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IMPROVED DIAMOND STONE SAWING MACHINE.

The working of stone, although one of the greatest of human industries, has, up to this time, probably received less assistance from steam machinery than any of the principal arts. It is therefore with special gratification that we chronicle and portray the new mechanism here presented, which, by its remarkable performances, entitles it to rank among the important mechanical achievements of the age. As a labor-saving device, this Emerson machine executes in stone almost what the common circular saw does in wood.

Our engraving is from a photograph of the original machine as arranged for practical operation. It is very strongly built, weighing about 24,000 lbs The metal portion alone comprises about 20,000 lbs. of this weight, The apparatus is mounted with a circular saw, 73 inches in diameter, carrying 48 diamonds and steel points.

Without changing the velocity of the main shaft, the speed of this saw may be varied from 5 revolutions to 500 per minute, an advantage of importance, as in the use of hard metal points a slow speed and heavy feed are required, while in the use of diamonds for the cutting points the reverse is necessary. The feeding of the stone to the saw may be varied from one sixteenth of an inch to four inches at each revolution, the feed motion being taken from the mandrel of the saw. The carriage or beds upon which the stone is mounted are moved by a separate feed motion, back and forth, much faster than when the saw is cutting. A single hand lever suffices for this operation

By the aid of simple mechanism in connection with another hand lever, the saw, with all of its appliances, may be raised or lowered without stopping its motion or changing the tension of a belt; so that when it is desirable to saw stone more than thirty inches in thickness or in width, the saw can be elevated and an upper cut made through the stone as deep as the saw will cut. The stone is then run back, and the saw lowered. The carriage next passes over the top or upper part of the mandrel, and an under cut is made. The time taken in raising and lowering the saw does not occupy more than five minutes, notwithstanding that the weight raised and lowered may exceed 4,000 lbs. In ordinary work, the stone is not moved after it is placed upon the bed until it is sawn into slabs or pieces of the required thickness. The saw is made movable upon its own mandrel by the turning of a small hand wheel. At each revolution the saw is moved sidewise one fourth of an inch, being four turns of the crank to one inch. The carriage or bed, upon which the stone rests, runs, it is claimed, as perfectly as the bed of an iron planer. It travels upon heavy iron rollers, the journal boxes of which are made perfectly grit proof and self oiling.

Stone may be sawn to any length up to 14 feet, and of any angle or depth to five feet, so that a corner piece may be sawn out of a stone block. All stone to the hardness of ordinary grindstone, may be sawn with hardened steel or metal points; diamonds are substituted in working upon the harder grades.

It is claimed that one circular saw in this machine will do the work of more than one hundred hand saws, and this accurately true and out of wind. The machine has already sawn one hundred and twenty-five superficial feet of actual cutting in one hour, of the hardest kind of Berea sandstone, a material harder than ordinary grindstone grit. This was done with the diamonds as cutting points.

In our second figure (see page 163) is shown a section of two teeth of the saw with the holders in position; A is the diamond holder, and B the steel point holder. The steel holders are made adjustable and interchangeable in the saw, so that either the steel tooth holders or diamond holders may be used in the same blade.

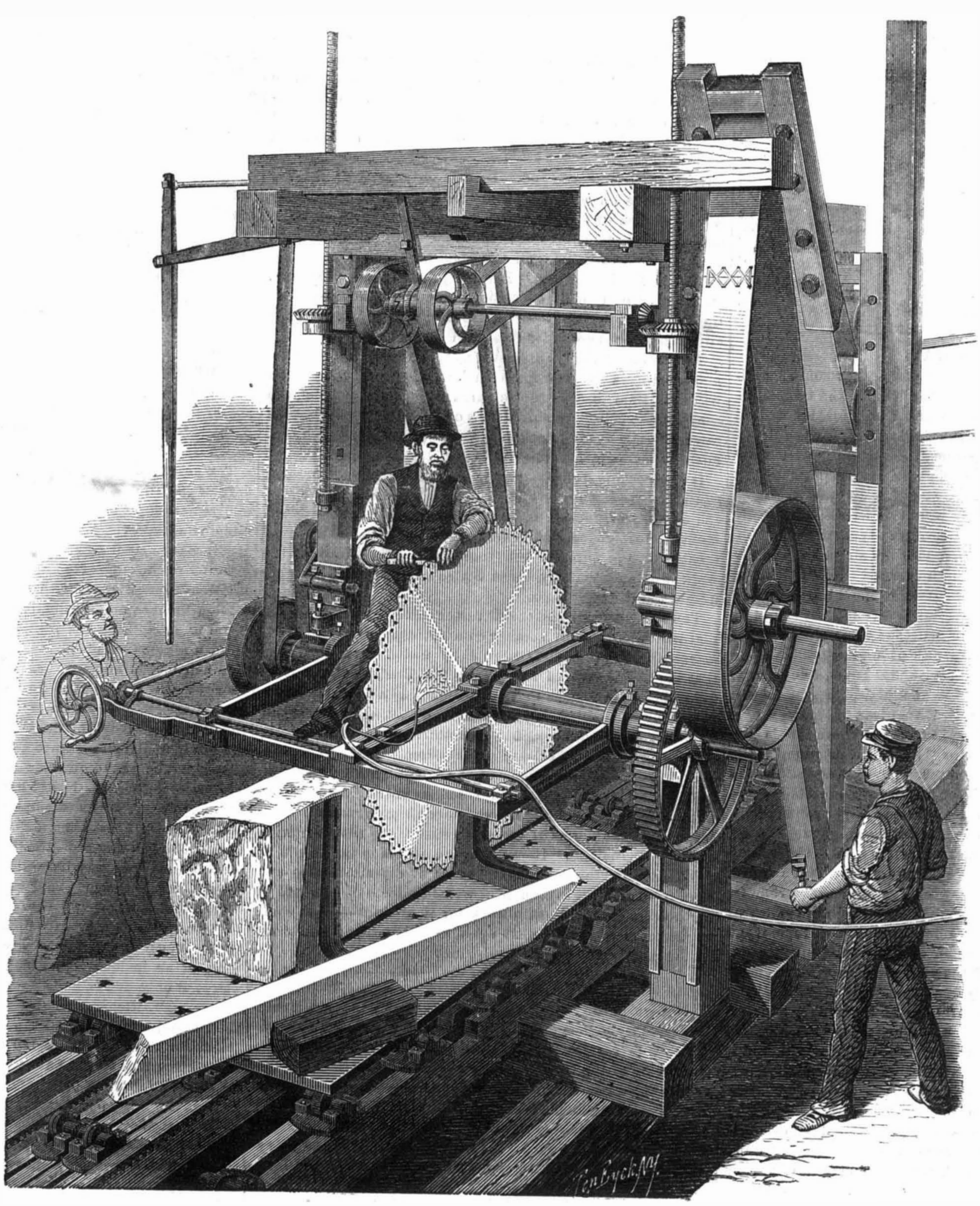
Fig. 3 (page 163) shows the diamond holder and diamond detached from the saw, C C being a full sized holder with diamond inserted; D a half section, showing the cavity cut to receive the diamond, and E the diamond, inclosed or partially embedded in a soft metallic casing (copper by preference). The method of setting and holding the diamond, as now adopted, is here clearly represented. The diamond is first wrapped in a casing of copper, and placed so as to present the most desirable cutting part in suitable direction and position. The casing is then closed around it so as to maintain it in position. The diamond is then, with the casing, placed between two metal or other suitable substances of sufficient hardness to press the casing into every jagged shape and irregularity of the diamond, but not of sufficient hardness to crush or break the same. The surplus part of the casing is then cut away. A cavity is then formed in the steel holder, approximating the outer shape of the diamond casing. The latter is then placed between the jaws of the holder, and under pressure is forced, to a perfect fit or profile, into the steel and on the diamond. The lower portion of the casing is gripped between the jaws of the holder, as in a vise, forming a perfect fit and substantial connection. This exceedingly simple method enables any mechanic of ordinary skill to set the diamond.

Fig. 4 (page 163) is a holder with three or more diamonds set in one piece, designed more particularly for straight saws, to be used with reciprocating motion.

Machinery for the use of this saw may be varied and constructed to suit all kinds of stone sawing and dressing.

We understand that the machine here illustrated is to be set up and operated at the Cincinnati Industrial Exposition, which opens September 2, 1874. The stone saw and machine is the invention of Mr. J. E. Emerson, and is covered by numerous patents.

Further information may be obtained by addressing Messrs. Emerson, Ford & Co., Beaver Falls, Pa., or Richard S. Robertson, Esq., No. 12 Smithfield street, Pittsburgh, Pa.



EMERSON'S PATENT DIAMOND STONE SAWING MACHINE.

Structure of Coal.

By close investigation E. W. Binney, F.R.S believes he has established the following facts: Soft caking, or cherry, coal is chiefly composed of the bark, cellular tissue, and vascular cylinders of coal plants with some macrospores and microspores. Caking coal has much the same composition, except that it contains a greater proportion of bark. Splint, or hard coal, has a nearly similar composition, but with a great excess of macrospores. Cannel coal, especially that yielding a brown streak, is formed of the remains of different portions of plants which had been long macerated in water; it contains a great excess of microspores. Macrospores are from $\frac{1}{20}$ to $\frac{1}{25}$ of an inch in diameter, and can be easily seen by the naked eye. Their exterior is composed of a brown coriaceous substance, containing within it carbonate of lime or bisulphide of iron, according to the nature of the matrix. The microspores are about 320 times less in size, and contain some form of hydrocarbon, which, by the action of heat, becomes paraffin. These conclusions were arrived at merely as to the composition of the different kinds of coal. Each seam is materially affected by the nature of the roof, since, if it is an open sandstone, gaseous matter can freely escape, which is of course not the case when the seam is roofed in with airtight black shale or blue bind.

THE Pilot Knob Iron Company have recently sunk a shaft on Shepherd Mountain, Iron county, Mo., and have now passed through 70 feet of almost solid ore.

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NEW YORK, SATURDAY, SEPTEMBER 12, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

CAN WE STAY?

It is time some one stood up for his country: some American, we mean. Not for its present prosperity and immediate prospects, there are plenty to do that: but for its distant past and distant future. We are tired of hearing the Continent called a graveyard of nations, the tomb of antecedent races, the one spot on earth which man cannot permanently inhabit!

It is bad enough to be told, by would-be wise ethnologists, that our climate is hostile to the Aryan type, that an irresistible Indianizing influence pervades the air and is rapidly converting us all into lean, high-cheeked, bilious-looking copies of Mr. Lo; and that our great grandchildren will be no better than so many Sioux. But that is not half so bad as to be told that it is a question whether their descendants will be able to stay here at all, except underground. Any existence is better than extinction: and it is possible to hope good things of our race even if it should assume the physical characteristics of the so-called American type.

The latest advocate of the extinction hypothesis is the somewhat prominent author of "Sex in Education." His essay, read before the National Teachers' Association the other day, set out with the discouraging announcement that no race of human kind has yet obtained a permanent foothold on this continent; and the lesson he sought to enforce was that, unless something extraordinary is done, we are doomed as a race to untimely extermination. The Asiatics, he said, trace their life to beginnings immensely remote. The descendents of the Ptolemys still linger in the valley of the Nile. The race which peopled Northern Europe, when Greece and Rome were young, more than maintains its ancient place and power. But the ancient races of America—where are they? "We only know that they are gone."

When Dr. Clarke talks of "Brain Building" and the "Education of the Sexes," he says much that is sensible and true: but when he infers our early destruction by climatic influences from the fact that other American races have vanished, our confidence in his judgment is seriously shaken. Grant that vestiges of two or more departed races are to be found within our borders, and that when the Mayflower discharged her marvelous cargo of cottage furniture to furnish heirlooms for all New England, the native race were hastening to the happy hunting grounds at a rate which whisky and gunpowder have but slightly accelerated: does that prove American races to be short lived? Rather let us call it evidence of exceeding long life. Where else on earth will you find so few races bridging over so vast an interval of time?

When the pioneers of Italy and Greece, wild as Mohawks, fought their way into Europe, a peaceful and populous nation—whose unhappy remnant has lately given a President to Mexico—was cultivating maize in the valley of the Mississippi, mining copper at Lake Superior, and building temples in the South. The man of the Florida corals antedates not merely the Ptolemys—men of yesterday—but the Pharoahs, the shepherd kings, it may be the very land they owned and ruled. What wonder that his lineage is lost? We know from recent exploration that the desert regions of North Africa were under water in later tertiary times. Since then the sea has dried away, and across its sandy bottom the Nile has laid its annual layers of mud for the creation of the ancient granary of the world. There is geological evidence that, when the first mud layer was put down, a broad fresh water sea covered the now barren Bad Lands of our great West. There is similar evidence that men dwelt on its shores and fished from its headlands.

Since the pioneers of Western Europe sought shelter in the caves of France and Belgium, the Somme has sunk its bed through a hundred feet of gravel. Since a settled population flourished on the then fertile, now arid, plains of the Colorado, that stream has cut its mighty cañons deep in earth through two, four, perhaps six, thousand feet of solid rock! When the upper strata of the Himalayas were in process of deposition, and before our Aryan fatherland began its upward course in civilization and altitude, human beings were fishing among the islands of our Pacific coast, since lifted up to form the Coast Range. Ages afterward, when the Golden Gate had been opened and California drained of the sea which had filled the valleys of the Sacramento and San Joaquin, but before the gold gravels were ground into existence or buried beneath lava floods, other men came in and occupied the land, leaving their remains, with those of animals long extinct.

Yet because we cannot trace these nations historically through intervening ages, because they seem to represent a number of distinct successive races, shall we blame the climate and call the land inimical to humanity?

PREPARE FOR THE CENTENNIAL.

The short time intervening between the present date and the opening of the Centennial Exhibition renders it imperative that intending exhibitors should begin their preparations at once. We need not urge the fact that, owing to the magnitude of the affair and the large interests involved, the delays, so common in our yearly fairs, caused by not transmitting objects for exhibition until the last moment, will not here be possible. The Centennial commission has announced its readiness to receive applications for space, so that this important matter can now be definitely settled, leaving nothing to be done but to get the articles ready in conformity with the area of surface secured. Applications should be made immediately, in order that the commission may be allowed time to decide on the amount of room to be assigned to foreign nations. Lack of promptitude, therefore, on the part of intending exhibitors will probably result in their finding the space desired already occupied by less tardy applicants or set apart for foreign contributors.

Those most directly interested at the present moment are manufacturers who propose making large entries which will take time to construct or arrange, and the people who contemplate collective exhibitions of the natural resources or raw materials of different sections of the country, which cannot well be made by individual exhibitors.

It is especially desirable that provision for these aggregate contributions should be speedily made. The importance of the plan, as an incentive to immigration and to the investment of foreign capital, is very great: and liberal arrangements for the prompt and thorough performance of the work will amply repay those States or communities which undertake it.

The advertisement of the Director General of the Centennial will be found in another column, and from it may be learned how applications should be made. It is high time that the public should realize the fact that, leaving out all debatable questions as to its expediency as a national enterprize, our Exposition of 1876 is not an abstraction, as seems to be the prevalent idea, but something upon which work, now commenced, is briskly progressing. Ground has been broken, and the foundations of the great buildings are beginning to appear. Foreign commissioners have already established offices among us, and foreign governments have set apart liberal sums of money to ensure the representation of their industries. If we propose to make the fair a fit celebration for the anniversary which it commemorates and worthy of the high industrial and intellectual standard of our people, we must begin work for it at once—not at some vague, future period in next week, next month, or next year, but, earnestly and emphatically, *now*.

PENHOLDERS.

Goosequills are round: consequently penholders are round. Professor Syllogism might dispute the logic of this observation; it is correct, nevertheless. Evolution—the clearest expression of the Great Artificer's will in Nature—is the one unbreakable law which determines the products of human invention. Solomon's assertion that there is no new thing under the sun was therefore true in a wider sense than the kingly preacher imagined. In Nature and in Art alike, everything is the offspring of something gone before; and however unique it may seem at first sight, it will prove on examination to be only a more or less modified copy of something else.

Downward from the first metal worker, whose weapons and implements of bronze were exact copies of those his neighbors were toilsomely chipping from stone—thus allowing the necessities of one substance to determine the fashion of objects made of another, of entirely different character, by entirely different processes—one may trace the tendency of men to perpetuate form, even at the cost of sacrificing substance and usefulness. The material may change, and the mode of working, to correspond; but the figure remains, as though to justify Goethe's assertion that form alone is real.

The original maker of metallic pens could do no other than imitate the time-honored goosequill, thrusting a round stick into the end of the barrel for a holder. Subsequently the barrel was taken from the pen and made a part of the holder, which has since been modified in numberless ways, without departing essentially, however, from the cylindrical form. Accustomed to this shape, we can with difficulty think of any other. Indeed, so strong is the natural feeling that whatever is is right, it is more than likely that, if our readers were individually asked why a penholder is round, the majority would reply: "Because that is the proper shape."

But the argument from universal assent, so convincing to the theologian, is practically as little worth in matter of fact as in matters of faith. At best it only proves the matter not intolerable. Penholders are round because no one has ever made them otherwise. It by no means follows that a change would not be beneficial.

Place your thumb and forefinger against the second finger as in the act of grasping a pen, and notice the shape of the space between them. It is triangular. It is easy to put a round stick into a three cornered hole; but it needs no mechanical genius to see that it will not make the closest possible fit.

To write steadily and with a uniform slope, the pen needs to be firmly held in a fixed position. To write easily the pen must lie in the hand naturally, so as to maintain its position with the least effort. With a rolling penholder, these conditions are but poorly met. The contrary obtains with a three-sided holder, which presents a broad surface to each side of the finger's triangular grip, and gives a steady hold, without apparent pressure and without appreciably separating the fingers. The advantage of a triangular holder over a round one in the last particular is very great; and we are confident that holders so made would rapidly supersede the present style if once placed in market.

There is reason to make the change, and pen stick makers will do well to consider it. Should it be made, would the logic of our first observation be impaired? Would the new form have any other reason for being than the fact that it is the best form? No, and yes. It is the best form unquestionably; yet it owes its existence not to that, but to the apparently irrelevant fact that horsefoot crabs have three-cornered tails!

Visiting the seashore, we chanced to find the empty shell of one of these singular creatures. While holding it up by its spiky tail, a friend, of the sex that is said to have no inventive genius, remarked that the tail would make an odd penholder. The suggestion was carried out, and the product was odd enough. But it was something more. It was a revelation of a needed reform in penholders. We have used it for weeks, with a daily increasing conviction that the goosequill was an unfortunate model. The perfect penholder is three-sided.

THE MICROSCOPE AS A CRIMINAL DETECTIVE.

