named works. To any who like to see what mechanical skill of the highest order can accomplish, it offers one of the most profitable studies that has been brought before the public in a long time, and it must, we think, revolutionize the present system of brush making.

MECHANICAL BIGOTS.

Bigotry is by no means confined to religionists, any more than pedantry is limited to schoolmasters. The good old way, whether it be in science, art or mechanics, is *so good*, in many men's eyes, that to them there can be nothing better. To them, innovations and innovators are abominations. Because unwilling to adapt themselves to a new order of things, and reluctant to make the effort, they are sure to be left behind in the race. Instead of "trying all things and holding fast to that which is good," they hold fast to that which they have, and try nothing.

The other day we carried a lock to four different locksmiths, for repairs. In itself peculiar (we believe it was imported from France) and being attached to an article in such a way that it was impracticable to substitute for it another lock, it proved too much for the ingenuity of the mechanics who were solicited to mend it. "*It can't be done*," was the unanimous verdict. In each case, we delicately suggested a method whereby the repairs could, we thought, be easily effected, and in each case we were met with an impatient assertion that the suggestion could not be put into practice. At the fourth shop we lost patience and offered, with the aid of a few simple tools, to convince our mechanical bigot that "some things could be done as well as others." It took us about a quarter of an hour to prove our position correct, and put the lock into good working order. We silenced this bigot, but did not reform him. The next time he is asked to do something out of the usual way, he will be just as pigheaded as before.

We once had a similar experience with a pattern maker, who declared patterns could not be made to cast a certain article, which could be drawn from the sand; yet that same impossible feat was accomplished by the bigot himself, finally induced, by some stinging remarks, to get out of his rut.

This sort of wilful blindness, is quite a different thing from that intelligent conservatism that, after carefully examining new things, refuses to adopt them, because they are no improvement on those already in use. Heaven only knows what the world would come to, were there not such a thing as intelligent conservatism. But the latter never says things are impossible; it simply says of that which it rejects, "it is unprofitable or impolitic." It places a wholesome restraint on that class of mind which believes that everything new must be useful, and is always eager to embrace that which has the charm of novelty. It calmly sifts the chaff from the wheat, and gives the former to the winds, whether it be old or new, while the wheat is saved; if old, valued neither less nor more than the new, on that account. Whatever is valuable is retained on account of its value, not on account of its ancient prestige, nor the brilliant *debût* it may have made into the world of letters, science or art.

The bigot, on the contrary, refuses to examine, and prejudges everything which has not the stamp of custom to commend it. To merit his disapproval, any proposition or process needs only to be different from that to which he is accustomed. He refuses to acknowledge proof, and turns himself away from attempted demonstration. He does not see, because he does not want to see, and hence his blindness is total.

We find plenty of just such bigots among mechanics and engineers, although the tendency of these occupations is to correct such a state of mind; but prejudice is so strong, and reasoning so difficult, that the world will probably never be rid of those who prefer to shut their eyes, rather than hurt them by looking at the light.

IMPORTANT IMPROVEMENT IN GLASS AND PLATE ENGRAVING.

We have heretofore chronicled the invention of Tilghman, who, by means of a powerful blast of steam or air, impels a jet of sand with such tremendous force against the surfaces of glass, stone, or other materials, that they are cut, engraved, or dressed, as may be desired. In fact, stone may be bored by this process.

We have now to record another improvement in an analogous direction, although the means employed are far simpler, while the results produced are very remarkable. We allude to the invention of George F. Morse, 287 West Twelfth street, New York, for which a patent has been recently granted.

The inventor provides a simple box or hopper, from which depends a small tube about eight feet long. No machinery whatever is used. A mixture of corundum and emery, in the form of powder, is placed in the hopper and allowed to descend through the tube. The article to be engraved, which may be a silver cup, a watch case, a sheet of glass, a goblet, or other object, is held under the extremity of the tube, so that the engraving powder will fall upon it, and in a few minutes' time the most splendid ornamental designs are cut, with marvelous exactitude and surprising beauty. We have seen engraved effects, produced by this process, upon glass and silver ware, that altogether surpass anything that has ever been attempted by the most skilled hand labor.

As fast as the supply of the engraving powder runs down through the tube, it is replaced in the hopper; and girls may do all the work. That portion of the surface of the articles that is not to be engraved, is protected by paper or other substance. The engraving, therefore, is done by cutting out the desired pattern in paper, which is then applied to the surface of the article. The powder only acts between the interstices of the pattern.

This simple and beautiful invention promises to revolutionize the art of plate and glass engraving. By its use the adornment of all kinds of wares, in the most superb manner, may be quickly accomplished, at a tithe of the cost of the ordinary methods. The invention is now in successful practical operation in this city.

SCIENCE RECORD FOR 1872.

We have in press, to be issued January 1st, a new and valuable book of 350 pages octavo, entitled as above, which, we think, will be read everywhere with interest. It will be a compendium of scientific progress of the present year, and is to be profusely illustrated with steel plate and wood engravings.

The following is a partial outline of the general contents of the *Science Record:*

Notices and descriptions of the leading discoveries and improvements invented or introduced during the present year, pertaining to Engineering, Mechanics, Chemistry, Philosophy, Natural History, Agriculture, Architecture, Domestic Economy, and the various Arts and Sciences, with many engravings.

Biographical notices of prominent men of science, with portraits.

Descriptions of the most important public works, began or completed during the year, with illustrations.

Notes of the progress and extension of railways, telegraphs, and other means of communication.

Descriptions of the new applications of steam, electricity, and other motive powers, with engravings.

Almanac for the year, and a chronological table of notable scientific events and phenomena.

Reports of Patent Office proceedings. Classification of inventions at the Patent Office, with the names of all examiners, officials and employees.

Portrait and biographical sketch of the Hon. M. D. Leggett, Commissioner of Patents.

Description of that great engineering work, the Mount Cenis Tunnel through the Alps, with engravings of the tunneling machinery, portraits of the chief engineers of the work, and other illustrations.

Description of the great Government works at Hell Gate, New York, with many illustrations, showing the wonderful galleries now being cut in the rocks under the bed of the East River, preparatory to removal of these obstructions by explosion, the drilling machinery, the electric apparatus, and other interesting objects.

Description of the great Suspension Bridge between New York and Brooklyn, now in process of erection, with interesting engravings.

Steel plate engravings of the celebrated Gatling Gun or Mitrailleur, showing its construction and use in various forms, upon wheels, horseback, camels, boats, etc.

Illustrations of recent improvements in cannon, fire arms, etc.

Recent applications of science to the construction of steam and sailing vessels, with illustrations.

Reports of the important law trials, and decisions pertaining to inventions and scientific matters.

Proceedings of scientific bodies, with notes of interesting papers.

Illustrations of late improvements in all the leading bepartments of mechanics and science.

Useful tables and practical recipes pertaining to the principal branches of industry.

The whole forming a convenient and popular SCIENCE RECORD of the present year, of permanent value and importance necessary for reference and interesting to everybody. It should have a place in every library.

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University of the City of New York---Free Lectures.

We have received the prospectus of a course of lectures, to be delivered in the University Chapel, Washington Square, New York city. The admission to the lectures is free, and the reputation of the distinguished lecturers should attract a full attendance. The following gentlemen will lecture as follows.

December 14th. Professor John W. Draper, M.D., LL.D., on Spectrum Analysis.

December 21st. Professor George W. Coakley, LL.D, on The Physical Constitution of the Sun.

January 4th., 1872. Professor Benjamin N. Martin, D.D., L. H.D., on The Natural Theology of the Doctrine of the Forces.

January 11th. Professor Henry Draper, M.D., on Respiration.

January 18th. Professor Henry Draper, M.D., on Respiration. (Continued.)

February 1st. Professor George W. Coakley, LL.D., on Comets.

February 8th. Professor E. H. Gillett, D.D., on The Future of Society.

February 15th. Professor Henry M. Baird, Ph. D., on Homer and his English Translators.

February 29th. Professor Charles Carroll, A.M., on Robert Browning.

March 7th. Professor E. A. Johnson, LL. D., on The Industries of the Romans.

March 14th. Professor F. D. Weisse, M.D., on Sensation and Thought, (illustrated.)

March 21st. Professor John J. Stevenson, Ph. D., on American Geology.

March 28th. Professor T. Addison Richards, N.A., on The History and Criticism of Art.

April 4th. Whitelaw Reid, Esq., on Journalism.

THE British Museum has an anvil which, it is said, belonged to one of the Pharaohs.

SCIENTIFIC INTELLIGENCE.

DETECTING OZONE.

A Russian chemist has devised a simple method for detecting ozone. He inverts a Hoffmann eudiometer, and, after connecting the platinum wires with an induction apparatus, passes oxygen gas slowly through the tube, and afterwards through Liebig's potassa bulbs, in which is a solution of iodide of potassium and starch. The presence of ozone will presently be shown by the liberation of the iodine and the consequent blueing of the starch.

BROMIDE OF SULPHUR AND AMMONIA.

If bromine be left for some time in contact with an excess of flowers of sulphur in a well stoppered bottle, and afterwards filtered through asbestos, a liquid is obtained which is composed of 83·33 per cent of bromine and 16·77 per cent sulphur. When this compound is brought into contact with aqua ammonia, the action is so energetic that the liquid begins to boil; and presently the liberated gases burst into flame. Chlorine and sulphur afford similar reactions, and it is a question whether this phenomenon could not be used for the production of explosive mixtures and also for signals. If the action could be moderated, as is the case with chlorine, it is possible that use, in medicine and in bleaching, could be made of the compound. At any rate, it affords a beautiful lecture room experiment, if performed with due caution.

OXIDATION OF CARBON AND ARTIFICIAL PRODUCTION OF ANILINE.

At the meeting of the chemical section of the German Association for the Advancement of Science, at Rostock, on the 18th of September, 1871, the President, Professor Schulze, read a paper, on the direct oxidation of carbon by means of permanganate of potash in an alkaline solution, which excited lively debate, and was justly regarded as one of the most important chemical discoveries of the year. In addition to copious quantities of oxalic acid and of other products not yet determined, the author obtained an acid to which he has given the name of anthraconic, and which he found to closely resemble mellitic acid in its properties. The experiment was repeated with charcoal purified in a stream of chlorine gas, also by calcining cream of tartar, by the reduction of carbonic acid with phosphorus, and from graphite. All of these varieties of carbon yielded analogous results. So great was the interest manifested in the announcement, that the leading chemists adjourned to the Professor's laboratory, there to repeat the tests and to examine into the nature of the incidental products. They soon came to the conclusion that the new body was identical with mellitic acid. By treating the anthraconic acid with caustic soda, benzole was produced, which was converted into nitrobenzole in the usual manner, and from this product aniline was manufactured. We have in this way the artificial production of aniline from charcoal, and are brought nearer to an explanation, of the chemical properties of carbon and of important practical applications likely to grow out of such knowledge. It is another step in the distinguishing characteristic of modern research, namely, the synthetical method, or the building up of compounds from their constituent elements. It is easy to rend asunder and destroy, but to rebuild requires the application of the highest genius. The discovery of Professor Schulze is likely to prove of great importance, as soon as it is thoroughly understood and applied.

TO GROW LARGE CRYSTALS.

In order to grow large crystals of such substances as sugar, borax, alum, and the like, Professor Schulze recommends the use of gelatinous solutions, such as pectin and gelatin. The crystals separate, suspended in the mass, and go on growing uniformly on all sides. In this way, irregularities and distortions are avoided. The determination of the amount of gelatinous matter to be added must be the result of experiment. The chief advantage appears to be to make the liquid of such a specific gravity as will hold the crystals in suspension.

CONSUMPTION OF GAS IN LONDON, 1870.

According to official reports of the thirteen gas companies of London for the year 1870, the following were the

RECEIPTS.

	£	s.	d.
For gas	£2,045,313	0	6
Rent of meters	31,558	2	4
Sale of old materials	5,766	5	4
Products	424,952	5	11
Miscellaneous	11,649	15	11
Total	£2,519,239	10	0

EXPENSES.

	£	s.	d.
Coal	£1,004,300	9	7
Purifying materials	22,235	16	7
Wages of workmen	224,432	3	10
Repairs	185,431	6	7
Taxes	63,172	2	1
Salaries	24,808	3	0
Commission of collectors	27,035	18	9
Office expenses	17,608	19	10
Directors	22,565	14	9
Auditors	1,314	10	0
Gas pipes	127,249	8	1
Gas meters	32,874	15	11
Lawyers' fees	3,643	16	9
Miscellaneous	29,736	11	2
Total	£1,786,409	16	9

Excess of receipts over expenditures, £722,829·13·3. The active capital and loan of the thirteen companies is £8,272,816; the receipts therefore exhibit an interest of 8·86 per cent on the capital stock. The private consumption of gas was 9,122,113,853 cubic feet; for the street lamps it was 1,500,000,000 cubic feet; the total consumption of gas in London for 1870 was therefore 10,622,000,000 cubic feet, which is double the consumption of Paris. Total quantity of coal used in making gas 1,225,839 tuns, and the average cost, including cannel, was 16s. 4¼d. per tun. In New York the annual consumption of coal by three gas companies is 200,000 tuns.

PREPARATION OF SULPHUROUS ACID.

In order to prepare sulphurous acid from sulphuric acid and charcoal, it is better to employ an acid of 74 per cent, or 1·825 specific gravity. If we take a stronger acid, a part of it is entirely deoxidized to sulphur, and if weaker acid be employed, sulphuretted hydrogen is evolved. To obtain absolutely pure sulphurous acid, it is well to put sulphite of lead and coarse charcoal in the wash bottle. With these precautions, it is possible to obtain pure sulphurous acid from sulphuric acid and charcoal.

REPERTORY OF TECHNICAL LITERATURE.

Many of our readers may not be aware that a continuation of Schubarth's famous repertory of technical literature is now going through the press in Leipsic, under the editorial management of Professor Bruno Kerl. The first volume of 696 octavo pages, from A to K, is now complete, bringing down the literature to 1868. By reference to Schubarth's and Kerl's *repertorium*, it is possible to obtain a complete history of the leading papers and researches, published upon any given subject, in the technological journals of the world since 1823. The work is a dictionary of reference, and is the richest mine of information to be found in any language; and it is only possible to get up such a book in a country where the compiler has access to complete series of journals in all languages. For an inventor who wishes to make an exhaustive examination of what others have done before him, such a book of reference is indispensable; and it also follows that our libraries ought to contain all of the journals, in which the original publications first make their appearance, to which reference is made in this work.

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers, either at their residences or places of business, at $3·50 a year, through the post office by mail carriers. The newsdealers throughout this city, Brooklyn, Jersey City, and Hoboken keep the SCIENTIFIC AMERICAN on sale, and supply subscribers regularly. Many prefer to receive their papers of dealers in their neighborhood. We recommend persons to patronize the local dealers if they wish the SCIENTIFIC AMERICAN or any other paper or magazine.

TIMELY SUGGESTIONS.

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It is the intention of the publishers of the SCIENTIFIC AMERICAN to make the paper next year better and handsomer than any previous year during the last quarter century it has been published.

It is the intention of the publishers to illustrate, by superb engravings, all new and practical inventions and discoveries that may be developed during the year.

For Prospectus and terms to Clubs see last page.

Examples for the Ladies.

Mrs. E. J. Stout, Elkader, Iowa, besides doing all the housework for a amily of four persons, made last year, with a Wheeler & Wilson Machine, one hundred and fifty fashionable dresses, hemmed over 2900 yards of biased ruffling, and made quite a number of under-garments. This is about her average work a year in all kinds of general sewing for seven years, with no repairs to her machine.

Barnett's Cocoaine is not greasy or sticky. As a hair dressing, it stands peerless and alone.

NEW BOOKS AND PUBLICATIONS.

A Compendious Grammar of the Greek Language. By Alpheus Crosby, Professor Emeritus of the Greek Language and Literature in Dartmouth College. Woolworth, Ainsworth & Co., 51, 53, and 55 John Street, New York; 111 State Street, Chicago.

This is an abridgement of the well known and long highly appreciated Greek Grammar by the same author, which has now reached its forty-fourth edition. The abridgement is, however, a sufficient *vade mecum* for the student in his progress through school and college. The intention has been to compress, as much as possible, the larger work, to form a portable simple grammar for the beginner, yet sufficiently comprehensive to accompany him throughout a whole course of Greek study as ordinarily pursued.

Magnetism and Electricity. By William Allen Miller, M.D., LL.D., Professor of Chemistry in King's College, London, etc. Corrected from the Fourth London Edition. New York: John Wiley & Son, 15 Astor Place.

This work is identical with the portion of Miller's excellent work on Chemical Physics," from page 313 onward to the end of the book. Some tables, scarcely germane to the subject matter of the reprint, are added. The book forms a good manual of magnetism and electricity up to the date (1864) of the third edition of "Miller's Chemical Physics."

Æsthetics, or the Science of Beauty. By John Bascom, Professor in Williams College. New York and Chicago: Woolworth, Ainsworth & Co.

The pressure, upon our time, of other duties has precluded such a perusal of this work as a fair criticism demands. A cursory examination, however, leads us to pronounce it a very useful and entertaining volume. We discern, however, that the author does not abstract the conception of beauty from the conventionalities, religious belief, and even superstitions of mankind, since, in establishing his standards of beauty in literature and art, he defers to all these, deprecating that which violates the "proprieties" of society as below the true standard. Now, we respectfully suggest this is not a "science of beauty," as the author styles it in his preface, but a dissertation thereon, having reference, at least in part, to the moral and religious effect of certain things which, scientifically judged, are beautiful in the extreme, but which our author denounces as inconsistent with a taste for the beautiful, because, to the prurient mind, they suggest immoral ideas. To such an argument as this, the most fitting reply is that art "labors not for prurient minds."

Speeches, Addresses, and Letters on Industrial and Financial Questions, to which is added an Introduction, together with Copious Notes and an Index. By William D. Kelley, M. C. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, $3.00.

To review this book adequately would require a column of our paper. It is a large octavo, filled with the views of a strong protective tariff advocate on questions, as its title indicates, intimately connected with production and labor. Such a book cannot fail to be interesting and profitable reading, when it is, as in the present case, the work of a strong mind devoted to the consideration of such topics through a life of public service. The social questions hinging upon the solution of the labor question are various and important. The book deserves, and will secure, a large sale, though many will doubtless take issue with the author in some of his views. But such a book, whether it agrees or disagrees with opinions already formed, arouses public attention to vitally important questions, the discussion and settlement of which cannot be delayed without danger. In this way the work before us will do good, and we cordially commend it to our readers.

First Help in Accidents and Sickness. A Guide in the Absence, or Before the Arrival of Medical Assistance. Published with the Recommendation of the Highest Medical Authority. Boston: Alexander Moore.

This appears to be a safe and comprehensive manual for the purpose set orth in its title.

The American Journal of Microscopy, which was among the journals burned out in the recent Chicago fire, will hereafter be published at Racine, Wisconsin. By those interested in microscopic science, this publication will be cordially welcomed on its reappearance. Mr. George Mead is the editor and publisher. An advertisement appears on another page.

APPLICATIONS FOR EXTENSION OF PATENTS.

Machine for Forming Sheet Metal Pans.—E. A. Smead, Corning, N. Y., has petitioned for an extension of the above patent. Day of hearing, February 14, 1872.

Harvester.—Joseph B. Butterfield, Philadelphia, Pa., administrator of Jesse S. Butterfield, deceased, has petitioned for an extension of the above patent. Day of hearing, February 14, 1872.

Machine for Packing Flour.—J. Mattison, Oswego, N. Y., has petitioned for an extension of the above patent. Day of hearing, Feb. 21, 1872.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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Inventions Patented in England by Americans.

From November 9 to November 11, 1871, inclusive.
[Compiled from the Commissioners of Patents' Journal.]

Canal Boat.—W. F. Goodwin, Metuchen, N. J.
Heating Bolt Rods.—G. C. Bell, Buffalo, N. Y.
Utilization of Tin Pickle.—G. Lander, New York city.
Water Meter.—G. W. Copeland, Malden, Mass.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured n foreign countries by Americans are obtained through our Agency. Address Munn & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Francis Schleicher, Consulting, Analytical and Man'fg Chemist. Laboratory, Newark St., bet. Jackson and Harrison St., Box 172, Hoboken.

Information wanted of where could be purchased, by the quantity, L. A. M. Pascol's patent Burglar Alarm—patentee, George W. Biglow, New Haven, Conn. Please address M. K., Box 313, Shreveport.

I will send, to any address, a plan and specification of my improvements in setting Steam Boilers, together with a shop license, for $25. Address, for particulars O. Ranney, Corry, Pa., Box 264.

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Taft's Portable Hot Air Vapor and Shower Bathing Apparatus Address Portable Bath Co., Sag Harbor, N.Y. Send for Circular.

Shoe Peg Machinery. Address A. Gauntt, Chagrin Fall, Ohio

Builder's Scaffold—Patent for Sale—For further particulars, address Redick & Kunkle, Butler, O.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Turkey Boxwood pieces for Sale, suitable for engravers and fancy turners' use. Address Stephens & Co., Riverton, Conn.

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Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

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Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

Railway Turn Tables—Greenleaf's Patent. Drawings sent on application. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. For circulars, address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

C. L., of Pa.—We cannot detect any silver in the mineral you send.

Prevention of Fermentation.—Cider can be prevented from becoming fermented by passing ozone through it.—C. F. D.

Incrustation in Boilers.—E. S. F. should put clean oyster shells in his boiler. These will keep it clean by attracting all the particles of carbonate of lime.—F. W. A. S., of Cal.

Canker in the Mouth.—In answer to F. S. C., November 18th, I will say: Take a piece of common blue vitriol, and either make a wash by diluting in water, or simply rub the vitriol over the affected part, taking care not to swallow any of the vitriol. I have used it a great many many times, and never knew it to fail.—J. C. C., of N. J.

S. H., of ——.—A perpetual motion, in the sense in which the term is used in mechanics, must supply its own power.

H. A. S., of N. Y.—A siphon cannot conduct water over a hight greater than that to which water can be raised by the pressure of the air at the point where the siphon is placed, less the hight of a column whose pressure would overcome the friction of the water in the short leg of the tube. It is atmospheric pressure alone that causes the water to rise in the short leg of the siphon. Your query relative to the motion of a rolling wheel has been repeatedly answered in this column.

W. M., of Pa.—The pressure of the atmosphere is all that raises water in an atmospheric pump. Such pumps are called suction pumps only by those unfamiliar with hydraulics.

Worms in Hickory.—Cut the hickory at a time when the bark will peel off. That is generally from June to September. We, in the West, find this to be the right time.—G., of O.

