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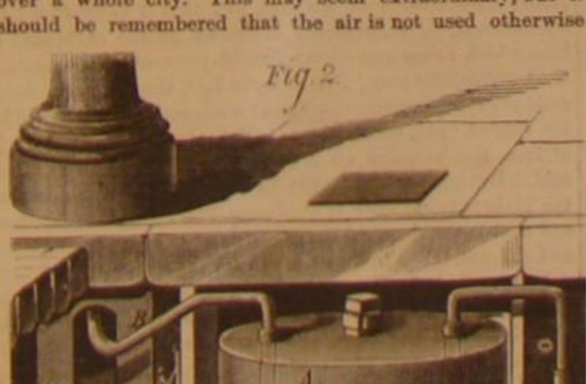
A NEW SYSTEM OF GAS LIGHTING.

A new system of lighting public thoroughfares, which for a year past has been in operation in a street in Jersey City, is certainly something novel in the practice of gas illumination, and, if we may judge from a brief examination, aided by the inventor's explanations, is an advance of considerable value considered from an economical point of view. The scheme abolishes gas works, and machines which produce gas by the passage of air through or mingling of air in hydrocarbon vapor. Paradoxical as it may seem at first, there are no gas pipes—in short, the gas generator is located in the burner, and the invention reduces itself simply to the means of sending the requisite gas-producing material to that point in each post or fixture. Without further preamble, let us state that the entire apparatus consists of an air compressor at some central locality, several small tanks (one to each lamp post) laid under the side walk, a small air tube connecting with each from the reservoir filled by the compressor, and another small tube which carries a petroleum product up to the burner. This is the simple plant which it is proposed to substitute for elaborate manufactories, miles of heavy piping, and innumerable meters at special points.

De GUINON'S SYSTEM OF GAS LIGHTING.

From the large engraving, Fig. 1, given herewith, the general arrangement of the tanks in the street will be understood; a sectional view of one of these receptacles is presented in Fig. 2. The tank is made of galvanized iron, with top and bottom of copper, and holds forty-eight gallons, that quantity of oil being somewhat in excess of a six months' supply. The hydrocarbon used is a benzine, grade 75, a product of low value and for which there is but little or no industrial employment. It is fed into the tank through an aperture in the top, this being accessible through an iron cover and scuttle arranged in the side walk. The pipe, A, is the main air conduit leading from the central reservoir, and communicating with the tank by the short tube shown. Extending up from the bottom of the receptacle is another pipe, B, which leads to the gas burner. It is evident that, an air pressure being produced in the tank by the current from pipe, A, the same, acting on the surface of the oil, will force the latter up pipe, B, and so to the point of combustion. The burner employed is provided with a small retort in which the oil circulates. A portion of the oil burning below this retort converts its contents into gas; the latter subsequently passes through various passages in which it becomes mingled with the proper quantity of air, and finally escapes from the orifice, where it is ignited. The exact form and nature of the burner it is not necessary here to dwell upon, inasmuch as the essential features of the device are those relating to the oil-feeding arrangements.

In lighting a large number of lamps—from 100 to 5,000—it would be necessary to have a small steam engine or water power to compress the air and keep it at a uniform pressure, which may be from four to six pounds per square inch. Clock work may be used for any number of lamps under 100. A two inch main pipe, distributing right and left and as near the center as possible, the inventor informs us, would be sufficient to supply two or three thousand lamps distributed over a whole city. This may seem extraordinary, but it should be remembered that the air is not used otherwise



than to supply the displacement by combustion of the oil in the tanks and such accidental leakage as may occur. By such leakage, however, obviously there is no loss of gas, as when the latter is transmitted through pipes. The air costing nothing, if it should escape—except the labor of pumping—the actual displacement, we are informed, would be only 64 cubic feet in 2,000 lamps in 10 hours burning, and a half inch pipe could supply this in less than five minutes.

The cost of operating the system has been determined by the actual working of eight street lamps using a six foot burner each. In 35 days of ten hours each, eight gallons of material per lamp were consumed, or sixty four gallons in all. This at the present price of the oil—ten cents per gallon—would cost $6.40. The aggregate number of hours is 2,800, so that, with the six foot burners, a total of 16,800 cubic feet of gas was consumed. From these data it is clear that the cost per thousand feet is about thirty-eight cents, a mere fraction of the average cost of coal gas.

On visiting lately the locality in Jersey City now lighted by this process, we were enabled to examine the practical operation of the apparatus. The light seemed to be smokeless, and apparently is as powerful as that of ordinary street gas. The street in which the lamps are located is near the river and almost unprotected by buildings, a fact which suggested to us the question of how the intense cold of the past winter had affected the gas. In answer, the inventor informed us that, although the wooden boxes in which the oil tanks were enclosed became filled with water, which froze solid and so continued all winter, the lights remained entirely unimpaired. A large conflagration of a factory in the vicinity gave, besides, an excellent opportunity for noting the effect of great heat. This, though sufficient to melt the lantern frames and burners, showed no influence on the gas, nor produced any explosion in the oil contained in the tanks.

The invention would seem to be especially adapted for use in country towns and villages where no gas works exist, as it renders the lighting of the streets a matter of small expense and easily accomplished. It is also well suited for the illumination of gardens and pleasure grounds, as there can be no escape of gas to injure vegetation; and the necessity of tearing up the soil to lay heavy pipes is obviated. It may also be adapted to the lighting of buildings of any description. The tanks may be made to hold enough oil to last a year, so that filling need be done only at long intervals.

The system is protected by two patents, the most recent dated March 9, 1875. For further particulars address the inventor, Mr. R. V. de Guinon, P. O. Box 59, Jersey City, N. J.

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NEW YORK, SATURDAY, JUNE 5, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE ORGANIC ORIGIN OF THE EARTH'S CRUST.

A popular theological dogma declares that life is the grand object of creation, that the composition as well as the contour of the earth's surface has special reference to its habitability, and that all things show a ruling design to fit the world to be the home of sentient creatures, more especially of man.

Strictly speaking, Science has nothing to do with such dogmas. It has no means of discovering the ultimate purposes of things, and no time to waste on their discussion. Nevertheless it is difficult sometimes not to take an indirect interest in the claims of those who presume to decide such questions, at least so far as to notice how aptly the facts of Nature contradict their assertions. Thus in the present case, it would be much easier to sustain the contrary thesis, namely, that so far from having been made what it is that it might be inhabited, the earth became what it is through being inhabited; in short, that life has been the means, not the end, of the earth's development.

In the light of recent discoveries, Byron's poetic extravagance: "The dust we tread on was alive!" becomes a simple statement of observed fact. And the earlier and more paradoxical assertion of Linnæus, that not the superficial dust merely but the very framework of the earth is the product of life, would seem to be equally true. "Fossils are not the children but the parents of rocks," he said; and Huxley declares that the whole effect of the discoveries made since his day has been to complete a larger and larger commentary on his words. The deeper we go into the history of the earth's crust, the greater the part we find to have been played by life in determining its composition and character. Even the rocks heretofore accounted azoic, and of an age anterior to the beginning of life, are now shown to be, in all probability, of organic origin; still more remarkable, as in process of formation to-day.

The observations of Dr. Hooker during Sir James Ross's voyage of antarctic exploration, confirmed by those of Dr. Wyville Thompson on the Challenger expedition, leave no doubt that the antarctic sea bottom, from the fiftieth parallel to the eightieth, perhaps to the pole, if the sea extends so far, is being covered with a fine deposit of silicious mud composed of the shells of diatomaceous vegetation, the skeletons of radiolarian animals (all microscopic and inhabiting the surface water) with the spicula of sponges which live on the bottom. In many parts of the arctic sea beds, a similar deposit is known to be in process of formation. Thus, through the agency of minute life, immense beds of silicious rock are forming in the polar regions, similar in character to those of early geological strata. In many cases the soft and friable fine-grained sandstones thus formed in fresh water have been changed by the action of percolating water into a dense, semi-transparent, opaline stone; and there is no reason to doubt that the same metamorphic agencies may convert the polar deposits likewise into a form of quartzite, a kind of rock whose organic origin was formerly unsuspected.

Throughout the broad belt of warmer water between the polar caps of silicious mud, the same accumulations are going on, but they are obscured and overpowered by an immensely greater amount of calcareous sediment, chiefly composed of the skeletons of dead *foraminifera*, also microscopic. This forms the *globigerina* ooze, containing a large percentage of carbonate of lime and a small percentage of silica: a chalky deposit capable of conversion into limestone and even crystalline marble by ordinary metamorphic agencies.

The formation of coral reefs has long been a favorite illustration of the gigantic results effected by minute organisms; but great as these are—and the longest coral reef extends, like a huge wall two thousand feet high, as far as from Boston to Chicago—the work of the little reef builders becomes insignificant in comparison with the *débris* of microscopic life which covers the beds of all the seas to unknown depths; while the coralline limestones of the continents, vast and massive as they are, are immensely overbalanced by the strata which undoubtedly owe their existence to minute plants and animals.

The cretaceous *globigerina* ooze is the most widely spread material of the sea bottom throughout all the great oceans, at depths from a few hundred to over two thousand fathoms. In shallower waters—and they are extensive—the gray ooze is slowly transformed into a green deposit identical in character with the greensands of the geologists: a formation which Ehrenberg found to be mainly made up of casts in a silicate of lime and alumina of the interior cavities of *foraminifera*, after Professor Baily had discovered that such was the origin of the greenish mud from the sea bottom off the Florida coast. "In these casts, the minutest cavities and finest tubes in the *foraminifera* were sometimes reproduced in solid counterparts of the glassy mineral, while the calcareous original had been entirely dissolved away." In other places, in the Gulf of Mexico, in the South Atlantic, and in the Pacific, the same transformation of *globigerina* ooze to greensand is going on.

But the most remarkable change goes on in the extreme depths of the sea, especially below 3,000 fathoms. Professor Thompson reports that, in crossing from the shallower regions occupied by the ooze into the deeper surroundings, the calcareous formation is found universally to pass gradually into an extremely fine, pure clay, which occupies, speaking generally, all depths below 2,500 fathoms, and consists almost entirely of a silicate of a red oxide of iron and alumina. "The transition is very slow, and extends over several hundred fathoms of increasing depth; the shells gradually lose their sharpness of outline, and assume a kind of 'rotten' look and a brownish color, and become more and more mixed with an amorphous red-brown powder, which increases steadily in proportion until the lime has almost entirely disappeared." The geological importance of this red clay formation is shown by the fact that, in sounding between Teneriffe and Sombrero, a distance of about 2,700 miles, two areas of red clay (aggregating 1,900 miles across) were discovered.

From his studies of the character and distribution of the red clay, Professor Thompson concludes that it is not a substance introduced from without, but that it is produced by the removal, by some means unknown, of the carbonate of lime which forms something like 98 per cent of the material of *globigerina ooze*; that it is, in fact, the ash or insoluble residue of calcareous organisms: a supposition sustained by the reddish mud, consisting of silica, alumina, and red oxide of iron, that remains after treating the ooze with a dilute acid. But one test remains to be tried to give, if successful, the highest probability to Professor Thompson's conclusion; and that is the chemical examination of *globigerina*, diatoms, and the rest, taken in the open sea for the constituents of the red clay. This done, we might rest satisfied that the clay is, as Professor Thompson believes, an essential element of the organic part of the ooze, and therefore to be classed, with chalk, as an organic product, not, as heretofore supposed, as in all cases the result of the disintegration of older rocks. The significance of this admission of clay to the list of organic products can scarcely be over-estimated, for it compels us to push back the probable antiquity of life to periods so remote that the Lower Silurian epoch becomes relatively modern. It is, as Professor Thompson observes, impossible to avoid associating the red clays of existing deep seas with the fine, smooth, homogeneous clays and schists of the remotest geological periods, formations which, more or less metamorphosed, obtain such a vast thickness in the so-called azoic strata.

Reviewing the results of the Challenger expedition in this field of research, Professor Huxley, assuming the correctness of Professor Thompson's hypothesis, shows how, by the agency of the microscopic plants and animals which are filling existing seas with silicious, cretaceous, and clayey sediments, the entire crust of the earth might have been developed. "Just as a silicious deposit may be metamorphosed into opal or quartzite," he says in conclusion, "and chalk into marble, so known metamorphic agencies may metamorphose clay into schist, clay slate, slate, gneiss, or even granite. And thus by the agency of the lowest and simplest of organisms, our imaginary globe might be covered with strata of all the chief kinds of rocks of which the known crust of the earth is composed, of indefinite thickness and extent."

The agency of organic acids in precipitating from chalybeate and other mineral waters our beds of iron ore, our veins of copper and other metals, according to Professor T. Sterry Hunt, falls in here as another indication of the vast, almost omnipotent, influence of life in determining the earth's mineral character, and consequently its geology, geography, flora, fauna, and the rest.

PROGRESS OF RAPID TRANSIT IN NEW YORK CITY.

The State Legislature has granted authority to the Elevated Railway Company, to extend its line northerly to the Harlem river, and it is said that the new work will soon be commenced. At present there is a single track supported on single iron posts over the sidewalk, commencing at the southerly end of Greenwich street, near the North river, and extending north as far as 30th street on Ninth avenue, a distance of 3½ miles. It is well patronized, but its capacity is limited. Under the new powers given to the corporation, the work is to be enlarged. The company has lately repaired the present track, put on wooden crossties, changed the gage, etc. A small space is left between each crosstie, and the bed of the road is not, therefore, quite a complete deck. The *Railroad Gazette* questions the propriety of using these crossties, believing them to be unnecessary in respect to strength, and likely to result in annoyance to pedestrians, owing to the drip caused by rain and snow.

With a view to strengthen the track, the Company has also lately added four braces or struts to each column, extending from the upper part of the column to the under sides of the track girders, with a longitudinal reach of about three feet. The *Gazette* says: "Whatever may be the object of these struts, their actual effect is the transmission of unbalanced longitudinal side thrusts to the columns, which bend, quite perceptibly, from the direction of approaching trains. These columns are ill suited to withstand side thrusts, and the frequent application of such can hardly fail to prove injurious. As every train bends all the columns over which it passes, more or less, it may be found a wise economy, in prolonging the life of the structure, to entirely remove these struts, which have just been attached at no small expense."

We are sorry that our cotemporary is not better satisfied with the improvements that have been made. Its fears as to the effects of the struts on the stability of the columns are in our view unnecessary. The Company appears to have done the best it knew how under the circumstances, and all the patrons of the road are pleased with the improvements.

A portion of the new Underground Railway, on Fourth avenue, has just been opened for traffic, namely, from the Grand Central Depot at 42nd street, northerly to 98th street, over two miles. All the trains of the Harlem, Hudson River, and New Haven Companies now run underground, and their withdrawal from the surface of Fourth avenue gives great satisfaction to the inhabitants residing on the line. The vibration produced by the passage of trains is scarcely noticeable in the adjoining houses. The avenue surface above the railway tunnels is now being repaved, and will soon present a most beautiful, attractive appearance. A stranger in passing through this portion of the avenue would be surprised if told that, directly under his feet, the trains of three great railways were flying along at lightning speed. The forty-ton locomotives are no longer seen or heard.

The underground tunnels are three in number, built side by side, consisting of a central single arch tunnel of 26 feet 8 inches width in the clear, for two tracks, and two single-track tunnels, 16 feet wide, one on each side of the central. The central tunnel is spacious, well aired, and tolerably well lighted, by frequent central openings through the roof. It is a complete success, being much more pleasing to the traveler, and far better ventilated, than any of the tunnels of the London Underground railways. The single track tunnels, however, are defective in respect to ventilation; but they could be easily rendered satisfactory by the use of mechanical means for introducing additional air.

The value of property along this portion of the line has augmented since the tunnels were authorized. The same may be said of property at the northerly or Harlem portion of the avenue, where the tracks, although not arched, are placed below the street surface, and bridged at the street crossings. But the contrary is the case along that portion occupied by the viaduct, from 98th to 116th street. The solid granite walls of this structure occupy the central portion of the avenue, for a width of 50 feet, and rise from 10 to 30 feet above the street surface. The prospect of a blank stone wall directly in front of one's window is not considered very inviting by householders, and the price of property here is comparatively low.

The State Legislature has also passed a general law, under which commissioners may be appointed in any city in the State, with power to locate a steam railway, and convey a franchise for construction, to stock subscribers.

GREAT GUNS.

It was thought by our government, not long ago, that a 15 inch cast iron gun, able to throw a 500 lbs. ball a distance of three miles, was about as big a thing in the way of armament as would ever be wanted. And so the forts in New York harbor and other places were supplied with them at great expense. The visitor at Forts Hamilton and Tompkins, down the bay, will see long rows of these grim monsters, arranged in battle line, vainly waiting for employmen against floating enemies. Compared with more recent guns they are now mere pigmies, of no sort of consequence, and the quicker they are broken up and removed the better.

Mr. Menelaus, now President of the Iron and Steel Institute, England, says: "Mr. Longsden informs me that they are making at Essen, at the present time, 14 inch guns of steel, which weigh, when finished, 57½ tuns, carrying a shot of 9 cwt. 9½ English miles, using a charge of 210 lbs. of gunpowder. They are about to make steel guns of the following capacities and weights: 15¾ inch bore, 30 feet long, weighing 82 tuns, using 300 lbs. of powder, with a shell of 1,500 lbs. weight; guns of 18 inches bore, 32 feet 6 inches long, weighing 125 tuns, using 440 lbs. of powder, with a shell of 2,270 lbs. weight. Mr. Longsden demurely adds: 'It is calculated, for the present, that these guns will be heavy enough to destroy any armor a ship can carry.' In gloating over the destructive properties of these weapons, he is leaving out of his calculation, perhaps, the flash of lightning ships which Mr. Reed is about to build, and which may, under smart management, be able to get out of the way of such a conspicuous object as a shell weighing over a tun, even when fired with about a quarter of a tun of gunpowder."

THE DISTRIBUTION OF WEALTH.

We cannot hope to give, in the brief space here at our disposal, more than a passing notice to a few of the more salient thoughts in the admirable address recently delivered by Mr. David A. Wells, before the American Social Science Association, at Detroit. The subject, "The Accumulation and Distribution of Wealth," is one which relates to the much discussed relation of capital and labor, regarding which no one topic exists more encumbered with sophisms and popular fallacies. In these times, when the latter underlie a constant succession of agitations, ranging from the French commune to a local trade uprising, such views as those of Mr. Wells, boldly spoken and widely published, are doubly welcome. We commend them to those who would limit the distribution of wealth, who believe in the subversion of the relations of employee and employed, who denounce the substitution of machines for hands, and indeed all who, while ostensibly laboring for the imaginary rights of a semi-deified ideal dubbed the working man, are themselves the main obstacles to the advancement and to the amelioration of the real grievances of the laboring poor.

Mr. Wells points out that never before has man been able to produce so much with a given amount of personal effort. The productive power of this country since 1860 has increased 20 per cent, and there is no more curious incident of this continuing progress than the fact that, in staple manufactures, the abandonment of large quantities of costly machinery, and its replacement by new, is periodically rendered a matter of absolute economical necessity to produce more perfectly and cheaply, and at the same time to avoid the destruction of a much greater amount of capital by industrial rivalry. On the other hand, a highly increased consuming power on the part of the masses is evident, showing a corresponding rise in the standard of comfort. Despite this, however, the difficulties of earning a living are not lessened, the cry of the poor is as loud, and the discontent with the irregularities of social condition even more strikingly manifested. The relative position of poor and rich, in other words, remains practically unchanged, although every one knows that the benefits conferred by Science and invention have fallen on all equally. The humblest laborer of the present day possesses luxuries which kings not many years ago could not obtain; but still, if a disparity exists between him and other men, due no matter to what cause, he becomes the propounder of that interminable social problem which, stripped of all disguises, amounts to the reduction of all men to the level of the weakest in mind or body, and the prevention of any future inequality by the abolition of every species of reward for superior effort, skill, or attainment.

There is no doubt but that, as Mr. Wells in another portion of his address remarks, the doctrine of every man for himself is a pernicious one from a social point of view. Society must protect itself; it must labor for its own benefit as if it were a body physical, and each member is thus compelled to work for the welfare of his fellows in order to serve his own material interests. The conditions precedent, however, to the future progress and well being of society are not merely that shall be increasing abundance, but that it shall be distributed among the masses to the greatest extent consistent with the retention and exercise of individual freedom. To gain this last end, demands have been made extending to the cutting down of the working time to six hours per day, and the actual *per capita* division of all the wealth of the country or of the world.