The annals of criminal jurisprudence furnish an abundance of cases in which the microscope, in the hands of an expert has been the means of eliciting missing links in the circumstantial evidence pointing to the guilt of the accused. Instances are cited where the instrument has shown hairs, clinging to the edge of an ax, to be those of a human being, in direct contradiction of the statement of the prisoner, ascribing them to some animal; and similar scrutiny of fresh blood upon clothing has proved the origin of the stain beyond a reasonable doubt.

When blood, however, has once become dry, several authorities assert that it is impossible to distinguish it from that of the ox, pig, sheep, horse, or goat. It is urged that the differences between the average sizes of their corpuscles are too irregular to measure accurately, and that a man's life should not be put in question on the uncertain calculation of a blood corpuscle's ratio of contraction in drying. In opposition to these views are some recent experiments, made by Dr. Joseph G. Richardson, of Philadelphia. This investigation disposes of the first objection above mentioned by pointing out that, while it may be valid as regards feebly magnified blood disks, it becomes void when these bodies are amplified 3,700 times. Regarding the second, he stamps it as incorrect, and cites a case in which seven human blood disks, whose mean diameter had been accurately determined at $\frac{1}{3236}$ of an inch, were subsequently computed to average $\frac{1}{3266}$, or only $\frac{1}{352292}$ of an inch less than their actual magnitude. Dr. Richardson also points out, with reference to the last objection, that, all the blood disks likely to be mistaken for those of man being normally smaller, instead of contracting they would have to expand to become conformed to those of human blood. This expansion does not occur, so that the only possible mistake in diagnosis would be to suppose that ox blood were present when man's blood had actually been shed; so that at the worst we might contribute to a criminal's escape, but never to the punishment of an innocent person.

In order to afford a positive demonstration of the facts, Dr. Richardson obtained, from each of two friends, three specimens of blood clots, from the veins of a man, an ox, and a sheep respectively, selected without his knowledge. By microscopical examination alone, he was able to determine, with perfect accuracy, the origin of each sample. The corpuscles of human blood averaged $\frac{1}{3430}$, with a maximum of $\frac{1}{3174}$ and a minimum of $\frac{1}{3636}$ of an inch; those of the ox blood gave a mean measurement of $\frac{1}{4662}$, with a maximum of $\frac{1}{4347}$ and a minimum of $\frac{1}{4874}$; while those of the sheep's blood afforded a mean of $\frac{1}{5952}$, with a maximum of $\frac{1}{5405}$ and a minimum of $\frac{1}{6461}$ of an inch.

From these and other experiments, Dr. Richardson concludes that, since the red blood globules of the pig, ox, red deer, cat, horse, sheep and goat "are all so much smaller than even the ordinary minimum size of the human red

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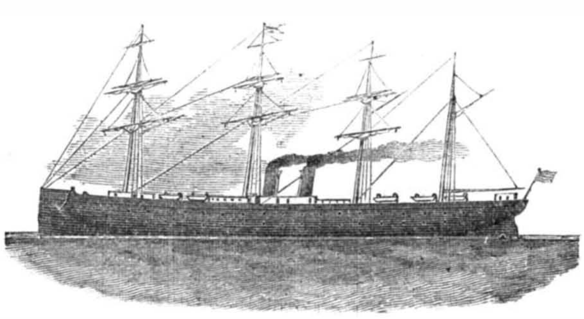
disk, as computed in my investigations, we are now able, by the aid of high powers of the microscope and under favorable circumstances, positively to distinguish stains produced by human blood from those caused by the blood of any one of the animals just enumerated; and this even after a lapse of five years (at least) from the date of their primary production."

THE ENGINEER'S TRIAL TRIP OF THE PACIFIC MAIL STEAMER CITY OF PEKING.



About fifteen hundred guests assembled, in response to invitations issued by the Pacific Mail Steamship Company, on July 22, to witness the trial of the company's new steamer City of Peking. This vessel is one of a pair, built by Messrs. John Roach & Son, in their yard at Chester, Pa., during the last year. The mate, City of Tokio, has been launched and is now receiving her machinery and equipment at the Morgan Iron Works, foot of East 9th street, New York city. These vessels were designed to meet the requirements of a law passed in 1872, granting the company a subsidy for carrying the United States mails between the United States and China, but stipulating that they should be carried in American built iron vessels of more than five thousand tuns burden. The following are the principal dimensions of the ship:

Length over all, 423 feet; length on water line, 407 feet; beam, 48 feet 9 inches; depth of hold, 38 feet 6 inches; tunnage (registered), 5,080 tuns; draft of water when loaded, forward 22 feet, aft 24 feet; displacement when loaded deep, 7,600 tuns; midship section, 930 square feet; total weight of iron used in construction of ship 2,400 tuns; thickness of iron in skin of ship, $\frac{11}{16}$ to 1 inch; tuns of space occupied by machinery, 1,120.

There are six watertight compartments. Three of the four masts are of iron, and the after or jigger mast is of wood. The total area of canvas that can be spread is 2400 yards.

The ship is propelled by two pairs of compound engines, each pair having two cylinders: Diameter of high pressure cylinders, 51 inches; diameter of low pressure cylinders, 88 inches; stroke of pistons, 4 feet 6 inches. The object of using two pairs of engines is to guard against having the ship disabled if one engine should break down. As the ship has to make a trip of more than five thousand miles, through an ocean which is almost always in a perpetual calm, the breakage of one pair of engines might necessitate her to make her way, under sail alone, twenty-five hundred miles to the nearest port. But now, if any accident (with the single exception of breaking the crank shaft of the after engine or the line shaft or screw) happens, the remaining engine will suffice to bring the ship into port at a very slightly reduced speed. In order to avoid as far as possible the liability of breaking the crank shaft, it has been made in excess of strength, the diameter being 18 inches (in place of 17½ inches as it would usually have been made), giving an excess of strength of 8 per cent over the usual practice.

The object in using a pair of cylinders in place of a single one was to divide the maximum strain upon the machinery into two portions, which are successively applied as each engine passes the center, thus allowing the machine to be built lighter, and still to retain the advantage of a high boiler pressure and great expansion, and to obtain as good or better economy than can be had in a single cylinder.

The general style of the engines is of the type developed by the late John Elder, of Glasgow, Scotland, having two cylinders connected to cranks at right angles, and an intermediate reservoir called a receiver. The steam enters the high pressure cylinders and follows the piston through about ½ of the stroke, at a pressure of about 50 lbs., the difference between this and the boiler pressure of 60 lbs. having been lost in the friction of the steam pipe and the intricate passages in the valves. The steam is expanded in the high pressure down to 8 lbs. above the atmosphere, and is exhausted into the receiver at a pressure of 5 lbs. above the atmosphere. From the receiver it is admitted into the low pressure cylinder during nearly ½ of the stroke, and is still further expanded to 7 lbs. below the atmosphere or an absolute pressure of nearly 7½ lbs., where it is exhausted into the condenser, giving a total measure of expansion of nearly 9 times. In order to obtain this in a single cylinder, the steam would have to be cut off at less than $\frac{1}{12}$ of the stroke, and the variation of pressure would be from 68 lbs. to 6½ lbs. per square inch, in place of from 50 to 5 in the one cylinder, and from 15 to 5 in the other, as is now the case.

The steam to work these engines is furnished by 10 cylindrical boilers, having each 3 internal cylindrical furnaces. The products of combustion return through tubes above the furnace, each furnace having its own nest of tubes, separated from the others by water legs. The steam passes through two superheaters on its way to the engine, where it is freed from the water held in mechanical suspension, and slightly superheated. The boilers are arranged in two sets, each set having its own superheater and smoke stack, coal bunker, feed pipes, and all fittings complete, as if placed in separate ships. The following are the principal dimensions of the boilers: Diameter, 13 feet; length, 10 feet 6 inches; diameter of furnaces, 3 feet 2 inches; length of grate bar, 5 feet 6 inches; diameter of tubes, 3 to 3¼ inches; length of tubes, 7 feet 6 inches; thickness of shell, $\frac{13}{16}$ inch; thickness of furnace, ½ inch; diameter of smoke stack, 8 feet 6 inches; hight of smoke stack, 70 feet; total grate surface, 520 square feet; total heating surface, 16,500 square feet; total superheating surface, 1,600 square feet.

It will be seen from the foregoing that, with the exceptions of the late Ville du Havre and the Great Eastern, the City of Peking is the largest trading ship yet built. The Great Eastern, on account of the tremendous space occupied by her machinery, did not prove a commercial success until she was employed in laying telegraph cables. The Ville du Havre was wrecked too early in her career as a screw vessel to determine her economy; but she was increased in size, after having been run a number of years, with the expectation of an improvement. The following comparison of the two ships shows that the City of Peking is not an experiment in marine engineering, as the managers of the French line gave their ship the same proportions after years of trial, although both vessels were being constructed independently at the same time

	City of Peking	Ville Du Havre
Length	423 feet	423 feet
Beam	48 feet 9 inches	49 feet
Tunnage	5,080 tuns	5,086 tuns
Draft	22 to 24 feet	22 to 24 feet
Diameter of screw	20 feet 3 inches	19 feet 6 inches
Pitch of screw (mean)	30 feet	29 feet 6 inches
Grate surface	520 square feet	532 square feet
Total length of ship occupied by machinery	92 feet	90 feet

The results of experiment may be more plainly seen by reasoning from the following facts: 1. The cost of a ship depends upon her tunnage or displacement. 2. The cost of fuel to propel her at a given speed is proportional to the square of the cube root of the displacement.

Take then the cases of two ships, to make a voyage of 5,000 miles at a speed of 15 knots per hour; and we have the following.

Tunnage	5080 tuns	2600 tuns
Displacement	7200 tuns	3600 tuns
Power required	5270 horse	3400 horse
Space occupied by machinery and coal	2130 tuns	1380 tuns
Available space for cargo and crew	2950 tuns	1220 tuns
Ratio of paying load	100	41
Ratio of cost to run	100	64
Ratio of first cost	100	52

Thus, it appears that, as the size of a ship increases, the economy increases, from the less cost of fuel to propel her in proportion to the paying load that she can carry, without considering the less proportionate cost of officers and crew for a larger ship. The size of ocean steamers has been continually increasing since their introduction, wherever they are able to run full and can be rapidly discharged and loaded. In addition to their economy, the large ships are much more comfortable for passengers on account of their less motion in rough weather.

The City of Peking will take the place, on the China and Japan route, of a vessel of 3,500 tuns burden. She is fitted for 150 cabin and 1,800 steerage passengers. The saloon and state room accommodations are as luxurious as in any ship entering the harbor of New York, while the comforts of the steerage are probably in excess, as will be appreciated by any one noticing the hight between decks, 8 feet, and the numerous air ports, whose hight above the water line at deep draft will allow of their being kept open in smooth weather. There is a Root's rotary exhauster, worked by a separate engine placed in the engine room, from which pipes are led into the most inaccessible portions of the hold and through the steerage, to withdraw the foul air and gas which would otherwise accumulate, its place being supplied by fresh air from the deck. The application of this exhauster is an experiment on merchant vessels, but it is believed that it will mitigate the poor ventilation incident to all ships, and the tendency of the inside of the skin of the ship to sweat, sometimes a serious objection to iron ships in warm climates.

The diagram shows the arrangement of the boilers and machinery in the City of Peking. The shaded portion shows the coal bunkers. There are eight doors to the coal bunkers for getting the coal into the fire room, four being forward and aft.

The starting engines and working handles are on the platform above the floor of the ship, allowing room for the oilers to walk beneath while watching the bearings, without interfering with the men working the engines, on the platform. The two independent centrifugal circulating pumps—one for each engine—are on the starboard side, on the floor of the ship. All other pumps, as also the donkey boilers, are on the deck, in order to be accessible if the lower hold of the ship be filled with water.

On the trial made on August 22, it was not attempted to run the engines at full speed, but only slowly, in order to wear the journals smooth, preliminary to the more extended trial which has since taken place, and to test the working of all parts of the machinery at sea. Such a trial was the more necessary, as the ship has, in addition to the propelling machinery, steam engines to move the rudder and to hoist the anchor. The ship left the North river, abreast of pier 42, at ten minutes past eleven, steamed around the light ship off Sandy Hook and returned, arriving abreast of the Battery at five minutes past four, having been under way five hours and fifty-four minutes. Only eight of the ten boilers were in use, and the pressure of steam carried was 50 lbs. The tide was running in during the whole trip, and there was a fresh east wind.

During the first part of the trip, the engines were run slowly, but were allowed to increase in speed; and during the last hour, they averaged the following:

Revolutions per minute, 46; horse power, 2,250; vacuum, 26 inches; temperature of feed water, 85°; temperature of discharge water, 87°; temperature of injection water, 70°: steam pressure 40 lbs.; speed, 12¼ knots; draft of water forward, 18 feet; draft of water aft, 19 feet.

The draft to the furnaces was very strong, and they will probably be able to burn 15 lbs. of coal per square foot. Therefore the following is an estimate of the probable performance of the ship at maximum power: Consumption of coal per hour $=520\times15=7{,}800$ lbs.; horse power $=\frac{7800}{2}=3900$; speed of ship $=\sqrt[3]{\frac{3900}{2250}}\times12\frac{1}{4}=14\frac{3}{4}$ knots. This speed can probably be maintained in smooth water without the assistance of the wind.

In a series of voyages, the winds blow as long in favor of as against any ship. When the wind is against her, she furls her sails; but when it is in her favor, she spreads them and takes all the advantage. Thus, on a long voyage or series of voyages, the wind helps more than it hinders. It appears from an average of a number of voyages that the wind increases the available power of a ship about one third, and therefore the available power of the City of Peking will be equivalent to 5,200 horse power, and the average speed, if worked at full power, at a draft of water of 18 feet 6 inches, will be: $\sqrt[3]{\frac{5200}{2250}}\times12\frac{1}{4}=15{\cdot}9$ knots. This speed would carry the vessel from San Francisco to China in 13 days on 85 tuns of coal per day. The amount of coal carried would have to be 1,500 tons, leaving 4,000 tuns of space for crew and paying load.

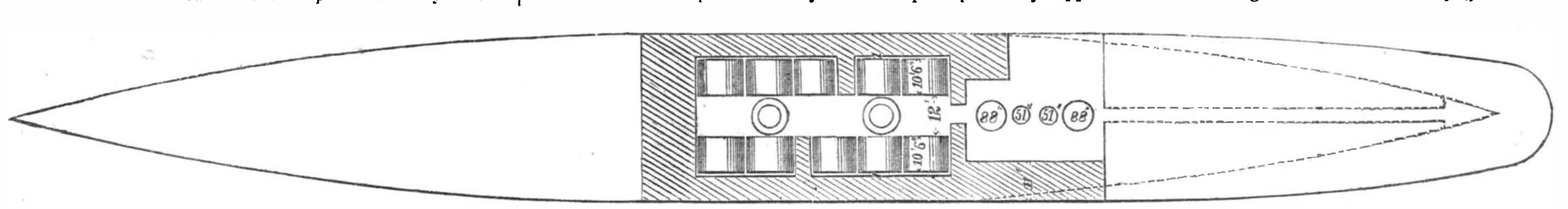


DIAGRAM SHOWING THE GENERAL ARRANGEMENT OF THE MACHINERY AND COAL BUNKERS OF THE CITY OF PEKING.

The Royal Yacht.

The new royal yacht Osborne was launched in 1870, but, proving weak, has been strengthened, replanked, and finally finished. She recently made a trial trip of six hours, and attained a speed of 14·85 knots per hour. The following are some of her particulars: Extreme length, 278 feet; extreme breadth, 35 feet 1 inch; oscillating engines, cylinders, 6 feet 8¼ inches; feathering paddle wheels, floats 11 feet 6 inches; 2 funnels, twenty furnaces; mean steam pressure, 23·3 lbs.; mean revolutions, 24·98; mean speed, 14·85; mean indicated power, 3,374; mean consumption of coal, per indicated horse power per hour, 3·95 lbs.; capacity for fuel, two days' steaming.

The Liverpool Landing Stage.

This structure, probably the most magnificent floating platform in the world, was recently totally destroyed by fire. It consisted of a large number of pontoons, having iron frames and wooden fittings, which in all aggregated a length of 700 yards, and a width of 80 feet. The structure was used as a place of debarkation and embarkation for the many steamships in the harbor. The timbers were creosoted or tarred, and it is believed that the gas arising therefrom became ignited, communicating the flames to the newly caulked deck.

John E. Gavit.

We regret to learn of the death of Mr. John E. Gavit which took place on August 25, at Stockbridge, Mass. Mr. Gavit was President of the American Bank Note Company, Secretary of the American Institute, and an earnest student and promoter of microscopical science, in which branch of knowledge he was recognized as an authority. He was also identified with the art of steel engraving.

AMERICAN shad have been lately shipped in cans to Persia

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THE GRAPE PHYLLOXERA—SIXTY THOUSAND DOLLARS REWARD OFFERED FOR A REMEDY FOR THE GRAPE DISEASE.

The French National Assembly has recently passed the following law, the text of which we translate from *La Nature:*

Article 1. A prize of three hundred thousand francs ($60,000), to which will be added the voluntary subscriptions of departments, of communes, of associations, and of individuals, will be granted by the State to the inventor of a method, both efficacious and economically applicable in the generality of soils, for the destruction of the phylloxera or the prevention of its ravages.

Article 2. A commission, named by the Minister of Agriculture and Commerce, will be charged; I. To determine the conditions to be fulfilled in order to compete for the prize. II. To decide upon the methods presented and to make the award.

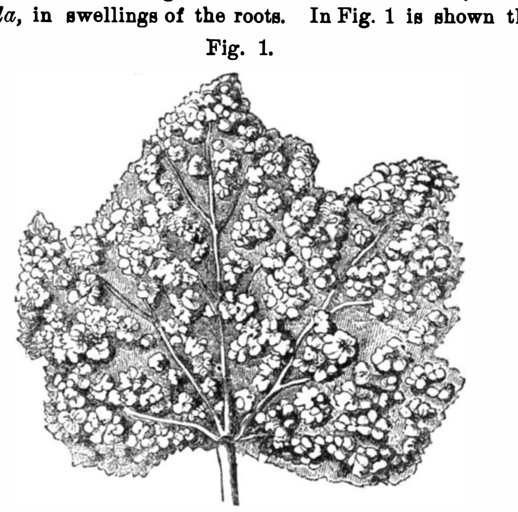
The commission, under M. Dumas, President, has already entered upon its labors. The reward, we believe to be open to the citizens of all nations.

None of the methods proposed for the destruction of that scourge of the vineyard have proved availing. The insect is indigenous to the North American continent, and has been found in nearly all portions of the United States; so that in this country abundant opportunity is offered for its study and for experiment. The successful inventor will not only earn a worldwide fame, but a large fortune, for the definite sum above named will probably be greatly augmented by the private rewards offered by the wine manufacturers of Southern France, whose business has been terribly injured by the destruction of their vines by the parasites.