Squeaking Boots.—In your issue of November 25, I noticed a remedy for squeaking boots, namely, to saturate the soles with kerosene oil. A much pleasanter way is to have your boots made to order, and, between each layer of leather in the sole, have apiece of oiled silk inserted. This is a sure preventive. Let Jones try it.—G. L. F., of N. Y.

Cutting Bevels.—In reply to C. H. S.: The surest, quickest, and best way to cut a bevel is to cut it in a box. To cut a miter on beveled work, place it in a miter box, giving it the same bevel in the box that it is to have in the work, and cut it with a saw, in the manner of cutting any other miter.—C. T., of Vt.

Increasing Power.—In answer to E. K., Nov. 4, I would like to say, it will be a disadvantage to put a fly wheel on his saw arbor. If his saw runs at a high speed, as it ought to, it will take a certain amount of power to run the fly wheel; this is always a dead loss. In sawing short work, it might serve to equalize the speed, but no one can gain power by its use.—F. C.S., of Conn.

Blast for Waste Shaft.—J. H. B., of Ohio, writes: "I am producing an exhaust or suction in pipes with a blast from a fan, which draws up and discharges, with great force, dust, shavings, sticks, blocks, shelled corn, and all kinds of grain. This I do without anything going through the fan or blower. But, sir, do you know of anything in use that does this?" Answer—Machines for removing sawdust and small rubbish from shops have been constructed on this principle.

Laying out Hoppers, etc.—C. H. S. asks for a rule for laying out the miter of hoppers, wagon seats, etc. I give the following simple and accurate rule: Bevel the top or bottom edge of the sides of the hopper to the same angle that the sides stand at; then lay a bevel set at a true miter on the beveled edge, and that will lay off the joint. When the sides stand at different angles, bevel the edge of each side to correspond with the angle of that side. If the corners are to be a square joint, lay a T square on the beveled edge instead of a true miter.—G. S. N.

Setting Saw.—A circular saw that is filed and set right for splitting is not right for cross cutting, and *vice versa*. If J. H. M. wants a saw for doing both kinds of work, let him file the front edge of the teeth in a line with the center of the saw, giving the teeth a slight bevel top and front. In setting the saw, use a hammer, holding a piece of iron against the saw on the opposite side. Do not set the teeth at the points, but as near the base as possible. I think this will give him a saw that will cut smoothly, and as near right for both kinds of work as he can get.—F. C. S., of Conn.

Spring in Shafting.—Answer to query 5, No. 22, current volume. Ten years since, our factory, in the basement of which was shafting of cast iron, from three to four inches diameter, in sections about ten feet long, was burned down. These were entire, but crooked as snakes, six to ten inches out of line. When we rebuilt, they were utilized, by being heated (by wood fires, made on the ground) to a red heat at the point to be straightened. At those points a steady pressure was applied; the shafts were forced into line, fitted, and are now in use, "as good as new."—R. L. B.

Exterminating Rats.—In your paper No. 14, Sept. 30, 1871, query 21, T. C. H. wishes to know some means of expelling rats from a building. Let him catch, by any ordinary trap, three rats, put them in a cage constructed of wire, in any place which is plagued by this animal, and give them no food whatever. On the third day he will find only two rats, one being eaten up by the two others, and on the sixth day, only a single rat in the cage. Let him give the survivor his liberty on the seventh day, and he will be, in the course of one week, rid of all the rats, except the one monster which ate up his two brothers, and which he may feed for sympathy's sake. This mode was adopted with great success in a building in the former Thiergarten, at Vienna, where all other means to expel these animals were useless.—L. S., of Vienna, Austria.

L. B. S., of Mass.—The compound engine is an engine having two cylinders, one a high pressure and the other a low pressure. In the high pressure cylinder the steam is used non-expansively, and it exhausts from this cylinder into the low pressure cylinder, where it is expanded as much as practicable, and then exhausted into a condenser. The method admits of more convenient application in marine engines, where, to obtain the same amount of expansion, a long cylinder would be needed. With the general adoption of surface condensers, marine boilers are not now liable to scale, and they carry a much higher pressure of steam than formerly, rendering the expansion of steam much more important than was the case when low pressures were the rule. For details of construction of various engines, made on the compound principle, you will find it necessary to read such works and publications as make marine engineering a specialty.

Curious Freak of Twin Steam Boilers.—Will you allow me to say, for the benefit of H. P. S., of Kansas City, Mo., that the difficulty lies only in his not having steam pipes large enough to allow the steam to pass freely from one boiler to the other, so as to equalize the pressure, attendant upon a larger amount of steam being generated in one boiler than the other and *vice versa*? No one can keep a fire perfectly regular, and therefore boilers set in the manner he states should be connected by a pipe of ample size to allow the pressure to equalize itself; when that is done there will be no trouble. The only curious freak about the boilers lies in the use of so small a pipe to connect them at the top. A six inch pipe wuold answer the purpose very well; then, if he chooses to use a two inch one to lead from that to the engine, good; but a four inch one would be better, as the friction of the steam in the pipe would be sufficiently less to compensate for the loss of heat by radiation, etc., by the saving in fuel, if it costs as much as it does generally. A quarter of a pound friction in a pipe amounts to considerable in time, as it is constant; for instance, a cent per minute for ten hours will amount to six dollars. The greatest trouble with engineers in general is that they overlook these seemingly trifling matters for the sake of saving in cost; while, if they were attended to, a vast amount of money might be saved.—A. L., of Mass.

CUTTING BEVELS.—C. H. S. asks for a rule for mitering bevels or "flaring boxes." I submit two methods, original as far as I know. 1st. Draw a rectangular parallelogram, the shortest side corresponding with the thickness of the board to be mitered, the other side with a line cutting the board horizontally when set at the required flare. Draw the diagonal line and the angle formed by the diagonal, and the shortest side is the required miter. If different sides of the box or seat flare unequally, each side must be treated by the same rule separately. 2d. Add half as many degrees to the miter angle (forty-five degrees) as the side of the box deflects from the perpendicular. For instance, if the side of the box flares at an angle of forty-five degrees, an angle of sixty-seven and a half degrees will miter the corner.—J. S. O., of N. J.

CASE HARDENING.—If E. N. G. will make a paste of prussiate of potash, and cover his screws and nuts with it, and then heat until red hot, he will have them case hardened. Any quantity can be heated at a time provided he has a furnace large enough.—E. O. McC., of S. C.

Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—LIQUID GLUE.—M. M., Havana, Cuba, asks:—Can any of your correspondents inform me through your scientific paper, how to prepare a good liquid glue for banks, commercial offices and general use?

2.—MARKING FLUID.—Will some of your many readers inform me how to make a good marking fluid, for marking boxes, barrels, etc?—R. W. R.

3.—VENTILATING ICE HOUSES.—Can any of your correspondents tell me the best way to ventilate ice houses?—J. M. D.

4.—BINIODIDE OF MERCURY IN SOLUTION.—I often have prescriptions calling for bichloride of mercury with potass iodide, combining which I have the biniodide of mercury (Hg I 2) as a precipitate. I wish to inquire through your columns how to retain the salts in solution.—H. G. I.

5.—SOLDERING CAST IRON.—Will you inform us what preparation has been most successfully used for putting solder on to cast iron?—G. D. & S.

6.—DECAY OF INDIA RUBBER BANDS.—Is there any manner of rendering elastic rubber bands proof against decay? Those now in use in business houses are useless after a year or two.—W. H. S.

7.—DEOXIDISING ZINC.—Can any one inform me of any method by which I can restore oxidized zinc or spelter? I use it in a liquid state, but have a great deal of waste by over heating.—G. A.

8.—FIREPROOFING TIMBER.—Can any one inform us of any wash that can be applied to wood to make it fireproof? We have a building of easily fired timber, and would like to avert the danger.—K. K. & W.

9.—COMPOUND GEARING ON SCREW CUTTING LATHE.—I wish a simple and reliable rule for compounding gearing on screw cutting lathes, the traverse screw having four threads to the inch.—R. F. S.

10.—BATTERY POWER.—How many cups of Daniell's battery would be required to work a telegraph line 650 feet long with common sounders at each end? The wire is copper, No. 16.—E. M. D.

11.—SALT AND ICE.—Why is salt mixed with ice to freeze ice cream, while, in winter, we put salt in our pumps to keep them from freezing?—M. A.

12.—CARBON BATTERY PLATES.—I wish to know how to make carbon battery plates for voltaic batteries.—A. N.

13.—DRESSING FOR SHOES.—Can any one give me a receipt for making the best dressing for ladies' and children's shoes, waterproof, and that will not injure the leather?—M. L. K.

14.—FREEZING OF MORTAR.—Does lime mortar undergo any chemical change by freezing when in a soft state? I am informed that it is customary, upon the continent of Europe and in England, for all lime mortar which is to be used in the masonry of buildings of importance to be made up months, or perhaps longer, before it is used. Is it ever allowed to freeze, or does it injure the setting of it, or the durability after it has set, by freezing in a mass when wet?—H. D. C.

15.—RESULTANT POWER.—Does the resultant equal the power applied, in that class of machinery where the power is applied at the axle (as in reapers), no account being taken of friction or the power required to draw the weight of the machine? If any power is lost, how can it be accounted for, or, in other words, what becomes of it?—C. A. B. of Ill.

16.—LAND AND SEA BREEZES.—I would like to inquire what causes the wind to moderate at sun setting, and then a breeze to get up after dark? I have often noticed the same at sea, and on land in heavy gales.—B. R., Jr.

17.—JEWELLER'S LAP.—Can any one give me directions for making a lap, such as is used generally by jewellers in polishing? I want to know what the different kinds of metals are, and their proportions, so that I may cast one.—O. B. F.

18.—REVOLUTION OF BODIES.—The following question has given rise to a good deal of discussion in this place, and both parties have agreed to leave the matter for your readers to decide: A man starts to go around a squirrel that is on the trunk of a tree, and, as the man goes round, the squirrel travels around the tree, and remains in the same position to the man until both arrive at the point whence they started. Does the man go round the squirrel?—R. O. H.

19.—HYGROMETER.—I wish to know what to do with my hygrometer, that is, the wet bulb thermometer, when it is so cold that water freezes, so that I can find the relative humidity of the air? Is there an instrument made called a hygrodeik?—T. M., Jr.

20.—ANNEALING LAMP CHIMNEY.—Every person who has used a "German Study Lamp" one season, knows that the glass chimneys of the kerosene lamps in common use are an imposition on the public. Can any of your readers give a simple process to anneal or temper them, so that they, with judicious care and careful usage, will not be broken by the heat of its burning wick?—R. L. B.

21.—MARKING INK.—How can I make a good marking ink, suitable for marking boxes and barrels, etc?—T. L. S.

22.—RESTORING BUFFALO ROBES.—What can be applied to buffalo robes to make them soft and pliable after having been wet?—T. L. S.

23.—SOFTENING LEAD.—Will some one please give me, through your paper, a receipt for softening lead, that has become hard by repeated melting and using?—C. W. L.

24.—BRONZING.—Can any one give me some information about bronzing? And where can I obtain a work on bronzing, and which is the best work to get?—C. R.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

CUTTING AND ASSORTING PLAYING CARDS AND STRIPS.—Victor E. Mauger, of New York city.—This invention has for its object to produce simple and effective means for assorting—that is to say, putting upon one another in regular order—the several strips or pieces cut from strips. The invention is to be more particularly applicable in the manufacture of playing cards, but may also be advantageously used for other work. Playing cards are by rotary knives, cut from large sheets, each sheet containing about thirty or more cards. Every sheet is first printed, and then, by parallel incisions cut into strips, each strip being subsequently cut up into as many cards as it contains. When thus cut rapidly, the cards of several sheets are apt to become mixed, and those of each sheet are liable to be indiscriminately arranged, making it difficult and laborious to assort them into "packs;" but by this invention the cards of each sheet are regularly arranged and placed one upon another in desired succession, so that the entire labor of subsequent assorting is dispensed with. The invention consists chiefly in the use of a graduated plate, upon which the strips cut from sheets or the cards cut from strips are deposited, and in the use thereon of a sliding carriage or belt, which conveys each higher strip or card to the one next below it and places it on top, so that finally all pieces will be one above another in regular succession. The invention also consists in the combination, with the graduated plate, of guide chutes, which convey the several pieces, respectively, to the several steps of the plate.

WATCH ESCAPEMENT.—Don J. Mozart, of New York city.—The ordinary escapement has a projecting pin or ruby on the staff, which receives an impulse from the double pronged anchor alternately in opposite directions. The impulse for either movement is given when the ruby pin is in one—the central—position, and exerts its influence to the very end of its extent—or, in other words, until the power of the hair spring exceeds that of the impulse. The hair spring will then, in attempting to adjust itself, carry the staff back until the ruby pin is again in the central position, where it receives an impulse in the opposite direction, and so forth, every stroke using the entire force of the impulse as against that of the hair spring. This arrangement although satisfactory in a limited degree, is nevertheless unreliable as to exactness, since too much reliance is placed upon the slender hair spring, whose slight power varies under the least change of temperature and atmosphere. The division of the movements of the second hand, which is, more than any other part of the watch, dependent upon the exactitude of escapement, becomes difficult by the use of the old mechanism, and has, whenever effected, added greatly to the complication and expense of the watch. By a double regulating and impelling mechanism the inventor is enabled to give the impulse at the end of each swing of the balance wheel between certain definite limits. A beautiful precision is thus produced by simple means, and the subdivision of the second movement made easy by the mere application of detent arms to the arbor.

BORING MACHINE.—Frank S. Allen and Charles F. Ritchel, of New York city.—This improved boring machine is designed more especially for use in boring holes upon a flare and at different inclinations, and is so constructed and arranged that all the holes, whatever or however different their inclination, may be bored at the same time and at one operation; and it consists in the construction and combination of various parts, which can not well be described in such a notice as the present, but which constitute a very ingenious invention.

KEY FOR SEWING MACHINE LOCK.—Edward L. Gaylord, of Bridgeport, Conn.—This invention has for its object to furnish an improved key for locks to be attached to sewing machine covers and other articles that are turned up or over so that the key is liable to fall out and be lost, and which shall be so constructed as to retain its place in the key hole however much the article to which the lock is attached may be turned up. The key is made in two parts, secured to each other at the handle end by rivets. The forward ends of the parts or pieces of the key are made square, and are beveled or slightly bent inward at their extreme ends, to enable them to be conveniently inserted in the square key hole of the lock. The parts of the key are made elastic and their forward parts are set out, so as to be pressed inward or toward each other when the key is pressed into the key hole, where the key will be retained by the elasticity of said parts.

ASH PANS FOR STEAM BOILERS.—John Gates, of Portland, Oregon.—This invention consists in certain improvements in connection with the ash pans of steam boilers. A surrounding pan, within which the ash pan is placed, is so adjusted that a water space will be formed between the two. Stays of proper strength are interposed for holding them the requisite distance apart and supporting the ash pan. A water supply leads to the water space. An adjusted pipe extending from the side of the outer pan is bent upward, and its upper end is bent down to discharge water into a funnel held on a discharge pipe. The water entering the space through the supply pipe circulates around the ash pan and escapes through the discharge pipe. The engineer can, at the end of the latter, always observe whether the circulation of water is interrupted or not. Air is admitted to the ash pan in front through an opening. A hinged door or damper is applied to the front of the boiler for the purpose of more or less closing the opening, and thereby regulating the draught. A rope or chain is connected with the damper, and extends thence to the engineer's room, passing over friction rollers. Its other end is, or may be, weighted to balance the door in any desired position, or is otherwise secured or connected in such manner that the engineer can readily control the position of the damper, and increase, reduce, or extinguish the fire.

ROCK DRILLING APPARATUS.—Lycurgus Nelson, of Smyrna, Tenn.—This invention has for its object to so combine the necessary shafts and devices of a power drill that either of the processes of drilling, extracting tools, and sand pumping may be carried on without much preparation or difficult change or gearing. The arrangement consists in a general new arrangement of parts, which appears to be admirably adapted to the purpose intended, but the nature of which cannot be well described without engravings.

COMBINED WASHER AND BOILER.—George C. Taylor and John B. Chrisman, Port Jervis, N. Y.—This invention furnishes an improved washing machine, claimed to be very effective in operation, washing the clothes quickly, thoroughly, and without injuring them, and, at the same time, so constructed that the water may be heated and the clothes boiled in the machine. A heater is placed below the water chamber, in which the clothes are agitated by suitable mechanism, and provision is made for the circulation of the water to and from the chamber or heater through pipes.

SKATE FASTENINGS.—Edward Lawson Fenerty, Halifax, Canada.—This invention has for its object to furnish an improved skate fastening which shall be light, strong, simple, and inexpensive, and so constructed that it may be firmly secured to the boot by a single motion. When the fastenings have been adjusted to the boot, the skate is placed upon the boot sole with the rear side of the boot heel resting against the fixed jaws. A lever is then brought up to its catch. This forces a jaw back against the forward side of the boot heel, and draws the forward fastening back from a narrower to a wider part of the boot sole, so as to clamp the edges of the sole and hold it firmly.

APPARATUS FOR TESTING CANS, BARRELS, ETC.—William D. Brooks, Baltimore, Md.—In this case, an apparatus is constructed for testing cans, barrels, and other vessels, by forcing air into the same, so that, if the vessel is not perfectly tight, the condensed air therein will leak out and indicate the spot where the hole is, the fact of leakage being revealed by the backward rotation of the index of a pressure gage that is connected with the force pump.

FIRE PLACE FENDERS.—Charles C. Algeo, Pittsburgh, Pa.—This invention consists in having an inwardly projecting flange at the base of the fender with the spindle or pivot of the caster passing through said flange up to the under side of the top of the fender, where a cavity is made for the reception of the top of the spindle, and the latter is confined against falling out by a pin passing through it above the aforesaid flange. This plan is very simple in construction, and is claimed to afford a more durable arrangement than any other in use.

FLUTING SAD IRONS.—Edward A. Franklin, of Brenham, Texas.—This invention relates to a new combination of fluting and sad iron, of such kind that the upper fluting roller will serve as handle for the sad iron, there being thus no loose or separate parts required for the two functions. The body of the sad iron has a projecting stem. The lower roller hangs in a cavity which is provided in the top of the iron, while the projecting axle of the upper roller is fitted through a hole in the stem which thus constitutes the support for said roller. The operating crank is screwed to a left-handed thread of the axle of the lower roller, and will thus, when used for fluting, so turn the rollers that they take the cloth from the operator when the crank is turned When not used for fluting, the crank is unscrewed and the roller transferred to the upper part of the stem where there is a hole for the reception of the axle. After the crank is re-applied, the roller is in position to constitute the handle of the sad iron.

LIFTING JACKS.—Walter S. Burgin, of Washington, Vt.—This invention relates to a new arrangement of parts constituting a lifting mechanism for a wagon jack. The case or main frame of the jack is made in form of a rectangular narrow box, standing on a stout base or board, and open on top for the reception of a lifting slide. The slide has its upper edge made in the form of steps, to be originally applicable to articles of different hights. The lower end of the slide rests, with a small rounded point which is formed on it, upon a lever pivoted to the case. The free end of the lever projects through a slot in the case, and is, by a link, connected with the short arm of a lever handle, which is pivoted to ears projecting from the side of the case. By swinging the handle down, the lever will be swung up and the slide elevated, the connecting hinge or pivot between the link and handle being carried beyond the line drawn through the lower hinge or pivot of the link and the pivot of the handle, so as thereby to lock the parts and prevent the weight on the slide from crowding it down. By swinging the handle up the slide will be let down. The combined leverage gives great power and facilitates the raising of heavy weights.

SASH HOLDERS.—Charles T. Tessier, of New York city.—This invention consists of a T headed lever, a sliding locking bolt with a retracting spring, a flexible locking roller, and a shifting inclined plate in connection with said roller, all arranged in a case adapted to be applied to the stile of the sash, and to lock the sash by the bolt, and free it from the flexible roller by a down movement of the lever, the bolt being employed for locking the sash when down. By an upward movement of the lever the bolt is freed so as to be withdrawn by its spring, and the shifting inclined plate behind the flexible roller is actuated to press the roller against the window frame, so that it will jam between said plate and frame to hold the sash up.

STONE CRUSHER.—Peter Wood, Jersey City, N. J.—This is a powerful machine, the principle of which may be briefly described as follows: A fly wheel shaft receives power from a belt, and, through a crank of short radius and a stout pitman, actuates a powerful lever, which, through a bar, applies the force thus multiplied to toggle levers which actuate a pivoted jaw which, moving to and from a fixed jaw, crushes the stones as they are fed in between the jaws.

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121,447.—CUTTER.—E. Benjamin, Chicago, Ill.
121,448.—FENCE.—C. E. Brown, Pamelia, N. Y.
121,449.—MOLD.—G. Carnell, Philadelphia, Pa.
121,450.—BRICK MACHINE.—J. Cooke, Muncy, Pa.
121,451.—STEAM ENGINE.—C. P. Deane, Springfield, Mass.
121,452.—FASTENING.—J. C. Desumeur, C. & E. Dudin, L. Delscourt, Guise, France.
121,453.—CARRIAGE.—E. Falkingham, San Francisco, Cal.
121,454.—SAFE.—D. Fitzgerald, New York city.
121,455.—ORDNANCE.—D. Fitzgerald, New York city.
121,456.—LAMP POST.—S. W. France, Brooklyn, N.Y.
121,457.—ENGINE.—A. Goulding, Worcester, Mass.
121,458.—BRUSH, ETC.—S. G. Groff, Vogansville, Pa.
121,459.—WAGON.—A. Iske, Lancaster, Pa.
121,460.—SEWING MACHINE.—M. H. Kernaul, Berlin, Prussia
121,461.—WASHER.—C. Larrabee, Haywood, Cal.
121,462.—HUB.—J. Monk, Norwich, Conn.
121,463.—HOIST.—J. Nicholson, Monticello, Ind.
121,464.—DRAFT HOOK.—J. Nicholson, Monticello, Ind.
121,465.—EDGE PLANE.—A. J. Parker, Lynn, Mass.
121,466.—SAW MILL.—L. C. Pattee, Lebanon, N. H.
121,467.—COMPOUND.—P. Paul, Black Earth, Wis.
121,468.—TRAP.—H. Polley, San Francisco, Cal.
121,469.—BOAT.—W. E. Prall, J. D. Defrees, Washington, D.C.
121,470.—DESK, ETC.—J. S. Rankin, Minneapolis, Minn.
121,471.—DESK, ETC.—J. S. Rankin, Minneapolis, Minn.
121,472.—WATER WHEEL.—B. Redding, Kentville, Canada.
121,473.—BED BOTTOM.—R. A. Smith, East Weare, N. H.
121,474.—WATCH CASE.—C. L. Thiery, Boston, Mass.
121,475.—TINTING.—H. Vander Weyde, New York city.
121,476.—INDICATOR.—F. F. Warner, J. W. Benham, Chicago, Ill.
121,477.—SEWING MACHINE.—J. N. Wilkins, Chicago, Ill.
121,478.—PAINT.—D. R. Averill, New Centerville, N. Y.
121,479.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,480.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,481.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,482.—FORCING LIQUIDS.—J. S. Baldwin, Newark, N. J.
121,483.—PIPE HOLDER.—V. A. Bond, Cotton Gin, Tex.
121,484.—CULTIVATOR.—D. W. Bowman, Tippecanoe, Ohio.
121,485.—SAFETY PIN.—W. H. Brock, Bridgeport, Conn.
121,486.—CAR SEAT.—G. Buntin, Boston, Mass.
121,487.—FAUCET.—M. Burnett, Boston, Mass.
121,488.—SEWING MACHINE.—R. G. Bush, Jamestown, N.Y.
121,489.—EARTH CLOSET.—D. B. Collins, Richmond, Va.
121,490.—CAN HEAD.—E. T. Covell, Brooklyn, N. Y.
121,491.—PIN PACKAGE.—C. O. Crosby, Milford, Conn.