Mr. Wells shows very clearly the fruitlessness of these propositions, by pointing out that, even with the better mode of living wrought by the introduction of improved machinery, people must labor as much as they do now, in order to maintain themselves in their present condition. There is not enough capital in existence to allow of reduced laboring hours. The maximum value of the annual product of this country is $7,000,000,000; and of this, nine tenths must be immediately consumed in order that we may live, and to make good the loss and waste of capital. The result has been that, after 250 years toiling as a nation, we have only managed to get three and a half years ahead in the way of subsistence. If now, as a whole people, we should stop working, four years would be more than sufficient to starve three fourths of us out of existence, and reduce the remaining one fourth to barbarism. If the annual profits of the country could be divided among the inhabitants, it would give each an income of but $175 a year. The average annual earnings of common unskilled laborers is about $400; or allowing each man to support three other people, this would average $100 to each individual. The wealth of the country, according to Mr. Wells' estimate, is $35,000,000,000, which, if divided among the inhabitants, would be $6,000 each. The division, however, would be of short duration, as the money would inevitably find its way back into the hands of the most prudent, cunning, and skillful.

In conclusion, Mr. Wells said that "it is entirely within the power of society to effect a remedy, by adopting agencies whose simplicity and effectiveness long experience has proven beyond all controversy. But herein lies the difficulty. Like Naaman, we are anxious to be cleansed, but, like him, expect to be called upon to do some great thing, and are apt to be disappointed when we are told that the simplest measures will prove the most effectual. In point of natural resources, we have all we can desire. To make these productive of boundless abundance, there must be industry and economy on the part of the individual; and on that of society, a guarantee that every man shall have an opportunity to exert his industry and exchange its products with the utmost freedom and the greatest intelligence. When society has done this, we shall have solved the problem involved in the relations of capital and labor so far as the solution is within the control of coöperative human agency; for in giving to each man opportunity, conjoined with freedom and intelligence, we invest him as it were with crown and miter, and make him sovereign over himself."

THE DURABILITY OF GLASS.

It is well known that many kinds of glass, especially when submitted to the influence of moist air, do, in the course of time, undergo certain changes; the polish is tarnished, the transparency diminished, while the surface becomes covered with thin iridescent layers, small fragments of which peel off, while threads show themselves in the mass. All kinds of glass are not equally subject to these changes; but certain qualities possess the tendency to undergo such modifications in the highest degree. They show, sometimes in the course of a few days or weeks, a very slight efflorescence on their surface, which we should be very much inclined to consider to be dust. But in order not to be deceived, it is well to apply the microscope and chemical analysis; and then, in many instances, the supposed dust is proved to be composed of transformed glass. Some kinds of glass soon become covered with an exceedingly thin layer of moisture, which causes the dust to adhere, and the glass never shows a fresh, clean, or brilliant surface.

These changes may be observed in the highest degree, and studied the most easily, in glass which has been buried a long time. Such glass, when unearthed, is found to be opaque, almost through its whole mass. It has often lost its solidity, and consists of a number of thin and opalescent layers. We have had the good fortune to obtain specimens of glass recently found in an ancient temple on the Island of Cyprus. It had been buried for 3,000 or 4,000 years, and most of it exhibits an opalescence, surpassing in beauty the finest mother of pearl. For these specimens we are indebted to General Di Cesnola, who made the collection of Cyprian antiquities known by his name, now belonging to the Metropolitan Museum of Art, New York city. General Di Cesnola has returned to Cyprus in order to continue his investigations, and, if possible, secure for our country a series of interesting antiquities forming the intermediate link which succeeded Egyptian and preceded Grecian art.

Colladon states that he discovered that, if our modern glass is buried for a long time deep in the earth, it becomes flexible, and may be changed in form without being broken; but that, when again exposed to the air for some time, it becomes hard and brittle as before.

The modifications which glass undergoes in the air are especially due to water and carbonic acid. It is well known that many of the hardest minerals, such as felspar, become disintegrated and change their nature entirely under the influence of these two agents. Their destruction is sure, and is only a question of time. All the particles soluble in water are gradually washed away; while, in regard to the others, when they are not carried off by mechanical action, they remain in the place where the disintegration happened. It is the same with glass. The silicic acid, which, in glass, is combined with an alkaline base, is set free by the carbonic acid of the air, which combines with the said alkali. The alkaline carbonate thus formed is dissolved by the water and washed away; and finally there remains, in the place of the glass, nothing but the almost pure silicic acid. According to Griffith, all very ancient glass proves by analysis to possess this composition. Hausmann has analyzed glass which had been buried for a long time. It possessed an opalescent surface, was opaque, and disintegrated; while only the interior layer was still transparent. He found that the opalescent surface contained almost no alkali, that the lime, as well as the sub-oxide of iron, had been carried off, and that the transformed mass contained nearly 20 lbs. of water. We found that the Cyprian specimens also, alluded to above, contained no trace of alkali, consisting as they did of an almost pure and beautifully opalescent silicic acid.

The first things carried off by the water are the soda and potash. Then follows the lime, which is less soluble. This was especially verified by Bingley, who analyzed specimens of glass which had, for various periods of time, been submerged in a lake. The action of water on glass was first investigated by Scheele, and is very remarkable. According to the old experiments of Bischof and Fuchs, if a good, hard glass is placed in water, after having been finely pulverized, the glass soon shows a blue reaction on red litmus paper, when placed in contact with it, which reaction can only be due to carbonates of the alkalies. Pelouse made recently the same experiment; and not being aware of the older experiments, he announced it as a new discovery.

A glass containing 77 per cent silicic acid, and thus quite hard, when finely pulverized and treated with water, gives to the latter over 10 per cent of its substance. This consists, however, not entirely of alkaline ingredients, as a small portion of the silicic acid dissolves at the same time. In order to comprehend the latter statement, it must be considered that insolubility is only relative; there is scarcely a substance which is absolutely insoluble. Water drops constantly falling will at last perforate a stone, so that every drop must carry off some of the substance. Water kept in glass bottles will ultimately dissolve traces of the silicic acid of the glass, and many springs of water contain silicic acid, as the chemical analyses of several kinds of spring and well waters have demonstrated.

The influence of carbonic acid on moistened glass gives rise to many interesting experiments. Pulverized glass moistened with water absorbs carbonic acid from the air, and becomes effervescent. If the glass powder be boiled with the water, it will, after cooling, absorb carbonic acid more rapidly. The researches of Louis on pulverized felspar show that this mineral, which resists most chemical agents so successfully, is easily disintegrated by simple boiling in water. Experience shows that the various kinds of glass found in commerce behave in various ways when exposed to moist air. And why should it be otherwise? These various kinds of glass differ in their chemical composition, in the ingredients used, and in their proportions. They differ in molecular structure, in thickness, mass, and solidity, all of which details affect the properties. At the same time, whatever be the physical or chemical condition of the glass, that is, its molecular state or composition, it is certain that the destruction is more rapid in proportion as a greater surface is exposed to the attacking atmospheric agencies. This being the case, it is an interesting problem to find out which kinds of glass are, by their chemical composition, best adapted to resist these atmospheric agencies.

Government Tests for Metals.

Among the recently passed acts of Congress was a provision for the appointment of a Board of Experts to test the Strength and Value of Iron, Steel, and other metals. The President has appointed the following persons to constitute the Board, namely: Lieut. Col. T. T. S. Laidley, President; Commander L. A. Beardslee, Lieut. Col. Q. A. Gillmore, Chief Engineer David Smith, W. Looy Smith, A. L. Holley, R. H. Thurston, Secretary.

This Board of seven persons has organized and divided itself up into fifteen separate committees of three individuals each. W. Looy Smith is chairman of four of the committees, R. H. Thurston chairman of three, Lieut. Col. Gillmore chairman of two, A. L. Holley chairman of two, and Chief Engineer Smith chairman of one.

Most of our modern scientific discoveries are the results of investigations made under adverse circumstances, in many cases by obscure persons living in penury; in others, by teachers or college professors of limited means, oppressed by laborious professional duties. Of late the idea has begun to prevail that the true way to promote original investigation is to employ prominent men at the expense of the government, giving them good salaries, comfortable quarters, and first-rate apparatus for experiments. Relieved of all anxiety in respect to making a living by other duties, it is supposed they thus will be able to devote themselves so exclusively to Science that the boundaries of knowledge will be rapidly extended. The present Board has been created on the above idea. All the members are persons of ability, and if we do not now learn a thing or two that is new about metals, their strains and qualities, it will probably be because nothing remains to be discovered. But our expectations of the present Board are very exalted, and, as fruits of their labors, we hope to chronicle many early, interesting, and important discoveries.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE PROPAGATION OF CELERY.

Celery is a native of Norway and Sweden, where it grows near the edges of swamps. This plant is rarely cultivated as it should be, hence the stunted specimens which appear in our markets. A deep trench should first be dug, at the bottom of which a layer of sticks of wood, say six inches thick, should be placed, a drain pipe being placed endwise upon one or both ends of the layer. The sticks should be then covered with about a foot of rich mold, wherein the plants should be set, in a row and about five inches apart. The plants should be kept well watered, the water being supplied through the drain pipes, so that, passing through the layer of sticks, which serves as a conduit, the water is supplied to the roots of the plant. In earthing up, care should be exercised to close the stems of the plant well together with the hand, so that no mold can get between them. The earthing process should be performed sufficiently frequently to keep the mold nearly level with the leaves of the outside stems. If these directions are carefully observed, the plant may be grown at least four feet in length, and this without impairing the flavor, which deterioration is commonly noticed in overgrown vegetables and fruits.

PHOSPHORUS CRYSTALS.

M. Blondlot announces that crystals of phosphorus may be be obtained by heating dry phosphorus in a sealed tube at 112° Fah. The phosphorus volatilizes and forms crystals on the upper portion of the tube.

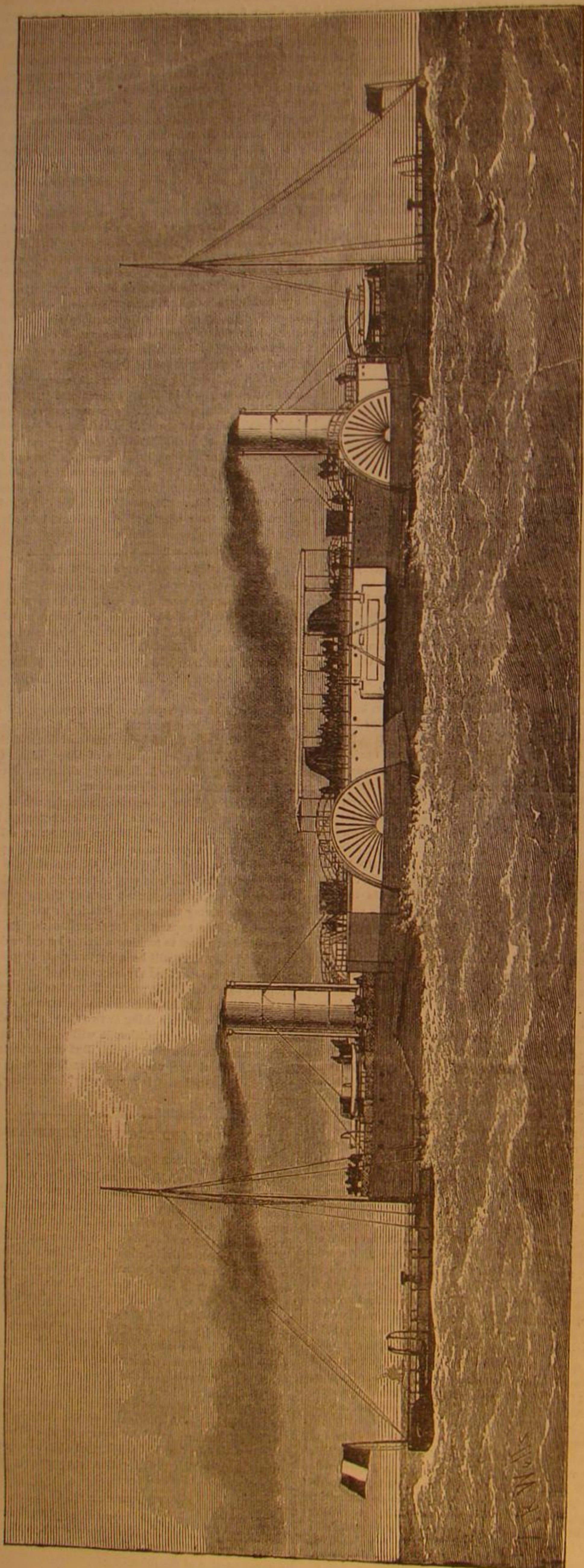


Fig. 1.-THE NEW SWINGING SALOON STEAMER BESSEMER.

THE BESSEMER CHANNEL STEAMER.

This steamer is now about to commence her regular traffic between England and France, and naval authorities will soon have their doubts as to the success of Mr. Bessemer's invention resolved. Whatever be the fate of the ingenious device of the renowned inventor, there can be no doubt but that the vessel is a magnificent experiment. The voyage is about 22 m les in length; and steamers of 400 or 500 tuns tuns burthen, and 300 or 400 horse power, have been hitherto found large enough for the traffic. But the Bessemer is 350 feet long and 40 feet broad, as large as many of the Atlantic steamers, although her tunnage is somewhat less than her dimensions would indicate, owing to the low freeboard at each end of the vessel, as shown in our first illustration. Her engines have already indicated 4,600 horse power, which aggregate is divided between two pairs of paddle wheels. Even if the suspended saloon does not answer all expectations, the new ship will be a great benefit to invalids, for she will shorten the time required for the passage to a little more than one hour. Our second illustration shows the general appearance of the deck of the steamer, with the promenade on the top of the oscillating saloon.

At a recent meeting at the Institute of Naval Architects, London, a discussion on this ship took place; and Admiral Sir Spencer Robinson stated that he was on board the Bessemer when she left Hull (where she was built), and the ship proved herself to be remarkably steady in a very heavy sea; and Mr. J. Scott Russell stated that Mr. Reed, the designer (who was present at the meeting), had succeeded in building a vessel of the maximum stability in a cross sea, besides endeavoring to gain an advantage by the use of the Bessemer saloon. All the speakers complimented the designer on the speed and behavior of his vessel, and anticipated very quick travel in her, without regard to wind or weather. It was stated by Mr. Scott Russell that it is in contemplation, by the French Government and the Northern Railway of France, to construct a deep water harbor at Calais, and so avoid the landing of passengers at half and low tides at the long wooden jetties which traverse the great width of sand that fringes the coast. This improvement would make a saving of perhaps 15 or 20 minutes in the journey from Dover to the Calais railway depot.

Mechanical Effects of Light--The Radiometer.

At a recent meeting of the Royal Society, at Burlington House, Mr. William Crookes, F.R.S., read a paper detailing his new discoveries on the action of light, and illustrated his remarks by experiments. It had long been supposed that no direct mechanical effects could be produced when luminous rays were allowed to fall upon one end of a most delicately balanced lever arm suspended *in vacuo*; but the author of the paper proved conclusively, by experiment, that not only heat, but also luminous rays, were capable of producing direct mechanical effects; so that, by the employment of a new instrument (called by him a radiometer), it was as possible to measure the intensity of the rays of light falling on it from either side as it was to measure the rays of heat with a thermometer.

The radiometer consists of four small pith disks, fixed at the extremities of two crossed arms of straw, balanced upon a pivot at the point where the straws cross each other, so that they can spin round on the pivot. The pith disks at the extremities of the four arms are white on one side, and blackened with lampblack on the other. The entire arrangement is inclosed in a glass bulb, from which the air is removed by the aid of a Sprengel's air pump. The disks and arms spun round rapidly when submitted to the action of light, but dark radiant heat had no effect on them. When submitted to the action of light, from which 95 per cent of the heating rays had been cut off, by means of the interposition of a plate of alum, the disks still rotated, though with slightly decreased velocity. Contrary to what might have been expected, it was the blackened surface of the disks which was repelled by light. In order to test Professor Osborne Reynolds' suggestion—that the effect of repulsion might be produced by residual vapor in the bulbs, and not directly by radiation—Mr. Crookes exhibited the same effects with a lever arm of platinum, suspended by an arm of platinum, the whole of which had been heated to redness again and again, during thirty-six hours of exhaustion by the Sprengel pump, so that it was difficult to suppose that any residual vapor, competent to produce the observed effects, remained in the bulb.

Mr. Crookes further stated that, in some refined experiments made by Dr. Balfour Stewart, at Kew Observatory, when rapid motion was obtained *in vacuo*, radiation was obtained outside; while in Mr. Crookes' experiments radiation was produced outside, and motion in the vacuum, so that the experiments appeared to be the converse of one another. The lever arms used in some of the experiments were suspended upon single fibers of glass, so thin that, when one end of the fibers was held in the hand, the other portion would float about like a spider's thread, and usually rise until it took a vertical position. The whole apparatus was of the most delicate description, and was made by Mr. Gimingham.

Petroleum Oil.—Good petroleum should be colorless or light yellow, or with the faintest tinge of violet. It should have no unpleasant odor, and at 59° Fah., should have a specific gravity not exceeding 0 804, or not less than 0·795. When shaken with sulphuric acid diluted with its own bulk of water, it should only color the acid a light yellow, becoming itself lighter in color by the treatment. At 95° Fah., it should not burn when a light is applied.

Fig. 2.—THE NEW SWINGING SALOON STEAMER BESSEMER.—THE DECK AND UPPER PART OF THE SWINGING SALOON

The International Exhibition of 1876.

English manufacturers have scarcely done with the Vienna Exhibition of 1873 before they are officially invited to take part in a similar international demonstration in 1876. This time, however, the scene shifts from the old world to the new—from Vienna to Philadelphia—the actual *raison d'être* of the exhibition being to celebrate the hundredth anniversary of American independence. For this purpose, a large part of Fairmount Park, one of the boasts of Philadelphia, has been allotted, and since many months engineers and contractors have been pushing on the work with untiring energy; for although a year has yet to pass before the exhibition opens, unceasing labor will be necessary to complete the task.

We shall in due time publish full drawings of the designs and construction of the various buildings, but we may take this opportunity of giving some idea of the scale of the exhibition. There will be five main structures—the Industrial Hall, the Machinery Hall, the Art Gallery, the Horticultural Pavilion, and the Agricultural Hall. Besides these, there will of course be the numberless smaller buildings in the park, which will spring up of necessity in all directions.

The main building is constructed chiefly of iron and glass, and in its general design bears a marked resemblance to the Great Exhibition of 1851. It lies about due east and west, and covers a rectangular area 1,880 feet by 464 feet in width. The greater part of this large building is only of one story, the hight being 70 feet. At the corners are four towers 75 feet high, and in the center of the building the roof, for the space of 184 feet square, is raised, and at each corner is placed a tower 120 feet high. The total areas of this building are as follow:

	Acres.
Ground floor	20·02
In galleries	0·85
In towers	0·60
	21·47

In the direction of its length, the building is divided into seven parts. In the center is a main avenue 120 feet wide and 1,832 feet long; on either side is an aisle 48 feet in width, then two more avenues each of 100 feet, and between them and the wall of the building on each side are two other aisles of 24 feet. Three transepts of the same width, and divided in the same way, break up this enormous hall, and destroy the monotony of a long, unbroken roof line.

The Machinery Hall is also on a grand scale, but neither its design nor construction call for special remark here. It is 1,402 feet long and 360 feet wide, with an annexe 208 feet by 210 feet, and the area covered is 12·82 acres, the available floor space being 14 acres, including the galleries. This building is divided into two main avenues, each 90 feet wide, with a central aisle, and one on each side, all 60 feet wide. In the center is a transept 90 feet wide. The annexe already mentioned is to be devoted to the exhibition of hydraulic machinery.

The Art Gallery resembles somewhat in general design the corresponding building at Vienna. It is built of granite, iron, and glass, so as to be practically fireproof. It is 365 feet long, 210 feet wide, and 71 feet in hight.

The Horticultural Building is a large and elegant structure of glass and iron, 383 feet long, 193 feet wide, and 72 feet high. The Agricultural Hall is also of great dimensions, and of some little architectural pretensions. The materials employed are wood and glass. The general plan consists of a long nave crossed by three transepts, and the leading architectural feature is a Gothic Howe truss. The nave is 820 feet long and 125 feet wide. The central transept is 100 feet in width, and the outside ones 80 feet, the hight being about 75 feet.