The phylloxera is a peculiar genus of plant lice, comprising several species, none of which affect man's interest excepting that known as the vastatrix. Its attack upon the vines of France began to attract serious attention soon after the close of our civil war, the roots of the plants affected becoming swollen and bloated, and finally wasting away. Professor Planchon, in 1868, recognized the injury as caused by the puncture of a minute insect, to which, after study, he gave the name by which it is now known, and which Professor Riley, State Entomologist of Missouri, from whose recent report we extract the following facts and engravings, subsequently found to be the same as that indigenous to the United States. The disease continued to spread in Europe, and especially in France, to such an alarming extent that a standing phylloxera committee has been organized in the French Academy of Sciences, of which M. Dumas is secretary. In Portugal, Austria, and Germany, and even in England, the plague has also appeared.

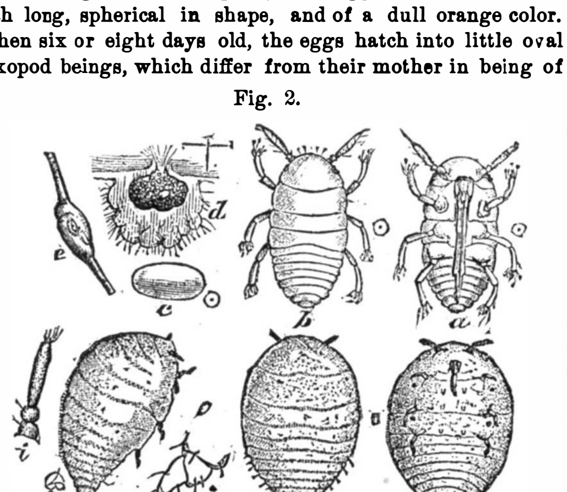
There are two types of the phylloxera, one termed the *gallæcola*, which lives in galls on the leaves: the other, or *radicicola*, in swellings of the roots. In Fig. 1 is shown the

Fig. 1.



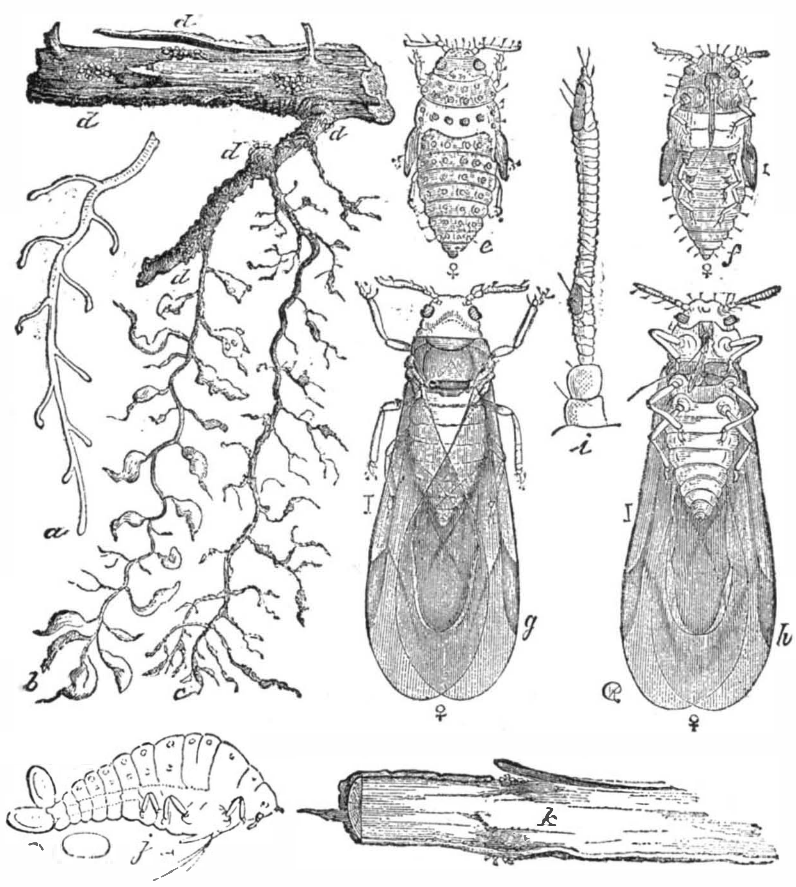
underside of a leaf covered with the galls. On opening one of the latter (see *d*, Fig. 2) the mother louse is found at work, surrounding herself with pale yellow eggs. She is about 0·04 inch long, spherical in shape, and of a dull orange color. When six or eight days old, the eggs hatch into little oval hexopod beings, which differ from their mother in being of

Fig. 2.



a brighter yellow, and having more perfect legs and antennæ. These issue from the gall, scatter over the vine, and, on reaching the tender terminal leaves, begin to pump up and to appropriate the sap. In a few days the gall is formed, and the louse, also growing, begins a parthenogenic maternity by the deposition of fertile eggs, from 200 to 500 in number. Each egg brings out a fertile female. So prolific is the generation that Professor Riley estimates that the product of a year would encircle the earth thirty times, each individual touching the end of another.

In autumn, the dwellers in the galls descend to the roots, and there hibernate. During the summer the number of the parasites is immensely reduced by their natural enemies. The precise conditions which determine the production and multiplication of the type cannot be stated, but it is said to be evident that the nature and constitution of the vine are important elements. In our second figure are shown various characteristics of the type. *a* and *b* are ventral and dorsal views of newly hatched larvæ, *c* is an egg, *d* a section of



THE ROOT-INHABITING PHYLLOXERA (Fig. 3).

gall, *e* swelling of an attacked tendril, *f g h*, views of the mother larva, *i* her antennæ, and *j* her two jointed tarsus. The natural sizes are indicated at the sides.

The newly hatched larvæ of the *radicicola* at first resemble those of the type just described; but they shed the smooth skin, and acquire raised warts or tubercles. After this they appear in two principal forms; one, *e f g*, Fig. 4, is of a more dingy greenish yellow, with more swollen fore body and tapering abdomen. In the same illustration, *b* is the larva, hibernating; *a* the roots of the vine; *c d* the antennæ and leg of larva, and *h* the granulations of the skin. The second or more oval form eventually develops wings. In Fig. 3, *a* is a healthy root; *b*, one on which the lice are working; *c* a deserted and decaying root; *d* shows how the parasites are found on larger roots; *e* is a female pupa (dorsal view), and *f*, ventral view; *g* and *h* are similar views of winged female; *j*, side view of wingless female, and *i* the antennæ; and *k* shows how the puncture of the lice causes the larger roots to rot.

As to the best means of coping with the disease, Professor Riley suggests grafting the more susceptible vines on the roots of the more resistant varieties. The Southern fox (*vulpina*) is the only species exempt from both leaf and root lice, but this does not flourish above latitude 35°. The same authority recommends a bath of weak lye or strong soap suds before planting the young ones, as the best safeguard. A thorough sprinkling of the ground with lime, ashes, sulphur, salt, or similar substances destructive to insect life, in from July till fall, will also have a beneficial effect. Planting the vines in a soil mixed with sand and soot is also advised. The natural enemies of the phylloxera are the thrips, the lace wing fly, the lady bird, the syrphus fly, and the phylloxera mite. Fig. 5 represents the last mentioned. The leaf lice, it seems, may be controlled by care in destroying the first galls and in pruning and destroying the terminal growths of infested vines later in the season. The root lice are not so easily reached, and it is for a direct remedy for these that the large French reward is offered.

The only known and certain cure is submersion for 25 or 30 days, in September and October, or 40 or 50 days in winter. Temporary irrigation will not answer. Carbolic acid, oil of cade, arsenious acid, sulphide of calcium, sulphide of mercury, and arsenate of potash, will all kill the insect when brought in direct contact; but this, in field practice, cannot be done, or else a strong enough solution cannot be used without injuring the vine. A thorough mixing of the soil with carbolic powder has given good results. Bisulphide of carbon, upon which extensive experiments have been made by a special French commission, proves to be costly and laborious in application: while there is great difficulty in its reaching and killing all the lice without injuring the vine. Besides, it is dangerous to use, its vapor being extremely volatile and explosive. The application of fertilizers intended to invigorate the vine, and, at the same time, injure the lice, has been productive of good. Especially has this been the case with fertilizers rich in potassic salts and nitrogenous compounds, such as urine. Sulphuret of potassium dissolved in liquid manure, alkaline sulphates with copperas and rape seed, potassic salts with guano, soot, and cinders, are among other applications favorably mentioned.

The Bamboo.

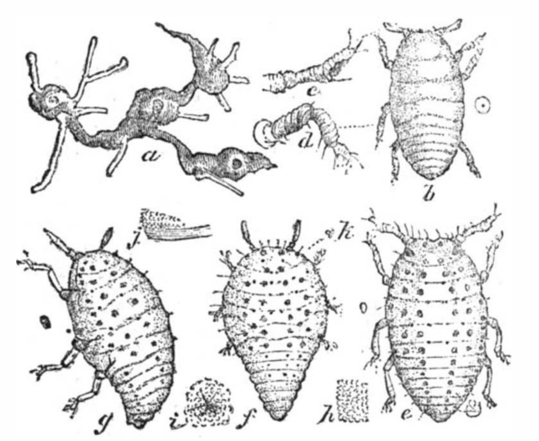
A pamphlet has been published at Cairo by the Agricultural Department of Egypt, on the Indian bamboo, which, it is said, is being acclimatized there with great success. We append a few notes therefrom:

The gigantic bamboo, which is of colossal dimensions, growing to the hight of 64 feet, and is 15 to 18 inches in circumference, from the joints of which, especially those of the middle and upper parts, grow numerous branches with long leaves, is the most vigorous species of this arborescent plant. It was introduced some years ago into the gardens of the Khédive of Egypt, at Ghézireh, from whence it has been multiplied in two or three other gardens of Egypt. It was so much admired by the Emperor of Brazil, on his visit to the gardens of the Khédive last autumn, that he expressed his determination to import it into Brazil, and to cultivate it upon the Imperial estates as a shade for animals during the heats of summer. The gigantic bamboo originates in India and China, and is highly appreciated wherever it is cultivated, being used for posts in pavilions and the houses of the inhabitants. The hollow joints are utilized for carrying liquids, for flower vases, etc.; and in China, and especially in India, for bottles and tobacco boxes, highly wrought and polished, and sold at great prices. The larger stalks are also used for bridges, water pipes, and carts and other vehicles. In fine, the wood is employed in the arts, in a multitude of industries, and for implements of agriculture. This species of bamboo vegetates with such rapidity that it can almost be said that one can see it grow. Its progress may be seen from day to day, and at Ghézireh it has been known to grow 9 inches in a single night. In China, criminals condemned to death are subjected to the atrocious punishment of impalement by means of the bamboo.

A humid soil is congenial to the gigantic bamboo, although it suffers under a prolonged inundation. It is proposed in Egypt to cultivate it upon the borders of the canals in the vast domains of the Khédive.

There is also in the gardens of Egypt another species of bamboo, believed to be the *bambusa arundinacea* of Wildenow. It presents the following characteristics: The stalks are smaller and shorter than the gigantic bamboo of India; it attains about 39 feet in hight; it forms larger tufts or clusters than the great bamboo, and throws out a great number of stalks, which are furnished with numerous slender and flexuous branches, bearing, ordinarily, tolerably large thorns, a little arched at the joints or articulations; and the leaves are smaller than those of the gigantic species, being rounded at the base, lance-shaped, tapering to a point, and a little downy.

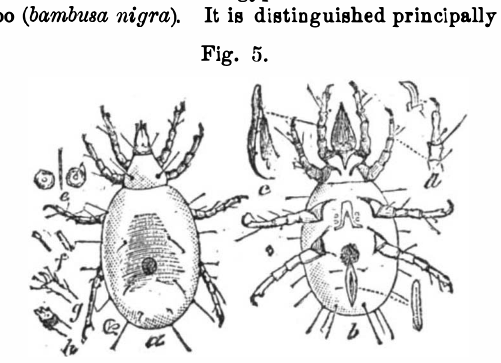
Fig. 4.



There is another species of bamboo which it is proposed to cultivate in Egypt. It attains a hight of 16 or 20 feet, produces enormous clusters of canes, about the size of the finger, and makes excellent props for use in horticulture. A plant of two or three years' growth will furnish a hundred stalks, forming a cluster of vast size. This species is the *bambusa edulis*, so called from the fact that its young shoots are edible, and in China regarded as very nourishing.

There is still another species of bamboo to which the attention of the cultivators in Egypt is called. It is the black bamboo (*bambusa nigra*). It is distinguished principally by

Fig. 5.



its slender branches, which are of a fine black color, and from which canes are manufactured extensively for exportation. Pens are made from the smaller stems, which are commonly used for writing in Egypt.

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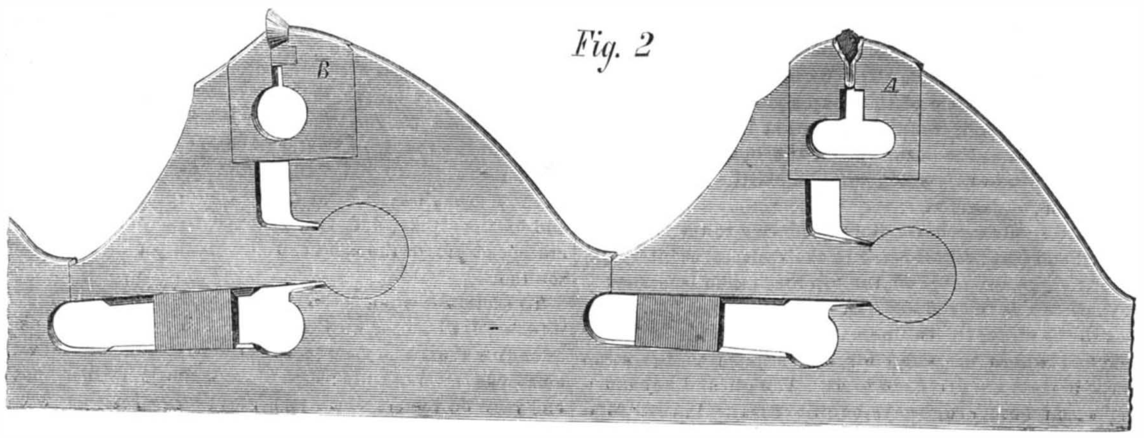
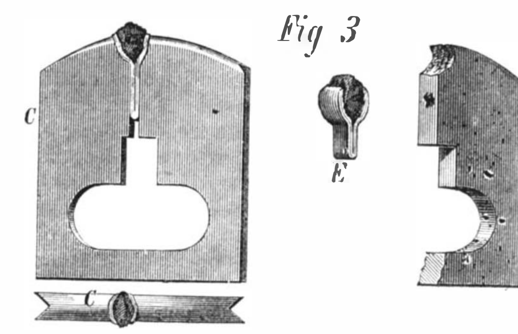
Static Induction Produced by Means of Ruhmkorff's Coil.

The author finds that if the current of a battery, alternately interrupted and re established, is made to pass through the thick wire of a Ruhmkorff's coil, two induced currents in contrary directions appear in the fine wire, and for a certain explosible distance there seems to be only one current produced. This current is direct, and the sparks given by it have quite the appearance of sparks of static electricity. Reciprocally, if a series of sparks of static electricity are passed through the fine wire, we receive in the thick wire currents quite analogous to those given by the battery. On examining these currents by means of a voltameter, there appears to be merely one current in an inverse direction.—*M. E. Bichat.*



EMERSON'S DIAMOND HOLDERS, AS INSERTED IN CIRCULAR SAWS. See page 159.)



DIAMOND HOLDER AND DIAMOND.

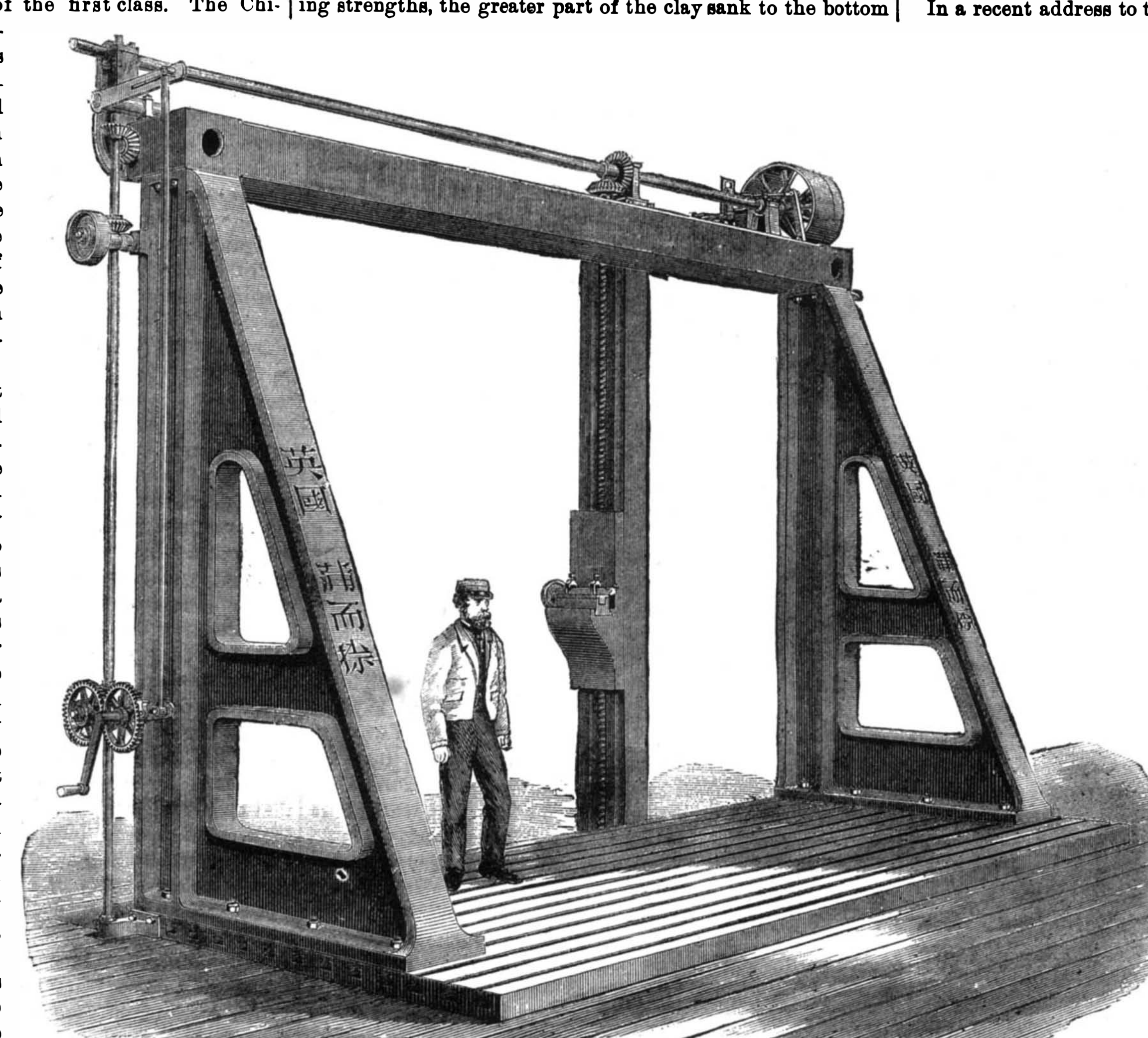
Leaf and Flower Impressions.