121,492.—PIN PACKAGE.—C. O. Crosby, Milford, Conn.
121,493.—STICKING PINS.—C. O. Crosby, Milford, Conn.
121,494.—CHUCK.—A. F. Cushman, H·rtford, Conn.
121,495.—EYELET.—A. Delkescamp, New York city.
121,496.—MOLD.—A. J. Derrick, Sheridan, Nev.
121,497.—BURNER.—T. B. Doane, New York city.
121,498.—KNUCKLE PROTECTOR.—G. W. Doty, Wooster, O.
121,499.—FIRE ARM.—W. H. Elliot, New York city.
121,500.—PITCHER.—C. Englebert, J. S. Von Nieda, Phila., Pa.
121,501.—BROOM.—T. R. Evans, Blacksburg, Va.
121,502.—TOY.—J. Fallows, Philadelphia, Pa.
121,503.—SAFE.—D. Fitzgerald, New York city.
121,504.—DESK.—D. Fitzgerald, New York city.
121,505.—FINISHING SILK.—C. L. Frink, Vernon, Conn.
121,506.—STOVE.—J. H. Goodfellow, Troy, N. Y.
121,507.—DOOR SPRING.—W. M. Gray, Brooklyn, N. Y.
121,508.—DOOR SPRING.—W. M. Gray, Brooklyn, N. Y.
121,509.—SUSPENDER.—H. C. Griggs, Waterbury, Conn.
121,510.—GLUING TABLE.—S. P. Groocock, Clifton, N. J., W. J. Brassington, Brooklyn, N. Y.
121,511.—NAIL.—G. L. Hall, Boston, Mass.
121,512.—SWAGE TOOL.—I. S. Hamilton, Hamilton, Ohio.
121,513.—TOOL.—I. S. Hamilton, Hamilton, Ohio.
121,514.—FLUE EXPANDER.—I. S. Hamilton, Hamilton, O.
121,515.—EJECTOR.—J. T. Hancock, West Roxbury, Mass.
121,516.—HEMMER, ETC.—M. Harris, Jamestown, N. Y.
121,517.—SPINNING MACHINE.—G. H. Hathorn, Bangor, Me.
121,518.—PACKING SUGAR.—C. E. Haynes, Boston, Mass.
121,519.—WAGON SEAT.—G. G. Heermance, Claverack, N.Y.
121,520.—CUTTING WHALEBONE.—F.E.Hibbard, Boston, Mass.
121,521.—LAMP.—M. W. House, Cleveland, Ohio.
121,522.—DENTAL PLATE.—J. W., Jr., I.S.Hyatt, Albany, N.Y.
121,523.—COMPOUND.—C. L. Jones, Pedler, Va.
121,524.—PAVEMENT.—J. S. Kelly, New York city.
121,525.—FOOT POWER.—G. B. Kirkham, New York city.
121,526.—TREATING ORE.—S. R. Krom, New York city.
121,527.—AMMONIA ENGINE.—E. Lamm, New Orleans, La.
121,528.—BLINDER.—J. B. Low, Homerville, Ohio.
121,529.—BAG HOLDER, ETC.—W. F. Lum, Waterloo, Wis.
121,530.—REFRIGERATING CAR.—A.S.Lyman, New York city.
121,531.—SASH HOLDER.—W. W. Lyman, West Meriden, Ct.
121,532.—MOTOR.—J. A. Macauley, Wheeling, W. Va.
121,533.—ELEVATOR.—P. W. Mackenzie, Blauveltville, N. Y.
121,534.—COMPOUND.—N. McKelfresh, Elizabeth, Ind.
121,535.—PLOW.—T. Meikle, Louisville, Ky.
121,536.—COMPOUND.—A. Miles, Toledo, Ohio.
121,537.—SEWING MACHINE.—R. S. Morse, East Dixfield, Me.
121,538.—RAILWAY.—J. B. Newbrough, New York city.
121,539.—CAR.—J. B. Newbrough, New York city.
121,540.—CAR STARTER.—J. North, New York city.
121,541.—PLANT STAND.—B. B. Nourse, Westborough, Mass.
121,542.—VALVE.—S. J. Peet, J. W. Willis, Boston, Mass.
121,543.—DESK.—I. N. Peirce, Philadelphia, Pa.
121,544.—PAVEMENT.—R. C. Phillips, Cincinnati, Ohio.
121,545.—OIL CAN.—G. S. Prior, Boston, Mass.
121,546.—NUT LOCK.—H. L. Purdie, Buffalo, N. Y.
121,547.—NUT LOCK.—H. L. Purdie, Buffalo, N. Y.
121,548.—NUT LOCK.—H. L. Purdie, Buffalo, N. Y.
121,549.—NUT LOCK.—H. L. Purdie, Buffalo, N. Y.
121,550.—BURNER.—F. S. Robinson, Boston, Mass.
121,551.—MORTISE.—E. J. Rowe, Eureka, Cal.
121,552.—WAGON.—L. B. Snow, Cleveland, Ohio.
121,553.—CAMERA.—J. J. Stock, New York city.
121,554.—TREATING ORE —P. T. G. Stockman, Brooklyn, N.Y.
121,555.—WATER WHEEL.—J. S. Teed, Guilford, N. Y.
121,556.—BRIDGE.—J B. Tracy, Lincoln, Del.
121,557.—LUBRICATOR.—S. Ustick, Philadelphia, Pa.
121,558.—STEAMER.—C. E. Wahlgren, Galesburg, Ill.
121,559.—BUTTER WORKER.—E. L. Walker, Twin Grove, Wis.
121,560.—CHURN.—J. S. Ward, Plattsburg, Mo.
121,561.—SIGNAL.—W. H. Ward, Auburn, N. Y.
121,562.—RIVETING.—C. P. S. Wardwell, Lake Village, N.H.
121,563.—SEAT.—N. Warren, T. Underwood, Wilmington, Del.
121,564.—BLEACHING WOOL.—J. Watteau, Antwerp, Belgium.
121,565.—PULLING WOOL.—J. Watteau, Antwerp, Belgium.
121,566.—STOVE.—J. A. Weakley, Indianapolis, Ind.
121,567.—PLOW.—W. Yost, Goshen, Ohio.
121,568.—WHIP SOCKET.—F. Adams, Middlebury, Ohio.
121,569.—DRYING, ETC.—C. Alden, Newburgh, N. Y.
121,570.—SPRING.—T. H. Allen, Corry, Pa.
121,571.—WAGON BOX.—A. R. Ambrose, Chicago, Ill.
121,572.—AXLE BOX.—W. S. Auchincloss, Wilmington, Del.
121,573.—OVEN.—G. E. Bailey, Mansfield, Mass.
121,574.—AXLE.—E. Ball, Jr. Canton, O.
121,575.—LUBRICATOR.—J. Barber, Bridesburg, Pa.
121,576.—SCRAPER.—G. W. Bayly, Stuyvesant, N. Y.
121,577.—PRESERVING BEER.—F. Blucher, Mascoutah, Ill.
121,578.—BROOM HEAD.—C. Blom, Jr., J. Aling, Holland, Mich.
121,579.—TAP.—J. A. Bostwick, New York city.
121,580.—FOUNTAIN.—H. Broezel, Mauston, Wis.
121,581.—TESTING CANS, ETC.—W. D. Brooks, Baltimore, Md.
121,582.—PLOW.—J. Butler, Huff, Ind.
121,583.—SUPPORT.—H. Campbell, San Francisco, Cal.
121,584.—TICKET HOLDER.—W. J. Campbell, St. Louis, Mo.
121,585.—VIBRATOR.—C. E. Canan, Coldwater, Mich.
121,586.—PURIFYING ACID.—J. F. Cavarly, Flushing, N. Y.
121,587.—INDICATOR.—J. C. Chapman, Waltham, Mass.
121,588.—DRYER.—C. F. Chichester, Brooklyn, N. Y.
121,589.—WRINGER.—J. M. Clark, Lancaster, Pa.
121,590.—ROCK DRILL.—T. H. Coate, L. A. John, Pleasant Hill, O.
121,591.—PRESS.—E. S. Collins, Trenton, Tenn.
121,592.—CHERRY STONER.—A. M. Comstock, Galesburg, Ill.
121,593.—THILL.—H. S. Cox, Franklin, Mich.
121,594.—HAIR NET.—J. Dalton, New York city.
121,595.—BLEACHING POWDER, ETC.—H. Deacon, Widnes, Eng.
121,596.—FURNITURE.—J. M. Dennis, Galesburg, Ill.
121,597.—BEE HIVE.—A. F. Dickey, Benford's Store, Pa.
121,598.—WASHER.—O. L. Dorr, South Walpole, Mass.
121,599.—FORCEPS.—N. A. Durham, Duquoin, Ill.
121,600.—SUSPENDER.—R. H. Eddy, Boston, Mass.
121,601.—PERFORATING PAPER.—T. A. Edison, Newark, N.J.
121,602.—PRINTING TAGS.—G. H. Fayman, Washington, D.C.
121,603.—FIFTH WHEEL.—A. Finley, Bainbridge, Ind.
121,604.—CHURN.—M. Fisk, Adrian, Mich.
121,605.—RAILWAY.—D. Fitzgerald, New York city.
121,606.—CARTRIDGE.—S. Forehand, H. C. Wadsworth, Worcester, Mass.
121,607.—BUNG.—V. Fountain, Jr., New Brighton, N. Y.
121,608.—TRAP.—D. M. Francisco, Three Rivers, Mich.
121,609.—TREMOLO.—L. K. Fuller, Brattleborough, Vt.
121,610.—TREMOLO.—L. K. Fuller, Brattleborough, Vt.
121,611.—LUBRICATOR.—W. T. Garratt, San Francisco, Cal.
121,612.—GRAIN CAR.—A. E. Gordon, New Brunswick, N. J.
121,613.—CULTIVATOR.—M. L. Gorham, Rockford, Ill.
121,614.—SIGN.—W. Graham, W. Snyder, P. O'Brien, Pittsburgh, Pa.
121,615.—PAPER FOLDER.—R. R. Gubbins, West Troy, N. Y.
121,616.—BURIAL CASE.—J. Hackett, Louisville, Ky.
121,617.—COUPLING.—A. S. & H. H. Hallett, E. Abington, Mass.
121,618.—BEE HIVE.—J. N. Hieronymus, Fairbury, Ill.
121,619.—SELF OPERATING GATE.—A. N. Holmes, Tyrone, Mich.
121,620.—INDICATOR.—E. Holmes, Brooklyn, N. Y.
121,621.—HARROW.—C. Hood, Seneca Falls, N. Y.
121,622.—SEWING MACHINE.—G. M. Hopkins, Albion, Conn.
121,623.—WAGON BODY.—I. N. Hoyt, Wayland, Mich.
121,624.—TILE.—J. B. Hughes, Terre Haute, Ind.
121,625.—PARASOL.—J. L. Jacquin, New York City.
121,626.—MOTOR.—T. B. Jeffery, Chicago, Ill.
121,627.—PENCIL CASE.—E. S. Johnson, Jersey City, N. J.
121,628.—ENAMELING.—J. Johnson, Boston, Mass.
121,629.—PULVERIZER.—T. B. Jones, Hiawatha, Kan.
121,630.—GLOVE.—H. Z. & A. J. Kasson, Gloversville, N. Y.
121,631.—EXTRACT.—S. H. Kennedy, Johnstown, N. Y.
121,632.—POINTING WIRE.—R. Kent, Brooklyn, N. Y.
121,633.—CHIMNEY TOP.—T. Ketchen, New York city.
121,634.—STENCIL.—H. Kimball, Poughkeepsie, N. Y.
121,635.—CAR STARTER.—J. P. Leavitt, New York city.
121,636.—SEWING MACHINE.—I. B. Lewis, Belvidere, Ill.
121,637.—ELEVATOR.—T. J. Lovegrove, Phila., Pa.
121,638.—SEWING MACHINE.—G. W. Manson, New York city.
121,639.—VENTILATOR.—A. Marriott, St. Louis, Mo.
121,640.—PRESERVING EGGS.—W. S. Marsh, Raymond, Wis.
121,641.—STAIR ROD.—H. C. Marston, New York city.
121,642.—FITTING, ETC.—W. H. Mayer, Newark, N. J.
121,643.—TRAVELER.—G. M. McClain, Rockport, Mass.
121,644.—STIRRUP.—W. B. McClure, Alexandria, Va.
121,645.—COMPOUND.—J. McDonald, Kankakee, Ill.
121,646.—FASTENING.—T. McGrane, New York city.
121,647.—BED BOTTOM.—A. D. McMaster, Rochester, N. Y.
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REISSUES.

4,654.—CORK MACHINE.—M. F. Crocker, West Winsted, Conn. —Patent No. 13,714, dated October 30, 1855.
4,655.—GOVERNOR.—J. Judson, Rochester, N. Y.—Patent No. 33,743, dated November 19, 1861.
4,656.—DIVISION A.—REVOLVING CASTER.—C. H. Latham, J. S. Lugg, Lowell, Mass.—Patent No. 116,722, dated July 4, 1871
4,657.—DIVISION B.—REVOLVING CASTER.—C. H. Latham, J. S. Lugg, Lowell, Mass.—Patent No. 116,722, dated July 4, 1871.
4,658.—LUBRICATOR.—J. B. Wickersham, Phila., Pa.—Patent No. 70,058, dated October 22, 1867.
4,659.—MAKING CANS.—E. W. Bliss, Brooklyn, N. Y.—Patent No. 82,4?1, dated September 29, 1868.
4,660.—LAMP.—H. Halvorson, Nashua, N. H.—Patent No. 25,506, dated September 20, 1859; reissue No. 4,413, dated June 6, 1871.
4,661.—TENDER FRAME.—B. W. Healey, Providence, R. I.—Patent No. 103,878, dated June 7, 1870.
4,662.—FINISHING BELTINGS.—C. McBurney, Boston, Mass.—Patent No. 115,890, dated June 13 1871.
4,663.—NEEDLE.—C. H. Wilcox, New York city —Patent dated March 19, 1851.

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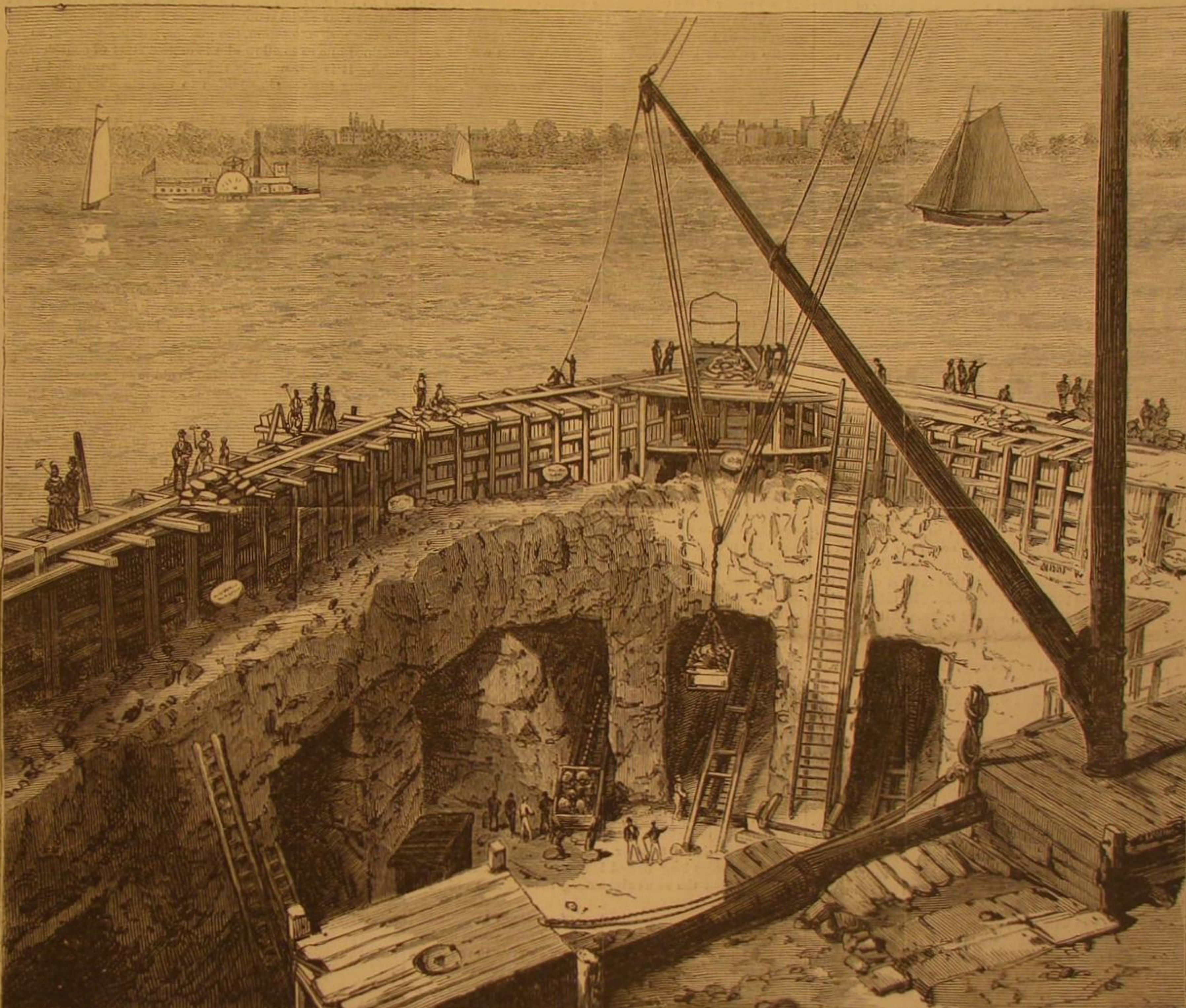
Vol. XXV.--No. 26. [NEW SERIES.] NEW YORK, DECEMBER 23, 1871. $3 per Annum. [IN ADVANCE.]



COFFER DAM, MAIN SHAFT, AND ENTRANCE TO HEADINGS, HELL GATE, EAST RIVER.

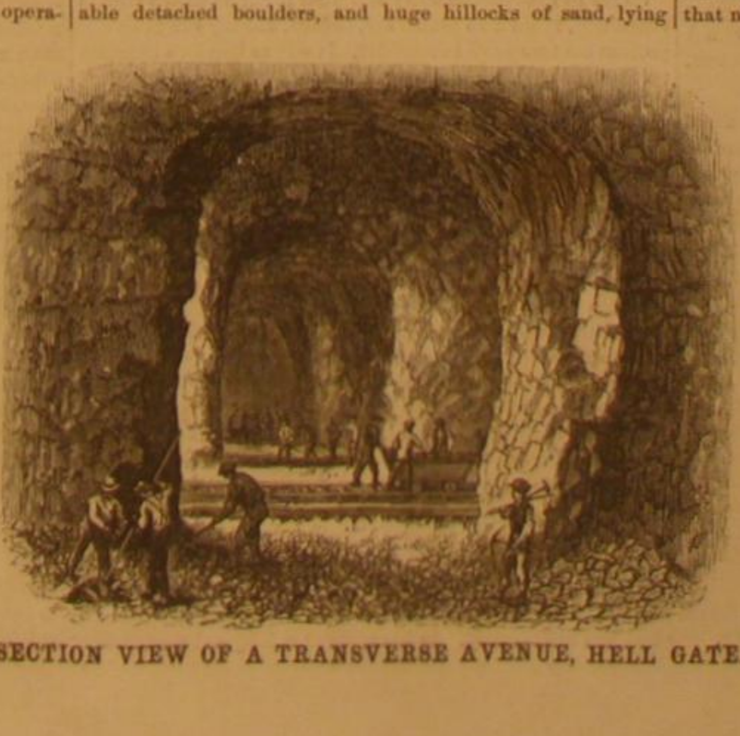
THE TUNNELING AND BLASTING OPERATIONS AT HELL GATE, EAST RIVER NEW YORK.

We give this week some engravings illustrating the operations now in progress for the removal of the obstructions at Hallett's Point, East River. Having often referred to this great work, our present notice will be rather historical and general than technical.

HISTORY OF THE WORK.

The following sketch of the origin and progress of the work is from the New York *Times:*

"Complete surveys of New York harbor have been made at different periods, as is well known, with the object of removing the obstructions to navigation, by Admirals Porter and Davis, Commodore Craven, and the present able and successful topographical engineer, General John Newton, of the United States army. In September, 1870, experimental blasts were made by General Newton, which proved to him beyond a doubt that the work he had undertaken, though a task of immense magnitude, could be accomplished, and at a comparatively trifling cost to the Government. Last May, General Newton commenced work with the steam drills on the dangerous rocks, in mid stream between Governor's Island and the Battery, known as Diamond Reef. After laboring assiduously for over five weeks, and making repeated blasts, between 700 and 800 yards square of the reef were blown away. Surveys were made of three blasts, which disclosed at the bottom of the river a mass of crushed rock, innumerable detached boulders, and huge hillocks of sand, lying around, and over which was once Diamond Reef. A contract was soon made to have the *débris* removed, a work which has almost been finished, and which has demonstrated the fact that no additional blasts will be required, and that the dreaded Diamond Reef is no more. Soon after the work of the drills upon Diamond Reef was concluded, the drill scows were securely moored over Coenties Reef, and immediately commenced operations. The number of cubic yards of rock to be removed at Coenties Reef is roughly estimated at over 3,000, and much of this has already been blasted out by General Newton's indefatigable workmen. Besides at Coenties Reef, General Newton's drills are now at work on the Shell Drake, Way's Reef, Hog's Back, Pot Rock, at the Hell Gate, or Horll Gatt as the old Dutch navigators termed it, and at Willett's Point. The operations at the Hell Gate are the most extensive, the most important, and decidedly the most interesting. The Hell Gate, as every New Yorker knows, is a narrow, rocky passage in the East River, and in the old Knickerbocker times its raging current was the terror of the Dutch skippers and their heavy and unwieldy craft. Of late years, many improvements have been effected by blasting away the surface rock, and the most salient points of the jagged ridges; but only since August, 1869, has the United States Government commenced to deal with the dangers of Hell Gate in a measure corresponding with their importance.