Such is a very general outline of the exhibition buildings, which, covering an area of about 50 acres, will be opened in Philadelphia in May, 1876, and to which English manufacturers are invited to come with their exhibits. It should be mentioned that it is not a government undertaking, but simply a public enterprise, to which, however, the government has lent its support by a payment of some $200,000. The responsibility of failure or success rests, therefore, with the promoters; but we believe we may say with certainty that American public spirit will carry through the exhibition to a triumphant conclusion, even if a pecuniary loss should be sustained. With this matter, however, we have little to do, but it is a question of paramount importance whether there exist sufficient inducements to English manufacturers to encourage them to come forward as they have done at previous foreign international exhibitions, or whether the probable disadvantages are too certain to justify their incurring the large expense and great trouble which must inevitably attend the representation of British industry.

It must be evident at once that the disadvantages, if not many, are at least serious. The distance to be traversed, and the cost attendant upon the transport of goods, are of themselves sufficient reasons to discourage many, and we think it is to be regretted that the English Commission can offer no facilities for free transport under government aid, such as will doubtless be afforded by some foreign governments. But the most serious objection is found in the existence of the prohibitive import duties, which rule in the United States, and which effectually check competition of foreign with native manufactures in many branches of industry. Again, the English manufacturer fears, and doubtless his fears have some good foundation, that any special merits possessed by the objects he exhibits will, unless protected by patent right, or by secret of production, be copied or improved upon by some appreciative American competitor. These objections must weigh most powerfully with a large number of manufacturers, and especially with those who would, under more favorable conditions, crowd the space allotted to the British section in the Machinery Hall.

On the other hand, the Philadelphia Exhibition offers strong inducements to exhibitors, above all to some of a certain class. The facilities afforded by the United States patent law have been taken advantage of by a large number of inventors, who, having thus secured their inventions, have every reason for gaining as much publicity as possible, and may do so, not only without fear that they will be grossly pirated, as was the case in the Paris and Vienna Exhibitions, but with the certainty that, if the invention is of such a nature as to create a demand in the United States, they will be able to make advantageous arrangements during the period of the exhibition, either for the sale of their American patents, or for the granting of licenses under them. British exhibitors will also be dealing with an English-speaking, appreciative nation, always eager to adopt anything of promise.

Another powerful inducement is found in the fact that English manufacturers will not contribute their exhibits only for the inspection of United States visitors. For a long while past American manufacturers have been pushing their trade with great success in the various countries of South America, and these countries will look with interest to the Philadelphia Exhibition as a means for making them better acquainted with the United States market. If English exhibitors refrain from contributing, they will lose the opportunity thus afforded of entering into direct and profitable competition, as the objection of prohibitive tariffs does not apply in this connection, and English makers can far outstrip those of the United States in point of price.

In all branches of the industrial arts, English exhibitors have strong reasons for being present, because not only can the producer in this country compete even in the face of the high duties, but the people of the United States, while they possess keen appreciation of the beauty of form and material, are not able either to originate, or even to imitate, high class productions of this nature. That this fact is well known amongst manufacturers is evidenced by the numerous and extensive applications for space in the Industrial Hall made to the English commission. The area originally allotted to Great Britain and her colonies in the building was 46,000 square feet, and already the applications have exceeded a space of 60,000 square feet for the United Kingdom alone, while Canada demands 30,000 feet, and all the remainder of our colonies have yet to be provided for. These applications, moreover, do not include those for hanging exhibits, and for these 27,000 square feet for carpets alone have been applied for. These facts indicate that in the Industrial Hall, at all events, this country will be powerfully represented.

Regarded from a higher point of view than that of immediate trade benefit, it may be urged that a powerful and concerted action on the part of British manufacturers may do much towards breaking down the barriers existing in the channels of free trade with the United States. No better way of appealing to the people of that country in favor of this object could be found than by thus convincing them of the cheap producing power of England; but we think that the chances of success are too remote to encourage our manufacturers into such united action.

Fortunately English exhibitors will have facilities for bringing forcibly under the notice of the American public the difference in cost between free goods and those subjected to existing duty, by marking on each exhibit the actual price, and that made necessary through protective policy.

Judging from present appearances, we believe that the space in the Industrial Building allotted to this country will be crowded to excess, while that in the Machinery Hall will be but scantily filled. The Agricultural Building will, as we gather from (in our opinion) the somewhat premature announcement of the English agricultural engineers, be left without any exhibits of machines and implements belonging to this class, and we fear that but little space will be required in the picture galleries for English paintings or statuary.

Upon one all important point English exhibitors have good reason to congratulate themselves. The government has wisely placed at the head of the British commission the man who, of all others, is best suited for the position, and in whom those who had to do with the Vienna Exhibition have learned to place perfect confidence. Mr. Philip C. Owen will find, we feel sure, a far less onerous and ungrateful task before him than that of 1873, and the liberal grant made by our Government will enable him to render more assistance to exhibitors, and to carry through his work in such a way as to reflect credit upon the country and himself.—*Engineering*.

Purification of Metals by Filtration.

If the substance of which a filter is composed has no attraction for the particles of the liquid to be filtered—that is, is not wetted by it—the interstices of the filter do not act like capillary tubes, and the liquid will not pass through. Mercury will not run through a very fine sieve of iron or copper wire unless the wire be amalgamated; and if this be done, although the meshes be very fine, the mercury will pass through easily, while any pieces of iron, copper, or amalgam will be retained on the filter.

Lampadius, formerly Professor of Metallurgy at Freiberg, Germany, has attempted to make use of this principle in purifying the easily fusible metals, and with what success the following will show: Tinned sheet iron, as thin as paper, was cut into strips six inches long and four inches wide. Five hundred of these were placed face to face and fastened in an iron frame, with wedges driven in to bring them closely together. This frame was luted into the bottom of a graphite crucible. Some impure Bohemian tin was melted in another crucible, and allowed to cool until crystals began to form on the surface, when it was dipped into the filtering crucible. The tin, which was still fluid, ran through almost chemically pure, while a pasty magma remained on the filter, which contained iron, arsenic, and copper chemically combined with iron.

ASTRONOMICAL NOTES.

Observatory of Vassar College.

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

Positions of Planets for June, 1875.

Mercury.

On the 1st of June, Mercury rises at 5h. 53m. in the morning, and sets at 9h. 15m. in the evening. It is at its greatest elongation, east, on the 9th, and should be looked for after sunset, north of the point at which the sun disappears. On the 30th, Mercury rises at 5h. 32m. A. M., and sets at 7h. 51m. P. M.

Venus.

Venus is seen in the morning, rising on the 1st at 3h. 8m., and setting in the afternoon at 4h. 46m. On the 30th Venus rises at 2h. 47m. A. M., and sets at 5h. 48m. P. M.

Mars.

Mars rises on the 1st at 9h. 17m. P. M., and sets the next morning near 6 o'clock. On the 30th Mars rises near 7 P.M., and sets at 3h. 11m. the next morning.

According to the *Nautical Almanac*, Mars occults or hides from our view the star Σ *Sagitarii* on the 30th, at 1 in the morning. As Mars passes the meridian at 11 P. M., it will be in the southwest, when the occultation occurs, and, as its greatest hight above the horizon is but 20½° (in this latitude), it will not be very conspicuous; but the star is of the fifth magnitude, and a telescope of small power will show the phenomenon.

Jupiter.

Jupiter rises on the 1st at 3h. 11m. P. M., and sets at 2h. 17m. the next morning. On the 30th, Jupiter rises at 1h. 15m. P. M., and sets at 0h. 22m. the next morning.

On the 19th of June two of Jupiter's satellites will disappear by coming in front of the planet, and one by going behind the planet; so that for two hours a telescope (unless it be a powerful one) will show but one of the moons, and that the fourth, or the satellite farthest from the planet.

Saturn.

Saturn rises on the 1st just after midnight, and sets at 10h. 26m. A.M. the next day. On the 30th, Saturn rises at 10h. 9m., P.M., and sets at 8h. 24m. the next morning. The best time to look at Saturn is between 3 A. M. and 4 A. M., when it is about 34° in altitude and near the meridian.

Uranus.

Uranus rises on the 1st at 9h. 12m. A. M., and sets at 11h. 25m. P. M. On the 30th, Uranus rises at 7h. 25m. A. M., and sets at 9h. 35m. P. M.

Neptune.

Neptune can be seen to be a planet only by the use of the best telescopes, and at present is above the horizon almost wholly in daylight, so that it is useless to attempt observations.

Sun Spots.

The report is from April 20 to May 18 inclusive. The picture of April 20 shows, near the western limb, the pair of spots mentioned in the last report, one still distinct, the other divided into two smaller ones. On April 4 this group was seen on the very edge, while a small spot appeared, coming on. In the photographs of April 23 and 24, no spot is seen. On April 29 a large group, consisting of penumbra containing several spots and closely followed by two small ones, appeared coming on, while near the center of the disk was another small pair. The pictures of April 30, May 2, and May 3 show a change of motion and position of spots in the penumbra, independent of the motion across the disk.

Photographing was interrupted from May 3 to May 11 by clouds; and since that time till to-day, May 18, no spots have been visible with a glass of 2¼ inches aperture.

Paint.

At a recent meeting of the Society of Engineers, a paper by Mr. Ernest Spon on "The Use of Paint as an Engineering Material" was read. The author, in the first place, considered the necessity for the use of paint, and then noticed the composition and characteristics of the pigments usually employed by engineers. White lead, he observed, should be of good quality, and unmixed with substances which may impair its brightness. It is usually adulterated with chalk, sulphate of lead, and sulphate of baryta, the latter being the least objectionable. Zinc white is not so objectionable as white lead, but is dry under the brush and takes longer in completely drying. Red lead is durable and dries well; but should chemical action commence, it blisters and is reduced to the metallic condition. Antimony vermilion was suggested by the author as a substitute for red lead, and its qualities enlarged upon. Black paints from the residual products of coal and shale oil manufacture, and oxide of iron paints, are generally used for iron work, for which purpose they are peculiarly suited. Allusion was also made to anticorrosive paints, and to those containing silica. Referring to the oils used in painting, the author stated that linseed oil was by far the most important, and that its characteristics deserved careful study. It improves greatly by age, and ought to be kept at least six months after it has been expressed before being used. It may be made a dryer by simply boiling, or by the addition of certain foreign substances. Nut oil and poppy oil are far inferior in strength, tenacity, and drying qualities to linseed oil, and are used to adulterate the latter. The author noticed the dryers employed, and alluded to the properties and means of testing the purity of spirits of turpentine. He then dwelt at length upon the mixing and practical application of paint to new and old woodwork, the preservation of cast iron by means of Dr. Smith's pitch bath, and the cleansing, painting, and care of wrought iron structures. He stated that, when used under proper supervision, no better protection could be found for iron structures than oxide of iron paints. He concluded by observing that the real value of any paint depended entirely upon the quality of the oil, the quality and composition of the pigment, and the care bestowed on the manufacture; and that the superiority of most esteemed paints was due to these causes rather than to any unknown process or material employed in their preparation.

PRACTICAL MECHANISM.

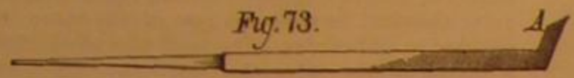
BY JOSHUA ROSE.

NUMBER XXIV.

HAND TURNING—FINISHING TOOLS.

The tool shown in Fig. 73 is an excellent one for finish-

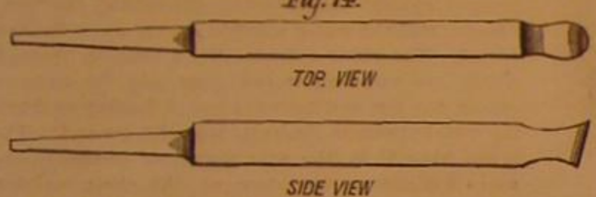
Fig. 73.



ing wrought iron or steel; it must, however, always be used with water, and should be hardened right out at and near the cutting edge, A.

For cutting out a round corner, a round-nosed tool, such as shown in Fig. 74, is the most effective; it will either rough out

Fig. 74.

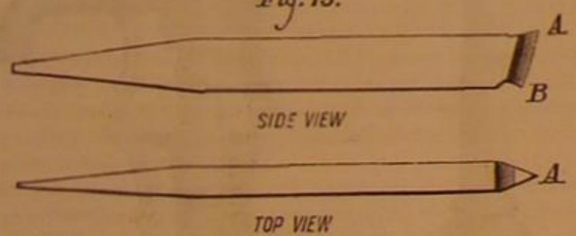


or finish, and may be used with or without water, but it is always preferable to use water for finishing wrought iron and steel. A is the cutting edge, and B, the heel of the tool. This is a sample of a large class, applicable to steel and wrought iron, the metal behind the cutting edge being ground away so as to give to the latter the keenness or rake necessary to enable it to cut freely, and the metal behind the heel being ground away to enable it to grip the rest firmly.

CUTTING A THREAD.

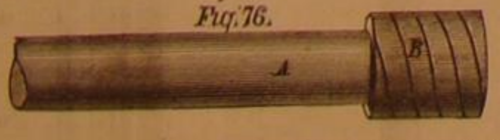
Our next operation will be to cut a thread upon an iron bolt, supposing it to be roughed out according to the instructions already given. The tools necessary for this purpose are a graver or V tool, with which to start the thread, and a chaser, with which to cut the thread after it is once started. Fig. 75 presents a V tool, A being the cutting point,

Fig. 75.



and B, the heel. To start the thread, the lathe should be run at a fast speed; and the heel of the tool being pressed firmly to the face of the lathe rest, the handle of the tool must be twisted from right to left at the same time as it is moved bodily from the left to the right, the movement being similar to that already described for the graver, save that it must be performed more rapidly. It is in fact the relative quickness with which these combined movements are performed which will determine the pitch of the thread. The appearance of the work after striking the hread will be as shown in Fig. 76, A being the work, and

Fig. 76.



B, a fine groove cut upon it by the V tool; from which it will be observed that the judgment alone must be depended upon to gage the speed of the movement of the tool necessary to cut the fine groove, B, which must be the same width from one groove to the next as is the chaser from the point of one tooth to the point of the next.

The reason for running the lathe at a comparatively fast speed is that the tool is then less likely to be checked in its movement by a seam or hard place in the metal of the bolt, and that, even if the metal is soft and uniform in its texture, it is easier to move the tool at a regular speed than it would be if the lathe ran comparatively slowly.

If the tool is moved irregularly or becomes checked in its forward movement, the thread will become "drunken," that is, it will not move forward at a uniform speed; and if the thread is drunken when it is started, the chaser will not only fail to rectify it, but, if the drunken part occurs in a part of the iron either harder or softer than the rest of the metal, the thread will become more drunken as the chaser proceeds. It is preferable, therefore, if the thread is not started truly, to try again, and, if there is not sufficient metal to permit of the starting groove first struck being turned out, to make another further along the bolt. It takes much time and patience to learn to strike the requisite pitch at the first trial; and it is therefore requisite for a beginner to leave the end of the work larger in diameter than the required finished size, as shown in Fig. 76, so as to have metal sufficient to turn out the first few starting grooves, should they not be true or of the correct pitch. If, however, a correct starting groove is struck at the first attempt, the chaser may be applied sufficiently to cut the thread down to and along the body of the bolt; then the projection may be turned down with the graver to the required size, and the chasing proceeded with.

After the thread is struck, and before the chaser is applied to it, the top face of the rest should be lightly filed to remove any burrs which may have been made by the heel of the V tool or graver; or such burrs, by checking the even movement of the chaser, will cause it to make the thread drunken. Where the length of the thread terminates, a hollow curved groove should be cut, its depth being even with the bottom of the thread; the object of this groove is to give the chaser clearance, and to enable you to cut the thread parallel from end to end and not to leave the last thread or two larger in diameter than the rest. Another object is to prevent the front tooth of the chaser from ripping in and breaking off, as it would be very apt to do in the absence of the groove.

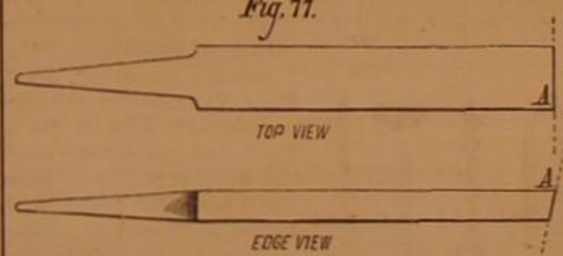
TO MAKE A CHASER.

Chasers are cut from a hub, that is to say, a cutter formed by cutting a thread upon a piece of round steel, and then forming a cutting edge by cutting a series of grooves along the length of the hub. These grooves should be V-shaped, the cutting side of the groove having its face pointing towards the center of the hub, as shown in Fig. 78. Hubs should be tempered to a brown color. A chaser is made from a piece of flat steel whose width and thickness increases with the pitch of the thread; the following proportions will, however, be found correct:

Number of threads per inch	Number of teeth in the chaser	Thickness of the chaser
24 to 20	12 to 14	1-4 inch
18 " 14	10	5-16 "
12 " 8	9 to 6	5-16 "
6 " 4	7 " 6	3-8 "

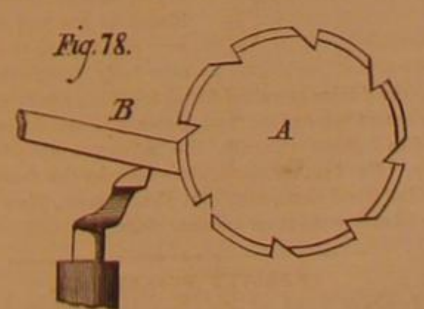
The end face of the chaser should be filed level and at an angle with both the top face and the front edge of the steel,

Fig. 77.



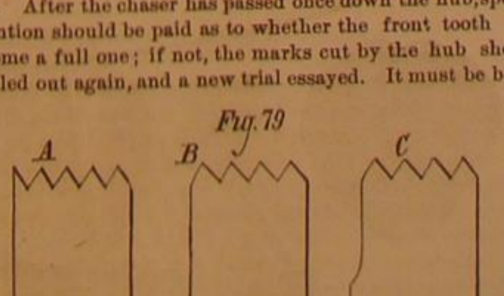
as shown in Fig. 77, the edge, A, being rounded off so that it shall not strike against any burr upon the face of the rest, and thus be retarded in its forward movement while being cut. The hub is then driven in the lathe between the centers, the chaser being held in a handle sufficiently long to enable the operator to hold it with one hand, and press the shoulder against the end so as to force the end of the chaser against the hub, which will of itself carry the chaser along the rest. The position in which the chaser should be held is shown in Fig. 78, A being the hub, and B, the chaser, from

Fig. 78.



which it will be seen that the chaser is held upside down while it is being cut, the cutting face resting upon the lathe rest. After the chaser has passed once down the hub, special attention should be paid as to whether the front tooth will become a full one; if not, the marks cut by the hub should be filed out again, and a new trial essayed. It must be borne

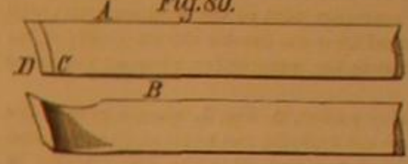
Fig. 79



in mind that, the chaser being held upside down, the back tooth, while cutting the chaser, becomes the front one when the chaser is reversed and ready for use. The hub should be run at a comparatively slow speed, and kept freely supplied with oil, it being an expensive tool to make, and this method of using preserves it. In Fig. 79, A is a chaser whose front tooth is not a full one; B is a chaser with a full front tooth; and C is of the same form as A, when it is, as far as possible, corrected.

The cutting operation of the hub upon the chaser is continued until the thread upon the latter is cut full, when it is taken to the vise and filed as shown in Fig. 80, A being the

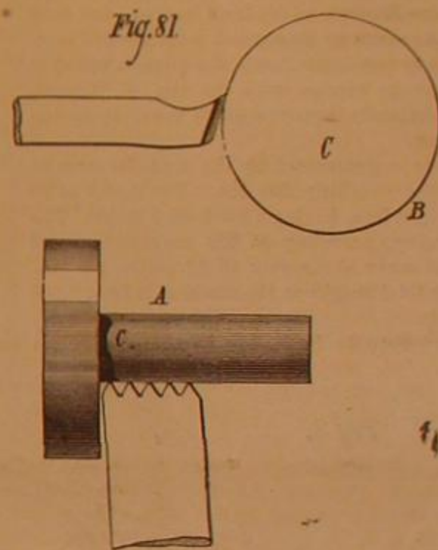
Fig. 80.



chaser as it leaves the hub, and B, as it appears after having the edge, C, and corner, D, rounded off.