Oil a piece of white paper on one side; hold the side that is oiled over a lamp or pine knot smoke till quite black; place the leaf on the black surface, as the veins and fibers of the leaves show plainer on the under part; now press it on all parts of the leaf with the fingers; then take up the leaf and put the black oiled sides on the page of a book (made for leaf impressions) with an extra piece of nice paper on the top to prevent smutting the opposite page; press it a few moments; then remove the green leaf, and the impression will be left on the page as beautiful as an engraving. Flowers of single corolla can be pressed in like manner. Many of the geranium leaves make beautiful impressions. The impression book can be made still more interesting by giving botanical classifications of each leaf and flower.

IMPROVED VERTICAL PLANING MACHINE.

Vertical planing machines are now becoming pretty general in engineering workshops of the first class. The Chinese Government have lately established arsenals and dockyards on the European system at several of their principal ports, and among the tools sent out from this country by Messrs. John Bourne & Co., to furnish these establishments, there is a type of vertical planing machine which offers several features of advantage. Of this machine we give an illustration, for which we are indebted to *The Engineer*.

Upon a planed base of cast iron formed with grooves fitted with T headed bolts, for the attachment of the object to be operated upon, two strong standards are erected which carry planed cross pieces at the top and bottom, along which is drawn, by means of screws, a great upright bar, which carries the cutting tool. The tool holder with the tool, or, if desired, three tools, is made to travel up and down upon the vertical bar by means of a screw—shown in the engraving—and after each cut the vertical bar is drawn sideways by the top and bottom screws through a suitable distance, whereby an action resembling that of an ordinary planing machine is maintained, except that the cut is vertical. The foundations in many parts of China being precarious, the tool is so constructed as to be independent of walls or buildings. The vertical travel is 12 feet, and the horizontal 16 feet. The cutting tool travels up at twice the speed that it travels down, and, as will be seen by a reference to the engraving, the design is one which combines strength with simplicity. The base plate is formed in two parts bolted together laterally for facility of shipment. Only about one third of its depth is shown above the floor. At the back of the machine there is a pit about 3 feet deep in which the attendant stands when the machine is at work.

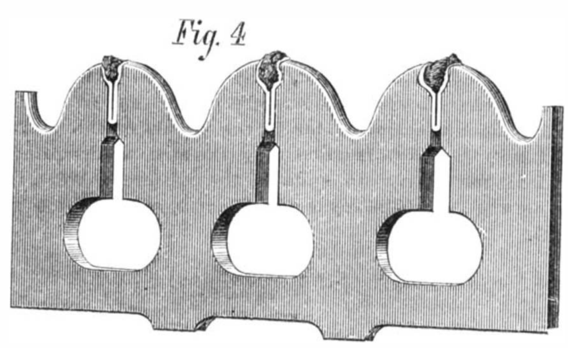


VERTICAL PLANING MACHINE FOR THE CHINESE GOVERNMENT.

Interesting Experiments upon the Suspension of Clay in Water.

In a paper read before the Royal Physical Society, Edinburgh, by William Durham, F.R S.E., he says: "It has been long known that pure water has the power of holding clay in suspension for an indefinite time, and also that salts of lime when added, even in small quantity, to water, destroy this power. I have made a considerable number of experiments on this subject, and the results appear to me extremely interesting.

The power which water possesses of sustaining clay is gradually destroyed by the addition of an acid or salt. For example, by stirring the jar of water with a glass rod slightly wet on the point with sulphuric acid, the power of sustaining clay was considerably diminished; by adding one drop of acid it was still further diminished, while with two drops the power seemed completely destroyed, as the water cleared rapidly.



DIAMOND HOLDER FOR STRAIGHT SAWS.

In solutions of sulphuric acid and sodium chloride of varying strengths, the greater part of the clay sank to the bottom of the jar, and the liquid became clear in the order of the specific gravities of the solutions, so that the densest liquid settled and cleared last. This effect was more decided in the acid than in the salt solutions.

The power which water possesses of sustaining clay in suspension is gradually increased by the addition of small quantities of the alkalies, or their carbonates, and lime. Thus water having 3 grains of sodium carbonate in it was quite opaque for three days, while water only was seen through in about a day and a half

In solutions of sodium carbonate of varying strengths (and most probably in all alkaline solutions), the greater part of the clay sunk to the bottom, and the liquid cleared in the inverse order of the specific gravities of the solutions, so that the densest liquid settled and cleared first.

Water whose power of sustaining clay had been destroyed by an acid had this power restored, in great measure, to it by the addition of any of the alkalies.

On substituting finely powdered white silica for clay, the same general results were obtained, but in a much modified form as to the time of clearing, the silica settling much more rapidly in every case than the clay.

These remarkably contrasted actions of acids and alkalies have not been noticed before, so far as I know, and, besides being of much scientific interest, may be of practical importance. I have not been able as yet to discover the cause of these phenomena, but it appears to me extremely probable that the clay, in falling through the water, generates, by friction, electricity; and as water is a bad conductor, the difference in potential between the clay and the water continues for some time, hence they are mutually attracted; but, when acid or salt is added, the liquid becomes a good conductor, the potentials are equalized, and the clay falls. With the alkali, on the other hand, although the liquid does become a better conductor, it at the same time becomes a better generator of electricity; and it is only when, by adding a considerable quantity of alkali, the conducting exceeds the generating power that the potentials are equalized and the clay falls. I hope to be able shortly to put this idea to the test of experiment."

Dealing with Workmen.

In a recent address to the British Association of Gas Managers, Mr. Geo. T. Livesey, the president, made the following observations, which apply not only to gas men, but to workmen of every class and profession:

"A source of great anxiety has been, and is still, the difficulty of dealing efficiently with their workmen. Undoubtedly the advance of wages so universally applied for, or expected, has been founded on circumstances that must be admitted in many cases to be a justification for the claim. When such grounds exist for an advance, I hold it to be to the interest of the manager, as well as his duty, to be the first to move in the matter, for I have found that men in regular constant employ, being generally steady, honest workmen, do not often make a request for an increase unless they have fair reasons for doing so, and it is a mistake to wait until they make the application. I have felt, when this has been the case on the part of a good servant, that I had done him an injustice in not giving him the advance unsolicited. I would further say, "Do not put a man off with excuses. Consider the matter at once, and give him an answer. If he is already sufficiently paid, tell him so; but, if not, remember that 'he gives twice who gives quickly'; and from that day let the extra pay be granted." So small a sum as 3d. or 6d. a day may make all the difference between a contented and a discontented workman; while the one may be worth, in the value of the work done, twice or four times that amount more than the other.

It is all very well to say that the price of labor, like that of coal or iron, is regulated by the inexorable law of supply and demand; but this law, though perfect in its application to the purchase of materials, has only a partial application where a man's labor is concerned.'

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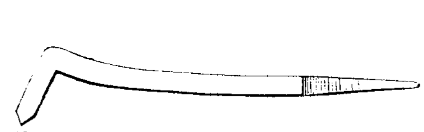
PRACTICAL MECHANISM.

NUMBER VIII.

BY JOSHUA ROSE.

VISE WORK—TOOLS FOR SCRAPING SURFACES.

Surfaces requiring to be very true may be got up with the scraper, the best form of which is that shown in the following illustration, the point, *a*, being the cutting edge. It is



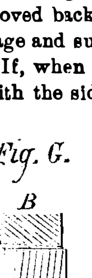
ess liable to jar and more readily sharpened than any other. For use on wrought iron, the cutting edge should be kept moistened, or it will tear the metal instead of cutting it cleanly. All surfaces intended to be scraped should first be filed as true as possible with a smooth file, care being exercised to use a file that is evenly curved in its length and slightly rounding in its breadth. After the surface has been scraped once or twice, a well worn, dead smooth file may be passed over it, which will rub down the highest spots of the scraper marks and greatly assist the operation of scraping. Scraping should be executed in small squares, the marks of one square being at a right angle to the marks of the next; then, after the surface plate has been applied, repeat the operation of scraping in squares, but let the marks cross those of the previous scraping. The face of the surface must be wiped off very clean before the surface plate is applied, or the surfaces of both the plate and the work will become scratched. The face of the plate may be moistened by the application of a barely perceptible coat of Venetian red, mixed with lubricating oil, rubbed on by the palm of the hand, to operate as marking to denote the high spots. In applying the surface plate, move it both ways on the work, and reverse it endwise occasionally. If the work is light, it may be taken from the vise and laid upon the plate; but much pressure need not be placed upon the work, or it will spring to suit the surface of the plate, and thus appear to be true when it is not so. Small surfaces should be rubbed on the outer parts of the surface of the plate, by which means the wear on the surface plate will be kept more equal.

FITTING CONNECTING RODS.

The planing work on a connecting rod being complete, the first thing for the fitter to do is to mark off the key ways, the bolt holes (if there are any), the holes for the set screws, the oil holes, etc., so as to have the drilling completed before the straps or rod ends are filed up, because drills leave a burr where they come through the metal, and because the clamps, which hold the work while it is being drilled, are apt to leave marks upon it. The holes should then be tapped, when the rod will be ready for the file. The faces of the rod whereon the straps fit should then be surfaced with a surface plate, and made quite square with the broad faces of the rod, parallel crosswise with each other, and a little taper with each other in the length. The strap should be made narrower between its jaws than the width of the rod end, so as to require to spring open when placed upon the rod end if the brasses are not in their places. The inside faces of the jaws of the strap must be made quite square with the side faces, so that, when the strap is placed upon the rod end, the latter faces of the strap will not spring out true with the broad faces of the rod end. The rod end must have a light coating of marking rubbed over it, and the strap moved back and forth on it, so that the rod end serves as a gage and surfacing block to the strap.

If, when the strap is on its place, its side faces are uneven with the side faces of the rod end, as shown in Fig. G (which is a sectional view of a strap and rod end, *a* being the rod end, and B B the jaws of the strap), either one or both of the inside side faces of the strap require filing in the direction denoted by the dotted lines, because it is only in consequence of the inside faces not being square with the outside faces that this twist occurs. The key ways in the strap and rod end should be filed out together, that is, while the strap is on its place and secured by being clamped or bolted. If the strap is one held to the rod by a gib and key, the width, from the end of the rod to the crown of the strap when it is placed in position to cut or file out the key way, should be that of the extreme width of the brasses when the joint of the brasses is close, less the amount of taper there is on the key. The key way should then be filed out parallel, both in its width and breadth, and surfaced with a surface plate, the breadth being equal to that of the gib and key together when the head of the key is even with the head of the gib; then when the key way is finished and the strap is placed in its intended position on the end of the rod, the strap will have moved back from off the rod end for a distance equal to the amount of the taper on the key, so that there will be the requisite amount of draw on the key way of the strap on the one side and on the key way of the rod on the other side, while the key will at the same time come through the strap to its required distance. The faces of the rod end, whereon the jaws of the strap fit, having been made (as directed) a little taper, and the strap allowed (as described) a little spring, the rod end will enter the strap somewhat easily, and tighten as it passes up the strap, so that, when quite up, the strap will fit a little tighter than it is intended, when finished, to do. When the strap is fitted and keyed to the rod, a light cut should be taken off the faces of the rod and strap while they are together, the bolts of a bolt rod being sufficient to hold the strap for that purpose; but in the case of a gib and key, a piece of wood should be placed between the rod end and the crown of the strap, that is, in the space intended to be filled by the brasses, and the wood keyed up so as to lock the strap on the rod while the faces of the rod and strap are planed. This being complete, the strap is ready to receive the brasses. The bottom of back brass must be made to a tight fit, so as to spring the strap open sufficiently to make it fit the the rod end as easily as required; thus both the brass and the strap will be closely fitted. The top brass must be fitted to the strap while the bottom brass is in its place in the strap, and must be made to fit the strap without being so tight as to spring it open. The corners of both brasses where they fit the corners of the strap should be eased away with the edge of a half round file, so that they will not destroy the corners of the strap (when the brasses are being driven in and out to fit), which would make the strap appear to be a bad fit on the rod.

Fig. G.



While fitting the top brass, it is necessary to try the strap on the rod end (the brasses being in their places) at intervals, so as not to take any more off the top brass than is necessary to let the strap fit the rod end. As a guide, when fitting the brasses to the strap, the callipers may be set to the width of the rod end where the strap fits, and applied to the strap when the brasses are driven in to fit. The gib and key must, when placed together edgeways, be quite parallel in their total breadth, so that they will fit properly against each other and against the key way in the rod end and the strap. When setting the gage for the size to which the brasses are to be planed, place the strap on the rod end to get the correct size, for the strap is narrower (between its jaws) when it is off than when it is on the rod, because of the spring. In bedding the back brass to the strap, let it bear the hardest, if anything, upon the crown, for if the bevels of the brass should keep the crown from bedding, the strap would spring away from the rod end, in spite of the gib (or the bolts, if there are any), when the key is driven home, as illustrated in Fig. 35.

Fig. 35.

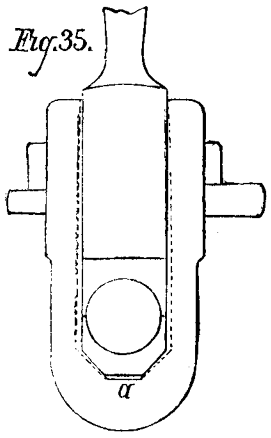
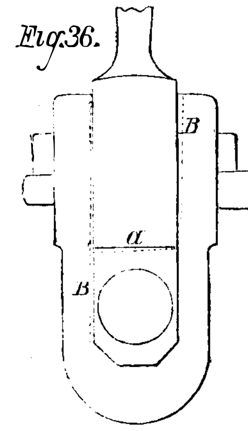
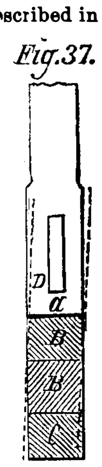


Fig. 36.



If the back brass does not bed down upon the crown, *a*, of the strap, the latter will spring away from the block end of the rod and from the brasses on the sides, and will assume the shape denoted by the dotted lines. Should the top brass not bed properly against the rod end, the trap will spring as described in Fig. 36.

Fig. 37.



The dotted line, *a*, is the back of the brass, supposed to bed improperly against the rod end, as shown; the dotted lines, B B, denote the manner in which the strap would, in consequence, spring away from the rod end when the key was driven home. If the brasses fail to fit properly against the rod end or strap, in the direction of the breadth of the strap, it will spring out of line, as described in Fig. 37, which is a sectional view of a connecting rod end. C is the strap, D is the rod end, and B B are the brasses, the top one of which, if it did not fit square against the rod end (but on one side only), as represented by the line *a*, would spring the strap out of true with the rod end, in the direction of the dotted lines. The strap is, by reason of its shape, very susceptible to spring; and unless the brasses, or even the gib and key, are quite square and fit well, it is certain to spring out of true. The brasses should be a fit on the journal when they are "brass and brass," that is, the joint of the two brasses close together, so as to take the pressure of the key, which thus locks the strap and brasses to the rod end, and prevents them from moving, or working, as it is called, when the rod is in action; especially is this necessary in straps having a gib and key to hold them to their places, because, if the joint of the brasses is not close, the key cannot be driven home tightly, and hence there is nothing to lock the strap firmly to its place. If, however, the strap is held to its place by bolts, it is not so imperative to keep the joint of the brasses close together, although it is far preferable to do so, especially in the case of fast-running engines, not only on account of the assistance lent by the key to hold the strap firmly, but also because it holds the brasses firmly, and the key cannot bind the brasses too tightly to the journal, even though the key be driven tightly home, so as to assist the set screw in preventing it from slacking back.

The brasses should be left a little too tight in the strap before boring, because they invariably shrink or go in a little sideways from being bored, as do all brasses, large or small, even if bored before any other work has been done on them. For driving the brasses in and out of the strap to fit them, use a piece of hard wood to strike on so as not to stretch the skin of the brass and alter its form, as will be explained in future remarks on pening.

The brasses should be of equal thickness from the face forming the joint to the back of the brass, so that the joint will be in the center of the bore of the brasses. The respective faces forming the joint should be quite square with both the faces and sides of the brass, so that they will not spring the strap when they are keyed up, and so that, when the brasses are let together in consequence of the bore having worn, the faces may be kept square, and thus be known to fit properly together without having to put them together in the rod and on the journal to try them, which would entail a good deal of unnecessary labor.

To get the length of a connecting rod, place the piston in the center of its stroke, and the distance from the center of the crosshead pin to the center of the crank shaft is the length of the rod from center to center of the brasses. Another method is to place the piston at one end of its stroke and the crank on its dead center corresponding to the same end of the stroke, and the distance from the center of the crosshead pin to the center of the crank pin is the length of the rod.

To ascertain when the crank of a horizontal engine is upon its exact dead center, strike upon the end face of the crank axle or engine shaft a circle true with the shaft, and of the same diameter as the crank pin; then place a spirit level so that one end rests on the crank pin and the other end is even with the outline of the circle; and when the spirit level stands true, the crank will be upon its dead center.

The length of a connecting rod cannot be taken if the crank is placed in the position known as full power, because the position in which the piston would then be cannot practically be definitely ascertained; for the angle at which the connecting rod stands causes the piston to have moved more or less than half the length of the stroke when the crank has moved from a dead center to full power, according to which end of the cylinder the piston moved from. If it was the end nearest to the crank, the piston moved less, if the other end, it moved more, than half of its stroke; so that in either case the piston stands nearer the crank than is the center of the length of the cylinder when the crank is in the position referred to. This variation of piston movement to crank movement is greater in the case of short connecting rods than with long ones.