SECTION VIEW OF A TRANSVERSE AVENUE, HELL GATE.

The operations undertaken by General Newton at Hallett's Point, for the Hell Gate, involve the solution of an important problem of engineering as regards the most effective and economical process of submarine blasting. The *modus operandi* employed at Hallett's Point is entirely different from the manner in which the work of removing the obstructions has been accomplished at Diamond and Coenties Reefs, and is what is technically termed tunnel blasting. At Hallett's Point, in August, 1869, a coffer dam was commenced under the superintendence of General Newton, and was completed in October.

The dam is an irregular polygon in shape, having a circumference of 443 feet and a mean interior diameter of about 100 feet. The dam is built between low and high water marks. The excavation of the shaft immediately followed the construction of the dam, and during the spring of 1870 the shaft was sunk to the depth of twenty-two feet below water.

The theory of the mining operations contemplates the removal of as much rock as can be excavated with safety previous to the final explosion, the result of which will be the sinking of the remaining mass into the deep pit excavated for its reception. The mass of rock remaining for the final explosion will be supported by piers, each of which will be charged with nitro-glycerin. These piers are simply a portion of the solid rock left standing. From the bottom of the main shaft, tunnels proceed in all directions, and are ten in number. Each of the tunnels extends from 150 feet to 350 feet outward, and they are all connected together by cross-galleries at intervals of twenty-five feet. The tunnels were begun towards the close of July, 1870, the shaft being at the same time sunk to a line nearly forty feet below low water mark. The tunneling is really an object of a great deal of interest, as much from the novelty as from any other feature. The tunnels are of various cross sections, some over twenty feet in hight, and varying in width from ten to fifteen feet."

The "Improved Drill" of the American Diamond Drill Company, recently illustrated and described in the Scientific American, has been recently introduced into one of the headings, and, we are informed by General Newton, gives prospect of affording efficient aid in hastening the completion of the work, which will take probably two or three years more continuous labor. As the work advances, room is made for more miners, and therefore the rate of advance may increase with the progress of the excavation.

The liberal views of the Engineer in Chief, General Newton, are rendering this work important in another respect. He has made it a sort of engineering arena for the trial of different explosives and drilling machines; and the relative value of most of the mining appliances in market will be determined during the progress of the work. In this way, important contributions to engineering science will be made, whose value will be second only to the splendid results anticipated by the removal of the obstructions from the Hell Gate passage. These out of the way, the upper end of the island will become a scene of busy thrift, scarcely less prosperous than that which fills with unintermitting hum the lower part of the city.

The Holly System of Hydrants for Extinguishing Fires.

A correspondent, Mr. J. H. Balsley, of Dayton, Ohio, writes to inform us that the Holly system has been adopted in that city. Twenty-one miles of pipe have been laid, and the propelling power is a stationary engine, capable of producing a water pressure of 130 lbs. on the inch. A pressure of 80 lbs. on the inch will throw water 100 feet high, through 100 feet of hose, out of a one inch nozzle. With iron pipes to stand this pressure, all the connections must be equally strong, especially in buildings, as the bursting of a pipe under that pressure will flood a building in a few minutes. This apparatus will throw six or eight good fire streams when running at a safe speed. As the supply of water for domestic and manufacturing purposes is taken from these pipes, the engine must be kept always in motion to keep up a pressure sufficient for fire extinguishing purposes; in any other case, two sets of engines and pipes would be needed. The bursting of a four inch pipe will destroy the fire streams, and a large consumption for domestic or manufacturing purposes will have the same effect. The consumption of fuel in proportion to the water raised is considerable, and the expenses of the fire department, and the insurance premiums have not decreased in consequence of the introduction of this system.

The Eclipse of the Sun.—In the number of our journal for October 21, of the present year, we informed our readers of the preparations being made, at home and abroad, for obtaining accurate and detailed accounts of the solar phenomena visible during the eclipse taking place on December 11; and we are glad to be able to report that the most favorable conditions existed during the critical period, and that perfect photographs of the corona were obtained. A party of astronomers, English, French, and Italian, journeyed to the East for the purpose of observing the eclipse, the most approved instruments having been forwarded in advance; and we hear, by telegraph *viá* the Red Sea, that the desires of the party were fully satisfied, and that the settlement of several disputed facts as to the sun's composition, atmosphere, and luminosity may be looked for on the publication of the report. Mr. Norman Lockyer had charge of the expedition, Italy being represented by Signor Respighi, and France by M. Jannsen.

The Russian Grand Duke, Prince Alexis, has contributed $5000 for distribution among the poor of New York city.

NOTES ON FLYING AND FLYING MACHINES.

[From the Cornhill Magazine.]

NUMBER II.

We owe to M. de Lucy, of Paris, the results of the first actual experiments carried out in this direction. The following account of his observations (made in the years 1868, 1869) is taken from a paper by Mr. Brearey, the Honorary Secretary to the Aëronautical Society. "M. de Lucy asserts," says Mr. Brearey, "that there is an unchangeable law to which he has never found any exception, amongst the considerable number of birds and insects whose weight and measurements he has taken—namely, that the smaller and lighter the winged animal is, the greater is the comparative extent of supporting surface. Thus in comparing insects with one another—the gnat, which weighs 460 times less than the stag beetle, has 14 times greater relative surface. The lady bird, which weighs 150 times less than the stag beetle, possesses 5 times more relative surface, etc. It is the same with birds. The sparrow, which weighs about ten times less than a pigeon, has twice as much relative surface. The pigeon, which weighs about eight times less than the stork, has twice as much relative surface. The sparrow, which weighs 339 times less than the Australian crane, possesses 7 times more relative surface, etc. If we now compare the insects and the birds, the gradation will become even more striking. The gnat, for example, which weighs 97,000 times less than the pigeon, has 40 times more relative surface; it weighs 3,000,000 times less than the crane of Australia, and possesses relatively 140 times more surface than this latter, which is the heaviest bird M. de Lucy had weighed, and was that also which had the smallest amount of surface, the weight being nearly 21 lbs., and the supporting surface 137 inches per kilogramme (2 lbs. 3¼ oz.). Yet of all travelling birds the Australian cranes undertake the longest and most remote journeys, and, with the exception of the eagles, elevate themselves highest, and maintain flight the longest."

M. de Lucy does not seem to have noticed the law to which these numbers point. It is exceedingly simple, and amounts in fact merely to this, that instead of the wing surface of a flying creature being proportioned to the weight, it should be proportioned to the surface of the body (or technically, that instead of being proportioned to the cube, it should be proportioned to the square of the linear dimensions). Thus, suppose that of two flying creatures one is 7 times as tall as the other, the proportions of their bodies being similar, then the body surface of the larger will be 49 times (or 7 times 7) that of the other, and the weight 343 times (or 7 times 7 times 7) that of the other. But instead of the extent of wing surface being 343 times as great, it is but 49 times as great. In other words, relatively to its weight, the smaller will have a wing surface 7 times greater than that of the larger. How closely this agrees with what is observed in nature will be seen by the case of the sparrow as compared with the Australian crane; for M. de Lucy's experiments show that the sparrow weighs 339 times less than the Australian crane, but has a relative wing surface 7 times greater.

It follows, in fact, from M. de Lucy's experiments that, as we see in nature, birds of similar shape should have wings similarly proportioned, and not wings corresponding to the relative weight of the birds. The same remark applies to insects; and we see, in fact, that the bee, the bluebottle, and the common fly—insects not unlike in their proportions—have wings proportioned to their surface dimensions; the same holding amongst long bodied insects, like the gnat and the dragon fly, and the same also among the different orders of flying beetles.

So that, setting apart differences of muscular capacity and adaptation, a man, in order to fly, would need wings bearing the same proportion to his body as we observe in the wings of the sparrow or the pigeon. In fact, the wings commonly assigned to angels by sculptors and painters would not be so disproportioned to the requirements of flight as has been commonly supposed, if only the muscular power of the human frame were well adapted to act upon wings so placed and shaped, and there were no actual inferiority in the power of human muscles (cross section for cross section) as compared with those birds.

So far as the practicability of actual flight on man's part is concerned, these two points are, indeed, among the most important that we have to consider. It was to Borelli's remarks on these points, in his famous treatise, *De Motu Animalium*, that the opinion so long entertained respecting the impracticability of flight must be referred. He compared the relative dimensions of the breast muscles of birds with those of corresponding muscles in man, and thence argued that man's frame is altogether unadapted to the use of wings. He compared also the relative muscular energy of birds and men, that is, the power of muscles of equal size in the bird and the man; and was yet further confirmed in the opinion that man can never be a flying animal.

But although the reasoning of Borelli suffices perfectly well to show that man can never fly by attaching pinions to his arms, and flapping these in imitation (however close) of a bird's action in flying, it by no means follows that man must be unable to fly when the most powerful muscles of his body are called into action to move suitably devised pinions. M. Besnier made a step in this direction (towards the close of the last century) when he employed, in his attempts to fly, those powerful muscles of the arm which are used in supporting a weight over the shoulder (as when a bricklayer carries a hod, or when a countryman carries a load of hay with a pitchfork). But the way in which he employed the muscles of the leg was less satisfactory. In his method, a long rod passed over each shoulder, folding pinions being attached to both ends of each rod. When either end of a rod was drawn down, the descending pinion opened, the ascending pinion at the other end closing; and the two rods were worked by alternate downward pulls with the arms and legs. The downward pull with the arms was exceedingly effective; but the downward pull with the legs was altogether feeble. For the body lying horizontally, the muscles used in the downward pull with the legs were those by which the leg is carried forward in walking, and these muscles have very little strength, as any one will see who, standing upright on one leg, tries, without bending the knee of the other, to push forward any considerable weight with the front of his leg.

Yet even with this imperfect contrivance Besnier achieved a partial success. His pinions did not, indeed, serve to raise him in the air; but when, by a sharp run forward, he had brought that aërial supporting power, of which we have spoken above into action, the pinions, sharply worked, so far sustained him as to allow him to cross a river of considerable width. It is not unlikely that, had Besnier provided fixed sustaining surfaces, in addition to the movable pinions, he might have increased the distance he could traverse. But, as regards flight, there was a further and much more serious defect in his apparatus. No means whatever were provided for propulsion. The wings tended to raise the body (this tendency only availing, however, to sustain it); but they could give no forward motion. With a slight modification, it is probable that Besnier's method would enable an active man to travel over ground with extreme rapidity, clearing impediments of considerable height, and taking tolerably wide rivers almost "in his stride;" but we believe that the method could never enable men actually to fly.

It may be remarked, indeed, that the art of flying, if it is ever attained, will probably be arrived at by means of attempts directed, in the first place, towards rapid passage along *terra firma*. As the trapeze gymnast avails himself of the supporting power of ropes, so the supporting power of the air may be called into action to aid men in traversing the ground. The following passage from Turnor's *Astra Castra* shows that our velocipedists might soon be outvied by half-flying pedestrians:—"Soon after Bacon's time," he tells us, "projects were instituted to train up children from their infancy in the exercise of flying with artificial wings, which seemed to be the favorite plan of the artists and philosophers of that day. If we credit the accounts of some of these experiments, it would seem that considerable progress was made that way. The individuals who used the wings could skim over the surface of the earth with a great deal of ease and celerity. This was accomplished by the combined faculties of running and flying. It is stated that, by an alternate continued motion of the wings against the air, and of the feet against the ground, they were enabled to move along with a striding motion, and with incredible speed."

A gymnast of our own day, Mr. Charles Spencer ("one of the best teachers of gymnastics in this country," says Mr. Brearey), has met with even more marked success, for he has been able to raise himself by the action of wings attached to his arms. The material of which these wings were made was too fragile for actual flight; and Mr. Spencer was prevented from making strong efforts because the wicker work, to which the apparatus was attached, fitting tightly round his body, caused pain, and obstructed his movements. Yet he tells us that, running down a small incline in the open air, and jumping from the ground, he has been able, by the action of the wings, to sustain flight for a distance of 150 feet; and when the apparatus was suspended in the transept of the Crystal Palace (in the spring of 1868), he was able, as we have said, to raise himself, though only to a slight extent, by the action of the wings. It should be remarked, however, that his apparatus seems very little adapted for its purpose, since the wings are attached to the arms in such sort that the weak breast muscles are chiefly called into play. Borelli's main objection applies in full to such a contrivance; and the wonder is that Mr. Spencer met with even a partial success. One would have expected rather that the prediction of a writer in the *Times* (calling himself Apteryx, or the Wingless) would have been fulfilled, and that "the aëronaut, if he flapped at all, would come to grief, like the sage in *Rasselas* and all others who have tried flying with artificial wing."

The objection founded on the relative weakness of the muscles of man as compared with those of birds (without reference to the question of adaptation), seems at first sight more serious. Although there can be little question that the superior strength of the muscles of birds has been in general enormously exaggerated, yet such a superiority undoubtedly exists to some degree. This gives the bird a clear advantage over man, insomuch that man can never hope by his unaided exertions to rival the bird in its own element. It by no means follows, however, that because man may never be able to rival the flight of the eagle or the condor, of the pigeon or the swallow, he must therefore needs be unable to fly at all.

It should be remembered, also, that men can avail themselves of contrivances by which a considerable velocity may be acquired at starting; and that when the aëronaut is once launched with adequate velocity, a comparatively moderate exertion of force may probably enable him to maintain that velocity, or even to increase it. In this case, a moderate exertion of force would also suffice to enable him to rise to a higher level. To show that this is so, we need only return to the illustration drawn from the kite. If a weight be attached to a kite's tail, the kite, which will maintain a certain hight when the wind is blowing with a certain degree of force, will rise to a greater hight when the force of the wind is but slightly increased.

Kites afford, indeed, the most striking evidence of the elevating power resulting from the swift motion of an inclined plane through the air, the fact being remembered always that, whatever supporting and elevating power is obtained when air moves horizontally with a certain velocity against an inclined plane, precisely the same supporting and elevating power will be obtained when the inclined plane is drawn or propelled horizontally with equal velocity through still air. Now the following passages from the *History of the Charvolant*, or kite carriage, bear significantly on the subject we are now upon. The kite employed in the first experiments (made early in the present century) had a surface of fifty-five square feet. "Nor was less progress made in the experimental department when large weights were required to be raised or transposed. While on this subject, we must not omit to observe that the first person who soared aloft in the air by this invention was a lady, whose courage would not be denied this test of its strength. An arm chair was brought on the ground, then, lowering the cordage of the kite by slackening the lower brace, the chair was firmly lashed to the main line, and the lady took her seat. The main brace being hauled taut, the huge buoyant sail rose aloft with its fair burden, continuing to ascend to the hight of a hundred yards. On descending, she expressed herself much pleased with the easy motion of the kite and the delightful prospect she had enjoyed. Soon after this, another experiment of a similar nature took place, when the inventor's son successfully carried out a design not less safe than bold—that of scaling, by this powerful aërial machine, the brow of a cliff two hundred feet in perpendicular hight. Here, after safely landing, he again took his seat in a chair expressly prepared for the purpose; and, detaching the swivel line which kept it at its elevation, glided gently down the cordage to the hand of the director. The buoyant sail employed on this occasion was thirty feet in hight, and had a proportionate spread of canvas. The rise of the machine was most majestic, and nothing could surpass the steadiness with which it was manœuvred, the certainty with which it answered the action of the braces, and the ease with which its power was lessened or increased. . . . Subsequently to this, an experiment of a very bold and novel character was made upon an extensive down, where a wagon with a considerable load was drawn along, while this huge machine at the same time carried an observer aloft in the air, realizing almost the romance of flying."

We have here abundant evidence of the supporting and elevating power of the air. This power is, however, in a sense, dormant. It requires to be called into action by suitable contrivances. In the kite, advantage is taken of the motion of the air. In flight, advantage must be taken of motion athwart the air, this motion being, in the first place, communicated while the aëronaut or flying machine is on the ground. Given a sufficient extent of supporting surface and an adequate velocity, any body, however heavy, may be made to rise from the ground; and there can be no question that mechanicians can devise the means of obtaining at least a sufficient velocity of motion to raise either a man or a flying machine, provided with no greater extent of supporting surface than would be manageable in either case. It is not the difficulty of obtaining from the air *at starting* the requisite supporting power that need deter the aëronaut. The real difficulties are those which follow. The velocity of motion must be maintained, and should admit of being increased. There must be the means of increasing the elevation, however slowly. There must be the means of guiding the aëronaut's flight. And, lastly, the aëronaut or the flying machine must fly with well preserved balance—the supporting power of the air depending entirely on the steadiness with which the supporting surfaces traverse it.

We believe that these difficulties are not insuperable; and not only so, but that none of the failures recorded during the long history of aëronautical experiments need discourage us from trusting in eventual success. Nearly all those failures have resulted from the neglect of conditions which have now been shown to be essential to the solution of the problem. Nothing but failure could be looked for from the attempts hitherto made; and indeed, the only wonder is that failure has not been always as disastrous as in the case of Cocking's ill judged descent. If a man who has made no previous experiments will insist on jumping from the summit of a steeple, with untried wings attached to his arms, it cannot greatly be wondered at that he falls to the ground and breaks his limbs, as Allard and others have done. If, notwithstanding the well known weakness of the human breast muscles, the aëronaut tries to rise, by flapping wings like a bird's, we cannot be surprised that he should fail in his purpose. Nor again can we wonder if attempts to direct balloons from the car should fail, when we know that the car could not even be drawn with ropes against a steady breeze without injury to the supporting balloon. And we need look no further, for the cause of the repeated failures of all the flying machines yet constructed, than to the fact that no adequate provision has yet been made to balance such machines so that they may travel steadily through the air. It seems to have been supposed that if *propelling* and elevating power were supplied, the flying machine would balance itself; and accordingly, if we examine the proposed constructions, we find that in nine cases out of ten (if not in all) the machine would be as likely to travel bottom upwards as on an even keel. The common parachute (which, however, is not a flying machine) is the only instance we can think of in which a non-buoyant machine for aërial locomotion has possessed what is called a "position of rest."

Perhaps the gravest mistake of all is that of supposing that, on a first trial, a man could balance himself in the air by means of wings. Placed for the first time in deep water, man is utterly unable to swim, and if left to himself will inevitably drown; although a very slight and very easily acquired knowledge of the requisite motions will enable him to preserve his balance. And yet it seems to have been conceived by most of those who have attempted flight, that, when first left to himself in open air, with a more or less ingeniously contrived apparatus attached to him, a man can, not only balance himself in that unstable medium, but resist the down drawing action of gravity (which scarcely acts at all on the swimmer), and wing his way through the air by a series of new and untried movements!

It encourages confidence in the attempts now being made to solve the problem of aërial locomotion, that they are tentative—founded on observation and experiment, and not on vague notions respecting the manner in which birds fly. Fresh experiments are to be made, more particularly on the supporting power of the air, upon bodies of different form moving with different degrees of velocity. These experiments are under the charge of Messrs. Browning and Wenham, of the Aëronautical Society, whose skill in experimental research, and more particularly in inquiries depending on mechanical considerations, will give a high value to their deductions. The question of securing the equipoise of flying machines has also received attention; and it is probable that the principle of the instrument called the gyroscope will be call into action to secure steadiness of motion, at least in the experimental flights. What this principle is, need not here be scientifically discussed. But it may be described as the tendency of a rotating body to preserve unchanged the direction of the axis about which the body is rotating. The spinning top and the quoit (well thrown), afford illustrations of this principle. The peculiar flight of a flat missile, already referred to, depends on the same principle; for the flight only exhibits the peculiarities mentioned when the missile is caused to whirl in its own plane. But the most striking evidence, yet given of the steadying property of rotation, is that afforded by the experiments of Professor Piazzi Smyth, the Astronomer Royal for Scotland. During the voyage to Teneriffe (where, it will be remembered, his well known Astronomer's Experiment was carried out), he tested the power of the gyroscope in giving steadiness by causing a telescope to be so mounted, that the stand could not shift in position without changing the axial pose of a heavy rotating disk. The disk was set in rapid rotation by the sailors, and then the Professor directed the telescope towards a ship on the horizon. A fresh wind was blowing, so that everything on deck was swayed in lively sort by the tossing vessel; nor did the telescope *seem* a whit steadier—the motion of objects round it giving to the instrument an appearance of equal instability. But the officers were invited to look through the tube, and to their amazement, the distant ship was seen as steady in the middle of the telescopic field as though, instead of being set up on a tossing and rolling ship, the telescope had been mounted in an observatory on *terra firma*. The principle of the gyroscope has also been used for the purpose of so steadying the stand of a photographic camera placed in the car of a balloon, that photographs might be taken despite the tendency of the balloon to rotate. As applied to flying machines, the gyroscope would to be so modified in form that its weight would not prove an overload for the machine. This is practicable, because a flat horizontal disk, rotating rapidly, will support itself in the air if travelling horizontally forward with adequate swiftness. In other words, since travelling machines *must* travel swiftly, the gyroscopic portion of the machine may be made to support itself.

It is this property of enforced rapidity of motion which renders the probable results of the mastery of our problem so important. It has been well remarked that two problems will be solved at once, when the first really successful flying machine has been made—not only the problem of flight, but the problem of travelling more swiftly than by any contrivances yet devised. In the motion of a flying machine, as distinguished from the flight of man by his own exertions, the swiftness of the bird's flight may be more than matched. It is a mere mechanical problem which has to be solved; and few mechanicians will deny that when once the true principles of flight have been recognized, the ingenuity of man is capable of constructing machines in which these principles shall be carried out. Iron and steam have given man the power of surpassing the speed of the swiftest of fourfooted creatures—the horse, the grayhound, and the antelope. We have full confidence that the same useful servants place it in man's power to outvie in like manner the swiftest of winged creatures—the swallow, the pigeon, and the hawk.