The angles of the end face of the chaser to the top and edge faces of the body of the steel, and the uses thereof, are made apparent in Fig. 81, in which A is a top, and B, a side view of a chaser when in operation, C being, in each case, the work. From this it will be observed that the angle in the direction of the thickness gives rake to the teeth, while the angle in the direction of the breadth serves to keep the front side of the chaser from coming into contact with the head, shoulder, or other projection of the work. In the absence of a hub, a chaser may be made by cutting a slot in a blank nut, fastening the end of the chaser in the slot, and tapping the hole. The difference in shape between a chaser for use on wrought iron, as shown in Fig. 81, and steel, and one for use on cast

Fig. 81

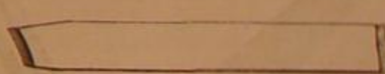


iron, brass, or other soft metal, is shown in Fig. 82.

The difference consists in making the teeth less keen, by beveling off the top face and cutting the teeth less hollow in their length. The latter object is obtained by moving the handle, in which the chaser is fixed, up and down while the hub is cutting it.

The lathe rest should be so adjusted that the chaser teeth cut above the horizontal center of the work. The teeth of the chaser should fit the thread on the bolt along all their length when the body of the chaser is horizontal, and then the least raising of the handle end of the chaser will present the teeth to the work in position to cut, while the teeth behind the cutting edge will fit the thread, being cut sufficiently close to form a guide to steady the chaser. This method of using will not only keep the thread true, but will preserve the cutting edge of the chaser. If a chaser has top rake, as shown in Fig. 81, and the handle end is held too high and so that the back of the teeth are clear of the thread, it will cut a thread deeper than are its own teeth; if, on the other hand, the top face is beveled off, as shown in Fig. 82, and the handle is held too high, it will cut a thread

Fig. 82.



shallower than are the chaser teeth.

The proper temper for the teeth is a deep brown, or, for unusually hard metal, a straw color. For chasing wrought iron, the lathe may be run so that the teeth will perform about 40 feet, for steel about 30 feet, for cast iron 50 feet, and for brass about 80 feet, of cutting per minute.

France and the Centennial Exposition.

We printed last week an extract from *The Engineer's* recent editorial on the Philadelphia Centennial, in which the general disinclination of English manufacturers of agricultural and other machinery was especially mentioned, and ascribed to the high duty which is charged in this country on the entry of such products. The same objection is now being urged in France to the contributions of French manufacturers. M. Herman La Chapelle, one of the largest engine builders of Paris, publishes a long letter in the *Moniteur Industriel Belge*, in which he strongly condemns the prohibitory nature of American duties, and points out that, with the exception of wines, silks, and works of art, of which France has almost a monopoly, it is useless to exhibit the principal industrial products of that country.

SIGNATURES made with a lead pencil are good in law

IMPROVED BELT-GEARED COTTON PRESS.

The improved cotton press herewith illustrated is driven by a belt in the same manner as a gin stand or mill. It is not necessary either to stop or slacken the speed of the driving shaft to reverse the motion of the screw, while the belt always runs in the same direction. The general construction of the apparatus is strong and durable, and it has withstood the strain of making bales ranging as high as 610 lbs. without breakage. The machine has now been in use for three seasons, giving, as we are informed, uniform satisfaction. The simple arrangement of the working parts will be understood from the details shown in Fig. 2, in connection with the perspective view of the same n Fig. 1.

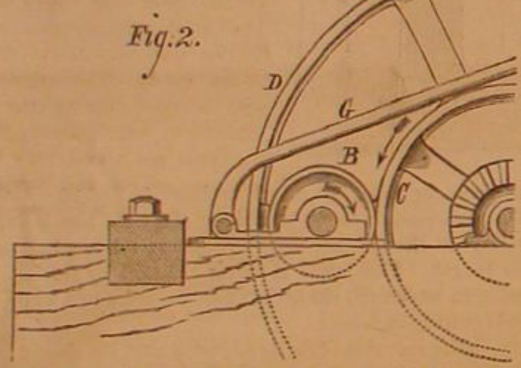
The driving pulley, A, Fig. 1, always runs to the right, and at the opposite end of its shaft is secured a wooden friction pulley, B. The latter works in the space between the two rims, C and D, of a larger pulley, Fig. 2, which is attached to the end of a shaft or pinion, on which rotates the bevel gear, E, and so turns the screw, thus raising or lowering the follower, F, Fig. 1. G, Fig. 2, is a lever which moves the sliding journal box, in which the end of the shaft-carrying pulley, B, is supported either to the right or left, so that the friction pulley is thus brought into contact with either rim, C or D, and, engaging with either, gives motion in one or the other direction to the double rim wheel. There is sufficient space between the rims to allow pulley, B, to run idle, by not engaging with either rim, when the operator so desires.

When pressing the bale, the friction pulley is caused to work against the rim, C, turning the latter in the same direction as its own motion, and thus running the screw up slowly and with the full power. To carry the screw down, the friction pulley is moved over to engage with the rim, D, through which it obviously imparts a quick lowering motion to the screw.

The press is guaranteed by the manufacturer to make a bale weighing 500 lbs. The screw is of solid wrought iron, having a pitch of 2 inches. The driving pulley, traveling at 250 revolutions, will run up the screw at the rate of 20 inches per minute. The total weight of the machine is from 3,500 to 4,000 lbs.

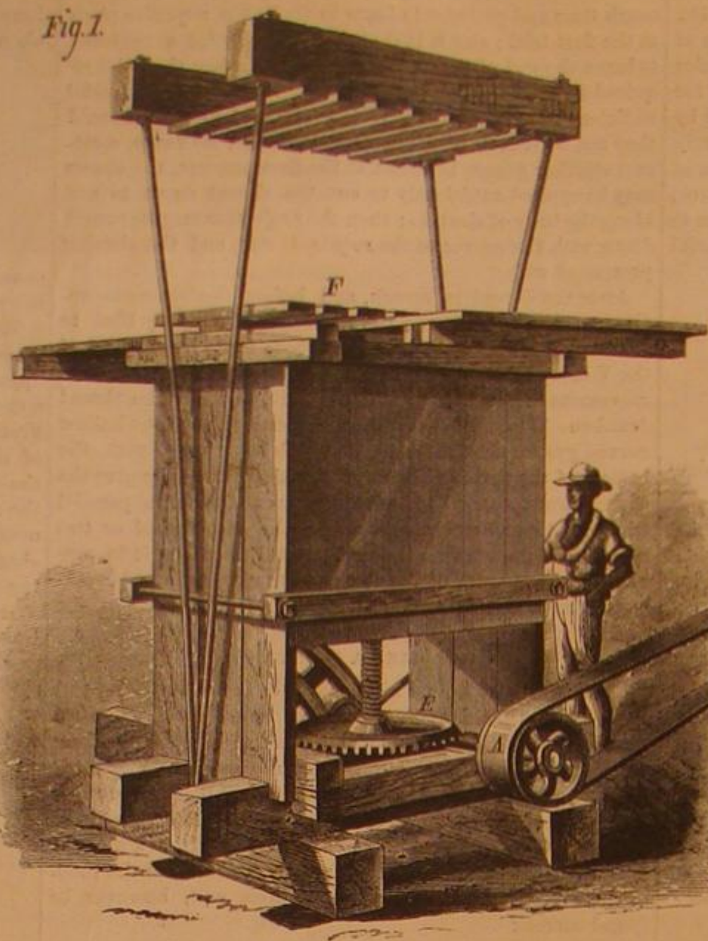
Patented April 29, 1873. For further particulars address

Fig. 2.



the manufacturer, Mr. H. Dudley Coleman, 12 Union street, New Orleans, La.

Fig. 1.

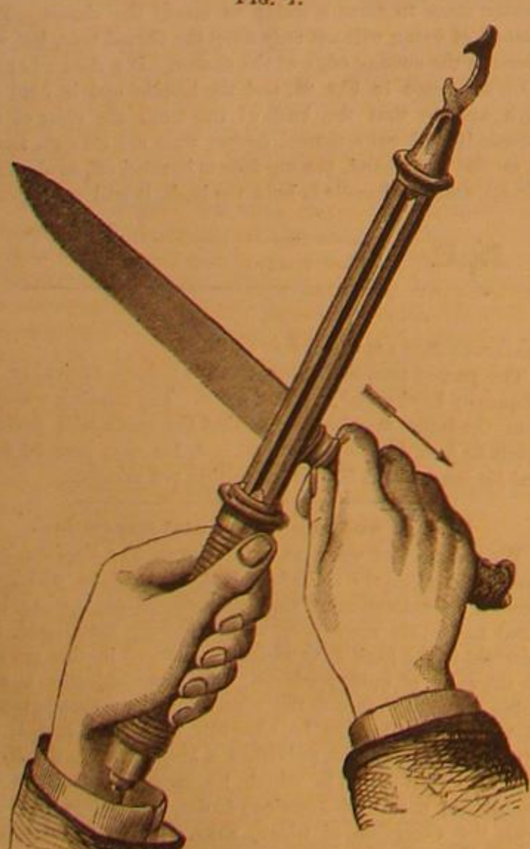


SIMMONS' BELT GEARED COTTON PRESS.

NEW SHARPENING INSTRUMENT.

The utility of this invention, shown in our illustration, is so

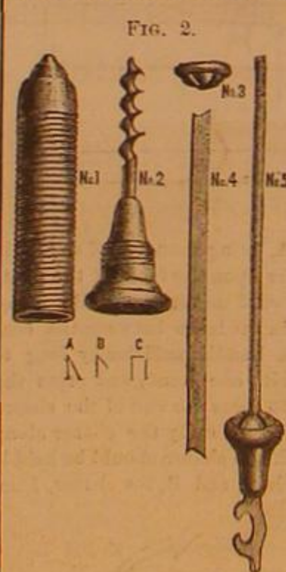
FIG. 1.



self-evident that any description is hardly necessary. Those who have struggled over a piece of tough beef with a dull knife, until worked into a state of actual ferocity doubly intensified by the pangs of hunger and a large number to carve for, know that a good steel, which will stay in respectable condition and not wear smooth in a fortnight, is something very akin to a treasure. Therefore, when we introduce an ornamental implement which will sharpen knives at a mere touch, which pulls out skewers, cuts cork wires, and which has a convenient corkscrew hidden away in its handle, always at hand at the right time and in the right place, we feel we are doing a large portion of the community a service.

The device shown herewith does all this. The implement consists of six blades of a very hard and tough steel, one of which is shown in No. 4, Fig. 2, which are grouped together radially, as represented in Fig. 1, around a central rod, No. 5, Fig. 2. The ends of these blades are secured in a socket, No. 3, Fig. 2, and by a suitable screw they are held tightly in place The handle, No. 1, Fig. 2, is hollow, and is made of polished corrugated metal. It incloses a corkscrew, No. 2, Fig. 2, and holds the same by screwing upon a thread formed on the bolster. At the end of the steel portion is a short knife for cutting cork wires; and just inside the blade a notch is made which affords a ready means for grasping and extracting skewers.

FIG. 2.



The arrangement of radial blades is entirely novel and is very effective in use. Though especially designed for family use, the device is suited for sharpening the largest knives.

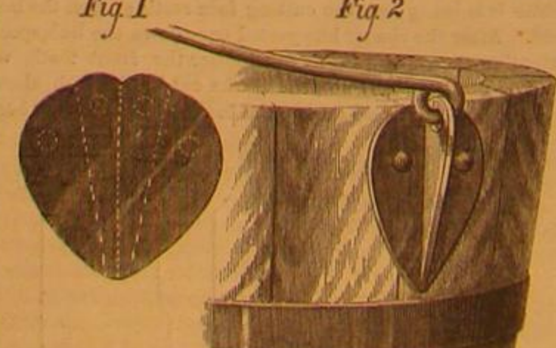
It is the subject of several patents obtained in this country and in Europe through the Scientific American Patent Agency. For further particulars address the manufacturers, the Radial Steel Company, 221 Pearl street, New York city.

[See advertisement on another page.]

IMPROVED BUCKET EAR.

Mr. James D. Field, of Blue Rapids, Marshall county, Kan

Fig. 1 Fig. 2



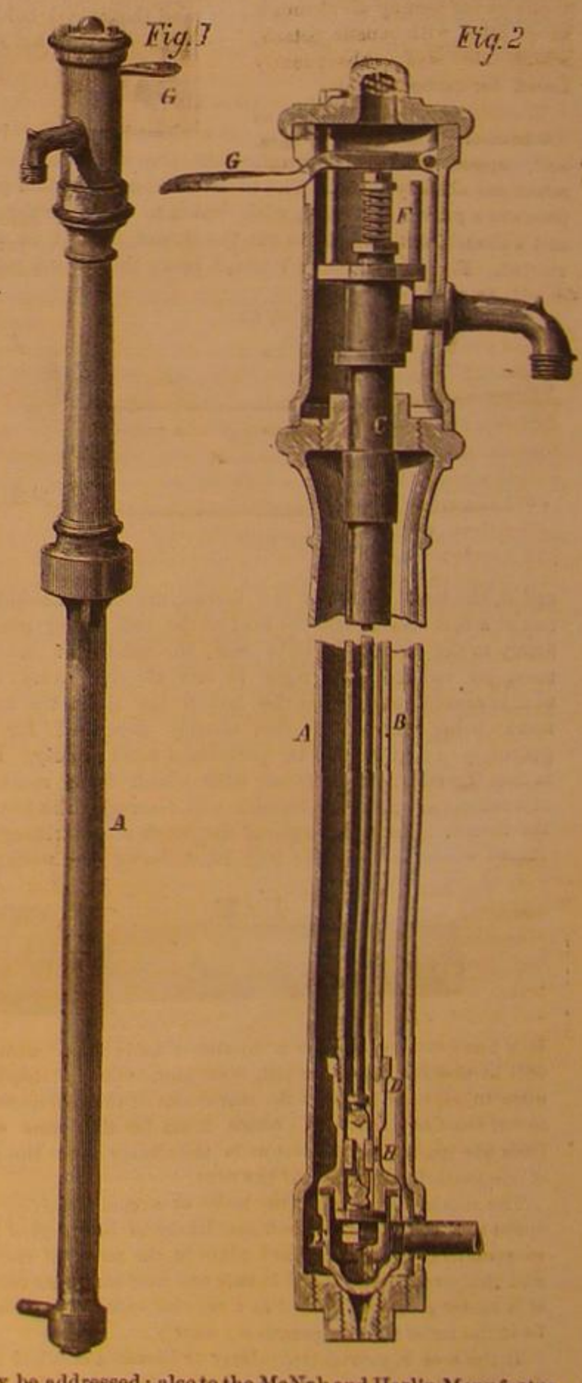
sas, is the inventor of an improved bucket ear, herewith illustrated, which was patented March 16, 1875, through the Scientific American Patent Agency. The advantages claimed for the device are that it is out of the way of cover and bail and not liable to catch in clothes; that it is strong, and cannot be readily broken off, and that it is cheap and easily made. It consists of a continuous piece of sheet metal, as shown in Fig. 1, which is folded as indicated by the dotted lines, so that a central rib is formed upon it. The rib is then perforated to receive the bail, and the side plate is similarly pierced for the admission of the screws which attach the appliance to the bucket. The completed ear in position is represented in Fig. 2. Further particulars may be obtained by addressing the inventor as above.

IMPROVED HYDRANT.

The advantage offered by the improved hydrant or street washer illustrated herewith is that the valve may be reached for repairs or clearing without necessitating the digging-up of the ground. To this end the entire interior mechanism may be lifted bodily out of the hydrant, so that the outer casing, when once placed, remains a fixture. The invention is represented in perspective in Fig. 1, and in section in Fig. 2. In the latter engraving, A is the outer casing which is set in the ground; B is an inner tube secured in said casing by a screw-threaded enlarged portion at C. Through this tube runs a rod which terminates below in a valve carrier, D, which is arranged to slide in a cylinder, which projects into the valve chamber, forming the seat of the valve, E, attached to said carrier. The inlet pipe screws into a branch of the valve chamber. The upper extremity of the rod is surrounded by a spiral spring, F, which raises it upward, and so keeps the valve pressed firmly against its seat, a packing ring located on the valve rendering the joint tight. Just above the end of the rod, the handle, G, is pivoted, so that, by pressing down thereon, the rod is depressed against the action of the spring, the valve opened, and the water allowed egress up to the exit faucet. The valve cylinder has a vent, H, through which the waste water can pass into the exterior casing, the screwed bottom piece, I, having an opening which permits leakage into the ground. The screw ring, C, is the sole means of confining the valve cylinder to its place on the chest; so that when access is to be had to the valve, it is only necessary to detach the nozzle, remove the cap and operating shaft, and then, by unscrewing the ring, lift out the interior apparatus.

Patented November 3, 1874, by Mr. B. E. Lehman, of Bethlehem, Pa., to whom inquiries for further information

Fig. 1 Fig. 2



may be addressed; also to the McNab and Harlin Manufacturing Company, 56 John street New York, sole agents for New York and the Eastern States.

THE FATAL BALLOON ASCENSION.

The story of the fatal balloon ascension in France, in which two of the most daring of living aeronauts, Croce-Spinelli and Sivel, lost their lives through suffocation in the highly rarefied air of the upper atmospheric regions, is told in detail by the survivor of the party, M. Gaston Tissandier, in *La Nature*, the journal edited by him. We have already given the main facts of this disastrous affair, but the following in addition thereto will also be found of interest. We extract from the periodical above named the engravings given herewith, one of which represents the aeronauts and their apparatus as disposed in the car of the balloon. Tissandier is shown noting the barometer indications, Croce is seated on the right, and is inhaling oxygen, and Sivel is about cutting loose the bags of ballast. The time chosen is after the balloon had mounted to a hight of over 23,000 feet, and a sense of faintness and oppression was already stealing over the occupants of the car. The temperature was about 14° above zero, Fah. Sivel, who had relapsed into a kind of stupor, suddenly awoke, and turning to Tissandier asked the altitude; the balloon had nearly reached 24,000 feet. Then he cut loose the bags of ballast, and this action is the last remembrance which M. Tissandier possesses of the course of events until he awoke and found his companions dead.

The small balloons shown just above the car contained a mixture of air and oxygen (70 per cent of the latter gas) which the aeronauts inhaled until suddenly overcome. The reservoir hanging outside of the car is an aspirator for forcing air through tubes filled with caustic potash, which air was subsequently tested for carbonic acid.

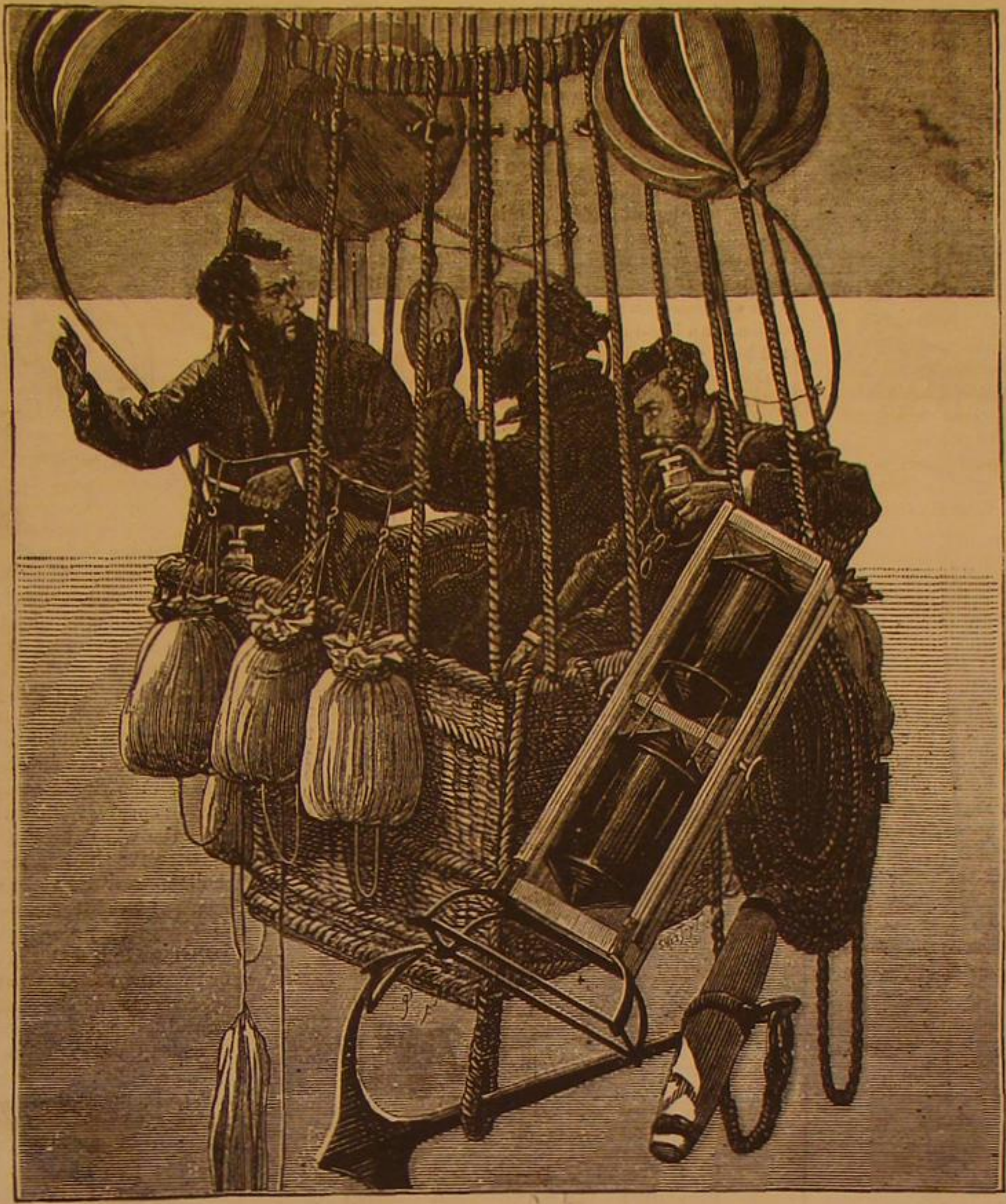


Fig. 1.—THE BALLOON "ZENITH."