To fit a connecting rod to an engine, first rub some marking on the crank pin, and put the crank pin end of the rod on its place, with the brasses in and keyed properly up. The other end of the rod, being free, can be placed so as to touch against the crosshead pin, when the eye will detect if it will go into its place without any spring sideways; if it will do so, the rod may be taken off the crank pin, and the brasses, if necessary, fitted to the pin sufficiently to allow each to bear on the crown. But if the rod end will not fall into the crosshead journal without being sprung sideways, then move it clear of the crosshead, placing a side pressure on it in the direction in which it wants to go to come fair with the crosshead journal, and move it back and forth under such side pressure, which process will cause the crank pin to mark where the connecting rod brasses want filing and scraping to bring the rod true. The rod must then be taken off, and the brasses eased where the marking and the knowledge of which way the rod wants to go determine, the rod being placed on the crank pin as before, and the whole operation repeated until the rod "leads" true with the crosshead journal. The crosshead end of the rod must be fitted in like manner to the crosshead journal until the crank pin end of the rod leads true to the crank pin journal. The rod must then be put on its place, with both journals keyed up, and, if it can easily be accomplished, the engine moved backwards and forwards, the brasses being then taken out and bedded, when the rod will be fitted complete. A connecting rod which has both straps held by gibs and keys gets shorter from center to center of the bore of the brasses as it wears, and that to half of the amount of the wear. This is, however, generally rectified by lining up the brasses—that is, placing pieces of metal behind them (they may be fastened to the brasses if it is desirable)—which pieces are made of the required thickness to replace the amount of the wear of the brasses.

A connecting rod whose crosshead end has a strap with a gib and key, or, what is better, two gibs and a key, to hold it, the crank pin end having its strap held by bolts, and the key between the bolts and the brass, would maintain its original length, providing the wear on the crosshead brasses was as great as is the wear on the crank pin brasses; but since that on the latter is the greatest, the rod wears longer to half the amount of the difference of the wear between the crosshead and crank pin journals. If both the straps of a rod are held by bolts, the key of one end being between the brasses and the main body of the rod, and the key of the other end between the brasses and the crown of the strap, it would maintain its original length if the wear on both ends was equal; but this not being so, it wears longer, as above stated. When marking off the end of the rod (that is, the circle on the brasses to set them by for boring), or when trammeling a rod to try its length, stand it on its edge; because if it rests on its broad face the rod will deflect, and appear to be shorter than it is; this is especially liable to occur in coupling or side rods, which are generally longer and slighter in body than connecting rods.

The oil hole of a strap for either a connecting or side rod should be in the exact center of the space intended to be filled by the brasses. It will thus be central with the joint of the brasses, and from center to center of the oil holes, and will, therefore, represent the proper length of the rod

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When, therefore, the brasses of a rod end whose strap is held by a gib and key, have worn so that the key is let down the brasses must be lined up to bring the key back to its original position, the back brass being lined up so that its joint face comes even to the center of the oil hole, and the other brass being lined up sufficiently to bring the key back to its original position; then the rod is sure to be its proper length. But if the strap is held by the bolts (in which case it does not move when the brasses are let together and the key further through), lining the back brass up to the center of the oil hole at once ensures the rod being of its correct length, without any reference as to what thickness of liner is put on the other brass, or how far the key may come through. In either case it will be observed that the center of the oil hole, when placed as described, forms a gage to keep the rod its proper length. To ascertain what thickness of liner is required for the brass back, place it in its place in the strap, and scribe a line (on the inside of the strap) even with the joint face of the brass; then mark a line across the strap so that the line will intersect the center of the oil hole, and the distance between the two lines will be the requisite thickness of liner.

To find the thickness of liner necessary to the other brass, put the strap in its place with both brasses in, and the back one lined up; then key the brasses up, and scribe a line on the key at its narrowest end, even with the face of the strap; then the difference between the width of the key (on the taper face) at the line (which is the distance it does come through), and the width of the key at or near the narrow end (that is to say, the distance it ought to come through) is the thickness of liner required.

Correspondence.

Car Ventilation.

To the Editor of the Scientific American:

If the public generally knew how soon the air in a railroad car is spoiled and vitiated, there would probably be more zeal in searching for a remedy of the evil; but comparatively few know it, and only those who make the subject a particular study.

Pure air, so called, contains 4 parts of carbonic acid gas in 10,000; and a large passenger car contains about 4,100 cubic feet of floating atmospheric air. If pure, it should not contain more than 1·66 cubic feet of carbonic acid gas. A man exhales 18 cubic inches of carbonic acid gas in a minute. If we suppose that there are 50 passengers in a car, they would exhale 900 cubic inches in a minute, or 5·21 cubic feet in 10 minutes, which is at the rate of 12·55 parts in 10,000; so that in 20 minutes the air is vitiated at the ratio of 25·10 parts in 10,000. Twenty-five passengers would need 40 minutes to come to the same result. This is from the impurities from sound lungs. Take into consideration the breath from diseased lungs, and uncleanness of person and clothes, and the case will be still more desperate. For this there is only one remedy: The air must be continually renewed. The question only is, how?

What is called natural ventilation is the flow of air caused by difference of temperature and weight. Where the temperature is equal, or nearly so, in and outside, there is little or no motion of the air. The displacement will increase with the difference in temperature. Suppose the external temperature to be 32°, and the internal 62°, a difference of 30°: the hight of a car from floor to ceiling 8·5 feet, and the opening for the discharge of air 2·25 square feet, or 1·5 feet square in all. We would then have: Difference of temperature, 30° × 0·002036 (coefficient of expansion) × 8·5(hight of car) = 0·51918 inches difference in hight of the pressing column. The amount of air displaced in a second is ascertained by the formula for falling bodies, which, in our case, would give $\frac{2\sqrt{0{\cdot}51918 \times 15{\cdot}6}}{4} \times 2{\cdot}25 = 2{\cdot}54$ cubic feet. The amount really displaced is ¼ the theoretical result. In a minute, 152 cubic feet are driven out; and as the car contains 4,100 cubic feet, it will be $\frac{4100}{152} = 27$ minutes before the air in the car can be renewed, when the atmosphere is at freezing point outside and moderately warm within, keeping, in all, 2·25 quare feet continually open; but with a difference of temerature of only 15°, it would require 54 minutes to renew he amount of air which is vitiated in 10 to 20 minutes. It very doubtful, however, if ever, in the most approved passnger cars, so large an area is always kept open. In winter would soon reduce the temperature to below the comfortae point, and most of the passengers would protest, preferg even a bad atmosphere to a chilling draft. In summer, r fear of suffocation, all windows must be kept open; and, course, dust, smoke, and cinders cannot be kept out. Air y be forced in by funnel-shaped tubes provided the wind ws in the right direction), but with it dust and smoke l come in.

Ve see that natural ventilation will not fully answer the pose; and all the neat and ingeniously arranged so-called tilators, in the frieze and skylight, are more ornamental n useful. There seems to be no other way to solve the stion but the application of mechanical means, such as or blowers driven by some power, to exhaust the foul supply the fresh air. The exhaustion should be near top in summer, and at the bottom during winter. If the er be given, this can easily be done; and any plan for ibution, warming, or cooling can be combined with it.

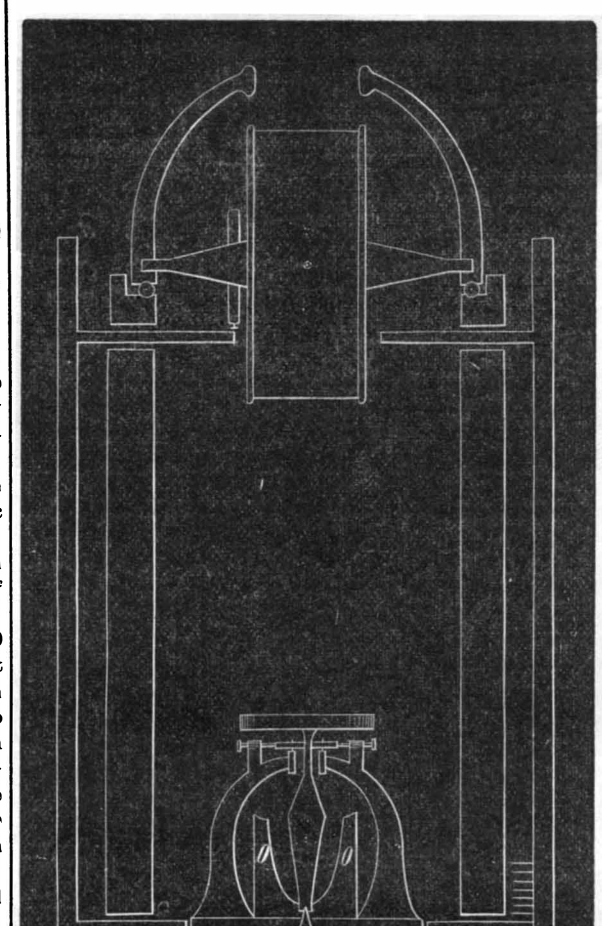
S.

Constructing Mammoth Telescopes.

e Editor of the Scientific American:

eing in your widely circulated paper that a project is tained in America of constructing a gigantic astronomical telescope, and as various methods have been proposed for carrying out that undertaking, I send you an account of a mercurial reflecting telescope (invented by me and exhibited before the New Zealand Institute), published in the "Transactions" of that Institute, Vol. V., p. 119: whereby advantage is taken of the parabolic figure assumed by liquids rotating in the plane of the horizon; so that objects at the zenith and a few degrees distant therefrom can be magnified by eyepieces in the ordinary manner. A zone of the heavens, a certain number of degrees in breadth, can thus be examined, the sweep of the telescope in right ascension being made by the earth's rotation. For viewing objects not near the zenith, a large plane reflector of silvered glass is used, which first receives the rays from the object, and then reflects them vertically downwards on to the mercurial speculum, which speculum then collects the rays and reflects them convergently upwards through an aperture formed in the plane reflector. In the publication (which I inclose) the theory is fully explained, together with a contrivance for causing the plane mirror to be always at the proper inclination, whenever the finder is directed to the object.

In the accompanying figure, showing the vertical section



of the telescope and observatory, the speculum cup containing the mercury is attached to the top of a long, hollow, conical axis, and a thin, hollow metal float is attached to the bottom of the axis. This float revolves in a vessel of liquid, and this liquid is rotated by conducting it tangentially into the vessel at its circumference, at the parts, O O, while its outlet is close to the bottom of the axis; a spiral motion is thus imparted to the liquid. The size of the float is so adjusted that it displaces nearly as much of the liquid as corresponds to the weight of the speculum. There is then but little weight upon the pivot supporting the axis, which is inserted in solid masonry.

Three curved pillars of stone, two of which are seen in the figure, form supports for three levers for leveling the speculum. These levers have a slow motion, communicated to them by screws fixed near the long end of the levers; and when properly adjusted, the short ends of these levers have contact with, but exert no pressure on, the axis. By this arrangement, the axis is secure from any vibration arising from the gyratory motion of the liquid round the float. Then, if this liquid is supplied from an elevated vessel kept full to overflowing, and if the inlets, O O, and the outlet be kept of a constant size, as gravity is a constant and friction at all parts of the axis nearly annihilated, therefore its periodic revolution is a constant too.

This arrangement contains within itself a centrifugal pendulum for regulating its velocity, and that without adding any other apparatus to the parts already described; for let the vessel containing the float be supplied with a slight excess of the liquid, it is then always full up to its edge, and, when rotating, its surface is rendered concave. If, then, from any circumstance, the revolution becomes accelerated, the liquid becomes still more concave, and consequently exerts less buoyant power upon the float; this leads to extra friction on the bottom pivot, which tends to retard the velocity.

A cylindrical wall of masonry surrounds the speculum, forming at the same time the tube of the telescope and also the observatory. The top of this wall supports a rotating dome with suitable openings, and attached to and rotating with this dome is a large plane mirror of glass silvered on its anterior surface and optically tested in every part, while constructed by a novel method.

The axis on which this mirror moves vertically is supported in a similar manner to the axis of a transit circle, and similar vertical graduated circles can be attached thereto; and if the dome is made to revolve on a graduated horizontal circle, we shall have a symmetrical arrangement for an altitude and azimuth instrument on a large scale. Exterior to the wall supporting the plane mirror, and entirely unconnected therewith, is another circular wall, and it is this outer wall that supports the floors, through apertures in the interior wall somewhat larger than the supports; so that any movement of the observer will not vibrate the telescope. The steps up the observatory are in the space between the walls and are attached to the outer wall only.

The symmetry of the horizontal speculum precludes any danger either of deflection by its weight or of irregular expansion arising from increase of temperature; for it possesses the same shape and weight in whatever position it is turned; it is, in fact, self-compensating.

The speculum admits of being beveled with extreme precision by an optical contrivance which can also be applied to test the figure of the plane mirror in all its parts, while being constructed

HENRY SKEY.

Dunedin Observatory, Otago, New Zealand.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

In reply to the last two communications of Mr. Hawkins upon the above subject, I have to say:

1. An experience of twenty years of workshop practice, here and in Europe, under the most favorable conditions, has proved conclusively to me that, by tempering taps, reamers, etc., in a tube "moderately heated," by performing the operation "slowly," and by tempering them to a "brown color," I could obtain a better tool than by the sand bath, or than by any other method of tempering at present practiced in our workshops. What difference there would be in the temper (the color being the same) if more rapidity, or some other changed conditions of tempering, were employed, I have no need to discuss.

2. My given methods for taps, dies, reamers, etc., determine both the elements of time and access of the air; for I say that the tube must be "heated," by which the workman understands "heated to a red." I then say that "care should be taken not to make the tube too hot, for the more slowly a tool is lowered, the more even the temper will be." I think that, if these instructions are followed, there is not much option as to time, since the tempering cannot be hastened, and can only be delayed by intentionally holding it out from the tube; by the term "slowly," I mean as slowly as it can well be performed without purposed delay. If the tube is merely "heated," the operator cannot go wrong.

3. In the tube process given by me, there is a current of air continually passing the steel being tempered, and it receives at the same time its heat equally all around. No other prevailing shop practice gives so free access to the air, and such evenness of heat at the same time. In the case of dies, my plan, as given by me, surrounds all but one face with air, and turns them over and over, that all parts may have equal access to both the air and the heat. Here again my conditions regulate themselves for the given purposes.

4 As to the oxide question, my reason for declining to discuss it was that I thought it liable to divert attention to matters not germane to workshop practice; and J. T. N., in disputing or questioning with Mr. Hawkins whether the colors produced in tempering are films of oxide, or of carbonization (as claimed by Nobili, who gives an excellent reason for his conclusions), proves the correctness of my premises. I have no objection to a discussion of this interesting but disputed question; it is of importance, I grant, but I can go on using my "color thermometer," be it caused by oxidation or carbonization.

5. It may be that the benefits I have found from the methods I give arise from the very fact that they permit of the proper access of the air, and entail, of themselves, a sufficiently defined limit of time to insure results, correct in themselves and at all times equal; and thus they are merely proofs of Mr. Hawkins' elements of time and exposure. I am inclined to think this to be the case, because the departures from the sand bath process (the most generally approved method), recommended by me, give, as Mr Hawkins advises, free access to the air, and determine of themselves the time by specifying that, in tempering, the hardened steel be subjected to the rays of heated (that is, red hot) iron; for iron "red hot" gives some idea of a certain temperature, while heated sand, not being made red hot, may be made of a wide range of degrees of heat with nothing to denote it, and may, as I have before stated, be hotter in one part than in another in consequence of the unevenness of the fire or of the depth of the sand.

6. I have never tried tempering under conditions which would give a more free access to the air, nor do I know of any method by which more free access to the air and, at the same time, more even heating of the hardened steel can be secured than by the methods I have given; but if Mr. Hawkins can suggest any, I shall be happy to test the same and to report thereon.

JOSHUA ROSE.

New York city.

MR. SAMUEL WEBBER, of Manchester, N. H., requests us to state that the power ordinarily required to card one pound of cotton is $\frac{1}{200}$ of a horse power, and not $\frac{1}{20}$, as printed in our article on his book entitled "Facts on Power," on page 48 of our current volume. Similarly, the best results in carding cotton should be $\frac{1}{400}$ of a horse power instead of $\frac{1}{40}$.

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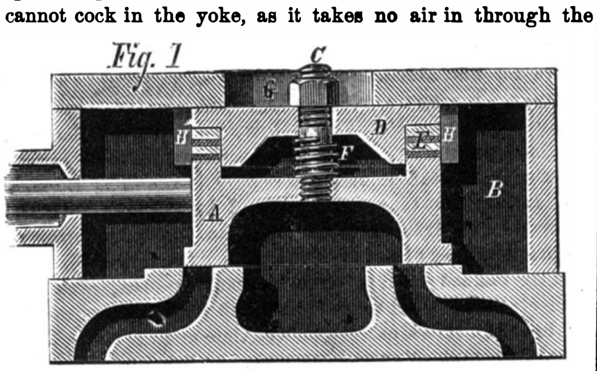
IMPROVED GAS REGULATOR.

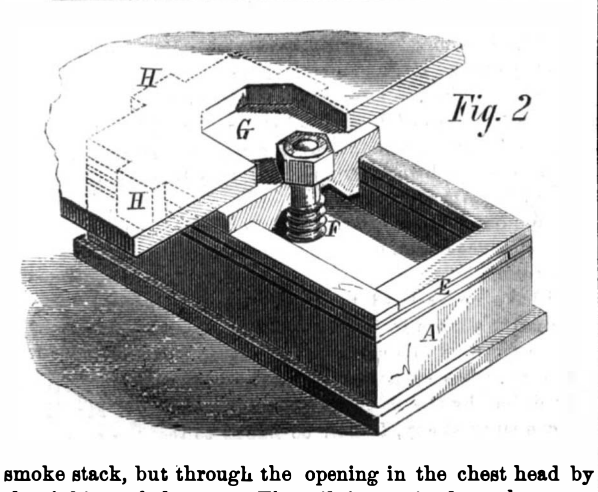
We give herewith perspective and sectional views of a new gas regulator, patented through the Scientific American Patent Agency, May 5, 1874, by Mr. Joseph Adams. The pressure of the gas acts on a flexible diaphragm, which is connected with a valve, which opens or closes as the gas is turned on or off from the burner or as the pressure varies in the street mains. The devices arranged with the diaphragm, described below in detail, contribute, it is claimed, to render the regulator extremely sensitive to differences in the flow.