The Pigeon's Wonderful Flight.

In September last a certain pigeon was heralded forth as having been let off the deck of a vessel near Cape Hatteras, and bearing to its birth nest, at Montclair, a message from Harry C. Bleecker. The distance and speed said to have been made by the bird, were so great as to create the gravest doubts as to whether they had really been done, but lately the distrust culminated in downright unbelief when a second bird was made to perform 1,004 statute miles at an average rate of over 196 miles an hour, and still a third, a distance of 1,596 statute miles at an average of 202 miles an hour; the last bird, appropriately named "Typhoon," exhausting itself by the effort and blowing out his last gasp as he reached his nest.

These birds all came from Harry C Bleecker and to Montclair, and at once a rush was made to Montclair to find the consignee pigeon man. It got to be quite the thing for the depot hackmen to be asked to drive strangers to Harry C. Bleecker's, and one hackman is reported to have driven a stranger all day, and to the tune of $25, looking for the mythical H. C. B. But alas! he was found not. At the Post Office, the official was fain to confess he knew no such man, and to add that he wished he did, for letters were accumulating for him, and the box accommodations for stray letters were getting overcrowded. At last in Montclair forbearance ceased to be a virtue, and the man who whispered pigeon or H. C. B. to a citizen of that town did it at the risk of his life. But when celebrated pigeon fanciers, men of science, and others of the believing and unbelieving stock, pretty equally mixed, began to call at the *Daily Advertiser*, and ask for further facts, pointing to the columns of that paper from which they had gained their first information, it became time for a representative of this paper to plunge into the pigeon war.

Not at Montclair, but near Whippany, a small village some five miles north of Morristown, Harry C. Bleecker was found at last, and proved to be a bright faced intelligent lad of 14, the son of a farmer. Both Mr. Bleecker and his son willingly gave all the information in their power, and laughed heartily at being told of the excitement caused by H. C. B. and his pigeons.

Mr. Bleecker having determined to send Harry on a sea voyage, arranged for him with Capt. William Bacon of the brigantine George W. Chase; and, on the 8th of September last, that vessel sailed from pier 17, East River, New York, with Harry on board and bound for Galveston. With Harry was a small coop, in which were three slate colored pigeons, perfect models of symmetry and beauty. These were brought to the vessel by a friend of Harry's father, a resident of Montclair, who instructed the lad to let off a pigeon on accomplishing each 500 miles of his journey. Poor Harry was a landsman and got very sick, but on September 10, the vessel being then beyond Cape Hatteras, he scribbled a note to his father, fastened it to his youngest pigeon, and amid the sneers and jeers of the ship's crew, placed the bird Tempest on the deck of the vessel. In an instant it arose perpendicularly, and, when at an immense elevation, took a direct homeward course. The captain would not countenance such folly as letting a fine bird be lost at sea, and did not see it start, but entered the fact in the log to please the lad. This bird was but six months old, was a male, and had never had any practicing flights whatever. During its two day's sea voyage it had been sea sick, had eaten little and was thought to be too weak to fly. Yet it accomplished its journey with ease, and reached its dove cot in the quick time given.

On the 15th, the vessel being off Key West, the female bird Tornado was let loose, and also made a direct course, first upward and then homeward. This bird was two years old and had made short journeys around its neighborhood, having also flown from Troy and Syracuse. Like the first bird, it had been sick and refused to eat, and again captain and crew laughed at the plucky lad who was so wilfully slaughtering his pets. Yet the ship's log bears the entry, giving latitude and longitude, with the hour of the start. This bird flew the 1,004 statute miles at an average speed of 196 miles per hour, and was in perfect condition on reaching home, eating and drinking freely.

On the 21st, the vessel being then in the middle of the Gulf of Mexico, and 1,596 miles from home by the captain's reckoning, the veteran bird Typhoon was let loose. This male bird was three years of age, and had made several trips flying last year from Chicago. It had not been sick at all but had eaten greedily, all the voyage, pieces of meat and wheat, with bread crumbs and anything the men fed to it. The crew had become attached to it, and it was with the greatest trouble that Bleecker persuaded them to let him release it. They were positive no bird could reach land, but the lad determined to obey orders and let it go at all hazards, although in consequence of a gale blowing off the shore, he had thought it best not to let the bird go when the vessel was at 1,500 miles distance. Again the entry was made in the log, the Captain still protesting against such foolishness. The noble bird safely accomplished its fearful voyage, but, after alighting at his coop, refused food and soon died of exhaustion, experts saping that he had been over fed and was too fat. His average speed was 202 miles per hour.

As to the question: Were these flights accomplished? they may now be safely believed, the testimony of the captain and his log all going to prove this. As a furthar proof, however, young Bleecker is soon to start on a much longer journey, and is to be provided with a large coop of birds. Among these are to be Tempest and Tornado, the latter of which is to be let loose at five hundred miles distance, and its owner is prepared to bet heavily on its flying the same in under two hours. Tempest is to fly at 1,000, and other birds at 1,500, 2,000, 2,500, and even 3,000. Experts have denied *in toto* that a bird can sustain itself in continuous flight over 1,500 miles. Typhoon has done it, and more too, and his owner is confident that he has others, of the same breed, who will still further outdo him.—*Newark Daily Advertiser.*

Fireproof Roofs.

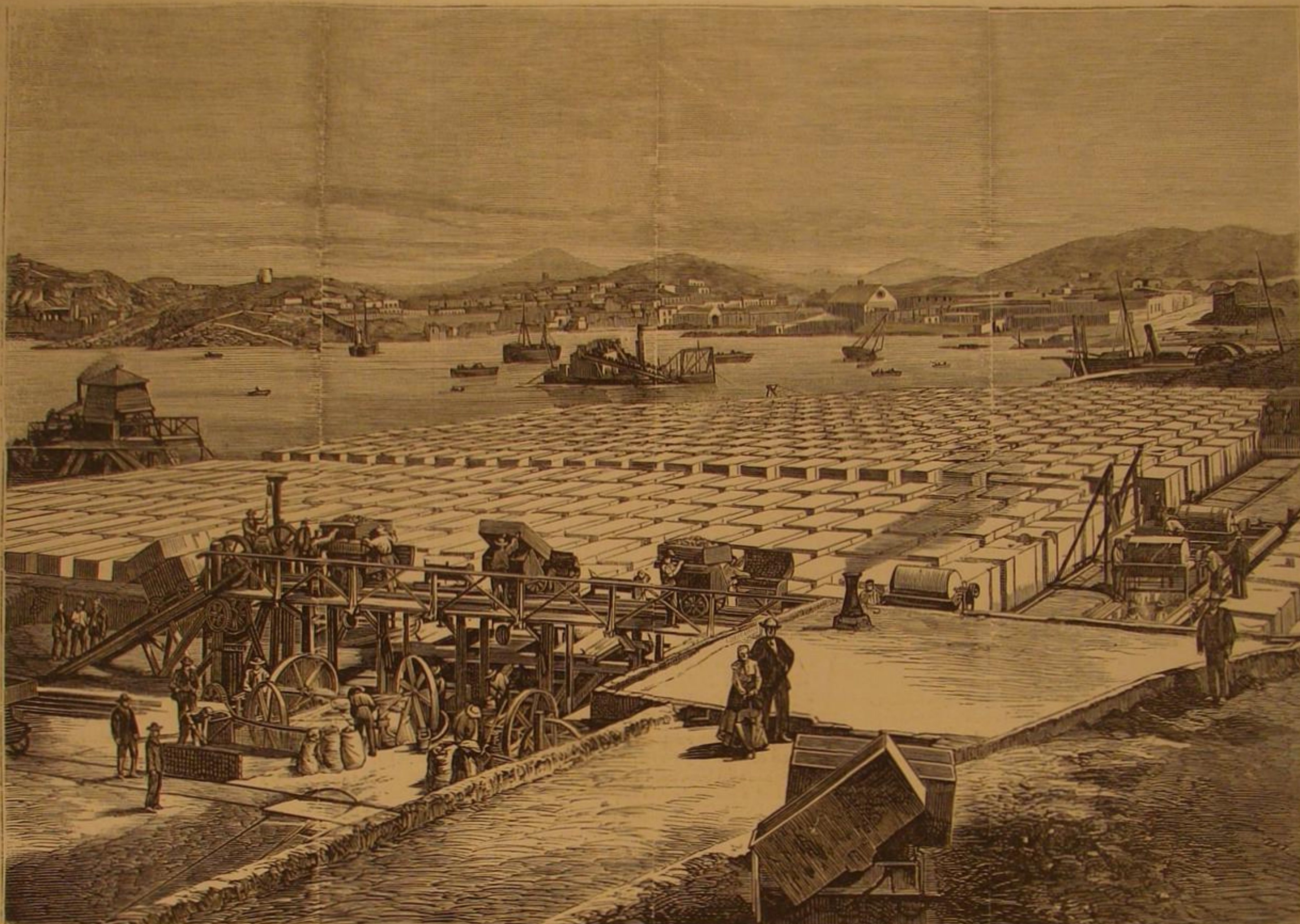
A wash, composed of lime, salt, and fine sand or wood ashes, put on in the ordinary way of whitewash, is said to render shingles fifty fold more safe against taking fire from falling cinders, or otherwise, in case of fire in the vicinity. It pays the expenses a hundred fold in its preserving influence against the effect of the weather. The older and more weather beaten the shingles, the more benefit derived. Such shingles are generally more or less warped, rough, and cracked. The application of wash, by wetting the upper surface, restores them to their original or first form, thereby closing the spaces between the shingles; and the lime and sand, by filling up the cracks, prevents the warping.—*Fireman's Journal.*

THE mind, as well as the body, needs its gymnasium. Each faculty should be developed to its appropriate power, and the whole molded into symmetry.

MANUFACTURE OF ARTIFICIAL STONE FOR THE CARTHAGENA BREAKWATER.

One of the marks of Spanish revival is the attention paid to its commerce and the improvement of its harbors.

After the harbor improvements successfully carried out at Gijon, it was resolved to carry out a similar work in the port of Carthagena, in the hope of restoring its ancient importance. The main works were to be two breakwaters, called Curra and Navidad—one 800, the other 180 meters in length —a pier for loading and unloading, 700 metres wide, and a general dredging of the port to secure a uniform depth sufficient for vessels of any size.



MANUFACTURE OF ARTIFICIAL STONE FOR THE CARTHAGENA BREAKWATER.

The work was begun March 29, 1870, by Angoitia & Co., under the direction of Don José Rodriguez Acerete, a skillful engineer, and was to cost thirty-two millions of reals.

The base was to be of rough stone, on which rose two walls of artificial stone; but after the foundation was laid up to the surface of the water, it was found that the weight was too much for the ground below, and a gradual sinking took place.

The engineer was thus compelled to adopt something different from an upright wall, and decided on the plan shown in our illustration. One tier of blocks of artificial stone is set vertically, and then others inclining at an angle of 45 degrees.

The weight is thus divided, and the sea, instead of dashing against a dead wall, requiring great strength and power of resistance, is met by a series of angles which break up its impetus with very little shock to the structure. A central wall of artificial stone runs through the length of the breakwater.

Our other illustration shows the operation of manufacturing the blocks of artificial stone, which are four meters, or about four yards long, by one and a half meters thick, and as many high.

The cement, composed of hydraulic lime and sand, is mixed by steam, which drives large wheels in the receptacle containing the mortar. This, when ready, drops into cars, running on a track, as do others with crushed stone, to cylinders in which the whole, revolving by steam, are thoroughly and densely worked together. These, in turn, run on another track to the molds, where the blocks receive their final shape. The blocks are then allowed to dry for ninety days, by which time they have all the character of real stone, and are slung on chains in the same way, for transportation to the portion of the works where they are required.

Spaniards now hope to make Carthagena the center of the short route from Paris to Algiers.

BREAKWATER AT CARTHAGENA.

CHARLES BABBAGE.

The following interesting sketch of the life of this extraordinary man is condensed from *Nature:*

There is no fear that the worth of the late Charles Babbage will be over estimated by this or any generation. To the majority of people he was little known except as an irritable and eccentric person, possessed by a strange idea of a calculating machine, which he failed to carry to completion. Only those who have carefully studied a number of his writings can adequately conceive the nobility of his nature and the depth of his genius. To deny that there were deficiencies in his character, which much diminished the value of his labors, would be useless, for they were readily apparent in every part of his life.

The powers of mind possessed by Mr. Babbage, if used with judgment and persistence upon a limited range of subjects, must have placed him among the few greatest men who can create new methods or reform whole branches of knowledge. Unfortunately the works of Babbage are strangely fragmentary. It has been stated in the daily press that he wrote eighty volumes; but most of the eighty publications are short papers, often only a few pages in length, published in the transactions of learned societies. Those to which we can apply the name of books, such as "The Ninth Bridgewater Treatise," "The Reflections on the Decline of Science," or "The Account of the Exposition of 1851," are generally incomplete sketches, on which but little care could have been expended. We have, in fact, mere samples of what he could do. He was essentially one who began and did not complete. He sowed ideas, the fruit of which has been reaped by men less able but of more thrifty mental habits.

It was not time that was wanting to him. Born as long ago as the 26th of December, 1792, he has enjoyed a working life of nearly eighty years; and, though within the last few years his memory for immediate events and persons was rapidly decaying, the other intellectual powers seemed as strong as ever.

As early as 1812 or 1813 he entertained the notion of calculating mathematical tables by mechanical means, and in 1819 or 1820 began to reduce his ideas to practice. Between 1820 and 1822 he completed a small model, and in 1823 commenced a more perfect engine with the assistance of public money. It would be needless as well as impossible to pursue in detail the history of this undertaking, fully stated as it is in several of Mr. Babbage's volumes. Suffice it to say that, commencing with £1,500, the cost of the difference engine grew and grew until £17,000 of public money had been expended. Mr. Babbage then most unfortunately put forward a new scheme for an analytical engine, which should indefinitely surpass in power the previously designed engine. To trace out the intricacies of negotiation and misunderstanding which followed would be superfluous and painful. The result was that the Government withdrew all further assistance, the practical engineer threw up his work and tools, and Mr. Babbage, relinquishing all notions of completing the difference machine, bestowed all his energies upon the designs of the wonderful analytical engine. This great object of his aspirations was to be little less than the mind of a mathematician embodied in metallic wheels and levers. It was to be capable of any analytical operation, for instance, solving equations and tabulating the most complicated formulæ. Nothing but a careful study of the published accounts can give an adequate notion of the vast mechanical ingenuity lavished by Mr. Babbage upon this fascinating design. Although we are often without detailed explanations of the means, there can be little doubt that everything which Mr. Babbage asserted to be possible would have been theoretically possible. The engine was to possess a kind of power of prevision, and was to be constructed that intentional disturbance of all the loose parts would give no error in the final result

Although for many years Mr. Babbage entertained the intention of constructing this machine, and made many preparations, we can hardly suppose it capable of practical realization. Before 1851 he appears to have despaired of its completion, but his workshops were never wholly closed. It was his pleasure to lead any friend or visitor through these rooms and explain their contents. No more strange or melancholy sight could well be seen. Around these rooms in Dorset street were the ruins of a lifetime of the most severe and ingenious mental labors perhaps ever exerted by man. The drawings of the machine were alone a wonderful result of skill and industry; cabinets full of tools, pieces of mechanism and various contrivances for facilitating exact workmanship were on every side, now lying useless.

Mr. Babbage's inquiries were not at all restricted to mathematical and mechanical subjects. His work on the "Economy of Manufacturers and Machinery," first published in 1832, is in reality a fragment of a treatise on political economy. Its popularity at the time was great, and, besides reprints in America, translations were published in four Continental languages. The book teems with original and true suggestions, among which we find the system of industrial partnerships, now coming into practice. It is, in fact, impossible to overpraise the work, which, so far as it goes, is incomparably excellent. Having assisted in founding the Statistical Society of London in 1834, Mr. Babbage contributed to their transactions a single paper, but as usual it was a model research, containing a complete analysis of the operations of the Clearing House during 1839. It was probably the earliest in which complicated statistical fluctuations were carefully analysed, and it is only within the last few years that bankers have been persuaded by Sir John Lubbock to recognize the value of such statistics, and no longer to destroy them in secret. In this as in other cases, many years passed before people generally had any notion of the value of Mr. Babbage's inquiries; and there can be little doubt that, had he devoted his lofty powers to economic studies, the science of political economy would have stood by this time in something very different from its present pseudo-scientific form.

Of all Mr. Babbage's detached papers and volumes, it may be asserted that they will be found, when carefully studied, to be models of perfect logical thought and accurate expression. There is, probably, not a sentence ever penned by him in which lurked the least obscurity, confusion, or contradiction of thought. His language was clear and lucid beyond comparison, and yet it was ever elegant, and rose at times into the most unaffected and true eloquence. We may entertain some fear that the style of scientific writing in the present day is becoming bald, careless and even defective in philosophic accuracy. If so, the study of Mr. Babbage's writings would be the best antidote.

Let it be granted that in his life there was much to cause disappointment, and that the results of his labors, however, great, are below his powers. Can we withhold our tribute of admiration to one who throughout his long life inflexibly devoted his exertions to the most lofty subjects? Some will cultivate science as an amusement, others as a source of pecuniary profit, or the means of gaining popularity. Mr. Babbage was one of those whose genius urged them against everything conducive to their immediate interests. He nobly upheld the character of a discoverer and inventor, despising any less reward than to carry out the highest conception which his mind brought forth. His very failures arose from no want of industry or ability, but from excess of resolution that his aims should be at the very highest. In these money making days, can we forget that he expended almost a fortune on his task? If, as people think, wealth and luxury are corrupting society, should they omit to honor one of whom it may be truly said, in the words of Merlin, that the single wish of his heart was "to give them greater minds?"

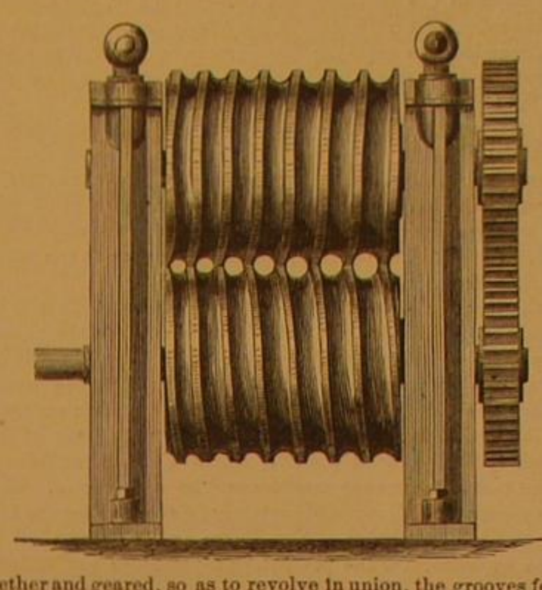
FEED AND TREATMENT OF HORSES.—Hay and oats make the best feed for horses that are obliged to work hard and regularly. If the hay is cut fine and the oats bruised or ground, the whole mixed and moistened, the horse will eat his rations quicker, digest them sooner, and thus have more time for resting and renewing his power for labor. Farmers' horses that work little during the winter time may be kept cheaper by cutting and mixing bright straw and hay in equal quantities, and adding a ration of steamed potatoes or raw carrots. Colts should be fed liberally on good hay—bright clover is best—and bruised oats; give them a roomy box stall in stormy weather and during nights. Litter freely, and do not let the manure accumulate under them. Sawdust or spent tan makes good and convenient bedding; in cities and villages they are often cheaper than straw. Groom horses well and let them have exercise every day; a run in the yard is excellent. See that stable floors over basements are sound and strong. Arrange the feeding racks so that dust and hay seed will not fall into the horses' manes or eyes; some horsemen build their mangers too high, thus forcing the animal to take an unnatural and painful position when eating. Farm horses that are not worked should have their shoes taken off, and those that are driven on the road should be kept well shod.—*Stock Journal.*

M. DEVERGIE, a French chemist, finds that water containing only one four thousandth of its weight of carbolic acid sufficed for the disinfection of the Morgue in Paris during the hottest weather, when it contained six or seven bodies.

TRUTHFULNESS is a corner stone in character; and if it be not firmly laid in youth, there will always be a weak spot in the character.

MACHINE FOR ROLLING TAPERED BARS.

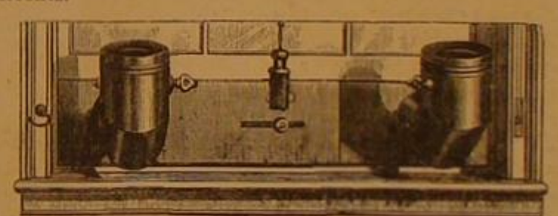
Mr. Henry Kesterton, of Birmingham, Eng., has patented an ingenious arrangement of rolls for rolling taper tubes or rods. According to his plan, there is employed a pair of rolls, each roll having a spiral groove of variable depth, and of half round section, turned on it. The groove in one roll is a right handed, and that in the other, a left handed spiral, as shown in the engraving, and when the rolls are placed together and geared, so as to revolve in union, the grooves form a series of eyes, which, as the rolls revolve, appear to move laterally, and gradually decrease in size. Thus, if a bar or tapered strip of iron, bent so as to approximately form a tube, be introduced between the rolls at that end where the grooves are largest and deepest, it will be gradually shifted towards the other end of the rolls as it passes between the latter, and will thus be rolled tapered.



MAINE'S PORTABLE WINDOW VENTILATOR.

We have been using the above ventilator (an engraving of which is annexed) in our office, with much satisfaction, for some time. By its means we find the condition of the air in the apartment much improved.

The principle of the invention is the deflection of the inflowing current directly up toward the ceiling, where it becomes diffused, and gradually falls without creating sharp currents.



Short sheet metal elbowed tubes are fixed in pieces of board, which overlap and are held together by a bolt which passes through a slot in one of them, so that they can be adjusted to fit windows of different widths. These boards are placed with their outer ends flush to the window casing, and the lower sash is raised to rest upon the upper edge of the apparatus. The joints are made tight with suitable packing. Each elbow tube has a damper to regulate the admission of air.

The apparatus is cheap and simple. It can be applied anywhere; and, if others are as well pleased with its working as we have been, it will gain a wide-spread popularity.

Patented March 1, 1870. Underhill & Co., 95 Duane street, New York, will give further information on application to them.

THE APPLICATION OF MECHANICS AND MECHANICAL PRINCIPLES IN AGRICULTURAL OPERATIONS.