The temperature of the air, as the balloon ascended, was carefully measured, up to the time when the observers succumbed. At the surface of the earth it was 57° Fah. By the time an altitude of 20,000 feet was reached, about 50 minutes intervening, the mercury had fallen to 32°; the last indication noted, two hours after starting, and when the balloon was 23,680 feet high, showed 13·8° above zero, Fah. During this period the temperature of the gas within the aerostat was constantly noted; this reached 73·4°, when the mercury outside marked but 23°, and remained at that point. This fact accounts for the rapid ascension of the balloon in the upper regions, and its precipitous descent after sinking into the denser atmosphere.

We remarked in our previous article that the registering barometers, which were to be opened by the French Society, and which fortunately remained intact during the fall of the car, would show how high the balloon ascended after the aeronauts became insensible and before it began its downward course. These have been examined, and show that the lowest pressure corresponded to about 10·3 inches of mercury, which indicates a hight of a little over 27,500 feet. From this point the balloon began to descend, falling swiftly to 20,500 feet. Here the aeronauts revived, and then cut away the aspirator and threw overboard more ballast, causing the balloon to rise once more to the same high altitude, and insensibility again to supervene. The track of the air ship forms a gigantic M, the ends about 150 miles apart.

In the smaller illustration, Fig. 2, are represented Sivel's sounding balloons, by means of which he recognized the presence of currents of air above or below. A rod, thirty feet long, was projected from the car and held in equilibrium by the upper balloon, which was 19 feet in diameter, and which was filled with gas. This was attached to a rope 3,000 feet long and allowed to ascend that distance above the car. The other small balloon was filled with air, and, being attached to a line of similar length, fell that far below. Mr. Donaldson uses an arrangement similar to this, kites being substituted, however, for the balloons.

Fig. 2.—SIVEL'S SOUNDING BALLOONS.

Piracy on a Railroad.

Presence of mind at the right time averted the possibility of a serious disaster on the Hudson River railroad, recently. Five convicts managed to break away from the working gang at Sing Sing prison, and, reaching the railroad track, suddenly jumped into the cab of a freight engine which, at the time, was slowly dragging a heavily loaded train. Presenting revolvers at the heads of the engineer and fireman, they ordered both men to alight. The engineer, unable to reach any heavy tools to fight the intruders, resorted to strategy. He noted that the fire was very low; and trusting that the convicts knew nothing of machinery, he seized his pump handle and, as he leaped from the cab, turned it far to the right, thus admitting a steady stream of water to the boiler. The convicts then uncoupled the locomotive, which, as the steam gage stood at 200 lbs., leaped forward with a jerk. As soon as the pumps began to operate, the water worked into the cylinders, and, in a few seconds, the head of one blew off, thus, of course, greatly retarding the speed of the machine.

Meanwhile a telegram had been sent to Superintendent Toucey, at the New York office, announcing the capture. Prompt action was necessary, as a locomotive, tearing over the line in utter defiance of time tables and trains ahead, was a dangerous intruder and liable to work considerable damage at stations and crossings. Recollecting that near Tarrytown there is a switch which runs parallel with the main track for a long distance and then abruptly ends in the river, Mr. Toucey, without an instant's hesitation, sent to the Tarrytown station master an order "to open the west switch and throw No. 89 into the river." The astonished official, although hardly crediting his senses, nevertheless prepared to obey the command He threw open the switch and locked it, and then stood calmly by, watching the cloud of steam up the track get bigger, and waiting for $20,000 worth of engine to go plunging, with whatever train might be behind it, down to the bottom of the Hudson.

Another explosion occurred, however, which saved the lives of the convicts and the destruction of the engine. The locomotive was within a mile of the switch when the other cylinder head was blown out. The machinery stopped, and the convicts, leaping out, took to the woods. The engineer, who had been running after his locomotive, well knowing that she could not travel very far, soon reached her, and, jumping into the cab, in a few seconds had the fire out, and the steam down.

While the prison officials should be held to a strict account for the fact of the escape of the convicts and of their being possessed of arms, the railroad people are entitled to much credit for their part in the affair. And this is equally due to the engineer for his presence of mind, to Superintendent Toucey for his prompt application of an heroic remedy, and to the station master at Tarrytown for his implicit obedience to an order which the majority of men would have hesitated over or have refused to obey without explanation

Steam Launches for Yachts.

A miniature steam launch, only 14 feet long by 4 feet 3 inches beam, has just been built by Messrs. Edwards and Symes, of Cubitt Town, Eng., as a tender to a sailing yacht for use on the fiords of Norway. The boat is to be carried at the ordinary davits, and it has, therefore, been made as light as possible, the total weight, including the machinery, being only 800 lbs. The hull is built entirely of mahogany, and it contains a vertical boiler with engine attached, the arrangement being such that the machinery can be detached from the hull in a few minutes, and hoisted out complete, and the launch then used as an ordinary boat, it being provided with oars and rowlocks. The boiler, which is worked at a pressure of 75 lbs. to 80 lbs. per square inch, is welded up throughout, there being no riveted seams. The boat will carry four persons and a good supply of coal; and during a trial trip made at Greenwich last week, it attained a mean speed of 6½ miles per hour.

Glycerin as an Illuminating Material.

M. Schering states that glycerin may be burned in any lamp so long as the flame is kept on a level with the liquid. The latter, on account of its consistence, will not ascend an elevated wick. As the flame, like that of alcohol, is almost colorless, and as the material is especially adapted for absorbing a large proportion of saline substances, M. Schering has recently made experiments in coloring the flame with various bodies, and with satisfactory results. By introducing substances rich in carbon, it appears that the flame may be rendered suitable for illuminating purposes. The low price of glycerin, and its property of not volatilizing at high temperatures, add to its advantages in this direction.

THE new British arctic expedition, which will shortly start for the north pole, is to go up through Smith Sound, on the west coast of Greenland, following the route of the last American expedition—Hall's.

HOOD'S ADJUSTABLE BRUSH HANDLE.

Here is an invention which is just in time for spring house-cleaning, for which reason, together with that of its handiness, we have no doubt but that it will meet with general approval, especially from our lady readers, who are looking forward with no cheerful anticipations to that serious yearly

undertaking. It is a handle easily attached to any scrubbing brush, and so adjusted that it will enable the user to do her work standing up, and with much greater facility and ease than when kneeling on the floor.

A, in the engraving, is a conical plate secured by screws to the back of the brush. It has an aperture in the center, around which and on the under side of the plate an inclined plane is formed. A similar conical plate, B, is provided with a tapering socket to hold the handle, and fits over plate, A. The two plates are firmly clamped together by a key bolt, C, which, passing through plate, A, engages against the inclined underneath portion when turned. The upper flat surface of plate, A, and the under surface of plate, B, do not come in contact, the bearing being had between the outer inclined portions, and thus rendered firm and strong. Plate, A, is made higher on one side, thus causing the handle to assume an angle, more or less acute, with the back of the brush, according to the position in which it may be most convenient to use the latter.

The brush may be placed nearly on a line with the handle, so as to facilitate working alongside the baseboard or near doors and windows.

Patented October 20, 1874. For further particulars regarding agencies for the introduction of the invention, address the patentees, Messrs. Hood and Joseph, Indianapolis, Ind.

ELDRIDGE'S SELF-ACTING KEY FASTENER.

The object of this invention is to provide a self-acting key fastener that will secure the key in a door lock on the inside of a room against turning, by burglars, with nippers and other instruments, from the outside.

The accompanying engraving represents a keyhole plate secured to the door, and to this, at the lower end, a movable arm, A, is pivoted. The arm is made concavo convex at the pivot end to contain a circular spring which operates it, one

end of the spring being secured to the plate and the other to the arm. A slot is formed on the upper end of the arm, to receive the shank of the key, which is filed square to fit the same; so that when the arm is closed by the spring, the key cannot be turned in the slot. The guide, C, and the shoulder on the arm form a stop, while the notch, D, passing under the guide, serves as a lock for the arm against outside pressure.

This little invention, we are informed, meets with much favor among Chicago architects. It has been patented by Mr. D. D. Eldridge, of 208 La Salle street, Chicago, Ill., from whom the manufacturing rights for the Eastern and Southern States may be obtained on reasonable terms.

Just So.

Snow's *Pathfinder and Railway Guide* (Boston) says, and we think truthfully, that, for a catalogue of all the most important inventions of the day, with scientific notes and explanations, the SCIENTIFIC AMERICAN has no competitor in this country; and it should have none, for it entirely fills the field of scientific information and research. Its pages contain information of interest to the most thoughtless reader; and it is difficult for the most unscientific mind to lay down a copy without scanning its excellent illustrations and explanations.

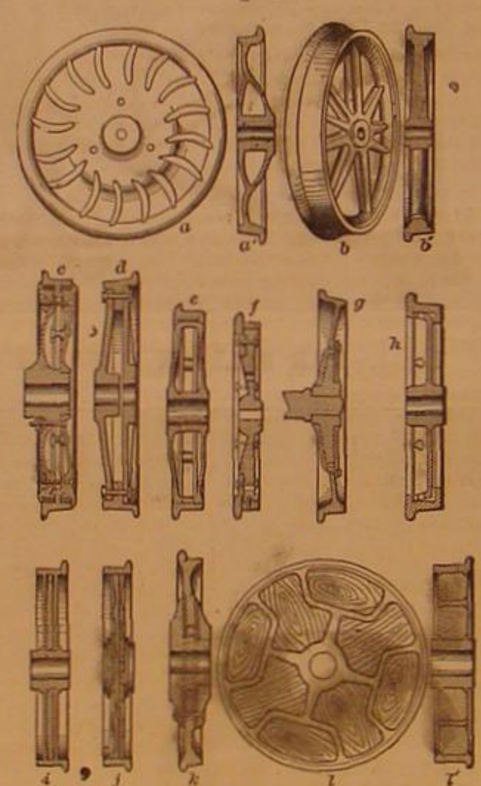
Dissolution of Hydrogen in Metals.

In previous researches on the metallic alloys formed by hydrogen, MM. L. Troost and P. Hautefeuille indicated the characters which distinguish these definite combinations from the solutions of hydrogen in metals. Potassium, sodium, and palladium combine with hydrogen, while a considerable number of other metals merely dissolve this gas. Iron, nickel, cobalt, and manganese offer striking analogies in the manner in which they behave with hydrogen at different temperatures. The facility with which they absorb or give off hydrogen gas depends greatly on their physical condition. An ingot of pure nickel gave out, in a vacuum, at a red heat, one sixth of its volume of hydrogen. Laminæ of nickel, obtained electrolytically, gave out forty times their volume. Pulverulent nickel gave up one hundred times its volume, and remained pyrophoric after the escape of the hydrogen. An ingot of cobalt gave up one tenth of its volume, electrolytic laminæ of cobalt thirty-five times their volume, and pyrophoric cobalt powder one hundred times. It also remained pyrophoric after the loss of the hydrogen. Soft iron in ingots gives off one sixth of its volume, and gray cast iron more than the half. Electrolytic laminæ of iron gave off 260 volumes. In fine, it may be said that iron, nickel, and cobalt absorb directly hydrogen gas, but it cannot be said that combination ensues, just as has been already shown in the case of lithium and thallium. Finely divided iron has a property which is not shared by nickel or cobalt: it decomposes water slowly at common temperatures, and rapidly at 100°. In this respect iron approximates to manganese.

CAR WHEELS.

It has been estimated by good authority that there are no fewer than 1,250,000 car wheels in daily use on the railroads of the United States. Each wheel travels 88·75 miles per

Fig. 1.

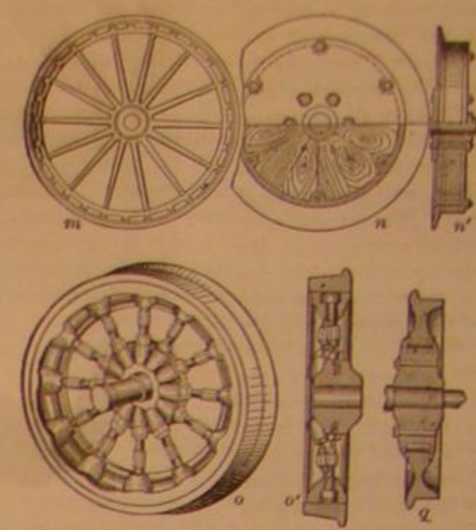


Car-Wheels.

day of 320 days per annum, and its average load is 3½ tuns. With this stress, the life of the wheel is about 45,000 miles, or 1·58 years On trains running at express speeds, the average life does not exceed 10 months' service, while wheels under tender trucks have a life of 18 months. A freight wheel, it is stated, often lasts over 3 years. Assuming the average life of car wheels under all kinds of service to be 5 years, the total number of wheels worn out annually in the United States may be placed at not less than 250,000. Allowing an average cost of $18 per wheel, and calculating about one half for the value of the old wheel, the annual loss may be stated at two and a quarter millions of dollars.

We present, in Figs. 1 and 2, a few examples of the numerous inventions of this class. *a a'* represent the well known Washburn wheel; *b b'* are perspective and sectional views of a spoked wheel of rather antiquated form; *c* is a Woodbury wheel, which has a compressed annular elastic packing between the cylindrical faces of the body and rim. The body is sectional, having two webs bolted together. Each portion has a flanged rim, the combination of the two forming an annular seat for the tyre. *d* is a wheel cast in three separate pieces, consisting of a rim and two portions, each of which latter has a hub and a web, between which the inner flange of the rim is gripped and bolted. The wheel, *e*, has side plates cast in one piece with the hub and cross pieces, which connect the peripheries of the side plates. The encircling tyre is secured by rivets. In the wheel, *f*, the tyre has pins upon its inner side, which enter slots in the rim of the wheel to hold the tyre from shifting. The flange piece has a shoulder projecting on the inside, that fits in a circular groove in the body of the wheel, to which it is bolted. The wheel, *g*, has a circular recess to receive a collar on the axle, over which is bolted a covering annular disk. This device is to allow the revolution of one of the wheels upon the axle on curves of the track. *h* is a car wheel constructed in two parts: first, a rim with two flanges forming an inner recess

Fig. 2.



Car-Wheels.

and second, a hub with a web, and a flange upon the same, flaring slightly outward. Slots in this flange permit it to spring past the flange of the rim into the inner recess. *i* and *j* are two forms of wheel, in each of which the cast hub and rim are connected by corrugated wrought metal disks. *k* is the Raddin wheel, in which the entire web and rim are cast in one piece. The hub has binding rings which are bolted together through holes in the web, with interposed packing rings of india rubber to lessen tremor and jar. *l l'* are two views of the Watson wheel, in which the space between the hub and the rim is occupied by a skeleton metallic frame, having openings filled with compressed panels of wood.

In the wheel, *m*, Fig. 2, the wedges of wood are driven between the rim and the tyre, in order to absorb the jarring motion. *n n'* are views of a compound wheel in which segments of wood form a web between the hub and the rim, and are secured by metal plates. *o o'* are views of a wheel in which the hub and rim are of cast iron united by wrought iron spokes, each alternate spoke leaning at an angle from the opposite side of the central circumference of the hub to the central line of the rim. *q* is a wheel somewhat similar to *k*, in which the web of the wheel is enclosed between binding plates, and has a packing between itself and the plates, and also on its inner edge.

Paper, when entering into the composition of car wheels, is tightly pressed in as a packing between the steel tyres and the cast iron hubs, so as to form a compact, strong, and yet somewhat resilient material, which deadens sound and diminishes the force of concussion.

The illustrations are selected from the pages of Mr. E. H. Knight's "Mechanical Dictionary."*

HAND SUPPORT FOR SHEEP SHEARS.

As the sheep-shearing season is now close at hand, a novel arrangement of a support for the hand while holding the shears, which we illustrate herewith, will doubtless

prove of timely interest. The object of the device is to enable the operator to have free use of his hand while the muscles of the same are firmly braced, and thus assisted during the fatiguing labor. He is thus enabled to exert greater strength, and may, at the same time, rest the hand without laying down the implement. The attachment consists of straps, of leather, rubber, or other suitable material, which are secured to one of the shears handles. Rings or loops are fastened to the other handle, and through these the straps are passed so as to form a cross over the back of the hand, the ends being secured and the length adjusted by suitable button holes and hooks. As illustrated in the engraving, elastic bands are employed, in which case the straps are riveted or otherwise permanently attached to the handles of the shears.

A caveat for the invention has been prepared by the Scientific American Patent Agency. Further information may be obtained by addressing the inventor, Mr. James L. Smith, P. O. box 290, Tuscola, Ill.

* Publishers, J. B. Ford & Co., New York city.

The Newly Elected Honorary Members of the Iron and Steel Institute.

The annual general meeting of the Iron and Steel Institute of Great Britain recently took place in London. Acting upon the authority vested in them at the last general meeting, the Council have elected the following gentlemen as honorary members: Professor Peter Tunner, Leoben, Austria; Professor R. Akerman, Sweden; Professor Grüner; Dr. Percy, London; Mr. Peter Cooper, New York; Mr. H. Schneider, Creusot; Mr. F. Krupp, Essen. The total number of honorary members, including the King of the Belgians, who was elected last year, is now eight.

The president, I. Lowthian Bell, Esq. said: "Most of you, I dare say, are familiar with the names and possibly also with the achievements of those gentlemen who have gained for themselves this distinction; but in the event of there being any here present to whom the names of those gentlemen are not familiar, perhaps it would be acceptable that I should mention the ground upon which we have accepted them. The first name on the list is that of my friend, Professor Peter Tunner, of Leoben, Austria. I have had the honor of personal acquaintance and, I may say, of personal friendship with this distinguished foreign metallurgist during the last five-and-thirty years, and can safely say, in practical acquaintance with every portion of the metallurgy of iron, it is impossible to imagine any one more proficient, or any one who takes a greater interest in the development and progress of our science.

The next name is that of Professor R. Akerman, of Sweden. Sweden, as you all know, is a classic country in the metallurgy of iron, and I am glad, and I am confident in the assertion, that the great repute of that very ancient country in the manufacture of iron is very well sustained by the exertions, by the knowledge, and by the learning of Professor Akerman, and the same may be said of Professor Grüner, of the *Ecole des Mines* in Paris. There is no subject connected with the progress of our art which does not receive the immediate attention of my friend Professor Grüner; but, in addition to that, I may say he has distinguished himself in the archives of scientific research in France, by his original investigations, many of which are of great value in connection with the smelting and subsequent treatment of iron.

Then comes the name of a gentleman, familiar, I am certain, to every one who has ever read a word upon the subject of the manufacture of iron in this country; I mean that of my friend Dr. Percy, of the School of Mines in Jermyn Street. If he had rendered no other assistance to iron manufacture than simply to have collated and extracted, from works written in almost every foreign language, an account of that which had been done in other countries as well as that which had been done in our own, I am quite sure that Dr. Percy would have entitled himself to this distinction at our hands; but in addition to that, the doctor has also distinguished himself by several very important investigations in connection with this chair.