The exterior of the invention is represented in Fig. 1, and from Fig. 2 the interior arrangement will be readily understood. The circular casing of the regulator is of metal, and the parts are joined together through the flanges shown. The latter also fasten, with a gas-tight joint, the outer edge of a flexible annular diaphragm, A, the inner edge of which is riveted between the flanges of the thin metallic hemispheres which form the balloon, B. Upon the top of the latter is a rod, upon which are placed weights, C, to adapt the governor to the variation of pressure for different elevations. The lower hemisphere opens through a pipe, D, to the supply of gas from the meter below, said pipe terminating in a funnel-shaped valve which plays in the valve seat, E. The latter is attached to the bottom of the case, and is adjustable, so as to be lowered to reduce the orifice around the valve, and by this means adapt the apparatus to a low pressure of gas. A movable plate, F, is screwed into the upper portion of the outer casing, and has in its center a small hole for the admission of air to counteract the pressure of gas upon the diaphragm. G is a conduit for the gas, and H the connection for the service pipe. In operation, the valve is adjusted to the particular elevation or pressure of the locality by means of the weights. As the valve, pipe, and diaphragm are in a state of suspension by reason of the buoyancy of the balloon, the pressure on the gas being neutralized by the atmospheric air on one side and by the weight on the other, the diaphragm becomes particularly sensitive to an increased or diminished flow. If the pressure be increased, the diaphragm, balloon, and valve are raised, and the valve orifices proportionally closed; if diminished, the same portions are depressed by the air pressure and weight, the orifice opened, and the flow augmented. For very low pressures, the weights may be entirely removed and the valve seat lowered, or both, as required. By this delicate arrangement, it is claimed, the flow of gas through the burners is made uniform and independent of the pressure from the main and also of the number of burners employed at a time. For further particulars address Joseph Adams, 1,025 Market street, Philadelphia, Pa.

YOUNGMAN'S IMPROVED SLIDE VALVE.

The invention herewith illustrated is an improvement on the ordinary D valve, which is designed to overcome the difficulties arising from the expansion of the metal when heated by steam. The valve fills up the whole of the space of the steam chest vertically, and, while highly elastic, is claimed to be as indestructible as the D valve under any speed or pressure. When the steam is shut off, the valve cannot cock in the yoke, as it takes no air in through the



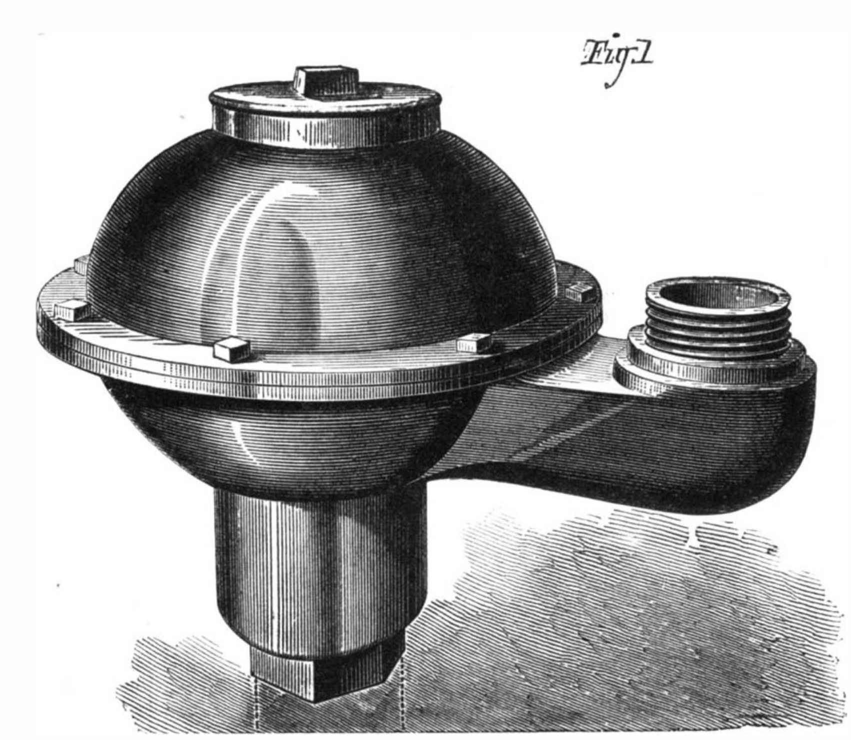


smoke stack, but through the opening in the chest head by the sinking of the cap. The oil is received at the same place.

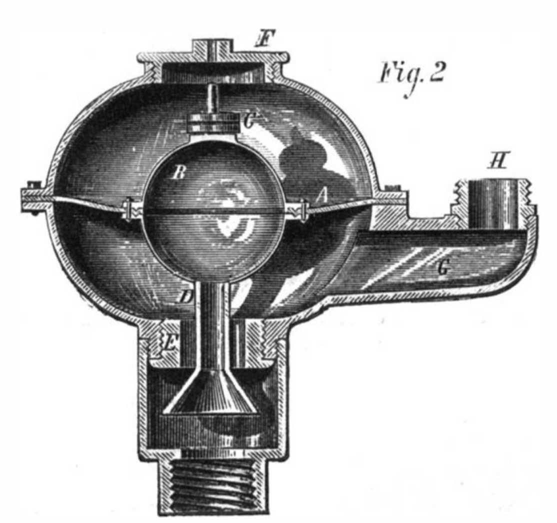
Fig. 1 is a transverse vertical section of the valve, A, as located in the chest, B. Fig. 2 is a perspective view showing a portion of the steam chest above. Attached to the valve is a screw bolt, C, which passes through the adjustable cap, D, Fig. 1, and is secured by the nut shown. At E, packing is placed, and at F, a spiral spring. An opening, G, Fig. 2, is made in the top of the steam chest in order to allow the nut to travel the full extent of the movement of the valve, and also to give access to the nut to use a wrench whenever necessary.

The packing is kept in place by lugs, H, depending from the cap. A gum gasket, we are informed, placed between the cap and valve, is all that is necessary on machinery where drifting cannot occur, consequently metallic packing can be dispensed with on steamboats.

The nut, in connection with the spring, regulates the cap, which forms a ground joint in connection with the inside



ADAMS' IMPROVED GAS REGULATOR.



surface of the steam chest head, elevating it and depressing it at will. All the upward force falls upon the nut, and not upon the chest head. Between the valve and the cap exists a space the full square of the valve, in which the packing is placed, consisting of four pieces of brass, three sixteenths of an inch in thickness and one half inch in width, shaped precisely like a carpenter's square. These are laid one on top of the other so as to break joint, and also so that, if expansion should take place and shove one out of position at the point of intersection, the other may take its place. Between each layer of metallic packing a gum gasket is placed. A space of about one eighth of an inch exists between the cap and the upper layer of packing. This forms a square of packing around the shoulder which occupies the chamber. The effect of this is that, when the steam is forced into the steam chest, it presses upon the packing inward and downward, inward against the shoulder and downward against the top of the valve. The packing is subject simply to pressure; there is no movement whatever connected with it. When the steam is off, and the engine is in motion, the cap sinks and rises according to the motion of the piston head and the operation of the spring, the shoulder sinking within the square of packing without any abrasion whatever. As the different parts of the packing are separated one sixteenth of an inch, and are brought instantly into place through the pressure of the steam, it never can become disordered.

The inventor claims the present device to be superior to a somewhat similar arrangement employed on board of the Great Eastern, and mentioned in a recent work by Mr. John Bourne. The English invention consists of two rings embedded in the chest head, between which is a gum gasket. This combination is subject to the operation of set screws, which keep the parts pressed closely upon the top of the valve, thus, we are informed, producing much more friction than the device above described.

The further claims regarding the present invention are, that it moves its weight only, is cheap, requires no alteration of machinery for its application, and may be very quickly substituted for the D valve. Using it, the engine can be reversed without shutting off steam, and it can be moved easily with one hand when surrounded by pressure. We are also informed that the valve has been successfully tested for some time past. It will be placed in locomotives, steamers or land engines, and warranted for six months.

For further particulars, address Jacob Youngman or J. M. Bostian, Sunbury, Pa.

The Tay Bridge.

The firm of Hopkins, Gilkes & Co., of the Tees Side Iron Works, Middlesbrough, England, have entered into a contract with the North British Railway Company for the completion of the great engineering work known as the Tay Bridge, near Dundee. This, when finished, will be the longest bridge over a running stream in the whole world. The total length will be 10,321 feet, or nearly two miles, so that it is 1,127 longer than the Victoria Bridge, Montreal, which is 9,194 feet in length and has hitherto claimed the distinction that will henceforth be awarded to the Tay Bridge. There are, of course, bridges of considerably greater length than either, although none spanning a tidal river. There is, for example, the Tensas and Mobile Bridge, on the Mobile and Montgomery Railway, which is fifteen miles in length; but the greater part of this bridge is carried over great morasses, where the engineering and other difficulties to be surmounted were not at all comparable to those met with in this case; and even after our American cousins have got all due credit for the big things they have done in this direction, the fact will still remain that the Tay Bridge is, in its way, perhaps the most remarkable structure in the world.—*Newcastle Chronicle.*

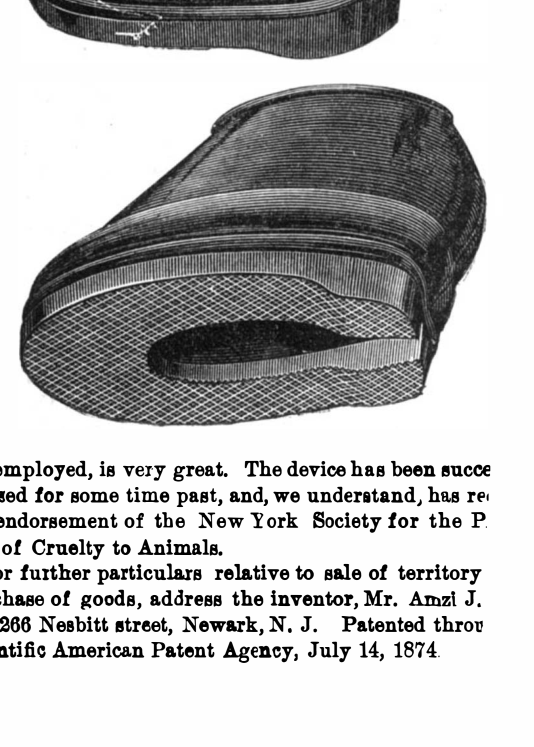
INDIA RUBBER SHOES FOR HORSES.

We can describe the invention illustrated in our engraving in no better or more concise terms than by stating that it is an india rubber overshoe for horses. It is made and lined in precisely similar manner to the articles of apparel worn by the human race, and, in fact, presents no points of difference save in its shape and its manufacture of the best quality of india rubber.

It is designed as a substitute for the iron shoe, and as a means of preventing the many maladies to which horses' feet are subject. The inventor informs us that horses suffering with cracked or contracted hoof, and similar painful hurts, are quickly cured by the substitution of the rubber covering for the unyielding metal shoe. The elasticity of the former allows the hoof to remain in its natural shape while protected from abrasion against pavements by the heavy rubber sole beneath.

The device is easily removed from or put on the hoof, and hence, while standing in the stall or turned out to pasture, the horse may be left barefooted. In winter time the covering serves as a protection against illness due to the common practice of mingling salt with the ice and snow in city streets, while the roughened surface of the rubber beneath serves to give the animal a foothold in slippery weather.

As compared with iron shoes, the cost of the rubber ones is about one third more, and their weight is some forty per cent less. Sixteen sizes are manufactured, so that accurate fits may be obtained. With reference to wear, the inventor states that the durability, owing to the fine quality of rub-



ber employed, is very great. The device has been succe ly used for some time past, and, we understand, has re the endorsement of the New York Society for the P tion of Cruelty to Animals.

For further particulars relative to sale of territory purchase of goods, address the inventor, Mr. Amzi J. No. 266 Nesbitt street, Newark, N. J. Patented throu Scientific American Patent Agency, July 14, 1874.

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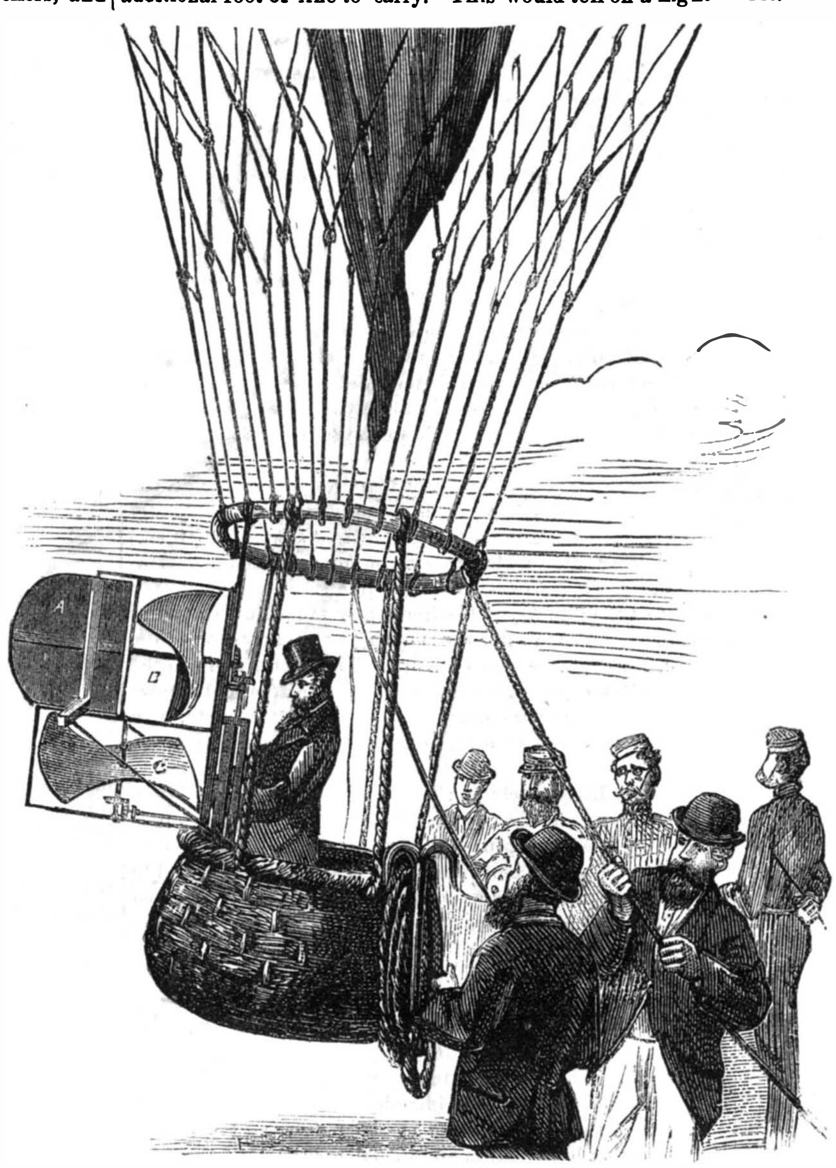
A BALLOON STEERING DEVICE.

Experiments have recently been made, at Woolwich Arsenal, England, with an invention designed to accomplish the long wished result of steering a balloon. It is the invention of Mr. Bowdler, and consists of two fans or propellers, and a rudder with simple hand gear, the entire apparatus weighing about 70 lbs. In our Fig. 1, C is a sheet iron propeller working on a vertical axis, and made to rotate by multiplying gear and winch at from 600 to 720 revolutions per minute, the object being to cause the balloon to ascend or descend without loss of gas or ballast. B is a similar propeller working on a horizontal axis at about the same speed, inasmuch as this may be required to act in any direction. A rudder, A, made of canvas, with strengthening bands, is fixed opposite the propeller, and is held in any desired position by ordinary rudder lines, while the propeller is made to revolve by hand and winch. This gear Mr. Bowdler did not consider was large enough to suit the balloon which the well known aeronaut, Mr. Coxwell, lent for the experiment, and which contained about 60,000 cubic feet of gas. He hoped, however, that a distinct indication of the effect of the propellers would be manifest.

The experiment was carried out under the personal direction and orders of Major Beaumont, R. E. The official programme was as follows: (1) The balloon to be balanced carefully, and when in a captive condition to be raised to about 150 feet, and lowered repeatedly by the vertical propeller in order to test its efficiency. (2) The balloon to be released, and as soon as the course be shown to be steady and the direction ascertained by means of Mr. Coxwell's indicator, maps, etc., the horizontal propeller to be worked at right angles to the course of the balloon, and its maximum effect thus obtained carefully noted. (3) The balloon then to be raised and lowered by the vertical propeller, without throwing out ballast or discharging gas. After attaching the gear to the side—as shown in the engraving—Major Beaumont, Mr. Coxwell, Mr. Bowdler, and a sergeant of the Royal Engineers entered the car and the first part of the programme was commenced, a series of small pilot balloons being sent off in succession to ascertain the direction of the wind and probable course of the balloon when liberated.

The balloon was fairly balanced and the vertical propeller worked, and the balloon raised to a hight of about 40 feet, and lowered again. (See Fig. 2.) The vertical propeller, when worked hard, produced a decided effect; probably the maximum rate of ascent did not exceed 50 feet per minute, but it was not far short of it. The was no great accuracy, speaking critically, in the arrangement of the conditions. For example, the line which held the balloon captive was held by hand, and thus every foot the balloon rose it had an additional foot of line to carry. This would tell on a hight of 40 feet, although the line was slight; and had the 150 feet laid down in the programme been adhered to, the effect would have been very considerable. A mean rate of ascent and descent might correct the error. After a few trials, however, the gear broke, and the vertical propeller became for the time disabled. Shortly after this the balloon was liberated for the trial of the horizontal propeller, and the remainder of the programme was visible only to those in the balloon.