We copy from the *Ohio Convention Reporter*, published at Columbus, Ohio, some extracts from the introductory address by Hon. L. F. Ward, delivered before the Ohio State Agricultural Convention at its last meeting. We would also state that from the *Reporter* we learn that another meeting of the convention will be held on the 3d and 4th of January 1872, at Columbus. We hope it will be well attended. Such associations do a vast amount of good in the dissemination of practical knowledge among the agricultural producers of a State, and we are glad to see that a growing interest is manifest among the farmers throughout the country to enlighten themselves on subjects so important to their prosperity. The speaker thus accords to the mechanic and inventor, due credit for the great advances made in the agricultural field:

"We may rejoice that we live in a period of mechanical triumph. The dreams of past ages are already *more* than realized. The "alchemy" of invention has learned the world more than the transmutation of baser metals into gold. By machinery, crude iron ore, in the hands of scientific manipulators, is wrought into delicate hair springs and tiny watch screws, worth far more than so much gold; and so is it in a thousand places. There is something truly wonderful to stand among the machines, and see what is accomplished by the mechanic arts of the age.

By the electric telegraph we have almost distanced time, and by steam locomotion we have nearly destroyed the idea of terrestrial distance.

This rapid advance of the world announces the dawning of "millennial morning," when wearied fingers can give place to those of steel; when exhausted muscles rest and let sinews of iron endurance do the hard work; when, indeed, emancipated humanity may rest, and the mind preside over mechanical agencies doing his work; when we may have leisure for cultivation of intellect and such development of both mind and matter as will elevate our race.

There is something impressive in contemplating the triumphs of mechanical skill exhibited in this nineteenth century. These triumphs come so rapidly, are being developed everywhere, that we scarcely note the wonders before they are displaced by others. Every department of industry has its new machinery and new modes of accomplishing wonderful results. New fields of enterprise are being constantly developed, while inventors are handing out new devices and improved machines to accomplish new work, and are teaching the world how to do things better and more surely.

I need hardly say that agricultural pursuits are entirely different and surrounded by a different kind of machinery than when we were boys on the farm. Do any of you remember the thump, thump, of the winter's flail, and the long weeks of hard threshing? These have given place to the thresher and separator, and the work of the winter is done in a day. We can some us remember the old flax brake, the "scutching" board, the old spinning wheels and hand looms, and the months it took our mothers and sisters to produce the wearing apparel of the family. These are all gone, and steam has been harnessed on to automatic machinery, and a thousand spindles hum and power looms "weave away the web" to warm and adorn us. You can remember the long weeks of back aching hand mowing. Since then the mowing machine, in a hundred forms, has been wheeled in, and with his team the farmer does in a few days and easily what was a tedious and long "haying." All departments of farm labor have improved tools and machinery, and new modes of accomplishing the work that used to make farm labor so wearying.

DEMAND FOR THE PRACTICAL APPLICATION OF SCIENCE.

A competent amount of knowledge of the fitness of machinery and its auxiliaries is a valuable attainment for him who would make agricultural work a success. The honest farmer, who had learned a part when he had learned that the axles of his wagon needed lubricating, and so kept his tar bucket filled and at hand, showed that he had not matured his mechanical knowledge when he applied tar to the cogs and pivots of his Yankee clock, and was, himself, much surprised when he found it would not run!

The use of machinery on the farm implies the want of mechanical principle, and the farmer would hardly use his steel plow for a stump machine, or his reaper for clearing brushwood, or his mower for trimming his hedges; yet as absurd things as these have been done. We do not expect the enlightened farmer will insist on putting his corn in one end of his sack, and a stone in the other, to balance it, even on going to mill on horseback; but we do often see the laborer working away at the wrong end of the lever, doing his work wrong end first, and in the hardest way. A little clear headed thought, that weaves in mechanical ideas, wonderfully helps on even herculean tasks.

AS AN IMPROVER OF FARM IMPLEMENTS.

The farmer ought to be the best judge of farm implements and farm machinery; and, if properly instructed in mechanical principles, could not only (as he now does) discover the defects of tools and machinery, but could at once cure and perfect them. He should indeed, select an easier and more rapid accomplishment of many agricultural employments now involving hard muscular labor.

It is the mission of applied mechanics to emancipate the agricultural laborer from that exhaustion that holds both soul and body in the slavery of a mere animal drudgery. Why may not a great deal that is now done by muscular exertion be accomplished by improved mechanical adaptations? Why not harness up the unmeasured power of steam to do some of his work? And what objection can there be to letting the idle winds pump water, for his stock or for irrigating his lands in time of drought? With a little mechanical and engineering skill, a whole farm could be well watered at a comparatively trifling expense. Can you see any reason why in the future, steam may not do our plowing—and indeed a great deal of our farm work?

Thought and mechanical science will enable any to judge as to how power should be applied—whether with rapid or slow motion, or whether great power is to be attained by reducing motion. I have no doubt that this single fact will account for the difference we find in the ease with which some accomplish much with little effort, while others do everything by the hardest. The farmer should know so much, of the strength and nature of the material and construction of the machinery he uses, that he may form an accurate judgment of its capability and durability. He is the only proper judge of his own machines.

THE FARM SHOP.

The farm should have a good shop, well furnished with material and tools, where, in stormy weather, tools and implements can be repaired, and new labor-saving machinery constructed; and if half the time lounged away by many in bar rooms and saloons were used in this shop, it would make the farmer so much a mechanic that he could repair much of his machinery in a great deal less time than is now spent in hunting for and being disappointed by mechanics."

After referring to the proposed new agricultural college of Ohio, and recommending the Professor to insist upon the pupil *doing* the science as well as reciting from text books, Mr. Ward closes with a word in behalf of

THE MECHANIC AND INVENTOR.

"The world has been in the habit of giving these producers a very unenviable place, and speaking of them as the "greasy mechanic" and "poor inventor," and has assigned to them a subordinate place in the social scale. "Yet by their works ye shall know them," and rank them too.

The mechanics and inventors of the nineteenth century are the "royal family" of the world—the true "aristocracy," before whom, if any, we should uncover. Inventors' and mechanics' skill have developed and opened this whole nation as it could not have been done without this agency. Without these (as the world was two hundred years since) it would have taken a thousand years to do what has been done in the United States in the last fifty years with steam and the fruit of invention. How magical the facts that meet us! How like enchantment the wonderful results attained! See the magnificent palaces flying along our railroad lines, at the rate of thirty or forty miles an hour, and ourselves talking with the wings of lightning across continents and through oceans! Ingenuity and mechanical skill, guided by science, have attained this glory. To the scientific mechanic and inventor is the chief honor due. Capital has aided and sustained this enterprise, but it has been repaid, principal and interest, and the chief pæan should be given to these active manipulators. Let us grasp the honest hand of skillful industry, and honor them as we ought."

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Traction Engines—Steam Plowing.

To the Editor of the Scientific American:

The combined efforts of inventors, to surmount the difficulties attending the practical use and introduction of steam road wagons and plows, may make a few words upon this hackneyed theme of some interest, especially to your many readers who are directly connected with agricultural pursuits.

The Williamson road steamer and plow, New York, the Parvin steam plow, Philadelphia, the Redmond steam plow, Rochester, N. Y., the New Albany, Ind. road wagon and plow, the Porter & Aveling heavy road locomotive, and a number of others which are now being perfected, make the list quite respectable.

The steamers enumerated above, in their efforts to get traction or hold to exert power upon the road, may be divided into three classes. The first class is by the resistance of the main bearing wheels at each contact, and embraces the Williamson, the Parvin, the Porter & Aveling, and most of the other heretofore unsuccessful machines. The second class consists in thrusting, through the tire, at earth contact, a pointed instrument; this includes, besides the Redmond, two or three more machines not now fully perfected. The third class consists of the use of shoving legs, hanging at an angle of 45° to 39°, which includes the New Albany machine.

The Williamson steamer is one of the most perfected forms of the first class of steamers. Yet when it is at its greatest strain, the machine will not exert a dead lift of more than one half its own weight, and to do that it requires 56·53 inches piston surface at one hundred pounds, compounded in the gearing 16 to 1. The weight of the machine, with wood and water, will be probably 16,000 lbs. Why 56·53×100 lbs. pressure×16 to 1 gearing(=90,480), should not produce better results, is incomprehensible to me.

The operations of devices of the second class (the Redmond) are much better; with only one half of the weight of machine of the Williamson, it can exert as much of a lifting power, or pulling force, in open field plowing; but the machine is not adapted to road service, as upon hard surfaces the thrusting points do not act; hence, as a road wagon it should be placed in the first class. Inventors are forced to make a machine equally efficient as a road wagon, portable power, or steam plow.

We witnessed a few days since the operation of the New Albany machine; weight 2,000 lbs., cylinders 2 inches diameter and 4 inch stroke, ten in number; steam 50 lbs. The cylinders were evidently too small, yet the movements were novel, and seemed to be suggestive of a principle that will yield better results than either the first or second class of machines mentioned. In this machine a toothed yoke, worked on the main engine shaft, operated backward and forward four horizontal slides; to each of these slides were suspended two straight pushing legs, with a hoof on each, resembling a horse's hoof. At the first trial these legs were suspended at an angle of 33°, and would slip occasionally, in soft ground. In the second trial they were shortened to 39°, and there was found no disposition to slip. At 45° angle of leg this machine would pull its own weight of lifting force; at 39°, one and one half times its weight, and at 33°, twice its own weight.

The inventor claims he is only using the mechanical movements of a horse, which can very readily, when required to do so, lift its own weight. Upon the machine was an eight horse power boiler, 50 gallon water tank, coal bunkers, etc. My attention was particularly directed to the boiler, it being a vertical sectional safety boiler, entirely surrounded by an outside exhaust case, where the feed water was heated and condensed, and waste water saved to use again. With engines in proportion to boiler, I look for good practice in this machine.

The urgent demand, all over the country, for the devices mentioned, makes any information in regard to them watched with more than ordinary interest. The writer is a farmer, not well versed in mechanism, but feels very much like purchasing some one of the implements mentioned above as soon as he can intelligently do so. I believe there are many farmers just like myself; hence the importance of scientific men expressing their opinions, that parties about purchasing may profit by their views.

Greenville, Ind. ADVOCATE OF STEAM FARMING.

An Underground Railroad in New York.

To the Editor of the Scientific American:

On reading your article on the "Progress of the Underground Railway System" (SCIENTIFIC AMERICAN of December 2d.), I cannot help calling attention to some points in the history of this important question, which now requires only a little public spirit, on the part of the inhabitants of New York city, to be finally set at rest in the manner most consistent with the economy and convenience of the business community. In view of the simplicity and cheapness of construction, the avoiding interference with structures and streets, and the safety in traveling, all of which are secured by the tunnel system, it may be fairly taken for granted that the superiority of this mode of construction is demonstrated. Especially is it so when the locality under consideration is a crowded city, of which every square foot of the surface is covered with costly buildings, and every street filled with daily increasing traffic. Leaving, then, this part of the subject, I propose to consider its special adaptation to the wants of New York.

The length and narrowness of this city necessitate a rapid means of transit from one end to the other; and the stream of traffic, as well as the already expressed public opinion, point out Broadway as the road under which the tunnel should be made. Another recommendation of this course is its termination at the Battery, the only situation at the southern extremity of the city where a depot, sufficiently large to accomodate the traffic could be constructed. Thus the route of Broadway will certainly be the best for the lower and business portion of New York; and it may be left an open question, for the present, as to whether the railroad should, at some point up town, diverge into one of the avenues, or continue up Broadway to the end, thus terminating on the west side of the city. It would probably be necessary, in the latter case, to make a bifurcation about halfway up the island, so that a branch might diverge to the east side and Harlem. If this plan were adopted, the branch should, if the non-interference of house property be kept in view, leave the main line at the junction of Fifty-ninth street and Eighth avenue, and pass under the Central Park. But it would be less expense, and it would afford accommodation to all parts impartially, to let the railroad quit Broadway at Union Square and then follow the course of Fourth avenue to Harlem.

Public needs would demand depots, not farther apart than half a mile, in the lower portion of the city. Starting from the Battery, these depots would be situated as follows: at Wall street, Worth street, Spring street, Washington Place, and Union Square. Beyond this point, the depots need not be in such close proximity to each other.

Trains stopping at all stations would reach Union Square from the Battery in nine or ten minutes. To effect this, locomotive engines specially designed to accomplish a high velocity as soon as possible after starting would have to be constructed. This has been done on the Metropolitan Railway of London, on which trains frequently attain a speed of twenty-five miles an hour between stations that are not more than half a mile apart. To free this traffic from perils of persons crowding on to trains that have started, a lesson from European management would have to be learned. No person under any pretence whatever should be admitted to the platforms after a train is in sight. If such a rule be rigidly enforced, a hundred passengers can safely mount a train in one minute, and so the detention would be as short as possible.

Under these regulations, trains at three minute intervals can be run with perfect safety. By never permitting a train to leave a station till the previous one has quitted the station in advance, trains can travel with complete immunity from disaster; an end which has not yet been reached on lines, with trains an hour or two apart, worked on the old happy-go-lucky system(?) of signaling.

There are many other suggestions I could give you, such as the construction of cars with several side entrances to facilitate rapid ingress and egress, but I forbear for the present. The chief point for the public consideration is how to get rid of the Ring and the viaduct thereof. This seems in a fair way to be accomplished; and when the course is clear, the Underground Railway will only require impartial consideration on its merits, and then we can go ahead and make it.

New York city. D. B.

Testing Kerosene Oil.

To the Editor of the Scientific American:

I obtained some kerosene which had been inspected by the Government inspector, and passed as standing the test of 110° Fah. before throwing off vapor, or the flashing point, as commonly called; and I placed the same in a long test tube, in which was placed a delicate thermometer. I then inverted the tube, full of oil, in a vessel containing water, so that the vacuum in the tube was complete. I then applied heat to the water, and watched carefully the thermometer; and, at 86° Fah., the vapor began to rise in bubbles and collect in the top. At 142° large bubbles rose rapidly, and at 190° about 33⅓ per cent of the oil was in vapor. I then allowed it to cool, when the bubble disappeared from the top by condensation. I then took some of the same oil which had not been heated, and passed ozonized air through it, then subjected it to the same test as the previous; and I found the thermometer stood at 174° Fah. when the first bubble of vapor rose to the surface, and at 190° Fah. only about 2 per cent of vapor was thrown off.

I think the apparatus for testing the flashing points of kerosene and petroleum oils, as at present used, are very ineffective and inadequate for the purpose, and oils are passed, as standing 110° fire test, which vaporize at much lower temperatures.

I believe an apparatus made like that described by me would be more simple and certain.

New York city. C. F. DUNDERDALE.

Equilibrium of Water in a "Nest" of Steam Boilers.

To the Editor of the Scientific American:

In last week's issue of your journal, H. P. S. of Kansas city, Mo., tells us of a "Curious Freak of Twin Steam Boilers" and asks the "decision of older engineers." Probably an explanation of the "mysterious working" would be acceptable from a young engineer.

A host of engineers have encountered and are still encountering the same difficulty. The cause in nine cases out of ten is malconstruction, which is the trouble in the case of H. P. S. The steam connections are entirely too small, and they must be enlarged to prevent the difficulty. When the production of steam in the boilers is equal, there will be no such trouble.

It is only when the production of steam in the different boilers is disproportionate that this difficulty developes itself. The water is depressed in the boiler producing the most steam. It is caused by the resistance the steam encounters in adjusting the pressure in the different boilers. A greater quantity of steam crowding through one stand pipe than the other, a greater resistance will be encountered and a depression of water in that boiler is the result.

There is a corresponding increase in the pressure of steam in the same boiler. This difference in pressure may be measured by the difference in the hight of water. If the difference in hight of water is two inches, the difference in pressure will be nearly one ounce; four inches, nearly two ounces, six inches nearly three ounces; or the difference in pressure will be the difference in weight of the column of water in each boiler. The pressure of steam may be 90 or 100 lbs to the square inch, speak of the difference only.

It is simply impossible to fire two or more boilers so evenly that the amount of steam produced in the different boilers will be equal. Then what is the remedy? It is to make the steam connections and stand pipes on top of the boilers large enough to allow the pressure of steam to adjust itself in the different boilers without disturbing the equilibrium of the water. The smaller these connections are, the more trouble it will be to maintain the same water level in the different boilers.

The pressure of steam and water in a "nest" of boilers may be compared to a huge balance suspended with equal weights, the equilibrium of which can be disturbed by the slightest cause.

In the case of H. P. S., he should have larger connections between the boilers—say a four inch pipe connecting the two boilers either above or below the water line, so as to allow a freer passage between the boilers, and he will have no further trouble; or, what is still better, he should compel the builders to place (at their own expense) larger and proper steam connections on the boilers.

It shows gross ignorance in the management of steam on the part of builders to set up two steam boilers "sixteen feet long and forty inches in diameter," with only "two inch" steam connections; with such imperfect connections boilers are positively dangerous.

Zanesville, O. W. A. C.

Making Flour without Millstones.

To the Editor of the Scientific American:

In regard to your article, page 353, current volume, on the manufacture of flour, I would like to answer a few questions and ask a few others.

I am constantly using a machine, such as you speak of, that will grind wheat, or, in fact, almost anything, without the use of stones, and will run for years without repairs. But your article says there is no heat. That is not so; the heat produced in the winter is about 60 or 70 degrees, and in summer about 100; and, as you say, it is done by extreme velocity and requires no skilled labor. But what I wish to ask is, will it make better flour, and what would be the difference in the price of labor now used, and the price of labor with one of these machines? I have had considerable experience with this machine, and have ground, in ten hours, 15,000 to 18,000 lbs. of a substance similar to flour.

Brooklyn, N. Y. G. T. GRANGER.

The Existence of an Open Sea at the Poles of the Earth proved by Magnetism.

To the Editor of the Scientific American:

As a general rule, fresh water from wells and brooks freezes at 30° Fahr., sea water at 28½° Fahr., regulated, however, by the amount of salt and saline matter it contains.

Rain water freezes generally at 30½° Fahr., and distilled water at 31° Fahr. Fresh and sea water ice melts at 32°. As sea water gives out its salt, etc., in the act of freezing, therefore the ice of both melts at the same degree of heat. These facts being understood, the following experiments were performed on November 28, 29, 30, and December 1, 1871. During the four days of these experiments, the thermometer in the shade ranged from 17° Fahr., to 24° Fahr., between 7 A. M. and 4 P. M. The wind blew hard from the north west.

Everything being ready, we commenced at 10 A. M., in the shade, and the experiments were continued until 12 noon, and the experiments on each day were made at the same time of day.

The experiments in detail are as follow; We took two wooden bowls, highly coated with shellac varnish, being 8 and 18 inches in diameter respectively. The smaller one was intended to represent the open polar sea, and the larger one, to represent the belt of ice which surrounds that sea. In the large bowl, we put 4 inches of water, and the same depth in the small one. The large vessel was placed upon a pine table insulated by a plate of glass beneath it and the table, and the small bowl was placed in the center of the large one, with another plate of glass under it.

The water, when first put into the two vessels, was of the same degree, that is, 34° Fahr. It was brought from the kitchen for this purpose.

Having the electromagnetic machine and the battery ready, we made the circuit at 10 A. M.. At 11 A. M., there was a thin scum of ice in the outer vessel but none in the inner one. The thermometer in the outside one at this time indicated $23\frac{1}{2}$° Fahr., the same as the one in the shade in the open air; but the one in the small vessel was $28\frac{3}{4}$° Fah., being $\frac{3}{4}$ of a degree above the general freezing point of sea water. Fifteen minutes after the circuit was broken (12 noon), there were signs of ice in the inside vessel, and, at $2\frac{1}{2}$ P. M., there was a thin sheet of ice covering the whole surface. The thermometers in both vessels and the one in the open air, now stood at $23\frac{1}{2}$ Fahr. The battery was supplied with crystals of the sulphate of iron during the operation, so as to keep up a strong and uniform current.

During the experiments, the water in the inside vessel was continually examined with a microscope, and we observed a vibration of the water and also a rotary motion around a common center, until the circuit was broken.

Now, as a slight agitation of water retards its freezing, will not such have a similar effect at the poles, to preserve the water from freezing?

We have long entertained the idea that electric and magnetic currents pass and counterpass over the surface of the earth, and are concentrated at the poles, where the intensity is the greatest.

For as heat, light, and electricity are nearly the same in principle, and as decomposition in nature, friction, concussion, and chemical combinations in the earth, all tend to develope them, we can readily conceive that, whenever they are in an active state, that h at and motion must be there also.

Therefore, if such a theory be true, the convergence of the electric and magnetic currents to the poles of the earth, will continually produce heat and motion, which will prevent the water from freezing; and, consequently, an open sea will be the result.

New York city. JAMES QUARTERMAN.

[For the Scientific American.]

SUBTERRANEAN EXPLORATIONS.

One of Nature's geological freaks during the ages past resulted in the formation of a large cave near where the city of Hannibal, Missouri, now stands. It is not a new or recent discovery, having been known for at least half a century.

Though not to be compared with the Mammoth cave or Niagara Falls, it is still deserving of more attention than it has heretofore received, from the travelling and scientific world.

The entrance to the cave is one quarter of a mile from the west bank of the Mississippi river, and about thirty feet above the bed of a small stream that joins the Mississippi at this point. The bluffs are limestone, and from 200 to 300 feet high. Passing within the portals of the entrance, the explorer finds there three passages diverging as the radii of a circle; following either of these he will soon find himself entangled in a perfect labyrinth of avenues and passages, passing into, through, above and below one another, at every conceivable angle. Instead of the one passage, with which he he started, there may be twenty or more, running in all possible directions. This is the general arrangement of the whole cave—a vast network of subterranean channels, a "mighty maze" and quite "without a plan."

In some places the cave is four stories deep; that is, there are that many distinct systems of galleries, one above another; at other places these may be all merged into one. The above will afford one some idea of the intricate and complicated structure of this wonderful underground city.

To get lost is one of the easiest things imaginable. The explorer needs to take every possible precaution, if he wou d prevent such a result. The truth of this statement has been proven on more than one occasion; but never, I believe, with any fatal or serious results. Two boys were once lost in the cave for a week, and had to subsist on *raw bats* during that time. On another occasion, a man, who had been lost for several days, came out at a point two or three miles from where he went in, and thus discovered a new entrance.

The extent of the cave is not known, with any certainty. One avenue, which has been named "Grand Hall," is quite straight for nearly a mile in length. Judging from its direc ion and length, it must pass under the Mississippi river, as lso do many of the other passages. So that the cave is at once subterranean and sub-fluvial (if I may be allowed to oin a word).