The next name is that of my venerable friend Mr. Peter Cooper, of New York. I cannot pretend that, in the processes or the practice of making iron, he has done much to distinguish himself in America, but he has been connected for many years in the manufacture of iron with his son, Mr. Cooper, and with his distinguished son-in-law, the Hon. Mr. Hewett; but in addition to these recommendations, Mr. Peter Cooper has, with a singleness of purpose which cannot be too much admired, devoted a sum which would have been considered enormous even in this country, for the advancement of Science, by founding the Cooper Institute in New York, in which young persons are instructed in every branch of art and science; and if it were only to evince the appreciation which we have for efforts in that direction, I am of opinion that the Institute, in conferring this honor upon Mr. Cooper, honors itself by so doing.

The next name is that of Mr. H. Schneider, of Creusot. Most of you are aware that the social position of Mr. Schneider was sufficiently great some few years ago to cause his selection to fill the very responsible office of President of the Legislative Council of the Government in a neighboring country; but with this, of course, we have nothing to do. What recommends Mr. Schneider to our notice is not his social position, but the manner in which he has identified himself, to my own certain knowledge, for the last forty years with the advancement of the art of making iron in a neighboring country. The works with which Mr. Schneider is connected were founded by Messrs. Wilkinson and Manby. I forget the circumstances which led to the transference of those works to my friend Mr. Schneider; but suffice it to say that, under his direction and under his skilful management, they have grown to be, as many members here can testify, one of the most important establishments of that country.

The last name on the list is that of Mr. Krupp, of Essen. If we measure a man's merit by the extent of the operations he directs, and the rapidity with which those operations are carried into effect, I do not know that we could find a more signal instance of progression than that of Mr. Krupp, and we have thought it proper to recommend that Mr. Krupp, be added to the list of our honorary members."

The Eagle Wing Propeller.

An interesting report, by Mr. Richard H. Buel, on the Eagle Wing propeller will be found in our inside advertising columns. The results of that engineer's calculations are somewhat approximate, but they serve to show a high degree of efficiency in favor of the screw, inasmuch as he concludes that there is a gain effected of 20 per cent in power, and 22¼ per cent in speed, as compared with a "true" screw tested under like circumstances. Further and more elaborate investigations into these facts, especially in the light of fuller data, will soon be made, we are informed, by Judge Patterson, the inventor.

A SELF-LIGHTING GAS BURNER.—We have recently been shown a gas burner, which does away with the use of matches, and the dangerous practice of carrying lighted paper. Attached to the burner is a tube containing a slip of paper, on which are dots of fulminating composition. A hammer falls on one of these dots, igniting the fulminate. The hammer is operated by a spring and is controlled by the cock by which the gas is turned. An engraving of this convenient arrangement will be seen on reference to our advertising columns.

Recent American and Foreign Patents.

Improved Steam Trap.

James M. Meharge, Montreal, Canada, assignor to Richard Patton, of same place.—The invention consists of a hollow vessel balanced on a weighted lever, and connected with the boiler and a water-collecting receiver. A weighted steam valve of the vessel, with cross head at upper end of spindle, produces, by the rising and the falling of the vessel, the closing and opening of the valve, in connection with the stationary fork, so as to admit the steam and force the condensed water through the discharge pipe to the boiler.

Improved Umbrella Support.

Richard J. Welles, St. Joseph, Mo.—At the upper end of the stand is a socket which receives a head. The head is made in two parts, one of which is serrated, and is made to engage with the socket by screwing up a nut. A clamp clasps and holds the handle of the umbrella. By lowering the tightening nut the head will be loosened, and may be turned in any direction, and the staff of the umbrella will be released.

Improved Emery Grinding Machine.

E. William Gunn, New Woodstock, and George D. Wells and Harrison Wells, Erieville, N. Y.—This emery wheel machine, which is so constructed that the emery wheel may be turned into any position that the form of the work being ground may require without stopping the wheel or checking its speed. It expands and contracts as the band is twisted and straightened, and allows the bands to be readily slackened and tightened as may be required.

Improved Saw Set.

Robert J. Granville, Astoria, Oregon.—By this improved saw set the teeth may be alternately set in opposite direction, so that the operation may be finished by passing the instrument once along the saw. An operating main piece, with adjustable clamps and set screws, gives each tooth the exact degree of set required.

Improved Fastening for Tool Handles.

William M. Fisk, Lancaster, Pa.—This consists in a fastening bar having a button, to which a cap, having a chambered cavity, is applied and turned about one fourth of a revolution, and thereby fastened. It also consists of a spring in combination with the fastening bar to hold the cap in place.

Improved Lantern Handle.

Theodore James, North Adams, Mass.—A small block turns and slides freely upon a wire ring. Through a hole in the block is passed another ring, which is made with a small loop in its middle part, to prevent the block from sliding upon it. The block turns upon a wire bail, so as to enable the lantern to swing or oscillate without changing the position of the first ring. Upon the ends of the wire are formed hooks to hook into the lantern, and thus suspend it.

Improved Sash Fastener.

John Singer Wallace, Philadelphia, Pa.—This is an improved device by which the upper sash may be readily pulled down, and both sashes be locked securely, without interfering with the opening, closing, or cleaning of the window. The invention consists in suspending from a metal bracket, at the upper cross piece of the window, a stiff rod, which extends below the double cross piece of the sashes sufficiently far down to be used as a handle for lowering and closing the upper sash. This pendent rod is provided with a spring in the shape of an inverted umbrella spring, which locks over the lower sash. The rod swings like a pendulum in a metallic oblong socket attached to the upper cross piece of the lower sash, and may be taken out of the same through an open front recess, for being removed, while the unobstructed opening and closing of either sash are permitted by a side recess in the rear part of the socket, along which the spring is allowed to slide out.

Improved Device for Felling Trees.

Charles C. Curtis, Coos, N. H.—The object of this invention is to provide a device by which the falling of sawn or cut trees in any desired direction may be controlled, and the breaking of the saws prevented. The invention consists of a spiked pole of suitable length, that is applied to the tree and seated on an adjustable inclined piece that is hinged to a base frame, and raised to upset the tree by a suitable braced supporting collar and elevating mechanism.

Improved Lamp Extinguisher.

Milan Waterbury, Mason City, Iowa, assignor to himself and William H. Betts, of same place.—Should the lamp be upset, a ball will immediately be dislodged from its seat in a cup; and in falling its weight will draw a chain tight, and thereby pull a lever downward, which in its turn will cause the extinguisher to overlap the top of the wick tube, and thus immediately extinguish the lamp.

Improved Hitching Device for Straps.

Christian H. Bausch, Holyoke, Mass.—This invention relates to straps for hitching horses: and consists in a metallic slide or lock, through which the strap passes, and in which it is confined, the lock being adjusted to any desired position on the strap.

Improved Ash Sifter.

William Montgomery, Chicago, Ill.—To one side of the sifter are attached the edges of a semi-cylindrical plate, which passes through a hole in the screen, to form a spout, through which stones, slate, cinders, and other rubbish may be dropped into the ash box without raising the sifter.

Improved Cover for Beds, etc.

John Foster and William A. Weant, Salisbury, N. C.—The object of this invention is to furnish a convenient screen or cover for beds, cribs, tables, etc., for the purpose of excluding flies, mosquitoes, and other insects; and it consists of a cover of wire or thread netting having a pivoted movable section in combination with hinges which attach the same to the bed frame, and brackets which support the cover when raised integrally from the bed.

Improved Barrel Croze.

J. H. Morrison, Portsmouth, N. H.—The invention relates to the joints by which heads are secured in barrels intended to hold liquids, but especially beer. It consists in forming this joint of an arc form, so as to strengthen the edge of head and stave, thus preventing fracture or leakage from internal pressure or external percussion.

Inclined Guide Wheel for Locomotives and Railway Cars.

Turner H. Lane, Holly Springs, Miss.—The object of this invention is to increase the security and durability of the rolling stock of railways, by providing a means whereby the car wheels are prevented from leaving the track. It consists in the combination with the car wheel of an inclined guide wheel having a flange that rests against the under side of the top of the rail, the said guide whee being contained in a detachable supporting frame, and provided with an elastic seat or cushion. The guide wheels may be located either between the wheels of the truck or upon one side, and may be either inside the track or outside.

Improved Railroad Crosstie.

Henry Reese, Baltimore, Md.—The object of this invention is to furnish at a minimum cost a practically indestructible and permanent crosstie for railroads, in place of those made of timber, which last but a few months, and whose removal is a source of great and never ending expense to the railroad corporations; and the invention consists in a T-iron crosstie, provided near each end with oppositely facing clips, between and beneath which the rails are placed and firmly fastened by wedges.

Improved Motive Power.

Henry Bolton, Brantford, Canada.—This invention relates to certain improvements in motors for driving sewing machines, etc., and it consists in a means for utilizing the power of a magazine spring through a secondary driving spring, the tension of which driving spring is relatively constant, and which said secondary spring is intermittingly wound up by the magazine spring as fast as it spends its force, and while it is in operation; the two springs being so relatively constructed and arranged that the constant tension of the secondary spring is less than the weakest tension of the magazine spring at any stage of its operation, so that the magazine spring can always wind up the driving spring.

Improved Permutation Lock.

Mott B. Brooks, Brockville, Canada.—This invention relates to certain improvements in permutation locks. It consists in a semi-circular link having one end extended and pivoted in bearings in the case of the lock, and so arranged as to be drawn out and turned upon its pivots. The extended straight portion of the link is provided with a recess with which a transverse spring bolt is made to engage for the purpose of locking the link, and the transverse bolt is also provided with a recess with which a longitudinal bolt is made to engage for the purpose of locking the spring bolt. Upon said longitudinal bolt the permutating devices are arranged, which consist of three numbered rings, a clutch collar, and a disk, whereby an almost unlimited number of combinations may be had, and the device locked or unlocked by both an absolute and a relative key.

Improved Scaffold Clamp.

William C. Fellows, Toledo, O., assignor to himself and Charles Whittingham, of same place.—The bracket consists of a band which slips over the uprights, with a key fastened therein by a pin. The upper inner edge of the band is serrated to prevent the band from slipping on the upright. Confined by the bolt is an eccentric arm, in a recess of the key. Teeth penetrate the upright and secure the brackets. As the weight of crosstree and scaffold bears on the key, the band is cramped on the upright, the serrated edge penetrates the wood, and the arm, as the load is put upon the scaffold, works eccentrically on the pin, and increases the resistance.

Improved Process of Manufacturing Cider.

William H. Gilmore, Shiloh, Ohio.—This invention relates to the manufacture of artificial cider, and it consists in combining, with water, sugar, and tartaric or citric acid, a concentrated cider essence, which is obtained by freezing cider and drawing off the uncongealed alcoholic portions from the center. The said uncongealed alcoholic portions contain in solution all of the essential oils and flavoring essences which, being more volatile than water, are lost in cider concentrated by boiling.

Improved Tank for Retailing Coal Oil.

John H. Boardman, Baltimore, Md.—The object of this invention is to provide a case for coal oil barrels for retailing purposes; and it consists in a closed barrel case having one side of the lower part of it extended so as to form, with a portion of the drip tray, a closed dispensing tray with independent movable entrance thereto. The barrel is provided with a siphon and a bar for holding the same in place, and the drip tray has a trough which receives the leakage.

Improved Bill File.

Maurice Langhorne, Maysville, Ky.—This invention relates to certain improvements in bill files, and it consists in a sheet metal box having its sides cut away obliquely from the front to the rear for a part of the distance, and horizontally for the balance, so as to leave the front of the box flush with the top of the files, and yet allow the files, when pushed back against a spring, to be placed in such a position as to be readily inspected, the box being provided with a flange cover to protect the files from the damaging influences of weather and dust.

Improved Scroll Sawing Machine.

Charles N. Trump and Samuel N. Trump, Wilmington, Del.—A piece of metal is fitted to the shoulder of the arm of the machine by means of a set screw. The saw is driven by power applied by a friction wheel. The boring device is driven by the same friction wheel. A lever is connected with the arm piece, to which an eccentric is attached, which eccentric bears on the pin and throws the friction pulley in contact with the friction wheel. When the lever is thrown back, the pulley is drawn back from the wheel by the driving band of the boring bit. The saw rests against straight faces, so that, when the clamp is drawn up, its whole inner surface bears on and clamps the saw. The boring mandrel is supported on the arm of the saw by means of a bracket.

Improved Let-off Mechanism for Looms.

John Turner, of Lonsdale, R. I.—This consists of the yarn beam, geared by a system of reducing gears, and a pair of long cone pulleys and belt, with the cam shaft of the loom, with which there is a long, slowly revolving screw. The last gradually shifts the belt to increase the speed of the yarn beam in the proportion of the reduction of the size of the yarn roll, thus constituting a positive graduated let-off. For varying the delivery, to make the cloth more or less close, wheels of different sizes may be put in the reducing train; for instance, the wheel on the yarn beam, and the one gearing with it, may be removed and others put in their places.

Improved Car Brake.

Solon G. Howe, Detroit, Mich., assignor to himself and James W Cheney, of same place.—This invention consists of double friction cones, which are placed on the axles and carried, by the action of a wedge bail on friction rollers, against corresponding double shells keyed fast to the axles. The friction cones are applied by the wedge bail, and released by spring braces, both being operated by intermediate rods and lever connection from the hand wheels at the ends of the car. The axle is lubricated through perforations in the center pins of the friction rollers, and the cones are secured in their regular position and motion on the axle by a stationary projecting pin of the axle entering annular grooves of the cone hubs. The spring braces are attached to the upper and lower part of each cone, and secured to their lever connecting rods by wedge shaped blocks with binding side ridges, by which the constant strain exerted on the cones, to withdraw them from the shells, is increased.

Business and Personal.

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

Hoadley Portable Engines. R. H. Allen & Co., New York, Sole Agents, and Makers and Dealers in Agricultural Machines.

For Sale—Large lot second hand Machinists' Tools, cheap. Send for list. I. H. Shearman, 45 Cortlandt Street, New York.

Microscopes, from 50 cts. to $500, for Scientific investigation and home amusement. Magnifying Glasses, Spy Glasses, Telescopes, and Lenses. Price List free. McAllister, M'f'g Optician, 49 Nassau St., New York.

Wanted—Situation as Engineer of Stationary Engine. Address N. C. Merriam, Leominster, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., 25 Whitney Avenue, New Haven Conn.

Second hand Machine Tools for Sale cheap. D. Frisbie & Co., 26 & 28 Grand St., New Haven, Conn.

A competent Civil Engineer is desirous of taking charge of the construction of Water Works. Address C. E., Lock Box 637, Poughkeepsie, N. Y.

For Sale by Geo. W. Grice, 436 Walnut St., Philadelphia, Pa.: One 2nd hand Dummy Engine, Cyl. 6x10, Gauge 4 ft. 8½ in.; two 2nd hand Locomotives, 25 tons, Gauge 4 ft. 8½ in.; one new Locomotive, 6 tuns, Cyl. 6x10, Gauge 3 ft.; one new Locomotive, 10 tons, Cyl. 10x16, Gauge 3 feet 2½ in.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

For Screw Cutting by hand or machine, use our adjustable dies. Work perfect on once going over, and each die good for 16,000 bolts. Wiley & Russell Manufacturing Company, Greenfield, Mass.

Want to correspond with Manufacturers of Ice-making Machines. Address H. Möller, care Loeb & Co., 112 Chambers Street, New York.

"Of late years, advertising has assumed a very important phase—in fact, has become a science in business, and no one has done more, or as much, to make it so, as Geo. P. Rowell & Co., of New York. Their prompt and systematic mode of transacting their business has gained the confidence of all large advertisers, and has raised them in a few years from one of the smallest to the leading advertising house in the world."—(Maple Leaves, N. Y. City.

Rights for Sale—Wooden article—2047 N. Y. P. O.

Position Wanted in Machine Shop as Foreman or Superintendent, by a thoroughly practical Machinist, city or country. Is sober, energetic, prompt and pushing, as well as a good disciplinarian. Can influence special work, if desired. Address Machinist, Station G, Brooklyn, N. Y.

Electric Insulators cure Rheumatism, &c. Send stamp for circular. T. Sharts, 156 East 56th St., N. Y.

Wanted—A Good Die Sinker on Coffin Trimming Moulds. Also, Tool Maker, Lathe Burnisher, and Drop Pressman. Address the T. C. Richards Hardware Co., West Winsted, Conn.

Bolt Headers (both power and foot) and Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

Lathes, screw-cutting, 2d H'd, for sale, good order. 2—10 ft. bed, 15 in. swing, each $275; 1—9 ft. bed, 15 in. swing, $240; 1—20 ft. bed, 25 in. swing, $725; 1—12 ft. bed, 24 in. swing, $125; 1—6 ft. bed, 15 in swing, $200. Also, 8½ ft. bed, iron speed or drilling lathe, 18 in. swing, $70; 1—15 ft. bed, double headed lathe, 20 in. swing, $350. Crank planer, 14 in. stroke, 16 in. square 2 ft. bed, $345. Forsaith & Co., Manchester, N. H.

Portable Engines, 2d H'd, in complete order, for sale. 25 h. p. Hoadley, $1,475; 35 h. p. Hoadley, 1,650; 25 h. p., $1,200; 8 h. p. Hoadley (10 h. p. boiler), $600; 4 h. p. (with 6 h. p. boiler), $350. Also, 50 h. p. "Chubbuck" Upright Engine, $1,200; 50 h. p. Horizontal Boiler, $700; 18 h. p. Upright Boiler, $225; 2½ h. p. Boiler and Engine, $200; 4 h. p. Engine, with 6 h. p. Boiler, upright, $420. One 4½ h. p. Bookwalter Portable Engine, $240. Forsaith & Co., Manchester, N. H.

Wood-working Machines—new—for sale: 25 ft. Circular Saw Mill, with patent set works, $450; Upright Bolt, Self-Setting, Shingle Mills and Jointers, $300; Iron Frame Band Saws, $150; 24 in. Rotary Bed Planers, $200. 26 in. Double-belted, Rotary Bed Planers, $350; Power Matchers, $250; Box Board Matchers, $65; Excelsior Machines (feed both ways), $325; Swing Cut-off Saws, $35 and $40; Blind Slat Crimpers, $50 and $75; Sticking Machines, 3 heads, $175; Emery Wheels. Circular Saws, Saw Gummers, Saw Tools of all kinds, Rubber and Leather Belting a specialty. Forsaith & Co., Manchester, N. H.

Wood-working and other Machinery, 2d H'd, for sale: 25 ft. Circular Saw Mill, set works, 48 in. Saw, Belts, and 70 ft. Drawing-in Rope—all $380; 25 ft. Circular Saw Mill, with Lane set works, $310; 5 ft. Whitney Turbine Water Wheel, $400; Iron Felloe Machine, $50; Shingle Sawing Machine and Jointer, $75; Eureka Gang Lath Sawing Machine, 6 Saws, $125; 42 in. Portable Grist Mill, Holmes & Blanchard, $340; 26 in. Double-belted, Rotary Bed Planer, $240; 22 in. Stationary Bed Planer, $75; Daniel's Planer, wide bed, $175; Iron Frame Blanchard Spoke Lathe, $225; No. 2 Blake Steam Pump, $110. Forsaith & Co., Manchester, N. H.

"Book-Keeping Simplified." The whole system briefly and clearly explained. Cloth, $1. Boards, 75 cts. Sent postpaid. Catalogue free. D. B. Waggener & Co., 424 Walnut Street, Philadelphia, Pa.

Boult's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Saw Ye the Saw?—$1,000 Gold for Hand Sawmill to do same work with no more power Expended. A. B. Cohu, 197 Water St., New York

For best and cheapest Surface Planers and Universal Wood Workers, address Bentel, Margedant & Co., Hamilton, Ohio

The Baxter Steam Engine, 2 to 15 Horse Power. Simple, Safe, Durable, and Economical. "The Best are always the Cheapest." Over One Thousand in use, giving entire satisfaction. Address Wm. D. Russell, 18 Park Place, New York.

Engines, 2 to 8 H.P. N. Twiss, New Haven, Ct.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau st., N. Y.

A complete bedroom earth closet for $5. Send for pamphlet. Sanitarian M'f'g Co., 41 Courtlandt St. N.Y.

Hydrant Hose Pipes and Screws, extra quality, very low. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

American Metaline Co., 61 Warren St., N.Y. City.

Grindstones, 2,000 tuns stock. Mitchell, Phila., Pa.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

All Fruit-can Tools, Ferracute W'k's, Bridgton, N. J.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

Temples and Oilcans. Draper, Hopedale, Mass.

Lathe Gear Cutters, Wm. P. Hopkins, Lawrence, Ms.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Mills for Flour & Feed, White Lead, Colors, Ivory Black, Printing Ink, &c, John Ross, Williamsburgh, N.Y.