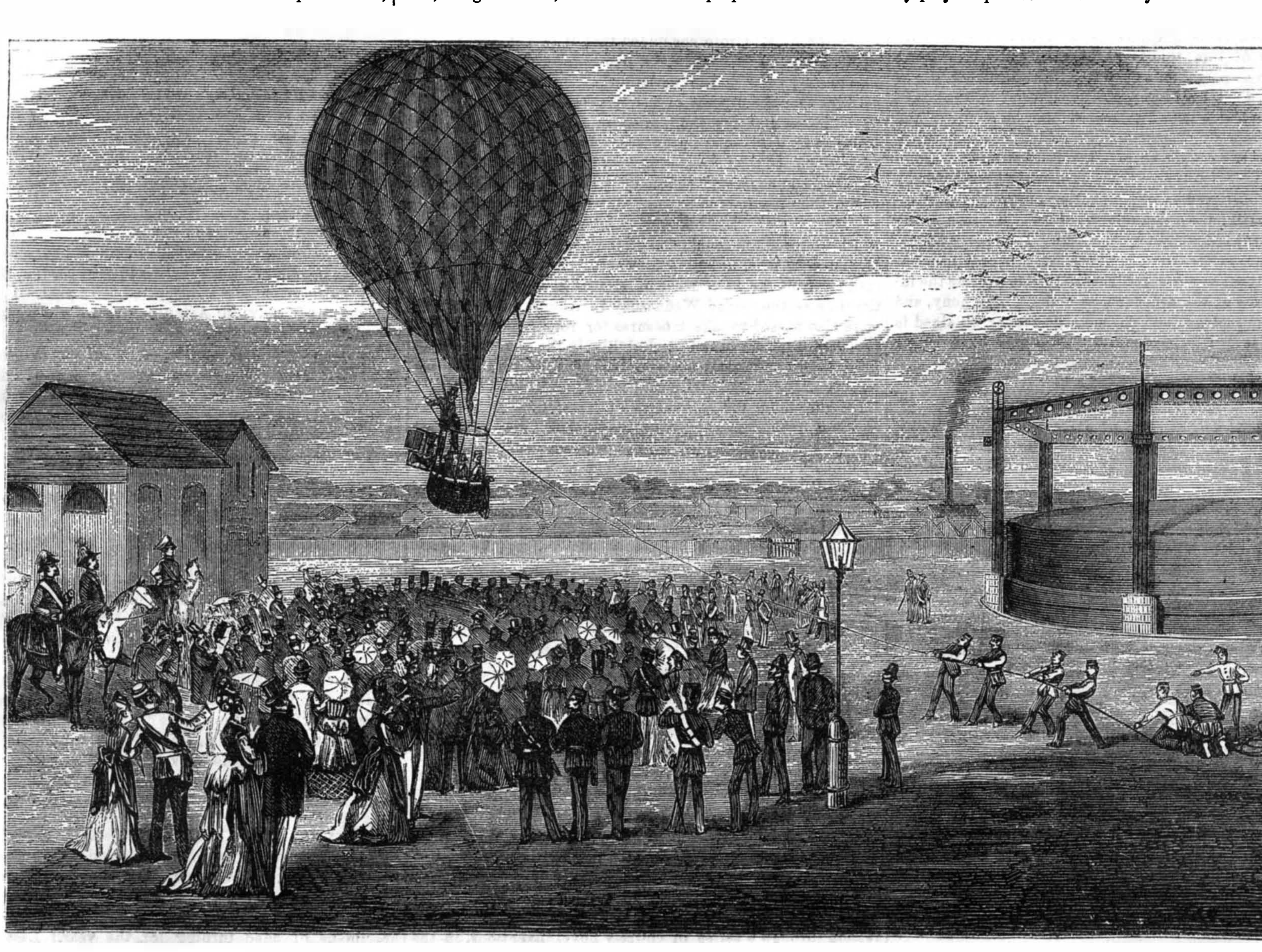
BOWDLER'S BALLOON STEERING APPARATUS.—Fig. 1.

Mr. Bowdler considered that his steering apparatus ought to be shown to have had an effect. This it had, but in the nature of things it could hardly be otherwise. The question is whether it gave promise of producing a sufficient effect to be useful, and this we cannot at present say it did.

The problem of how to develope sufficient power to alter and govern the course of a balloon is, says *The Engineer*, from which we extract the engravings, no easy one. The enormous bulk of gas required to support any given weight, and the fact that the balloon is bodily immersed in a moving medium, without access to any fulcrum by which the force of the air might be turned to account, as in the case of a ship on the water, constitute difficulties that are far from being surmounted. A hand propeller may produce an effect that is just appreciable on a still day; but when a balloon is liable, almost without notice, to find itself moving at twelve miles an hour, or much faster, it is evident that a power of a totally different class is necessary to be of any real use. We should be very glad to see something of greater promise tried in the fair and thorough way in which Mr. Bowdler's gear was tried.

Yellows in the Peach.

If you dig around a peach with the yellows, you will be first struck with a mushroomy smell. Picking out the roots, and examining them with a lens, you will see millions of thread-like fibers, which are the *mycelia* of fungi. These eat the young fibers, and leave only the main roots, through which all the nutriment of the plant has to be gathered; and as an old root is unable to do much more than draw in water, the tree becomes in a measure starved, and the leaves become yellow, just as they would be if growing in poor soil, which, though the plant might have plenty of roots, furnished nothing for the roots to eat. To have plenty of roots and no food is equivalent to having plenty of food and no roots. The effect on the plant is just the same. Remedies which look to the destruction of this root parasite are employed. Hot water has done it, so has a weak solution of salt; others have found a solution of potash succeed. The exact nature of this fungus, so far as we know, has not been investigated to entire satisfaction. Fungi are very polymorphous. This one may enter into the circulation



MR. BOWDLER'S BALLOON EXPERIMENT.—Fig. 2.

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of the plant, and exist in that case as an apparently distinct species, extending through the tissue, and destroying it as it goes. This seems likely from some experiments by Mr. Thomas Taylor, of the Department of Agriculture. At any rate it is generally believed that a bud, or even a knife used in pruning a diseased tree, will communicate the disease to a healthy one.—*The Gardener's Monthly.*

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We give below abstracts of papers read before the Hartford Convention, concluding our report of the proceedings of that body. Under the head of the

MOLECULAR VOLUME OF WATER OF CRYSTALIZATION,

Professor F. W. Clarke stated that, when water unites to form a hydrate or a crystaline salt, contraction ensues, and by studying that contraction we get at curious results. In the case of water of crystalization, Professor Clarke has studied over 30 salts, and in every case the molecular volume of the water is about 14. With water of hydration no such regularity is found. Evidently, then, when water unites with an anhydrous salt from water of crystalization, all the condensation which occurs is on the part of the water, the volume of the molecule of the salt itself remaining unchanged. Referring to the molecular heat of similar compounds, the same speaker said that it is commonly thought that similar compounds have equal molecular heat. This is only approximately true. In comparing about 20 series of similar compounds, Professor Clarke finds that the molecular heat increases slightly with the molecular weight, though in a very different ratio.

Professor Lovering exhibited a drawing of a new instrument which he had devised, by which vibrating flames reflected in a revolving mirror could be made visible to a large audience. Paymaster General Alvord, U. S. A., explained a table, from which it appears that the annual death rate of the officers of the army in the period of 25 years, from 1824 to 1848, was 27 per 1,000; the rate for the last 25 years, from 1849 to 1873, was 23 per 1,000, showing a decided decrease notwithstanding the civil war.

Professor T. Sterry Hunt, with reference to

THE SEWAGE QUESTION,

mentioned a new English method which consists in the use of finely divided charcoal, obtained by charring seaweed or street sweepings. Only one fourth as much charcoal is required as of earth. The odorless and partially dried mixture with this charcoal, after use, is removed from time to time and charred by heating to redness in close vessels like gas retorts, the products of the distillation being water, ammonia, acetic acid, tar, gas, and charcoal, the last being augmented in quantity, and ready for immediate use again, though containing alkalies, earth, and phosphates, which give it a great fertilizing power. From the product of the distillation the chief materials obtained are acetate of lime and sulphate of ammonia, the latter being the most valuable of fertilizers.

The same speaker also described a new wet process of copper extraction, devised by himself and Mr. James Douglas of Quebec. When oxide of copper is brought in contact with protochloride of iron, this is decomposed, the iron being thrown down as peroxide, and the copper converted into a mixture of one third soluble protochloride and two thirds of dechloride, insoluble in water, but soluble in a strong and hot brine. From this solution metallic iron throws down the whole of the copper or metal, regenerating the protochloride of iron, which is now ready to dissolve a fresh charge of oxide of copper, and so on indefinitely, using the same solution over again, the consumption of metallic iron being about two thirds the weight of the iron. To prepare the ordinary sulphurous ores for this treatment, it is only necessary to calcine them at a low red heat. In this process the injurious elements of the ore, such as arsenic, antimony, and tin remain undissolved, and the metallic copper obtained is so pure that it can be made into fine copper by a single fusion.

Professor R. E. Rogers described a new

DIRECT VISION SPECTROSCOPE,

which consists of a thick plate of glass with parallel sides, united to one of the faces of an ordinary bisulphide of carbon prism, or a prism of dense flint glass. According to the amount of dispersion desired, the light is made to enter either on the end of the glass plate or on the opposite face of the bisulphide prism. The results obtained from this instrument are as follows: The dispersion of this compound prism is nearly four times greater than that of the ordinary 60° prism. The mean emergent ray is practically parallel to the incident ray. It does not deflect the ray from its original path. Many Frauenhofer lines are visible by this prism with the naked eye, while with the observing telescope all the prominent lines are clearly reversed, without the use of the slit or collimeter, by merely throwing a strong beam of light by means of a mirror.

Professor C. V. Riley of Missouri, in a very interesting paper on

INSECTS,

described those more particularly associated with *sarracenia variolaris* (spotted trumpet leaf). It referred to the insect catching powers of those curious plants, the flytraps (*dionæa*) the sundews (*drosura*), and the pitcher plants (*sarracenia*), which have of late awakened renewed interest by virtue of the interesting experiments and observations on their structures, habits and functions, lately recorded by Professor Asa Gray.

The leaf of *sarracenia* is a trumpet-shaped tube, with an arched lid covering, more or less completely, the mouth. The inside is furnished with perfect *chevaux de frise* of retrorse bristles, commencing suddenly about an inch from the base, thence decreasing in size until, from about the middle to the mouth, they are so short, dense, and compact that they form a decurved pubescence which is perfectly smooth and velvety to the touch, especially as the finger passes downward. Under the hood, again, many of them become large and coarse. Running up the front of the trumpet is a broad wing with a hardened border, parting at the top and extending around the rim of the pitcher. Along this border, but especially for a short distance inside the mouth, and less conspicuously inside the lid, there exude drops of a sweetened, viscid fluid, which, as the leaf matures, is replaced by a white, papery, tasteless, or but slightly sweetened sediment or efflorescence; while at the smooth bottom of the pitcher is secreted a limpid fluid possessing toxic or inebriating qualities.

The insects which meet their death in this fluid are numerous and of all orders. Ants are the principal victims, and the acidulous properties which their decomposing bodies give to the liquid doubtless render it all the more potent as a solvent. Scarcely any other hymenoptera are found in the rotting mass.

Two species are proof against the siren influences of the destroyer, and in turn oblige it, either directly or indirectly to support them. The first is *xanthoptera semicrocea* (Guen.) a little glossy moth which may be popularly called the sarracenia moth. It walks with perfect impunity over the inner surface of the pitcher, and is frequently found in pairs within the pitchers soon after these open in the early part of the season, or about the end of April. The worm riots in the putrid insect remains, bores through the leaf, and burrows into the ground; there contracting to the pupa state, in a few days it issues as a large two-winged fly called *sarcophaga.*

Professor Riley concludes: That *sarracenia* is a truly insectivorous plant, and that by its secretions and structure it is eminently fitted to capture its prey.

That those insects most easily digested and most useful to the plant are principally ants and small flies, which are lured to their graves by the honeyed path, and that most of the larger insects fall victims to the peculiar mechanical structure of the pitcher.

That the only benefit to the plant is that the liquid manure, resulting from the putrescent captured insects, mostly descends the root stalk, and probably through tubular cells, passing through the petiole into the root.

That *sarcophaga* is a mere intruder, the larva sponging on and sharing the food obtained by the plant, and the fly attracted thither by the strong odor. There is nothing to prove that it has anything to do with pollination.

That *xanthoptera* has no other connection with the plant than that of a destroyer, though its greatest injury is done after the leaf has performed its most important functions.

That neither the moths nor the flies have any structure peculiar to them, that enables them to brave the dangers of the plant, beyond what many other allied species possess.

In a paper on the

COTTON WORM,

Professor A. R. Grote concluded that it is not indigenous with us, but an annual; not a denizen, but a visitant, unable to contend with the variations of our climate; and he believes that the process of artificial extermination may be simplified by limiting the period of successful attack and doing away with certain proposed remedies. The agent of destruction must be directed against the first brood in each locality; and concerted action on the part of the planters, where the remedy is to be applied, will be necessary.

THE CLOSING EXERCISES,

which followed the conclusion of the reading of the papers, consisted in passing resolutions accepting the invitation to make Detroit the next place of annual meeting, and fixing the time as the second Wednesday in August. Resolutions were also passed to take measures for representing to Congress the importance and desirability, in the opinions of the Association, of having a new census taken in 1875 with reference to the Centennial celebration; and to take measures for urging upon the legislature of Massachusetts the need of a new geological survey of that State. The following officers were then elected for the coming year: President, Professor J. E. Hilgard, of Washington; vice president for section A, Professor H. A. Newton, of New Haven; vice president for section B, Professor J. W. Dawson, of Montreal; General Secretary, Professor S. H. Scudder, of Boston; permanent secretary for five years, F. W. Putnam, of Salem, Mass.; treasurer, W. S. Vaux, of Philadelphia; secretary of section A, Professor S. P. Langley, of Pittsburgh; secretary of section B, Professor N. S. Shaler, of Newport, Ky.

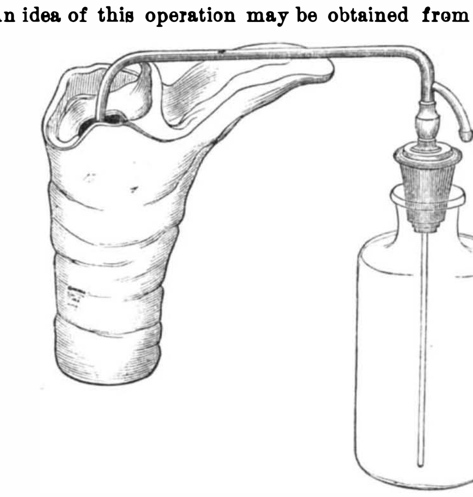
NEW TREATMENT FOR THROAT AND NOSE DISEASES.

We have been much interested, lately, in an examination of a comparatively new system of treatment of diseases of the throat and nose, maladies probably the most prevalent in the variable climate of our Northern States during the fall and winter months. Physicians who employ the old-fashioned probang are well aware of the difficulty in reaching therewith the very sensitive parts to which local application of a remedy is necessary; and as a substitute for this uncertain instrument, apparatus is by some employed, by which the medicine, in a finely divided state, is blown against the proper spot.

The system to which we refer is the last mentioned process, brought to a remarkable degree of certainty and perfection through a series of entirely novel inventions, in the shape of peculiarly constructed instruments, which are the result of long acquaintance with and experiment upon the diseases in question, by Dr. Otto Füllgraff, the founder and manager of the Bond Street Homœopathic Dispensary, and an eminent practitioner of this city.

By means of this apparatus, the surgeon can direct a powerful spray of liquid or cloud of powder, infallibly upon the part to be treated. Connected with the atomizing arrangement are tubes of vulcanized rubber and nickel-plated metal, provided with movable tips of various shapes and bent at different angles, so that the skillful operator, aided by ingeniously contrived reflectors, can direct his medicine directly to the vocal cords or into cavities impossible to reach by any other method.

An idea of this operation may be obtained from the an-



nexed engraving. From the bottle which holds the remedy a metallic piece arches over the cork and then passes at right angles over the tongue, at the root of which it is shown making another angle and passing over the epiglottis down into the larynx; so that the medicated fluid, forced by the air driven into the bottle by the compression of a bulb attached to the small projecting tube, is impelled directly into the larynx, trachea, and bronchial tubes. The end of the instrument terminates in a movable tip, which may be unscrewed, and another substituted, so as to throw a spray of finer or coarser particles.

Through this apparatus many important cures have been recently effected, notably in cases of well known vocalists, suffering from diseases of the throat, nasal catarrh, etc., due to our changeable climate. The instruments are, of course, not patented, and are, therefore, open to the examination and imitation of the profession. They have probably been the means of averting an immense amount of suffering among the poorer classes of this city, through the dispensary above alluded to, where, for the past twenty years, Dr. Füllgraff has, with that lack of ostentation which marks the true philanthropist, gratuitously given to hundreds of thousands the benefit of his skill. The institution now treats a larger number of cases than even the more pretentious dispensaries, largely subsidized by the city and State, 38,830 poor people of every nationality having been aided, surgically and medically, during 1873, directly at the dispensary; 5,589 outdoor visits were made by the medical staff, and 98,601 prescriptions given—and all this without fee or hope of reward. It is a grand and genuine charity, and, while it is greatly to be regretted that its pecuniary support comes more from the private practice of its generous founder than from city and State coffers, the institution is one of which, as a community, we may well be proud.

The Worker's Friend.

"Partly by the information I have received from the SCIENTIFIC AMERICAN, and partly by the advice it has contained in reference to the benefits of study, I have been raised from the position of a laborer in a lumber yard, at $6 a week, to that of foreman, at a salary of $1,200 a year. I therefore consider the SCIENTIFIC AMERICAN to be the worker's best friend."

Such are the casual remarks of one of our correspondents in a recent letter. They are an example of hundreds of similar expressions which we receive from various parts of the country. It is always a gratification to us to be thus assured of the usefulness of our journal in the hands of the great body of practical workers to whose interests it is devoted.

Premium for the Best Circular Saw.

The Board of Commissioners of the Fifth (1874) Cincinnati Industrial Exposition offer a special premium of $100 in gold for the best circular saw. The competition is to be determined under conditions as follows: All saws competing shall be of uniform diameter, namely, 56 inches. They may have either solid or inserted teeth. The gage to be at the option of the exhibitor. The eye of the saw to be 2 inches diameter; the pin holes ⅜ inch, and 3 inches from center to center. Each saw is to be submitted to a thorough practical test, upon a left hand mill provided for the purpose. Diagram cards are to be taken from the engine during the trial of each saw, by a disinterested expert, selected by the jurors. The test is to be made during the week beginning September 21, 1874. Other details of the examination are to be determined by the jurors.

PRIZES FOR HAND TURNING.—The Company of Turners of London, in continuation of their action in former years, propose to give, in 1874, their silver medal and the freedom of the company and of the city of London to any one workmen or apprentice in England who may send in the best specimens of hand turning for the year. Last year the prizes were awarded for turning in ivory and stone; this year the material to be used will be brass or gun metal.

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VENTILATION OF RAILWAY TUNNELS.

To ventilate a building containing various apartments, with opening doors and windows that interrupt or modify the air current, is somewhat difficult; but to thoroughly purify the atmosphere of a railway tunnel, which is a single closed apartment, is one of the most easy matters with which the engineer has to deal. The air in the long railway tunnel under the city of Liverpool is changed every ten minutes by means of a large steam fan, placed near the center.

A novel method has lately been adopted on a portion of the Underground Railway in London, which is described in a recent number of *Engineering* as follows:

"A very careful investigation of the condition of the air in the Metropolitan Railway covered way was undertaken conjointly by Messrs. George H. Bachhoffner, Henry Letheby, and J. Whitmore, and the result of their investigation showed that, while the air of the tunnel was sufficiently impregnated to impart disagreeable and, in some cases, inconvenient sensations, no source of danger could possibly exist. With regard to carbonic acid, a number of careful experiments showed that, in the railway tunnels, during the busiest period of the day, when its quantity attained a maximum, there were only 6·1 parts to 10,000 parts of air in volume. In many crowded places of public resort, such as churches, theaters, law courts, etc., the quantity of carbonic acid reaches the proportion of 32 parts per 10,000; and in Manchester, during foggy weather, it is often 8 parts per 10,000 in the streets. The presence of carbonic oxide can be scarcely detected. This result of this investigation proved conclusively that no danger from inhaling the air in the tunnel could possibly exist.