There is but little water in the portion of the cave visited by your correspondent, and the atmosphere is comparatively dy.

The temperature, of course, is always the same, and that is near 60° Fahrenheit. Summer heat and winter cold have never penetrated to these subterranean vaults. The absence of water, or some other cause, has prevented the formation of those beautiful stalactites and stalagmites which are usually found in limestone caverns.

The rock is the mountain limestone of the sub-carboniferous age; and it is a fact worth noting, that all the great caverns of this country, if not of the whole world, are found in this formation.

The walls of the cave are studded with water worn crystals of calc spar-carbonate of calcium; a light blow with the hammer reveals the beautiful interiors of these rusty looking nodules.

The origin of the cave is plainly and indelibly written on the walls of every passage and chamber; the characters are horizontal water marks and ledges, such as would be produced by a running stream of water. They are so plain and distinct as to preclude the possibility of its having been produced by any other cause than a subterranean river.

There is considerable niter—nitrate of potassium—in the clay or silt found in many parts of the cave. Tradition says that, during the war of 1812, a man and his sons manufactured saltpeter here. At any rate, there are still to be seen remains of old leaches, which were used for the lixiviation of the nitrous earth.

Bats seem to be the sole representatives of the animal kingdom; these melancholy creatures are found here in large numbers. They love the dark and shun the light; does it follow that their deeds are evil?

There are, in this part of Missouri, a great many caves, large and small, in some of which are found most beautiful stalactitic formations. But there are none as large or intricate as the one above described. R. O. C.

[For the Scientific American.]

LATENT HEAT OF LIQUIDS.

BY P. H. VANDER WEYDE.

The adoption of the unit of heat has not only given rise to discoveries of a purely speculative scientific nature (of which an example was given on page 389 of the last number of this journal), but it has also led to important practical results, of which the application of the knowledge of specific heat is an instance. A much more important result, however, was the knowledge obtained concerning that class of phenomena where heat actually disappears and reappears; this kind of heat has been called "latent heat," it is *the heat of form;* that means, this apparently disappearing heat is the cause of the fluid and gaseous conditions of matter; solids have no latent heat, fluids a certain amount, and gases a very large amount. Latent heat, therefore, must not be confounded with specific heat, as it gives rise to an entirely different class of phenomena.

Before the acceptance of the unit of heat, the phenomena referred to were totally misunderstood. It was, for instance, supposed that when water was cooled below 32° Fah., it all suddenly congealed by the abstraction of a single degree of heat; and, inversely, that ice of 32° had only to be heated a single degree above that point to convert it all into water. If this in reality were the case, the freezing of rivers in winter would be most inconveniently rapid, and the melting of ice, on the fields and mountain slopes, most disastrously sudden; so that it would produce the most fearful inundations every day that the temperature rose above 32°.

Fortunately this is not the case. When we attempt to raise the temperature of a very cold mass of ice, say of 10° Fah., by supplying it with heat from any source whatever, we find that its temperature will increase gradually till we reach 32°; when this point is attained the increase in temperature will suddenly be arrested, notwithstanding that we continue our supply of heat; and it appears that this further supply is all consumed in the operation of changing this solid condition of the substance gradually into the liquid. We see, further, that a very considerable amount of heat is, as it were, absorbed into the resulting water, and that this water will remain at the same temperature of 32° till all the ice is melted. If we try to find how much heat is absorbed in this way, we shall obtain as result 142 units, that means, that to convert one pound of ice of 32° into water of 32° will require as much heat as would suffice to heat a pound of water from 32° to 174°. This is 142°, which, if applied to one pound of water, is, of course, 142 units. It is evident that, in this case, the thermometer can be no guide, since the ice, just before and just after the melting, remains at 32°, notwithstanding the absorption or consumption of 142 units.

The heat thus disappearing is also called "heat of fusion," and any solid substance, when melted or converted into the liquid condition, will absorb heat in exactly the same way. The amount of heat thus rendered latent varies for different substances, of which the following table contains a few:

Name of substance.	Melting points.	Latent heat.
Ice..................	32° Fah.	142 units.
Spermaceti..........	130° "	144 "
Beeswax............	149° "	171 "
Sulphur............	230° "	142 "
Tin	430° "	490 "
Bismuth............	500° "	550 "
Lead...............	617° "	160 "
Zinc...............	700° "	480 "

It will be noticed that the units of heat, absorbed by melting, have no relation to the melting point; so the latent heat of ice and sulphur do not differ, while their melting points differ considerably. The melting points of lead and bismuth differ not a great deal, while the latent heat of the latter is three times as great as that of the former. No doubt that the crystalline tendency of the solidifying bismuth, which is absent in the lead, has something to do with the peculiarity that the body with the higher melting point has the less latent heat.

It may be well to explain some of the methods of determining the amount of heat absorbed by fusion, as this will, at the same time, give a clearer conception of the doctrine of latent heat. One method is to expose the solid substance, during melting, to a constant source of heat; for instance, a Bunsen burner, of which it has previously been determined how many units of heat it will produce per minute, or how many degrees it will raise a pound of water in that time. Suppose such a burner were arranged so as to raise the temperature of one pound of water two degrees per minute; every half minute would then be equivalent to a unit of heat; and, with such a flame, it would then be found that one pound of ice of 32° would require 71 minutes to be converted into water of 32°; or that one pound of solid beeswax of 149° would require 85 minutes to be entirely changed into the liquid condition. This method, however, is not adapted for correct estimates, especially in experimenting with the metals at high temperatures, by reason of the great loss of heat by radiation in such cases.

A more correct method is that of mixing, similarly to the method described on page 189, for finding the specific heat One pound of boiling water of 212°, poured in one pound of water of 32° will produce two pounds of water of the mean temperature of 133°; but when the pound of boiling water is poured upon one pound of ice, it will commence with losing 142°, which will be consumed to melt the ice and change it into water of 32°; we shall then have one pound of water of 212°—144°, or 68°, and one pound of water (the melted ice) of 32°; the mean of 68° and 32° is 50°, and this will be the temperature of the mixture. Or suppose we put, into the pound of water of 212°, one pound of spermaceti, previously heated to 129° or 130°, near its melting point. We shall then find that the water will soon be cooled down to 140°, and will have melted half the spermaceti, 72 units having been abstracted by the melting of half a pound of this substance. A pound requires 2×72 or 144 units of heat, or, in other words, the temperature of the boiling water exceeding that of the melting spermaceti, 212°—130° or 82°, and the latent heat of the spermaceti being 144 units, it would require 144÷82, or nearly 7÷4 lbs. boiling water, to melt the whole of the spermaceti.

A third and most reliable method is the measuring of the amount of ice melted by the solidification of the substance under investigation, which previously has been melted and cooled to near its point of congelation or solidification. Knowing that every pound of ice melted represents 142 units of heat abstracted, in that every 142d part of a pound of melted ice represents one unit, we have only to weigh the water obtained from the inside of a block of ice, into which the melted substance has been introduced, and which has been melted by the cooling and solidification of that substance. Take, for an illustration, a pound of melted tin, showing a temperature of 430° Fah., its melting point, and introduce it, in a proper vessel, in the inside of a previously hollowed large block of ice; the opening in the top is covered with another block of ice, and all is placed in a properly constructed box of non-conducting material so as to have no unnecessary melting on the outside. If we wait till the tin has solidified, but still has a temperature of 430°, we shall find that three and a half pounds of ice have been melted, as we may pour so much water out of the hole from which we remove the tin, and as every pound of ice melted represents 142 units of heat, we have $3\frac{1}{2}\times142$—497 units of heat for the latent heat given off by the melted tin during its solidification, without change of temperature. Or, if we wait till the tin has cooled to 32°, the temperature of the ice, we shall find that, in all, $6\frac{1}{4}$ pounds of ice have been melted; of this $2\frac{3}{4}$ is 400 units, the descent of solid tin of 430° to 32°; the balance represents the latent heat.

Electricity--Lecture by Professor Doremus.

Professor Doremus, in the last of his course of scientific lectures before the Young Men's Christian Association, New York, discoursed on electricity and its applications. In opening, he said that Oersted, of Copenhagen, was the first to make known the fact that electric currents have a marked influence upon the magnetic needle. This discovery led to a multitude of other discoveries, chief among which is the telegraph. The Professor here explained the minute details of operating the telegraph, and, in speaking of the rapidity with which the electric current moves, stated that recently a message was sent from Cambridge, Mass., to San Francisco and back in less than three quarters of a minute, excepting the time necessary to repeat it at the various stations. A prince visits us, and almost the very moment he lands on our soil, his family are acquainted with the fact by electricity. Another prince lies on his deathbed, and day by day, hour by hour, the whole civilized world is informed of his condition, and made to sympathize as one common family. It has been claimed recently that electricity will one day supersede the steam engine, but he could not think so, as it seems thus far to be utterly impossible to move anything but comparatively delicate instruments or machinery by its method. Professor Doremus next explained the various applications of electricity to heat for purposes of exploding torpedoes, blasts and mines, and even for assisting in surgical operations by heating the platinum knife, which, when used, of course cauterizes the wound; also the application of the galvanic battery to the human system in cases of paralysis and poison. The Professor had seen a person, whose arm was rendered utterly useless by the disease just mentioned, perfectly cured in from five to six weeks by the use of the battery. In conclusion, the speaker remarked that the greatest, most glorious field for this agency—its application to the human system to restore life, or, in other words, as a resuscitator—was as yet wholly unexplored; but he trusted that we should, before many years, find a solution of this problem.

A CONNECTICUT paper says that a lawyer hung out his shingle in the town of Bethel, in that State, but left after a year, having had only one case, and that was of inflammatory rheumatism. Hard on the lawyer, but creditable to the Bethelists.

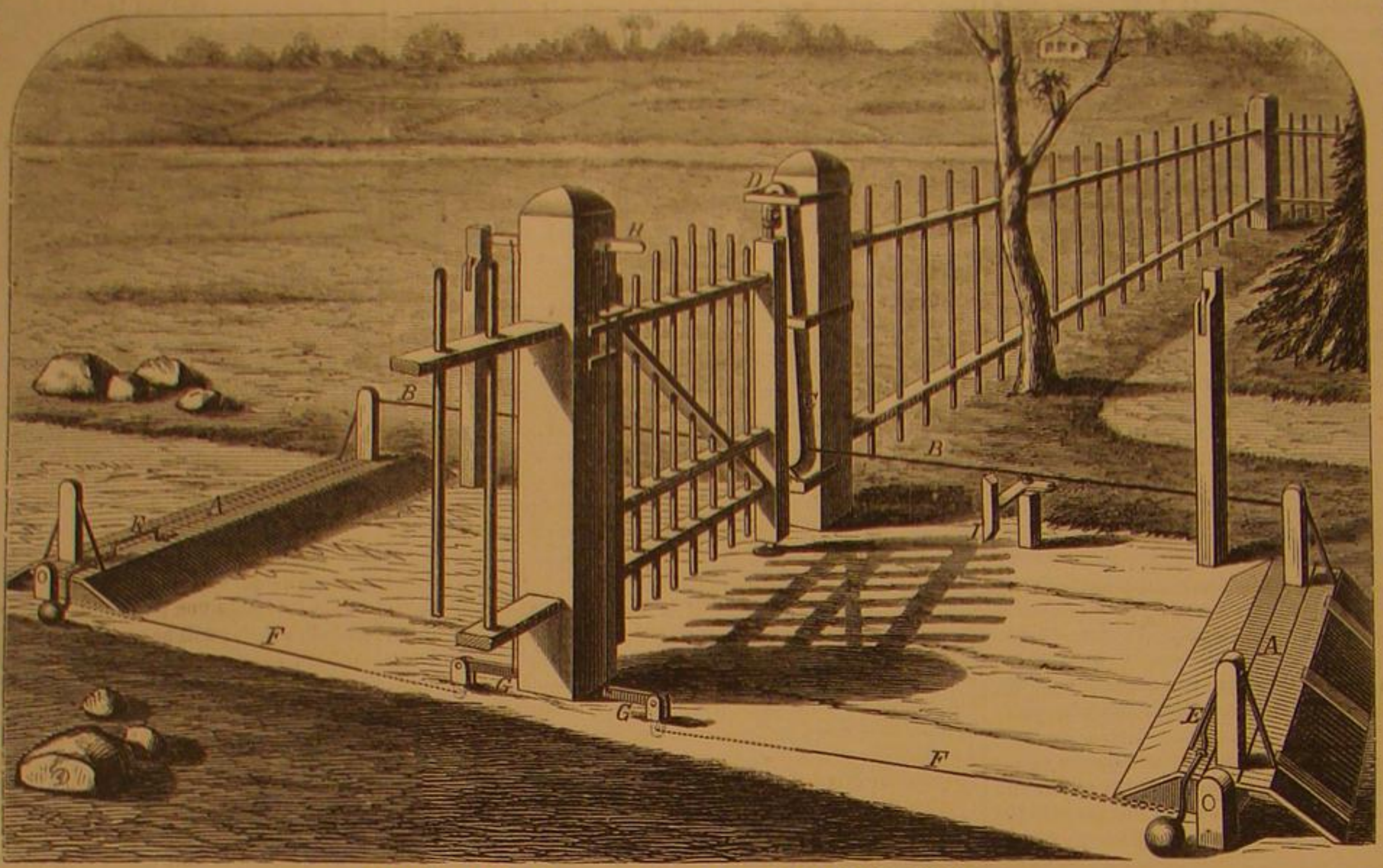
Automatically Acting or Rocking Gate.

Only when the points of support in a swinging door or gate are in the same perpendicular line, will it remain in any position in the arc of its oscillation on its hinges. If the top hinge be placed to one side of the perpendicular line which passes through the lower hinge, the gate will swing toward that side of the perpendicular. If the top hinge be made movable from side to side of the perpendicular line described, it is obvious that the gate may be made to swing, by its own gravity, either one way or the other, as the hinge is thrust to one side or the other.

The gate which forms the subject of the annexed engraving is thus constructed, and is also made to latch and unlatch itself automatically on the approach of vehicles, opening in the direction of the advancing carriage, and closing automatically after the vehicle has passed.

This is accomplished by very simple means. The carriage, as it approaches the gate, passes over a rocking bridge, A. From a perpendicular rock-bar, attached to A, passes a cord, rod, or chain, B, to a lever (not shown) behind a tilting bar, C, pivoted to the hinge post of the gate, which tilting bar carries the pintles which support the gate and on which it swings.

The top part of the tilting bar, C, slides back and forth in a metal guide, D, as it is tilted from side to side by the action of the bridges, of which there are two, as shown.



AUTOMATICALLY ACTING OR ROCKING GATE.

In swinging together, the gate latches itself. It is unlatched by the wheel of the carriage which, in passing over the bridge, depresses a weighted crank lever, E, which acts to raise the latch through the rod, cord, or chain, F, the bell crank lever, G, and rods which operate the latch.

The gate, as it swings open, strikes against wind guards, I. These are pivoted to the tops of the short posts which support them, and are attached by short chains to the connecting rods, B, as shown; by which means they act to give the gate a start in closing, this being necessary when the action of strong winds opposes the movement of the gate.

It is evident that when, in passing over either bridge, the tilting bar is inclined to swing the gate open, the rocking of the bridge on the other side of the gate will tilt the bar in the other direction, so that the gate will close. It is also evident that no animal can open the gate, nor can it be left open by accident, so long as the working parts are in order. A rider on horseback opens the gate by lifting with his hand the lever, H, which is connected with the latch. When droves of stock are passing through, the gate is held open by a hook on the wind guards.

The gate is easily made, by ordinary workmen, from materials generally at hand; and any ordinary swinging gate is easily altered into one of these rocking gates.

The invention was patented July 12, 1870, and February 7, 1871. For further particulars and descriptive catalogues, address J. Madison Cutts, attorney and counsellor at law, corner of 7th and E street, Washington, D. C.

Preserving Eggs.

The subject of the preservation of eggs, says the *Boston Journal of Chemistry*, has recently attracted a great deal of attention, and many methods of effecting it have been published; though none are altogether perfect, for the simple reason that the true cause of the spoiling of the eggs is either unknown by those who have attempted to furnish us with directions, or has been lost sight of by them. There are two efficient causes for the spoiling of eggs, and unless one or both of these are avoided, we cannot hope for success. The first is exposure to a high temperature, and the other is access of air. It may be safely affirmed that at temperatures below 32° Fahr. nearly all change ceases in organic bodies, while very few organic substances will bear continual exposure to a temperature above 90°. The freezing point is rather too low for the preservation of eggs in good condition, as freezing affects the flavor unfavorably; but, if we desire to preserve eggs in the best manner, we must keep them cool—say at a temperature below 50°, if possible, a temperature which is frequently maintained in good cellars. But it will be of no use to place the eggs in a cool cellar if they have been previously exposed for hours to a temperature of over 90°.

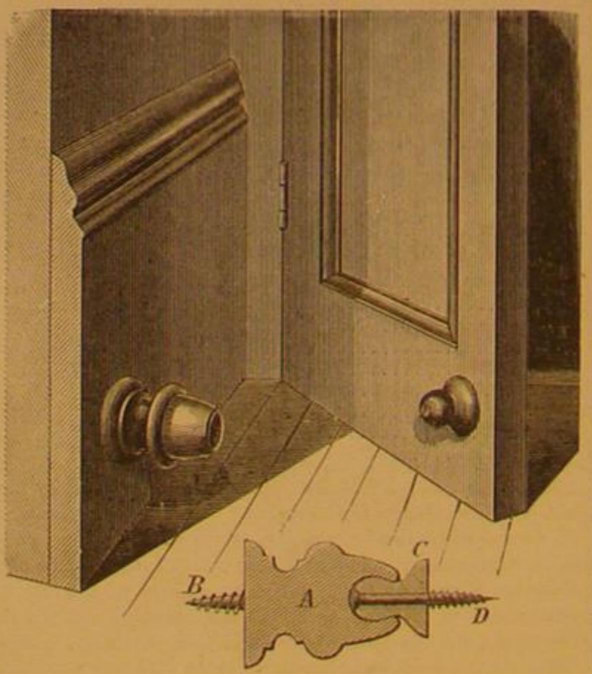
The collection of the eggs must, therefore, in the first place, engage our attention. Those who raise poultry, and especially those who keep fowls for the sake of their eggs, commit a great error when they fail to remove from their yards those birds that are inclined to set, and which consequently take every opportunity of warming the eggs in the nests. If any one will attempt to preserve eggs that have been subjected to the hatching process for one or two days, he will discover the force of this statement. Kohler, of Germany, who owns an extensive poultry raising establishment, and who every winter preserves thousands of eggs without ever losing one, has recently published an account of his method of proceeding, and has given the following rules for securing favorable resul's:

1. The nest must be placed in a cool position.
2. The fowls that show a tendency to set must be removed at once, and placed in separate inclosures until this propensity has left them.
3. If many hens be confined in the same inclosure, or use the same nests for laying their eggs, the eggs ought to be removed from the nests several times a day.
4. The eggs ought to be assorted according to age, and preserved in boxes with the covers always partially open. These boxes must be kept in a cool, airy, and perfectly dry place.
5. At the commencement of winter, the store of eggs is placed in some room that is not heated by fire, but that is, at the same time, thoroughly protected from frost.
6. The packages should be so arranged that the oldest may be used first.

Eggs treated according to these rules do not acquire the peculiar taste which is generally the result of the recipes in vogue for preserving eggs.

WENDELL'S COMBINED DOOR BUFFER AND DOOR FASTENER.

The object of this simple device is to act as a buffer in preventing door knobs from striking the wall when doors are



thrown open, and at the same time to keep the doors in the open position when so desired. The objection to devices now in use, for overcoming the concussion in throwing the door against the washboard pedestal, is the rebound they give the door, throwing it away from the position designed for it. To obviate this, several devices have been brought out, consisting of springs, ratchets, catches, etc., most of which have been proved too intricate and expensive for the purpose.

The door buffer and fastener in the annexed illustration has the combined merits of simplicity, durability, effectiveness, and cheapness, as will be seen from the following description and an inspection of the engraving in which a section of the stop is shown.

A represents the pedestal to be attached to the washboard by the screw, B. This pedestal can be made from wood, brass iron, or porcelain, in plain or ornamental forms, the gimlet pointed wood screw, B, being permanently attached. The rubber cushion, C, is to be attached to the door by a screw, D. It will be seen that the contraction of this rubber cushion when entering the cup-shaped cavity in the end of the pedestal, and its natural expansion, after entering, constitutes the catching device. It requires but little direct pushing to fasten the door, and but little to unfasten it, yet it is held firm against wind or draft.

The striking of the face of the pedestal against the base of the rubber cushion lessens the concussion. The simplicity, cheapness, and usefulness of this invention recommend it to builders, carpenters, and families, the cost above the ordinary pedestals now in common use being merely nominal. It requires no skill or special tools for application. In a word, it is one of that class of little things by which the public is benefitted cheaply, and from which the manufacturer generally reaps a substantial pecuniary reward.

Patented June 27 1871. For further information address Wendell & Francis, 436 Walnut street, Philadelphia, Pa.

Recent Progress in Chemistry.

I wonder what Sir Humphry Davy would have said to any one who talked about stellar chemistry. That great man, in ridiculing the idea of lighting London with gas, triumphantly asked the fanatics who proposed such a wild scheme, whether the dome of St. Paul's was to be the gasometer? Yet we cannot imagine Regent street illuminated, or rather darkened, with dips again, and to us stellar chemistry has a real meaning. Who will venture to bound a science which reaches far away through space, and with unerring accuracy tells us the composition of distant worlds and distant suns? What can be more humiliating to our small intelligences than the reflection that a distant star will photograph its spectrum on a sensitive surface with the ray of light that left it when the oldest man in this room was a boy? What would the great father of British chemistry have said, had he stood in the lecture room of the Royal Institution, where his great discoveries were made, and seen the burning hydrogen extracted by our great countryman Graham, from a meteorite, the heat and light of another world: or could he look with Lockyer on the burning flames of hydrogen, which dart up from the sun to a hight of 50,000 miles, or could he read the flashing telegrams which run so rapidly round our world, that all our notions of time are completely upset, and we actually receive intelligence today which was sent tomorrow? (Excuse the apparent absurdity; it only shows how powerless language is to keep up with human progress.) Had he lived with us, he would have seen a large city dependent entirely for its communication with the outer world by a marvellous kind of photography, so minute that it enabled a pigeon to carry a proof sheet of the *Times* under its wing.—*E. C. C. Stanford.*

The increasing use of bromide of potassium, another of chemistry's contributions, would have been impossible, were it not for the extraordinary discovery of an apparently evaporated sea water bed in Germany. The amount of bromide consumed in medicine is now enormous, and most of it is derived from this source. The same mines have also completely changed our sources of potash; they produce far more than all the other sources of England and France put together, and have so reduced the price that carbonate of potash is now largely made in this country at a price which competes most favorably with American pearlash, and will ultimately drive it out of the market. Bromide of potassium is an instance of a substance long used in medicine before its valuable properties were discovered.—*E. C. C. Stanford.*

It is stated that a little girl in Philadelphia died a few days ago from hydrophobia taken by biting off a thread after mending a rent in her dress which her dog had torn with his teeth in play. She had the disease in its most frightful and distressing form. This is probably a case of idiopathic tetanus or lock jaw, the symptoms of which often simulate to some extent those of hydrophobia.