Three Second Hand Norris Locomotives, 16 tuns each; 4 ft. 8½ inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

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Notes & Queries

C. G. V. D. B. will find full information as to the manufacture of bicarbonate of soda on p. 125, *Science Record* for 1875.—T. L. R. will find directions for tempering steel on p. 235, vol. 32.—J. M. L. and J. W. L. will find a full description of the paper process of stereotyping on p. 383, vol. 30. —J. T. H. will find directions for making clay crucibles on p. 330, vol. 32.—H. B. and many others should read Auchincloss on "Valve and Link Motions."—J. H. can transfer pictures to wood by the process described on p. 138, vol. 30. For method of transferring to glass, see p. 123, vol. 30.—A. B. will find an explanation of the floating iron mystery on p. 133, vol. 31.—J. G. will find a recipe for a hair stimulant on pp. 267, 363, vol. 31.—C. H. can polish walnut by the method described on p. 315, vol. 30.—J. F. A. will find a rule for finding the strength of cylinders on p. 186, vol. 32.—E. C. F.'s queries on water supply through pipes have been answered on p. 48, vol. 29.—H. E. N. will find a description of salicylic acid on p. 324, vol. 32.—W. R. B. can silver glass by the methods described on pp. 177, 203, 267, 331, vol. 31, and p. 234, vol. 30.—I. will find directions for painting boilers on p. 379, vol. 31.—J. H. M. will find directions for a black enamel on iron on p. 208, vol. 26.—J. H. J. will find directions for making a frost-proof pavement on p. 187, vol. 32.—J. M. W. will find a recipe for marking ink on p. 251, vol. 29.—A. B. will find directions for plastering a cistern on p. 203, vol. 32.—R. S. B. and many others are once more assured that there is no rule for ascertaining the horse power of a boiler.—H. B. will find full instructions as to lap, lead, and cut-off in our papers on "Practical Mechanism."—S. B. C. can make glass windows opaque by the method given on p. 264, vol. 30.—A. S. S. and G. F. D. must go at once to a physician, or to the clinic of a hospital.—C. D. J. can make white writing ink by following the directions on p. 75, vol. 31.—J. A. H. will find an explanation as to white being a color on p. 379, vol. 31.—S. B. will find a description of the madstone on p. 263, vol. 28. It is a vulgar superstition.—L. M. N. and T. H. G. will find a rule for determining the diameters of pulleys on pp. 26, 73, vol. 25.

(1) A. J. R. asks: What is the best plan of preventing dampness striking through a brick wall? A. You do not say whether the plastering is set off from the brick wall by upright wooden strips, called furring. This should be done on all outside walls, and, if not now done, would most likely be a remedy in this case.

(2) J. B. Jr. says: It is proposed to put up a block of buildings one story high in front, two stories in the middle, and three stories in the rear, with separate chimneys to each section. Will the two story building, being higher, interfere with the draft in the flues of the one story building, and the three story building with that of the flues of the two story building? If so, what is the remedy? A. The probabilities are that the flues will not draw well three quarters of the time. The remedy is to build the third story of the same depth as the second, to draw the flues of the first story extension over to the rear wall of the second story, and carry the chimney shaft up against the said rear wall, topping out above the main roof of the building at the usual height above said roof.

(3) J. B. S. asks: What steel is used and how is it tempered, for making steel magnets? A. A very hard steel containing a high carbon percentage.

(4) T. C. N. asks: 1. What ingredients are used in the white glazing of cast iron pans? A. For enameling cast and wrought iron vessels, two compositions are in use; one has for its base silicate of lead, and the other boro-silicate of soda. One of these enamels is applied to the scoured surface of the metal in the form of a powder, which is fixed by heating to a sufficiently high temperature to fuse; it then spreads over and covers the metal with a vitreous varnish. The boro-silicate of soda possesses great superiority over the silicate of lead, for it is not attacked by vinegar, marine salt, or the greater number of acid or saline solutions, even when concentrated; and resists the action of agents used in cooking or chemical operations. The silicate of lead enamel is whiter and more homogeneous, which explains the preference given it by the public, but it gives up oxide of lead to vinegar or to common salt; it acts upon a great number of coloring matters, and it is attacked by nitric acid, which communicates a dull color to it. On evaporation the liquid leaves a white crystalline residue of nitrate of lead. This enamel is instantly darkened by dissolved sulphides, and also by cooking food containing sulphur, such as cabbage, fish, and eggs. 2. Can the same glaze be used on earthen tiles or other ware? A. Yes. 3. Can the glaze be colored green, blue, or yellow? A. To color the enamel green, mix with it before heating 1 to 2 parts oxide of chromium to 10 parts enamel. For blue, use prepared cobalt, red lead, niter, each 1 oz. For yellow, use lead and tin ashes, litharge, and antimony, each 1 oz., and niter 4 ozs. Gold and purple of Cassius are used for red and purple. For black, use calcined iron and cobalt, each 1 oz., or zaffre 2 ozs., manganese, 1 oz.

(5) S. C. D. asks: In blowpipe analysis what does the abbreviation B.B. mean? A. Before blowpipe. 2. What is reddle? A. Reddle is also called ruddle and red chalk. It is red ocher containing some clay.

(6) J. M. asks: 1. Will mercury evaporate if its surface is covered with water? A. It will not. 2. Can any one use an electro-coppered plate for the purpose of collecting gold from any composition which may contain it, without infringing on any patent right? A. Yes. 3. Can copper be coated with mercury without first being silver plated? A. Yes: clean the surface with a little sulphuric acid (dilute) and sand, rinse in clean water, dip in the mercury, and rub evenly over the surface with a brush. 4. Will an iron muffle answer in a furnace for the cupelation of silver in any form? A. An ordinary muffle is to be preferred.

(7) O. H. L. asks: How can I make a cylinder for compressing gas for the oxy-hydrogen light? Is there any special joint or seam, or any composition, in use for making the joint tight? A. These cylinders are made of boiler iron riveted together in the same manner as a steam boiler.

(8) S. T. asks: 1. How are magnetic fish made? A. See p. 218, vol. 32. 2. Is the paper of which they are made magnetized? A. No.

What power of microscope is necessary for chemists' use, for examining blood corpuscles, etc.? A. Theoretically, the magnifying power of a lens bears a definite relation to its focal length; but practically this is not precisely the case, since the mechanical difficulties of grinding and fitting the component lenses produce slight variations in the focal distance, and, of course, in the power. A lens whose focal length is actually $1\frac{1}{10}$ of an inch, and its magnifying power, when arranged with an eyepiece as above, is about 45 diameters, may be sold as a one inch objective; or the error, as is more frequently the case, may be on the other side, so that the purchaser obtains, for the price of a 1 inch objective, a lens having an actual power, when combined, of 55 diameters. For the use of chemists, we would recommend a ⅜ inch object glass with an angular aperture of about 32°, magnifying, with the various eyepieces, from 75 to 450 diameters. For the use of physicians, a ⅛ inch object glass, with angular aperture of 100°, magnifying from 250 to 1,500 diameters, will be found most useful.

How can I make a sea green paint? A. The following will give a beautiful blue-green tint: Add to a solution of sulphate of copper a decoction of fustic, previously clarified by a solution of gelatin. To this mixture is then added 10 or 11 per cent of protochloride of tin, and lastly an excess of caustic potash. Wash and dry the precipitate.

What can I mix with common stable manure to make a good tobacco fertilizer? A. Lime, but ground bone is much better, or some reliable superphosphate of lime.

(9) C. A. K. asks: Is heat visible? A. Heat is a motion of the ultimate parts of a body, and is not visible.

(10) A. F. asks: What is the difference between ebonite and vulcanized india rubber? A. Ebonite is made by heating india rubber with half its weight of sulphur.

Is there any method of reducing tortoiseshell to a soft state, so that it could be easily molded? A. No.

(11) M. D. W. asks: 1. Can the same still that is used for distilling oil of peppermint be used for manufacturing sassafras oil? A. Yes, if well cleaned. 2. Is there any difference in the process? A. Very little. The peppermint oil generally requires rectification to render it bright and fine.

(12) J. J. KcK. says: My hair grows very low on my forehead, in fact it reaches my eyebrows and quite covers my temples, injuring my looks very much indeed. As I am a lady, I am vain enough to wish it removed, if it can be done without scarring my face. A. The following has been successfully used: Take sulphuret of calcium (fresh) and quicklime equal parts, reduce them separately to fine powder, mix, and keep the mixture in a well stopped bottle. When used, a portion is made into a paste with warm water, and immediately applied to the part, previously shaved close, a little starch being generally added in order to render the paste more manageable. It requires caution in its use. It should be applied to only a small surface at a time, and great care should be taken to prevent it from extending to the adjacent parts. The powder loses its properties unless entirely excluded from the air, and no liquid must be added until just before application, and then to no more than is required for immediate use.

(13) G. D. S. asks: Will Babbitt metal impart unhealthy properties to butter, when about 4 inches surface of the metal is in contact with about 4 gallons of cream? A. There would be some risk, especially if any souring took place.

(14) L. L. D. asks: Is it not good reasoning that, when an article is cut through with a saw, it ought to separate? Nevertheless, I have an article that I can honestly saw through ten times on the same line, and then hand it back very nearly as strong as ever. A. We have frequently seen a similar result brought about by the proper use of magnetic force.

(15) A. McG. asks: What is the cheapest method of finding water in a light, loose sandy soil? A. Drive an iron pipe well.

(16) G. S. asks: How can I make laundry blue paper? A. Make a concentrated solution of indigo carmine, in which steep the paper desired to be coated, and evaporate the solution until the paper is coated with a heavy deposit of the coloring matter.

(17) J. G. H. asks: 1. What ingredient in the egg causes the spoon to be stained? A. Sulphur. 2. What chemical change takes place? A. A compound of sulphur in the albumen of the egg attacks the silver, forming a sulphide.

(18) C. D. P. F. asks: How can the steel on an engine be cleaned so as to look bright and burnished? A. Use fine emery paper.

(19) G. L. S. asks: Is there anything that can be used in making cologne that will make the perfume lasting? A. No.

(20) E. E. E. asks: 1. Should green apple wood for handles be cut into pieces the size of a handle, and let it dry before using, or would it be better to saw into boards and cut up when dry? A. The latter is best. Let the boards dry thoroughly before using. 2. How are light colored handles made black and polished to imitate ebony? A. See p. 299, vol. 30. 3. What is the usual way of polishing apple and other hard wood handles? A. See p. ,72 vol. 26.

(21) C. E. C. asks: Is there any way in which the dates on coins can be made clearer? A. Carefully clean the coins with dilute nitric acid rinse with water, and polish.

(22) L. H. W. asks: How can I best remove a baked Japan surface from old sewing machines, in order to get a smoother surface for another coat of Japan? A. Use a steel scraper.

(23) G. S. R. asks: What size of cistern will it require to supply a school of about 75 pupils, collecting the rain water by spouting, about 80 feet of spouting being used? A. Make your cistern 6 feet in diameter in the clear on the inside, and about 5 feet deep below the crown. 2. Of what materials and shape should the cistern be? A. Build it of brick with 8 inch walls laid up in Rosendale cement mortar, and with brick bottom and crown. Make it circular. 3. How can I make the best filter? A. Partition off one third the space with a 4 inch brick partition; have small holes for the ingress of water at the bottom of this partition, and fill said one third space with a layer of gravel and clean coarse sand about 6 inches deep. Place on top of this a layer of charcoal about 3 inches thick, and then another layer of sand and gravel like the first. Let the water enter the cistern into the larger space, and be drawn from the smaller.

(24) H. A. M. asks: I intend to build an outdoor cellar of brick. Could I make it frost proof by having an eight inch wall outside and a four inch wall inside, with a four inch space between the walls, filled with dust from the bed of a charcoal pit? A. This would make a wall that should retain the warmth of the interior of the cellar; but care should be taken to bind the walls together to prevent their being thrown apart.

(25) J. V. says: I have just built a large fireplace 5 feet wide and 3½ deep, opening about 6 feet high, in the basement of a building 2½ stories high, connecting it with two flues about 8x8, in the room above, about 10 feet from top of fireplace. There is a good draft to both flues, but not enough to prevent the fireplace smoking terribly. How can I remedy it? A. If the flues are together, and it is practicable, you had better remove the dividing partition between them, and make them into one.

(26) D. J. F. asks: 1. How can I find the number of square inches on the face of a millstone or any other circle? A. (Radius in inches)² x3·1416 gives the area in square inches. 2. How can I find the number of square inches on the surface of a triangle? A. Half the hight in inches x by the base in inches gives the area.

(27) W. W. N. says: I tempered springs made from Bessemer steel in oil at a very low heat, and then flashed them off. But most of them would set too much, and a very few were good. I tempered some in very cold running water, then dipped them in oil, and flashed them off. But most of them were too soft, some broke, and a few were good. There is a point of hardness and toughness that I am unable to hit. Can you suggest some pickle that will help me? A. If the springs set too much, do not continue the blazing so long, but dip them in water as soon as the blazing commences. If they are too hard after blazing, let them cool without dipping. Blaze them in a tank of oil placed over a fire.

(28) A. S. asks: Can a shaft be driven by a belt at an angle of 45° or any other than 90°, without the aid of a third pulley? A. Yes, by crowning the pulley and keeping the shafts in line.

(29) S. S. S. asks: 1. Is there anything better for house plants than clear water? A. Soapy water with a little ammonia is good. 2. Should the dust in the pots be loosened often? A. If it hardens on top, yes. 3. What kind of plants will blossom the most? A. Geraniums, calceolarias, and verbenas. 4. What kinds of plants are best for hanging baskets? A. Lobelias, musk, and ferns.

(30) H. R. asks: Is the motion of the valve uniformly the same in a locomotive engine and in a stationary engine? A. Yes, practically.

(31) F. G. says: In tempering steel, some mechanics use the lead bath. Is the molten lead in any way injurious to the steel? A. No.

(32) W. S. R. asks: Which is the best way to drill saw plate? A. Use a flat drill, and run slowly, with a little oil.

(33) G. W. L. asks: How can I harden files? A. Heat them to a red heat, and quench endways in salt and water.

(34) W. G. B. asks: How can I stick cloth on glass, so that it will hold firm, in order to sew it into an article? A. Try painting the glass with oil paint, letting it dry, and then using glue as a cement.

(35) W. B. asks: What is the best kind of pipe to connect a cistern with an iron pump where the water is to be used for drinking and cooking purposes? A. Use tin-lined lead pipe.

(36) W. F. M. asks: 1. I have almost completed a small steam engine, 1·5 bore x 3 inches stroke, which I wish to run at a speed of about 200 revolutions per minute. I have made the steam ports $\frac{3}{32}\times\frac{3}{4}$, exhaust ports $\frac{3}{16}\times\frac{3}{4}$. I intend the fly wheel to weigh 10 lbs. The engine is a vertical link motion, so arranged that, by means of a lever and notched segment, I can cut it off at almost any point of the stroke. Will a ¼ inch tube be large enough to supply steam, and a ⅜ one to exhaust it? A. Yes. 2. Will such an engine, working under a steam pressure of 20 or 30 lbs. per square inch, at the above-named number of revolutions, develop sufficient power to run a sewing machine? A. Yes. 3. If it is necessary to have a governor, will it answer to attach it to the cut-off lever and let it operate in that manner? A. A governor is not absolutely necessary. The method of attachment you mention would answer very well. 4. Will you be good enough to tell me what you think of the engine, as near as you can judge? A. Judging from your account, you have turned out a very creditable piece of work. 5. I never worked in any machine shop, nor attended any scientific school, but I have always had a great liking for machinery. I made all my drawings, patterns, etc., myself, as also the hand planer I use. From what I have written, do you think it advisable for me to enter a machine shop rather than any other business? A. It would be better for you to enter a good scientific school; but if you are determined and persevering, you can enter a machine shop, and get a good education out of shop hours.

(37) D. B. W. asks: What makes our gage, in very cold weather, show 60 or 70 lbs. pressure when there is no steam in the boiler? A. The gage must be frozen.

(38) M. C. says: I saw a notice in your paper about using zinc in steam boilers. I had a pipe to convey the feed water into a boiler some 26 feet long; it was gas pipe; and in about 12 months' use, it had many holes in it, some so round that they looked as if drilled. To stop them, I covered them with a sheet of zinc, and the next time that I cleaned the boiler I found many scales had left the tubes and shell, and were in the mud receiver. At the time, I did not know the reason; but seeing the account in your paper, I have continued the zinc until now, and only stop using it because my employer is afraid it will injure the boiler. Does it act on the iron injuriously? A. We do not think it will injure the boiler; and by keeping a careful watch, you can discover any corrosion, should it take place, before much harm is done.

(39) A. A. C. asks: What would be the proper length of a belt to drive a stone crusher? A. It depends on the distance between centers of pulleys, and will be a little less than the circumference of the driving pulley increased by twice the distance between centers.

(40) H. J. M. asks: Given a cistern 10 feet long x 10 feet wide x 10 feet high. What is the pressure on any one of the four sides, when full of water? A. The pressure is the area of the side, in square feet, multiplied by the distance of the center of gravity of the side below the surface in feet, multiplied by the weight of a cubic foot of water in lbs.

(41) J. E. P. asks: Where can I get a book that tells about hunting and fishing? A. Address the publishers of "Rod and Gun," West Meriden, Conn.

(42) H. S. S. asks: What, if any, difference would there be in the power required to run a pulley with a given load and width of belt in the following three cases? (1) With a belt long enough to run loosely without slipping. (2) With a belt so much shorter as to require a tightener. (3) With a short belt stretched very tight. A. A general answer cannot be given to such a question. With narrow belts, there would be little, if any, difference in the three cases; but in the case of a wide and a thick belt, method No. 3 would probably give the most satisfactory results. We do not know of any work that treats specially of this subject; but we imagine many of our readers have information acquired by experience which they will be glad to impart, and which we shall be pleased to receive.

(43) J. A. W. asks: How can I put walrus hide on wooden polishing wheels, so that it will stay on? A. Use the best glue.

(44) L. W. asks: 1. Can I use a copper plate instead of platinum or silver in a Smee battery? A. No. 2. Will a galvanic pile, composed of 100 pairs of copper and zinc plates 1 inch square produce as heavy a shock as one of 100 pairs of 4 inch plates? A. Yes. 3. Will it produce a shock that can be felt by taking hold of the wire with the hands? A. Yes. 4. What is the best work on galvanic and frictional electricity? A. Noad's or De la Rive's are probably the most comprehensive works published in English. 5. How can I make carbon for battery plates? A. See p. 186, vol. 32.

(45) E. L. G. asks: Can permanent steel magnets be magnetized so strongly that their power will not be increased by use? A. We think they can.

(46) S. asks: 1. How shall I proceed to silver plate lightly sheets of thin copper on one side? A. Cover the other side with wax. 2. Must I prepare a special battery, and how? A. Use Callaud's or Daniell's battery. 4. Will the ordinary rolled sheet zinc of commerce answer to secure the negative action? A. It will answer for the positive plate. Use copper for the negative. 4. How shall I proceed to test a galvanic appliance to determine how many degrees it will deflect the magnetic needle? A. Connect the battery with a tangent galvanometer.

(47) B. D. asks: 1. Can a magneto-electric machine be made powerful enough to produce a two inch spark? A. Yes. 2. Is there any book explaining the construction of such machines? A. Yes, "Introduction to Chemical Physics," by J. R. Pynchon.

(48) H. S. says: I put up 5 Tom Thumb batteries, and connected them by wires. By leading the current through a drop of water on a slate, the oxygen immediately rose in very small bubbles on the negative pole. After a short time a small blue lump appeared between the poles. By moving the wires to different places such lumps were formed at every place. What are they? I had well water to try it in. A. The lumps are blue oxide of copper. The bubbles which arose from the negative terminal were of hydrogen gas. Hydrogen, being electro-positive, is always drawn to the negative pole of the battery, as are all electro-positive metals, for the same reason. The oxygen of the water, united with the copper of the positive terminal, formed small lumps of blue oxide of copper, and for this reason the oxygen is classified as electro-negative.

(49) R. G. W., of Glasgow, Scotland, asks. How can I solder or otherwise join broken cast iron stove patterns? A. Use hydrochloric acid killed by zinc, and sal ammoniac for a flux.

(50) H. N. S. asks: How can I determine at what distance from the end of a stick of timber, of uniform size, a bar must be placed under it in order that three men, two taking hold of the bar and the third taking the other end of the stick, may carry the stick and each carry an equal share? A. Place the bar at ¼ the length of the stick from the end.

(51) H. H. asks: How can I true up paper cylinders? The cylinder is formed of disks of paper pressed together. A. Tools for turning wood will answer. Run your cylinder at a very high velocity.

(52) J. B. W. says: In answer to several inquiries concerning the strength of flues, you have replied: To determine the strength of any flue, made of good iron, well put together and perfectly cylindrical, divide 806,000 times the square of the thickness in inches by the product of the diameter in inches and the length in feet; but to K. K., who asked what would be the difference between the pressure necessary to explode a boiler from the inside, and that necessary to crush or flatten it from the outside, you say the internal pressure required to rupture it is the thickness in inches × tensile strength in lbs. per square inch ÷ by the diameter in inches; while the external crushing force is 111,000 × (thickness in inches)² ÷ by the diameter in inches × length in feet. Why do you use the unit 806,000 for the flue, and 111,000 for the shell when the cases are identical? In Roper's "Handbook of the Locomotive," I find that the unit is 806,300 × by square of the thickness in inches ÷ by diameter in inches × the length in feet, and this sum × 3. In the example given, the length of his flue is 10 feet; where does he get the 3 from, and why have you discarded the odd 300? A. The 111,000 should have been 806,000. In Roper's rule, he probably uses a factor of safety of 3, and so makes the flue 3 times as thick as it would require to be, if it were just strong enough to resist the pressure. Our rules had reference to the ultimate strength of the flue, and we would recommend the use of a factor of safety of 7 or 8.

(53) A. R. C. asks: I want to run an engine, 4 inches bore x 9 inches stroke, at 150 revolutions per minute, at 100 lbs. pressure. I will cut off when piston has traveled ⅜ distance, or at 3 inches. I want to know what fire surface is necessary to keep up steam at that pressure. A. From 60 to 80 square feet.

(54) S. F. S. asks: Which is the most economical to carry, high or low water, in a boiler of the locomotive style? A. There is not a great deal of difference; but probably some of our readers have made experiments bearing on the subject, and, if so, we would be glad to hear from them.

(55) S. W. asks: Would a boiler 3 feet long x 1 foot in diameter be large enough for an engine of 4 inches stroke by 4 inches bore? A. No.

How long ought a person to be learning to be a good telegraph operator? A. A few weeks, if he is intelligent, and has a chance of learning in an office where much business is done.

(56) B. D. W. says: An engineer claims that the lead of an engine can be lengthened or shortened by turning the eccentric around on the shaft without touching the valve or connecting rod. I say it cannot be done without lengthening or shortening both ends of the valve. Which is right? A. The engineer.

(57) A. D. says: I am making a boiler of 12 pieces of 1 inch gas pipe, 12 inches long, connected at each end with Ts. Steam dome is 3 inches in diameter and 9 inches long. Grate surface is 8 inches square. All the pipes are exposed to the fire. Will the above be suitable for an engine 1¾ inches in diameter x 2¾ stroke? A. It is probably large enough, but you may have some difficulties in using it. We would be glad to hear from you again, after you get it done.

(58) J. B. says: I am building an engine 3 inches bore and 6 inches stroke. Will ports 2 inches long and ¼ inch wide be large enough to let the steam into the cylinder? A. Yes. 2. Will ⅝ iron be large enough for the piston rod? A. Yes.

(59) E. G. C. says: 1. I am making a small upright boiler, 15 inches in diameter x 30 inches high, of $\frac{3}{16}$ inch iron, with heads ⅜ of an inch thick, with flue 4 inches in diameter. What will be a safe pressure? A. About 100 lbs. per square inch. 2. What power from an engine, 1½ x 3 inches, would I get with 40 lbs. of steam, running at 100 feet per minute? A. Multiply pressure on piston by speed in feet per minute, and divide by 33,000.

(60) R. B. asks: How many horse power can be got from an engine of which the pulley is 32 inches and the belt is 9¾ wide, running over a 20 inch pulley? The 32 inch pulley runs at 150. A. Under favorable circumstances, from 15 to 18 horse power.

(61) P. S. H. asks: Is the pressure the same in the steam chest as it is in the boiler? A. It is generally less, some pressure being lost by the steam in passing through the pipe, and some being required to give the steam the velocity of flow.

(62) R. H. M. says: I. I want to put an engine into a boat 28 feet long by 6 feet beam, drawing 1 foot or 15 inches of water. What horse power do I require to drive her at 6 or 8 miles an hour in still water? A. About 2 horse. 2. How large a screw and of what pitch will be required? A. Diameter, 28 to 30 inches; pitch, 3 to 3¼ feet.

(63) J. F. asks: 1. Can the officers of a corporation of a town stop me from operating a steam engine within said town on the plea of danger from fire or any other cause? A. It depends entirely upon the local laws. 2. Can a steam boiler be supplied with water from a tank above it by a pipe running through upper shell of boiler to within an inch of lower shell by merely the force of water? A. Not unless the pressure of the column of water is greater than the steam pressure. Insert a steam pipe into the top of the tank, however, and you will have an arrangement similar to an equilibrium oil cup.

(64) S. N. M. says: To the questions lately asked by two of your correspondents, what is the force of the blow of a pile driver, and of a steam hammer of a given weight, falling a given distance, you reply that it can only be determined by experiment. You question whether the rule given in the books, that the "momentum of a falling body is equal to the weight multiplied by the velocity" will determine what weight, pressing steadily, will produce the same effect as the blow. By the rule, the momentum of 1 lb. falling $16\frac{1}{12}$ feet is equal to $32\frac{1}{6}$ lbs. I lately extemporized a simple, inexpensive apparatus. I took a small lever, of uniform size and density, and made a slight crease across the center of it; I balanced it on a dull knife edge in the crease and hung a weight of $32\frac{1}{6}$ ozs. to one end; I kept the lever horizontal by a stop over it near the other end, and let drop a 1 oz. bullet on to the end from a hight of $16\frac{1}{12}$ feet. It just sunk that end away from the stop, perhaps the $\frac{1}{50}$ of an inch. I next let drop a bullet about 2 dwts. lighter; it did not sink the lever away from the stop. Though my apparatus and experiment were necessarily somewhat imperfect, my result came so near the rule that I maintain that the rule does determine what weight, pressing steadily, will produce the same result as the blow.

(65) O. E. W. says, in reply to S. S.'s query as to cone pulleys: The offset from the size of the largest pulley in the treadle wheel must be the same as from the smallest cone to the second size of cone, and the offset from the second to the smallest size in treadle wheel must be the same as from the middle to the largest size in the cone.

(66) O. E. W. says, in reply to C. D., who speaks of water foaming and showing a boiler full of water, while in reality the boiler is nearly dry: This has been my experience. Our works having stood idle from February 20 to April 5, the scale in the boiler became loosened by successive freezing and thawing. It was then cleaned out and a boiler purge, composed of *terra japonica*, carbonate ammonia, and soda, freely used. The result was foaming to such an extent that the water would show in every gage and to the top of the glass tube, and in the same minute would run down out of sight in the glass, with a steam pump working at its highest speed to fill the boiler. We use steam to heat dry house and factory, and to run the engine (20 horse power) and steam pump, and for several other purposes; but were obliged to shut off all except the engine and pump for an entire day.

(67) D. N. says, in reply to H. M. F., who asks for a method of determining the pitch line of a cog wheel, having the number of cogs and the pitch. A very simple rule is to multiply the number of cogs by number of thirty-second parts in the pitch, and point off the two right hand figures for decimals. For example: In a wheel of 2 inches pitch with 100 cogs, there are 64 thirty-seconds; then 100×64=6,400: or 85 cogs, 85×64=13·60 inches. Take any pitch, say ⅜ and 25 cogs: 25×12=3·00 inches. This is the way that I have found the pitch line of wheels for the last 15 years, and it is perfect. The rule can be inverted and the number of cogs found if the diameter and pitch be given.

(68) O. E. W. says, in answer to E. R. C.'s query as to using lead pipe to convey steam: This should not be done if the pressure is more than 5 or 10 lbs. per square inch. I made an attempt to carry steam at a pressure of from 40 to 60 lbs. (underground), and the result was a reduction of the lead to a white paste or powder in a few weeks' time, and a consequent expansion and bursting of the pipe. I have found by many years' experience that lead in contact with steam under pressure of over 10 lbs. per square inch very soon loses its strength, and it is therefore good neither for packing joints nor conveying steam.

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

G. M. O.—Iron pyrites.—H. P. W.—It shows little particles of sulphuret of iron, but you must look farther if you suspect zinc or silver ore.—R. S. F.—It is a piece of ordinary spelter or cast zinc.—G. H. & J. S. C.—It is oxide of iron, with a large percentage of silex.—H. W. S.—It is not nitrate of potash; it is yellow magnesian limestone.—S. P.—It is brown hematite, an ore of iron extensively used.—T. H. R.—They are rock crystals or crystallized quartz.—H. W. B.—Iron pyrites.—B. E.—It is muscovite, or potash mica, containg about 10 per cent of potash. If spread upon the ground, it would decompose in the course of time, and the potash would be converted into a soluble form and would serve as a fertilizer to plants. It would be well to institute experiments of this kind with it. The other uses to which muscovite can be applied will be found in the *Science Record* for 1875, p. 137.—J. D. P.—The metal particles appear to be a sulphuret of some kind, probably pyrites. If you will send some of the metal free from the gangue, this can readily be determined. The amount sent was not sufficient for analysis.—C. G. O.—One of your specimens (from Yonkers, N. Y.) is beautifully white kaolin. The other contains a small amount of oxide of iron.—We have received specimens of porcelain clays of inferior quality from W. L., Central City, Col. Ter., and M. P. A., West Bloomfield, N. Y. The price depends largely on quality, etc. The purest is retailed in New York at 10 cents per lb.

S. L. G. asks: 1. Are violin tops and bottoms sawn thin and then bent? 2. Is there a block or anything of the kind inside the violin, to glue the neck to, or is the neck simply glued to the outside?—R. M. C. asks: How can I make blue marking ink, used by the express companies?—F. E. W. asks: Is here anything besides tin with which I can coat lead castings before covering them with vulcanized rubber?—T. C. H. says: I wish to run an engine of from 5 to 10 horse power in the smallest possible space. To do so I propose to use coke, with an apparatus for sprinkling small quantities of crude coal oil on the coke to increase the heat. Who can tell me of the results of this method?

COMMUNICATIONS RECEIVED.

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

On Drawing Ovals. By E. C. T.
On Light. By F. G. F.
On Criminal Entailments. By B. S. B.
On Chemical Elements. By W. T.
On Euclid, I, 47. By F. M. S.
On Curves in Nature. By E. C.

Also enquiries and answers from the following.
T. L. S.—O. P. S.—J. W. S.—P. O. H.—C. R.—W.—H. W. G.—X. Y. Z.—L. N. S.—J. S. L.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Whose is the best system of short hand? Who sells a book on the Turkish bath? Who sells works on chemistry? Where can I get a good microscope for laboratory use, and what will it cost?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

May 4, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Stove pipe damper, G. W. Leading	162,757
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Table slide, extension, J. C. Turner	162,975
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Tobacco, treating, G. S. Prince	162,767
Top, adjustable, A. Clarke	162,797
Torch, J. Benson	162,738
Toy building block, C. M. Crandall (r)	6,409
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Whiffletree, J. H. Brown	162,794
Wire way, endless, A. S. Hallidie	162,915
Wringer, T. E. McDonald	162,985

DESIGNS PATENTED.

8,304.—VALISE LOCKS.—G. Bernheim, New York city.
8,305.—FANS.—G. S. Farwell, Boston, Mass.
8,306.—STAIR COVERS.—W. B. Gould, Montrose, N. J.
8,307.—FANS.—B. Hecht, New York city.
8,308.—TYPES.—H. Ihlenburg, Philadelphia, Pa.
8,309.—CLIPS FOR CARDS.—G. W. McGill, New York city.
8,310.—FANS.—E. W. Perry, Cincinnati, Ohio.
8,311.—HAT BOXES, ETC.—H. F. Reinecke, Jersey city, N. J.
8,312.—CUFF-BUTTONS.—L. S. Beals, Astoria, N. Y.
8,313.—TYPE.—J. M. Conner, Greenville, N. J.
8,314.—TYPE.—H. Ihlenburg, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,412.—WHISKY.—Adams & Taylor, Boston, Mass.
2,413.—GIN.—Adams & Taylor, Boston, Mass.
2,414.—WHISKY.—Adams & Taylor, Boston, Mass.
2,415.—GIN.—Adams & Taylor, Boston, Mass.
2,416.—WHISKY.—Adams *et al.*, Boston, Mass.
2,417.—GIN.—Adams, Blake, & Taylor, Boston, Mass.
2,418.—SOAP.—J. P. Babcock & Co., Stonington, Conn.
2,419.—ESSENCE OF GINGER.—F. Brown, Philadelphia, Pa.
2,420.—LINIMENT.—G. O. Clark, College Point, L. I., N. Y.
2,421.—LEAD.—Forest River Co., Salem, Mass.
2,422.—ALCOHOL.—C. H. Graves, Boston, Mass.
2,423.—GALVANIZED IRON.—McCullough Co., Philadelphia, Pa.
2,424.—MEDICINE.—J. Purley & Co., Atlanta, Ga.
2,425.—AXLE OIL.—C. C. Richmond, Boston, Mass.
2,426.—SODA WATER.—S. F. Simes, Philadelphia, Pa.
2,427.—CARVINGS.—Sorrento Carving Co., Boston, Mass.
2,428.—OXYGEN WATER.—G. R. Starkey, Philadelphia, Pa.
2,429.—SEWING MACHINES.—Finkle *et al.* Manu. Co. Middletown, Conn.
2,430.—PAINTS, ETC.—D. F. Tiemann & Co., N. Y. city.
2,431.—SODA WATER APPARATUS.—J. W. Tufts, Medford Mass.
2,432.—COFFEE.—G. Boyd & Co., Philadelphia, Pa.
2,433.—BITTERS.—E. Brown & Co., Jersey city, N. J.
2,434.—COFFEE.—D. Focht & Co., Philadelphia, Pa.
2,435.—WOOLEN CLOTHS.—Middlesex Co., Lowell, Mass.
2,436.—CHAMPAGNE.—Moët *et al.*, Epernay, France.
2,437.—LARD.—G. C. Napheys & Son, Philadelphia, Pa.
2,438.—MEDICINE.—J. R. Nichols & Co., Boston, Mass.
2,439.—OILS, ETC.—H. Phillips, New York city.
2,440.—MUSTARD, ETC.—Pinckney & Co., N. Y. city.

SCHEDULE OF PATENT FEES.

On each Caveat	**$10**
On each Trade mark	**$25**
On filing each application for a Patent (17 years)	**$15**
On issuing each original Patent	**$20**
On appeal to Examiners-in-Chief	**$10**
On appeal to Commissioner of Patents	**$20**
On application for Reissue	**$30**
On filing a Disclaimer	**$10**
On an application for Design (3½ years)	**$10**
On application for Design (7 years)	**$15**
On application for Design (14 years)	**$30**

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, APRIL 22 to 29, 1875.

4,692.—A. Cummings, New York city, U. S. Screw. April 28, 1875.
4,693.—E. Hill, Jr., South Norwalk, Conn., U. S. Lining for cylinder. April 28, 1875.
4,694.—A. Mitchell, Wilkesbarre, Pa., U. S. Spark arrester. April 28, 1875.
4,695.—J. J. Cobb, Grand Rapids, Mich., U. S. Sides and wings for sleighs. April 28, 1875.
4,696.—R. Bentley, Owen Sound, Ont. Scantling roof. April 28, 1875.
4,697.—J. E. Wisner, Friendship, N. Y., U. S. Fertilizer sower. April 28, 1875.
4,698.—C. R. Snyder, Minneapolis, Minn., U. S. Work table. April 28, 1875.
4,699.—H. Behning *et al.*, New York city, U. S. Name board for pianos, etc. April 28, 1875.
4,700.—C. W. Jenks, Somerville, Mass., U. S. Shirt bosom. April 28, 1875.
4,701.—C. Kennedy, Aurora, Ill., U. S. Wire fences. April 29, 1875.
4,702.—P. Gendron, Toledo, O., U. S. Carriage wheel. April 28, 1875.
4,703.—S. Morrell *et al.*, Montreal, P. Q. Spring bed bottom. April 29, 1875.
4,704.—J. Moulton, Ossipee, Conn., U. S., *et al.* Barkrossing machine. April 29, 1875.

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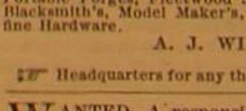

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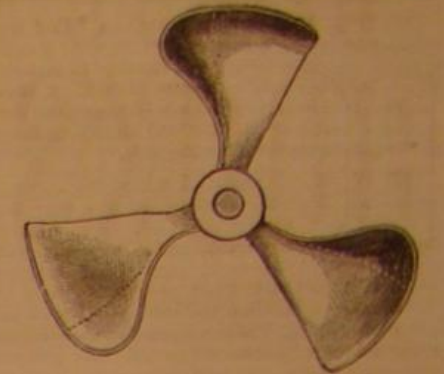

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(COPY.)

OFFICE OF RICHARD H. BUEL, Consulting Mechanical Engineer, No. 80 Broadway. New York, May 18, 1875.

N. A. PATTERSON, Esq., President Patterson Propeller Co., &c.

SIR: I present, herewith, the results of my calculations in regard to the comparative performance of the Common Screw Propeller, and the "Eagle Wing" Propeller, from data furnished by you.

The data referred are as follows:

The steam yacht of the *New York Herald* was originally fitted with a propeller of constant pitch. This was removed, and the "Eagle Wing" Propeller substituted; the new wheel having the same diameter, (and about the same) surface, and mean pitch as the former.

Before changing the propellers, a run was made from the Battery to Robin's Reef Light House—about 4 miles—and after the change, several runs were made over the same distance. For the purpose of obtaining uniform conditions, the run was made, in each case, 3 hours after high water; and, the valve motion of the Engines was adjusted, to admit steam for the same fraction of the stroke—¾ in each case. The conditions in regard to wind were approximately the same in each run. The following results of the runs were furnished to me:

1st. "TRUE SCREW":
Time of run, 19 minutes.
Revolutions per minute, 97.
Boiler Pressure, by Gauge, 55 lbs.
2nd. "EAGLE WING" PROPELLER:
Time of run, 19 minutes.
Revolutions per minute, 75.
Boiler Pressure, by Gauge, 55 lbs.
3rd. "EAGLE WING" PROPELLER:
Time of run, 15½ minutes.
Revolutions per minute, 80.
Boiler Pressure, by Gauge, 60 lbs.

It is required to determine the relative horse-power developed by the engines in the cases cited above.

In order to calculate the relative horse-power exerted, from the above data, it is assumed in the 1st and 2nd cases that the mean effective pressure in the cylinder was the same, so that the horse-power varied as the number of revolutions per minute. To make a comparison for the 3rd case, it is assumed that the clearance space at each end of the cylinders is 5 per cent of the piston displacement; that the mean back pressure is 4 lbs. per square inch; the mean total pressure in the cylinders 9-10 as great as for a theoretical case where there is no wire-drawing or exhaust lead; and that the loss of pressure between the boilers and cylinders was practically the same in each case. While I am unable to verify these assumptions, it is probable that they are approximately correct, and will give results which are not, seriously, in error.

The results of the calculations will be found below:

I. For the same speed of vessel, the "Eagle Wing" Propeller only required from 75 to 80 per cent as much power as the "True Screw."

II. When the same power was used, the "Eagle Wing" Propeller drove the vessel 22½ per cent faster than it was propelled by the "True Screw."

These results are so interesting and important that it seems desirable to confirm them by a series of tests in which all the data necessary for a complete calculation shall be determined by careful experiments.

Respectfully, RICHARD H. BUEL.

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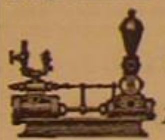

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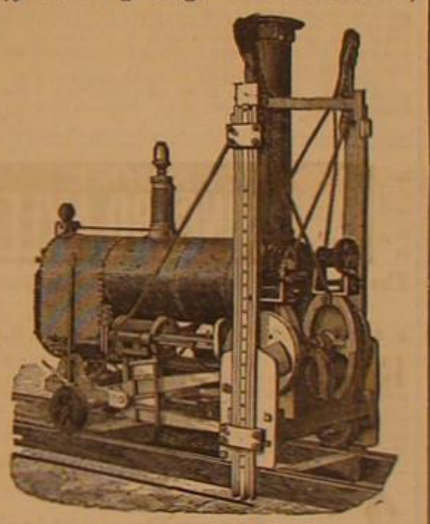

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