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NEW YORK, SATURDAY, DECEMBER 23, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

CLOSE OF THE TWENTY-SIXTH YEAR OF THE SCIENTIFIC AMERICAN.

Our readers will pardon us if we display in this article the natural gratification we feel in the continual and increasing prosperity of the SCIENTIFIC AMERICAN. This number closes its twenty-sixth year of existence. So long a connection with the publication of a single paper as we have had almost identifies it with our daily existence. The pride we feel in it redounds to the good of our readers, for our ambition will never consent to see our journal deteriorate either in quantity or in quality of matter.

Our editorial labors during the past six months have been arduous. These months have not been prolific in discoveries or inventions of such a nature as to furnish fertile subjects for discussion or numerous items of interest. Yet, we have, we think, succeeded in rendering our paper even more interesting and profitable than in preceding volumes. We have full evidence of this in the steady healthy growth of our subscription list, in the encouragement constantly received from correspondents, and in the increasing patronage in every department of our business.

The conviction we feel that our paper exerts one of the most important educating influences in the world, and tha its record may be scrutinized in vain to find in it anything that has not been salutary to mental and moral progress, gives us courage to urge upon all to help us in widening its circle of readers. We are not content to have the largest circulation of any paper of the kind now published. We wish to reach others who have not as yet learned, by long perusal, the real value of such a publication.

You, OLD FRIEND, whose long acquaintance with its merits has deepened your respect and regard for the SCIENTIFIC AMERICAN, and who feel and write that you have been our patron for more than a quarter of a century and would not be without the paper if obliged to dispense with one meal a day, say those kind words not to us only, but tell the same thing to your neighbor and shop mate. Tell him to send for a copy if he wants one to see how he likes it, and induce him to try it for six months or a year. When the SCIENTIFIC AMERICAN visits a house for six months, it generally finds a permanent home there.

As will be seen by our prospectus, we offer special inducements to those who aid us in getting new subscribers.

We have no solicitude about the old patrons renewing; we simply ask that they will do so promptly that we may not miscalculate the quantity of paper to print at the commencing of the volume.

THE GREAT EXHIBITION AT VIENNA, 1873.

We published, on October 28th of the present year, the announcement of the appointment, by the Emperor of Austria, of a commission to arrange for holding an international exhibition at Vienna, in 1873; and on November 18th our readers were given some further information on the subject, and some suggestions, for organizing a proper representation of American genius and industry, based on our experience gathered in Paris, London, and elsewhere. The Austrian scheme is gradually getting into shape, the form and dimensions of the building having been decided upon. A building 3,000 feet in length and 660 in width is to be erected; this structure will be crowned with a cupola, about 330 feet in diameter. This will be finished by October 1, 1872. A separate building will be provided for exhibiting machinery in motion, and another for the works of art. The novel features in the arrangements have been submitted by us to public approval, and it now remains for the manufacturers, inventors, and scientists of the United States to decide upon their course of action.

Constructors and patentees who have introduced their inventions in European countries have suffered grievous illtreatment at the hands of the Austrian authorities, whose regulations on the subject of patents are, to say the least, not formed for the protection and reward of foreign talent and ingenuity. One most vexatious rule is that which invalidates a patent unless the article be manufactured *in the realm*, within twelve months from the date of issue. Now as patents are, in a measure, characterized by the locality in which they take rise, and are generally most economically worked in the country in which they originate, it is almost equivalent to prohibition to enact that the locomotive engines of Great Britain, the telegraph instruments of the United States, and the printed muslins of France shall be manufactured on Austrian soil within a year from securing the patent, and is a preposterous requirement, which ill comports with our liberal system of granting patents to their subjects.

But worse remains to be told. An American gentleman, having a manufactory at Vienna, was enabled to comply with this obnoxious rule; but he recently had a taste of Austrian legal administration. He had obtained a patent and commenced the manufacture of the article almost simultaneously; and two trustworthy and credible witnesses were produced to prove this fact, but the officials deemed their affidavits insufficient, and the manufacturer has been summoned before a court of justice to prove the introduction. Such hindrance of the rights of foreigners gives rise to an uncomfortable suspicion that the value of Austrian patents, issued to Americans and other foreigners, can be easily escheated to the benefit of the Austrian public. The inventor in question even goes farther, and intimates that his production, being used by the Imperial government, was specially and purposely hindered from its proper protection, that the authorities might more readily convey it to their own use without reward to the patentee.

Under such laws, it would be well for the Austrians to consider whether their invitation to the nations is not likely to meet with a contumelious refusal. Here, as elsewhere, experience is valuable, and we remember that when we sent to Europe in 1851, 1855, 1862 and 1867, we took our inventions and processes to an open market. Neither in London nor in Paris was there any room for suspicion that our specimen machines and productions were there for Europeans to avail themselves of, the American being allowed a courteous protection of his invention while the exhibition lasted; but we do not learn that Austria proposes any such protection. The result of this most erroneous and destructive policy will easily be foreseen.

LYCEUM OF NATURAL HISTORY---DISCUSSION ON MILK AND DISINFECTANTS.

At the meeting of the chemical section of the Lyceum of Natural History, on Monday evening, December 11, two important papers were read, one on "Milk," by Dr. Schweitzer, Assistant Professor in the School of Mines of Columbia College, and the other on "Disinfectants," by Dr. Endemann, Assistant Chemist to the Board of Health.

Dr. Schweitzer has had occasion to analyse a very large number of specimens of milk, gathered by the sanitary inspectors of the Board of Health, and it was a satisfaction to hear him say that he had never found any other adulteration than water. The popular impression, that chalk, calves' brains, and similar unappetizing impurities are added by milk dealers, appears to be erroneous. The chief results obtained by Dr. Schweitzer were as follows: Normal milk has the specific gravity of 1·029, and contains from $12\frac{1}{2}$ to 13 per cent solid constituents. Two, out of numerous analyses, afforded:

Water	87·81	87·23
Butter	3·23	3·81
Casein (cheese)	3·57	3·71
Sugar	4·69	4·46
Ash	0·70	0·79

The best specimens of condensed milk gave: water, 53·54; butter, 13·12; casein, 14·44; sugar, 16·30; ash, 2·60. In the preparation of the condensed milk, 430 quarts were condensed to 100, and the solid constituents increased from 12·55 to 46·46 per cent. These results appeared to warrant the suspicion that 378 quarts had been reduced to 100; but by making the correction, called for by the fact that the quart was a measure of volume while all the determinations were made by weight, the company were found to have actually started with 430 quarts to make 100 of the condensed article. The ashes of milk are rich in phosphates and alkalies.

Dr. Schweitzer has added largely to our knowledge of the composition of milk, and it is to be hoped that his valuable paper will be published in full, in some technical journal.

Dr. Endemann, at the request of numerous members of the Lyceum, gave a sketch of experiments tried with various disinfectants, under the direction of the Board of Health, taking them up in the following order:

1. Metropolitan disinfecting fluid. This famous disinfectant is composed of 90 per cent of a saturated solution of sesquichloride of iron, and 10 per cent of carbolic acid. If it be entirely neutral, its operation is quite effective; but the chief difficulty encountered with it was in its acid character, which destroyed articles brought in contact with it, and often liberated bad gases.

2. Girondin disinfecting fluid is composed of zinc and copper salts, and can only be obtained on a large scale in countries where these salts are the incidental products in extensive chemical manufactures.

3. Chloralum had been subjected to a thorough trial, and found wanting. It is essentially composed of the hydrated sesquioxide of aluminum, and in its action has the tendency to liberate sulphuretted hydrogen instead of fixing it.

4. Bromo-chloralum is the preceding with a little bromine added to it; but as this bromine is in combination with alkaline bases, it is of no effect; and the disinfectant was found to be no better than it should be. The fact was brought out that forty years ago, M. Gannal, in France, proposed chloride of aluminum for the embalming of bodies, but did not seem to find acceptance, and was forgotten until Mr. Gamgee recently revived it for the preservation of meat. It appears to have disappointed the expectations that were raised in reference to it; and also as a disinfectant and antiseptic its value has been overrated.

5. Egyptian powder was declared to be only a little less disgusting than the bad odor it was intended to disinfect. The remedy was worse than the disease. It appears to be essentially clay, mixed with a few per cent of the carbolic acid contained in refuse tarry liquids, and was said to have a decidedly disagreeable smell.

6. Dry earth and peat. Dr. Endemann gave us the result of his experience, that for the disinfecting of night soil, there was nothing so valuable as dry earth and peat. Other disinfectants poisoned the rich soil and destroyed vegetation, but the simple earth prevented the growth of germs, and thus stopped the spread of disease and added to the growth of plants. We cannot dispense with disinfectants and antiseptics on all occasions, but there are many instances where dry earth could be more effective, while it is cheaper and more easily handled.

Professor Joy confirmed the observations of Dr. Endemann, and stated that he had tried the earth closet system for two years, and was convinced that it was destined to supersede all other methods of getting rid of the fecal matters, both in the city and in the country. He believed that it was better to stop the cause of disease at the outset, rather than to scatter it broadcast through our water closets and open privies, and then to try to prevent its further spread by the use of costly chemicals. The open country privy and the city water closet were declared to be the very hot bed for the germination of the worst forms of disease; and the sooner both are abolished the better for the welfare of the community. The ashes of hard coal, which the scavengers carry in enormous quantities from every house in the city, can be used as a substitute for dry earth. It is only necessary to run this through a tolerably fine seive, and to use it in the commode, and after use, to pass it into the garbage barrel, to be carried away in the carts.

All that any family requires is a hopper shaped reservoir for holding the sifted ashes, a galvanized iron hod, and a pull up similar to that which is provided in water closets. It is easy enough to try the experiment, as commodes of different patterns are now kept on sale. Such a use of fine coal cinders would be very valuable; and the material thus obtained from private houses would be highly prized by farmers. If the Board of Health would go to work energetically in this matter, they could do good work in introducing a much needed reform. We cannot expect to go on forever contaminating the rivers and bays with the contents of our sewers. A stop must be put to it some time, and the sooner the better. Who will put the earth closet system into such a practical shape as to drive water closets out of our city houses and banish the unsightly temples from country houses? We trust that the time is not far distant when this result will be accomplished.

THE MYSTERIES OF FLIGHT.

Perhaps in the whole range of animated nature there is no greater mechanical mystery than the flight of birds. We publish in this issue a well authenticated account of a most remarkable flight of some carrier pigeons, one flying at a rate of 196 miles per hour through a distance of 1,004 miles, and another, 202 miles an hour for a distance of 1,596 miles. The article referred to gives accounts of other remarkable flights which, as we do not deem them well attested, we shall not further refer to at this time.

The power necessary to propel a pigeon 200 miles per hour proves, upon computation, to be something astonishing. The shape of one of these birds is almost perfectly adapted to reduce cross-section resistance to a minimum; but we think we shall be considered as entirely within bounds when we assume that such resistance would be as great as that exerted upon one half a square inch of flat surface. The pressure upon this surface moving through air of ordinary density at the rate of one mile per hour is, according to Smeaton, 0·000017 of one pound. Though the air, at the hight at which pigeons fly, has less than the ordinary density close to the earth's surface, its rarity tells as much against the action of wings as it lessens resistance to advance, and may, therefore, be neglected in the computation. At a velocity of 200 miles per hour the resistance of air upon one half a square inch of flat surface would be 40,000 times that at a speed of one mile per hour, or 0·68 of a pound. The bird to fly three and a third miles per minute would, therefore, be be obliged to overcome 11,968 foot pounds per minute, or to exert a force of over one third of a horse power.

It is impossible to believe this can have been the case with the pigeons in question. We are rather inclined to believe that they availed themselves of the aid afforded by air currents flowing in the direction of their flight. Though the wind might appear blowing against them when released, it is well known that at different altitudes currents of air may be rapidly flowing in opposite directions, and thus we have good ground for our supposition.

We last week commenced the publication of an article, which is concluded in our present number, entitled "Notes on Flying and Flying Machines," which contains much interesting information. Mention is made therein of many kinds of bird and insects; but we believe that the flight of sea gulls affords a more useful study than can be obtained from the movements of any other bird of equal strength of wing, on account of the fearlessness with which they approach the observer. We think no one can watch the evolutions of these birds without conceding that we are far from having solved the mystery of flight. Taking into account their weight, it is impossible to conceive their power, to float in air and to sail against a strong current of wind, as due to the slow and easy movements of their wings. We have watched these birds daily for months together, and we are wholly at a loss to account for their ability to sustain themselves with so small an effort as they appear to exert. The most rapid movement of their wings appears to be made when they poise themselves in air without advance or retreat. When sailing either with or against the wind, they seem to need but little power to propel them. This peculiarity may be noticed in all the birds which can sail slowly through the air, like the eagle, hawk, etc. The swallow, which skims like an arrow, moves its wings, which are large in proportion to its size, with great rapidity. The stroke of the pigeon is also swift and strong. The wings of the wild goose scarcely move more than one hundred and twenty times per minute, yet they are small in proportion to the weight of the bird, which is often from ten to thirteen pounds.

Standing with a glass on some high peak, one may see, in certain localities and seasons, flock after flock of wild geese traversing the sky from horizon to horizon with steady and uniform stroke, and probably passing thirty or forty miles from the time they are first discovered till they disappear in the distance. Now let the curious reader calculate the power necessary to sustain a body weighing ten pounds, by one hundred and twenty successive and uniform impulses per minute, without taking into account cross section resistance to advance, and he will begin to appreciate the mystery of flight.

It is because this mystery exists that the problem of human flight through the aid of machinery is still unsolved. As soon as we know the mechanical principles of flight, we shall have some ground for judging its possibility or impossibility to "birds without feathers."

SCIENCE RECORD FOR 1872.

We have in press, to be issued January 1st, a new and valuable book of 350 pages octavo, entitled as above, which, we think, will be read everywhere with interest. It will be a compendium of scientific progress of the present year, and is to be profusely illustrated with steel plate and wood engravings.

The following is a partial outline of the general contents of the *Science Record:*

Notices and descriptions of the leading discoveries and improvements invented or introduced during the present year, pertaining to Engineering, Mechanics, Chemistry, Philosophy, Natural History, Agriculture, Architecture, Domestic Economy, and the various Arts and Sciences, with many engravings.

Biographical notices of prominent men of science, with portraits.

Descriptions of the most important public works, began or completed during the year, with illustrations.

Notes of the progress and extension of railways, telegraphs, and other means of communication.

Descriptions of the new applications of steam, electricity, and other motive powers, with engravings.

Almanac for the year, and a chronological table of notable scientific events and phenomena.

Reports of Patent Office proceedings. Classification of inventions at the Patent Office, with the names of all examiners, officials and employees.

Portrait and biographical sketch of the Hon. M. D. Leggett, Commissioner of Patents.

Description of that great engineering work, the Mount Cenis Tunnel through the Alps, with engravings of the tunneling machinery, portraits of the chief engineers of the work, and other illustrations.

Description of the great Government works at Hell Gate, New York, with many illustrations, showing the wonderful galleries now being cut in the rocks under the bed of the East River, preparatory to removal of these obstructions by explosion, the drilling machinery, the electric apparatus, and other interesting objects.

Description of the great Suspension Bridge between New York and Brooklyn, now in process of erection, with interesting engravings.

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APPLICATIONS FOR EXTENSION OF PATENTS.

FLOATING ANCHOR AND LIFE PRESERVER.—Joseph Humphries, Washington, D. C., has petitioned for an extension of the above patent. Day of hearing, February 28, 1872.

RAISING DOUGH.—James Perry, Brooklyn, N. Y., and Joseph C. Fuller Orange, N. J., executor of Elisha Fitzgerald, deceased, have petitioned for an extension of the above patent. Day of hearing, February 21, 1872.

Examples for the Ladies.

Mrs. Governor Branch, Enfield, N. C., has used a Wheeler & Wilson Machine since 1857 without the slightest repair, and it is now as good as when new; during the war it stitched country homespun for over 100 negroes.

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To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

T. B., of Pa.—We have not the address of manufacturers or dealers in white brass.

CARBON PLATES FOR BATTERY.—Gas carbon is rather a hard material to work. There are various ways of making plates for batteries of it. For an amateur, it has been recommended to cut it with a tenon saw. It will cost some elbow grease, but perseverance will give you success.

EXPANSION OF BELT.—I think, in the dispute between A and B, A is decidedly wrong in his opinion about belts being tighter in wet weather than in dry; and I can convince him that it is not so. At the late South Carolina State Fair, the belts that drove the cotton gins were run from two engines on the outside of the building, and I noticed that the belts were slacker on one day when it was raining, than they were on the other days that were clear. This, I think, is proof enough.—E. O. McC., of S. C.

CANKER IN MOUTH.—I notice that, in reply to F. S. C., a correspondent recommends the use of muriated tincture of iron as a mouth wash, for the above affection. If F. S. C. uses that remedy in that manner for a few months, he will ruin his teeth, and will injure them if he uses it for any time. He will find a solution of chlorate of potash—two drams to two ounces of water—a much more efficient remedy and perfectly harmless.—C. S. S.

TWIN BOILERS.—To H. P. S.: The trouble with your boilers is in the connections on top. From what you say you have no steam dome on either boiler, which is undoubtedly the cause of all your trouble. Put on a dome of fifteen or eighteen inches diameter, running to the center of each boiler; connect it by not less than a four inch pipe to each boiler. Then take your steam from the center of the dome, where you will connect your safety valve, and your trouble is over, if the mud drum is clear.—W. J. W.

GRAPE JUICE.—In answer to query 4, No. 23, I would say that if the grape juice be from cultivated varieties of grape, the way to make good wine out of it is to let it ferment without any admixture of any kind, and to draw it off clear in the spring, when it will be a pure and wholesome wine, ready for use or the market. If the juice be from wild grapes, and, as is usual in that case, very astringent and deficient in sugar, let M. T. M. add to it equal parts of water, and to each gallon of the mixture two or three pounds of white sugar. Both formulas make good wine, but the former pleases better the European and the latter the American taste.—D. L.

CURIOUS FREAK OF TWIN BOILERS.—Let me say that the trouble can all be got rid of by making the steam pipe, connecting the two boilers on top, 3½ or 4 inches inside diameter, and connecting the two at the water line with a 4 inch pipe. This allows the water to maintain its level regardless of unequal firing. The trouble is caused by the small connecting pipe; as two pounds pressure will raise water four feet high; by firing heavily under one boiler you can fill the other full to the safety valve. There is no trouble of this kind where large connections are used, even with four boilers connected together.—B., of O.

SUCTION PUMP.—In answer to M. W. Q., of Mo.: He is very much mistaken when he says "ten feet horizontal is equal to one foot perpendicular." I can show him a pump on the Chicago and Alton Railroad, at Shipman (now working and has been for seven years) that draws water 730 feet horizontally and 16 feet perpendicularly, and works well.—J. M.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING DECEMBER 12, 1871.

Reported Officially for the Scientific American.

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121,701.—SASH SUPPORTER.—W. H. Brown, Bangor, Me.
121,702.—TOY ENGINE.—A. Buckman, Brooklyn, N. Y.
121,703.—DOOR PLATE.—W. A. Caron, Springfield, Mass,
121,704.—HALTER.—J. Carpenter, Wilmington, O.
121,705.—MOWER.—D. H. Chamberlain, West Roxbury, Mass.
121,706.—BOX FOR WHEEL.—W. A. Clark, Westfield, Conn.
121,707.—AUGER.—W. A. Clark, Woodbridge, Conn.
121,708.—FLOUR BOLT.—J. C. Cookson, Lancaster, Pa.
121,709.—GUARD.—W. Darrah, J. Cutshall, Coshocton, O.
121,710.—SAFE.—J. Farrel, New York city.
121,711.—BOLT.—J. Farrel, J. Weimar, New York city.
121,712.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,713.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,714.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,715.—BACKGROUND.—A. R. Gould, Carrollton, O.
121,716.—HYDRANT.—P. H. Griffin, Albany, N. Y.
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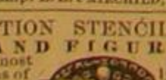
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"*Blade-o'-Grass*," by B. L. Farjeon, Author of "Joshua Marvel," with many beautiful illustrations, is just commenced in Harper's Bazar.

"*The Golden Lion of Granpere*," by Anthony Trollope, with illustrations, to commence in the February Number of Harper's Magazine.

They have also secured the plates and advance sheets of "*London: a Pilgrimage*," by Gustave Doré and Blanchard Jerrold, a new and magnificent series of illustrations from the pencil of the great French artist.

A new Novel by Miss Thackeray, whose writings have won deserved popularity by their purity of tone, genial imagination, and fascinating style, will be commenced early in the year.

The great Spanish statesman, Emilio Castelar, will furnish an important and interesting paper for an early number of Harper's Magazine on "*Republicanism in Europe*."

Mr. George William Curtis, under the now familiar sobriquet of "An Old Bachelor," will continue his weekly contributions to the Bazar entitled "*Manners upon the Road*." This series of Social Lessons, commenced with the first issue of the Bazar, has proved one of the most attractive features of that journal.

"Porte Crayon" will begin in an early number of the Magazine a series of illustrated papers portraying life and character in the Southern States under existing conditions. Colonel T. B. Thorpe will contribute to the March Number of the Magazine an interesting illustrated paper on the United States Treasury Department. Mr. Eugene Lawrence will continue his contributions on important historical subjects. Mr. Moncure D. Conway will resume his "*South-Coast Saunterings*" in an early number, and will contribute other illustrated papers on interesting European topics.

These unprecedented attractions will require occasional literary Supplements to Harper's Bazar and Harper's Weekly, which will be included in the regular issue, free of charge to subscribers.

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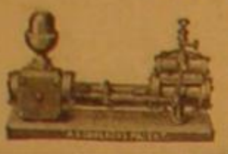

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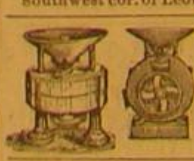

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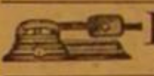

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