The section of the Metropolitan Railway lying between the Gower street and Portland road stations, a length of half a mile, has no communication with the outer air between the two points just named.

A means presents itself, however, for improving the ventilation of this length of the line through the fortuitous circumstance of the Pneumatic Dispatch Company's tube crossing the crown of the Metropolitan Railway arch between Gower street and Portland road. This tube connects the Euston square terminus with the company's pumping station at Holborn, whence a second section of the tube is carried on to the General Post Office. The Euston-Holborn tube, which is 3,080 yards in length, is of ∩ section, 4 feet 6 inches high, and 4 feet in width. On the floor of the tube, rails are laid, upon which run carrier wagons, 10 feet 4 inches in length, and weighing each 22 cwt. The ends of these carriers conform to the shape of the tube, and a close contact with the sides of the latter is always maintained by means of rubber packing. These carriers—either empty or loaded with letters and parcels—travel between Euston, Holborn, and the General Post Office. The motive power, which is located at Holborn, consists of an engine with a pair of 24 inch cylinders, of 20 inch stroke. This engine drives a fan 22 feet in diameter, at an average speed of 160 revolutions per minute. By this means a pressure of about 6 ounces per square inch is obtained, available either for forcing the carriers from Holborn to Euston, or on the return journey for exhausting the tube, and thus creating a sufficient difference of pressure against the ends of the carriers. The traffic between Holborn and the Post Office is conducted in precisely the same manner.

The relative positions of the pneumatic tube and the Metropolitan Railway tunnel are, as we have mentioned, such that openings could easily made between the roof of the latter and the floor of the former, for the ventilation of the railway tunnel.

This idea has been carried out very successfully by Mr. S. De Wilde, resident engineer of the Pneumatic Dispatch, with the approval of the Metropolitan Railway Company, and, as at present worked, a very sensible improvement in the ventilation of the tunnel is effected. Two rectangular openings, each 6 feet by 2 feet, are cut through the roof of the tunnel into the tube, and these openings are closed by valves hung upon trunnions, and so balanced as to open freely inwards. When the carrier is on its way from Euston to Holborn, and after it has passed the tunnel, the valves are opened by the passing carrier, the air is drawn in from the tunnel at the rate of about 1,000 cubic yards a minute, until the carrier reaches Holborn, when the action of the fan is reversed, and a pulsation of air is sent through the tube, until it strikes the valves, and closes them.

It will be worth while for the Metropolitan Railway Company to consider whether they cannot ventilate this section of their line more efficiently and a great deal cheaper than by the help of the Pneumatic Dispatch fan. The length of the line between Gower street and Portland road is about 900 yards, and the cross section of the tunnel is 450 square feet; its capacity is thus 1,215,000 cubic feet. Supposing this amount of air to be changed every hour, 20,250 cubic feet would have to be dealt with per minute. If openings no larger than those now leading into the pneumatic tube were adopted, a velocity of 22 feet per second through these openings would change the whole of the air every hour as above stated; and the pressure required to give this velocity, is only 0.122 ounces per square inch, the excess of pressure being absorbed principally by the friction of the tube. Even supposing that a Siemens steam blast be used for the purpose, it would be found more economical than the system now proposed. With this jet, the volume of air that can be exhausted by a volume of steam reduced to atmospheric pressure is 1·37 to 1, that is to say that, to exhaust 20,000 cubic feet of air per minute, 14,600 cubic feet of steam at atmospheric pressure would be required, corresponding to 9 pounds of steam per minute, or 540 pounds per hour, and representing a consumption of about 60 pounds of coal per hour. As we have said, this would not prove the most economical means of ventilating the tunnel, but the first cost of its establishment would be confined to the necessary connections and a small steam boiler. On the other hand, if a fan were placed close to the tunnel, an engine of three horse power, consuming from 10 to 15 pounds of coal per hour, would be ample for the purpose."

In view of facts like these, we hope that railway passengers, who find the atmosphere of our long railway tunnels sometimes disagreeable, will remember that the nuisance exists, not because it is difficult to overcome, but solely because railway companies are so careless and parsimonious as to refuse to burn a few pounds of coal, to promote the comfort of passengers.

Take, for example, the Erie Railway tunnel, at Jersey city, not quite one mile in length; was there ever a more smoky, foul, or disagreeable place for passengers to go through? The reason is obvious. Both tracks of the railway tunnel are constantly occupied by locomotives belching forth clouds of smoke, and the company employs no special means for ventilation. The area of the Erie tunnel is about the same as that of the London Metropolitan Railway, namely, 450 feet cross section, but it is twice the length of the Gower street station tunnel.

On the basis of the estimate given by *Engineering*, it would require the consumption of from 20 to 30 lbs., of coal per hour to ventilate the Erie tunnel, by an hourly change of its entire contents, while from 40 to 60 lbs. of coal would ventilate its entire length every half hour.

It will also be seen, from the foregoing, how utterly absurd is the bugbear which property owners and others have tried to raise against the construction of the Broadway Underground Railway in this city, namely, that its atmosphere would be bad. The truth is that the sectional area of the Broadway tunnel will not exceed that of the London Underground Railway. Calling the area 450 square feet, and the tunnels between the stations half a mile in length, the Broadway company will, according to the estimate of our cotemporary, be able to renew the entire contents of its tunnels every fifteen minutes on a fuel consumption of 40 to 60 lbs. of coal per hour, costing, say, 10 or 12 cents. This would probably give a better ventilation than is ordinarily found in our dwellings, offices, and stores.

Railroad Train Timer.

An ingenious invention has lately been successfully tested on the Vandalia Railroad, Ind., which records the motion of railway cars. There is a locked iron box, attached to one side of the car and containing a clock. The mechanism of the latter causes a small drum, on which is wound a sheet of paper, to travel at a constant rate. With the axle, by means of rods and gearing, a pencil touching this paper is connected. As the pencil is moved slowly across the paper, by its mechanism governed by the axle, and as the paper is slowly moved forward, the pencil point inscribes a diagonal line back and forth. The paper is ruled in very small sections, every fourth line being dotted and representing one mile; so that, supposing the car goes a mile in four minutes, the line will cross just four sections diagonally from one dotted line to the next one. If the car stops, the line crosses the paper directly and shows the number of minutes that the train is at rest.

The names of the stations are written at the proper places on the paper, and thus the exact rate of speed made at any point on the line can be subsequently noted. The apparatus thus affords an excellent check on the train officials, as, if the train be run ahead or behind time, the fact is sure to be detected.

The St. Joseph, Mo., Exposition.

An industrial and agricultural fair is to be held in St. Joseph, Mo., from September 7 to 12, inclusive. The grounds extend over an area of 100 acres, and form the site of large and commodious buildings, the main hall of which covers 30,000 square feet, and the machinery hall, 16,000 square feet, of surface. There is also a fine race course and ample accommodations for live stock. No entry fee is charged, and liberal arrangements have been made with connecting railroads.

The money premiums aggregate the large sum of $25,000, and are offered for almost every conceivable object and process. There are also special prizes, mainly awarded by the citizens of St. Joseph, two of which, at least, are evidently intended to benefit the community through the advantages of brisk competition. One is offered for the best calico dress made by any young lady under the age of twenty years, and the other to the mother of the best looking baby between the ages of one and two years. The individual who is about to undertake the arbitration of the last mentioned question has our cordial sympathy.

The Ruins of Farkin.

The Rev. Dr. H. D. Barnum, missionary in Turkey, in a recent letter to the New York *Observer*, gives an account of a visit he lately made to the ruins of Farkin, in Eastern Turkey, near the border of Persia. He says: *En route* to Van we spent several hours with great interest among the ruins of Farkin. The present town is little better than any of the other towns of Koordistan; but it is surrounded by a very fine ancient wall, and contains very imposing ruins, which for picturesqueness of effect fairly rival the Coliseum and the Forum at Rome. The most noticeable are a large cathedral and the elegant standing arches and pillars of a church, built 1,400 or more years ago, in memory of the Christian martyrs who were put to death by the King of Persia. There is likewise a very fine mosque or late date, also in ruins, and a palace, all of which combine to form a picture, the like of which is seldom seen in any land.

Spiral Bevel-Edged Arrow Heads.

We published not long ago an engraving of an Indian arrow head, with spiral bevels to give rotary motion to the arrow during its flight. The specimen was from the collection of Dr. Olmstead, who believed it to be unique. As a result of that publication, we have received several similar specimens; also letters from other individuals who are in possession of specimens. In the collection of 250 arrow heads belonging to Mr. A. J. Schultz, of Dayton, Ohio, there are six which have the bevels. From these evidences it appears that the rotating arrow was a not uncommon projectile with the North American tribes.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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NEW BOOKS AND PUBLICATIONS.

MECHANICAL HUMOR: a Collection of Original Anecdotes connected with Engineering and Mechanics. By J. Richards, Mechanical Engineer, Author of "The Principles of Shop Manipulation," etc. Price $1. Philadelphia, Pa.: George Richards, Franklin Institute Building.

Mr. Richards has collected in this volume several readable sketches and anecdotes of workshop life and its peculiarities, accidents, and remarkable occurrences. The last tale in the book, called "Struck by a Sea," is a good piece of descriptive writing.

AN INTRODUCTION TO THE STUDY OF GENERAL BIOLOGY, Designed for the Use of Schools and Science Classes. By Thomas C. McGinley, Principal of Croagh National School, Ireland. With 124 Illustrations. Price 75 cents. New York: G. P. Putnam's Sons, Fourth avenue and 23d street.

The rapid increase of our knowledge of the initial forms and phenomena of life, due so largely to the labors of Balfour, Carpenter, and Huxley, has awakened great interest in this most important branch of natural science; and there is a widespread demand for elementary and accurate text books of the subject, which Mr. McGinley has responded to in a terse, well written treatise, carried down to the latest date. We commend it to the notice of instructors in natural history.

THE LEADER, a Collection of Sacred and Secular Music for Choirs, Conventions, and the Home Circle. By H. R. Palmer and L. O. Emerson. Price $1.38. Boston, Mass.: Oliver Ditson & Co., 277 Washington street.

This volume adds one more to the number of books of dilute music which encumber the shelves of our school and other libraries. Most of the songs contained in this book would not pass muster as a school girl's first attempts at harmony; and the few meritorious selections in it (Mendelssohn's "May Bells" and one or two more) are garbled and disfigured to suit the "taste" of the compilers.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 31 to August 13, 1874, inclusive.

BOLT AND NUT LOCK.—I. D. Guyer, New York city.
CAR COUPLER AND BUFFER.—O. Pooley, Buffalo, N. Y.
CAR REPLACER.—E. Newcomb, Westbrook, Me.
CLOTHES WRINGER.—C. M. Howlett, Auburn, N. Y.
DENTAL ENGINE.—N. Stow, Binghamton, N. Y.
ELLIPTIC SPRING.—E. Cliff *et al.*, New York city.
EMBROIDERY ATTACHMENT.—G. M. Ramsay, New York city.
FORGING, DRILLING, & RIVETING MACHINE.—R. H. Thurston, Hoboken, N. J
FUEL FOR METALLURGY.—C. E. Lester, New York city.
GENERATING POWER.—C. C. Walcott *et al.*, Washington, D. C.
HARVESTER.—D. M. Osborne (of Auburn, N. Y.), London, England.
ILLUMINATING CLOCK DIALS, ETC.—H. O. Cook, Brooklyn, N. Y.
MAKING CHAIN, ETC.—J. Selden, Erie, Pa.
MAKING FISH HOOKS.—William Court *et al.*, Brooklyn, N. Y.
PAVEMENT.—P. Zadig, San Francisco, Cal.
PORTABLE FOUNTAIN.—G. J. Wenck, New York city, *et al.*
SELF-SUSTAINING MOTIVE POWER.—G. Rischmuller, San Francisco, Cal.
SEWING MACHINE FEED.—G. Merrill, New York city.
SHAFT COUPLING AND PULLEY HUB.—A. Brehmer (of Philadelphia, Pa.) London, England.
SWIMMING APPARATUS.—F. Tryon, Brooklyn, N. Y.
UMBRELLA.—C. A. Thompson, East New York, N. Y.
VEHICLE WHEEL.—J. H. Small (of Buffalo, N. Y.), London, England.

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Recent American and Foreign Patents.

Improved India Rubber Horseshoe.

Amzi J. Dean, Newark, N. J., assignor to himself and George D. Dean, same place.—This is a rubber horseshoe having an upper extending to the ankle, and drawn in on the rear part to overlap the heel. A full description with illustrations will be found on page 166 of this issue of the SCIENTIFIC AMERICAN.

Improved Horse Collar and Hames.

Martin Hubbell, Mount Kisco, N. Y.—In this device the hames are pivoted adjustably at the top, and are connected at the lower part by a pivoted adjustable latch, which slides, with its forked and notched end, over a guide bolt, and is locked thereon by a spring pawl.

Improved Machinery for Dressing and Finishing Hides and Skins.

John Pullman and John R. Edmonds, Wonersh, England.—This invention relates to improved machinery for "frizing," "fleshing," and 'scudding" hides and skins, and for staking and grounding leather. The machine consists of a suitable frame, in which is mounted a shaft, on which a long knife or a rubber is carried. Motion is imparted to the shaft, and to the knife or rubber which it carries, from a main shaft suitably disposed. The skin is laid upon a traveling apron, by which it is fed between a pair of rollers in proximity to the knife shaft and parallel therewith, the skin, after having passed through these rollers, being held by the operator against the knife or rubbers. Means are provided to stretch the skin and keep it flat when on the apron, and prevent it falling into folds or wrinkles in passing between the rollers.

Improved Means for Adjusting Knitting Burrs.

Geo. Campbell, Cohoes, N.Y.—This invention consists of an arm which supports the rotating loop, or stitch adjusting or discharging burr, of a knitting machine. It is fitted on a vertical screw stud of the permanent arm, and has a thumb nut below and a jam nut above, together with a steady pin in one of the arms working freely through the other, whereby the vertical adjustment of the burr relatively to the needles, and to the other burrs, can be easily and accurately effected, and the arms be rigidly and permanently fastened.

Improved Button Hole Bouquet Holder.

J. Albert Kimball, New York city.—A hooked plate is attached to the under side of the lapel of the coat, just below the button hole, through which the stems of the flowers are to be passed. An elastic strap is then passed around their stems, and secured by a loop passed over a projecting hook on the plate.

Improved Blacksmith's Tongs.

Daniel Kunkel, Oregon, Mo.—This is an improved instrument for use for a drill extractor, a blacksmith's tongs, a vise, a wrench, and for various other uses. It consists in a pair of pivoted jaws, arranged in suitable frames with a screw shaft, and so combined that the jaws are worked by moving the shaft out or in.

Improved Hog Elevator.

William Kelly, Susquehanna Township, Dauphin county, Pa.—Two posts are set in the ground and cross bars are passed through mortises in them. The upper sides of the cross bars receive longitudinal bars, a pair of which is connected with each pair of cross bars. The longitudinal bars are notched upon their upper edges, to receive the gambrels when suspending the carcasses. The upper ends of the posts are connected by a beam, in which is a pulley, around which passes a rope; in one end is an eye, to receive a hook attached to the gambrel. The rope is passed around a bar, which is pivoted in a mortise in the lower part of the post. With this construction, by raising the outer end of the bar, the end of the rope runs down, so that its eye may be placed upon the hook. Then, by lowering the free end of the bar, the animal will be raised, so that the gambrel may be turned to rest upon the bars.

Improved Cotton Press.

William H. Walker, Charleston, S. C.—The follower works up against a stationary press head, and is connected by rods with the crosshead. The under side of the latter is cam-shaped, and rests on friction rollers in the upper ends of segmental wheels, turning on axes, and having the power applied at the lower end for working them. Slotted heads connect with the wheels by pins in the slots, the heads being worked by an engine, to the rod of which they are connected, and the slots are curved so that the diminution of the throw of the head, which takes place as the wheels approach the vertical lines of the pivots, is to some extent compensated by the pivots being forced up said curves.

Improved Fluting Iron.

Charles Anderson, Boone, Iowa.—The upper surface of the bed piece is an arc of a circle, with grooves therein of any desired form. The lower side of the upper portion of the device is grooved to correspond. In this upper portion is a cavity to receive a heated flat iron, so as to allow the heat from the flat iron to be transmitted to the fluter indirectly through a stratum of air, and thus to be tempered.

Improved Wind Wheel.

George Candee, Paddy's Run, Ohio.—The wings consist of a frame and panel, the said panel fitting snugly into said frame. The ends of the panel are pivoted eccentrically to the ends of the frame. A weight of sufficient size is arranged to hold the panel in line with the frame, under ordinary circumstances; but should the wind greatly increase in force, the panel will turn upon its axis, presenting its edge to the wind, the weight bringing it back to its place as soon as the force of the wind abates. The wings are held against the wind by another weight, and mechanism is provided so that, should the wind increase in force, stop blocks will be pushed back, raising the weight. The wheel will thus be stopped by an excess of wind, and will start again automatically as the wind abates. There is also a vane with suitable wings, adapted to serve as a governor, and so arranged that, as the wind increases in force, the outer ends of the wings are forced back, which raises a belt shifter and prevents the machine from being driven any faster by the increased velocity of the wind wheel. Should the wind still increase in force, the other devices are operated to throw the wings of the wind wheel out of the wind. As the force of the wind abates, the belt shifter drops downward, which increases the relative velocity of the machinery.

Improved Car Brake.

Stephen C. Taft, Franklin, Mass.—Triangular brackets are attached to the truck frame, the angles of which are down, and directly below one of the axles. There is a friction wheel on a shaft, the latter entering a bent ever attached to one bracket. This shaft is free to revolve, one end in the bent lever and the other in the bracket. A chain wheel is fixed on another shaft, which shaft revolves in the brackets. A loose friction chain passes around the chain wheel attached to the lever. A rod is attached to an arm on the chain wheel shaft, which extends to the locomotive, and is connected with a windlass shaft and wheel, which is under the control of the engineer, by means of which he can apply the brakes to all the cars in the train. When the rod is drawn toward the locomotive, the friction chain is tightened on the wheel, which draws on the bent lever. One end of the friction wheel shaft being confined in this lever, this movement will raise the friction wheel, and cause it to come in contact with the axle. The axle being revolved rapidly will cause the friction wheel and shaft to revolve, winding up chains, one of which connects with the brakes of the cars in front, and the other with the brakes of the rear cars. As the wheels cease to revolve, the friction wheel will cease to act, and the cars will stop. The back motion of the rock shaft is produced by a spiral spring.

Improved Treadle.

James W. Staples, Biddeford, Me.—The treadle rod is pivoted to the sewing machine table, and hangs down to a point a little above the frame connecting rod, where it is provided with a foot piece. A bell crank is pivoted at its angle on the connecting rod, and connected by one arm by means of a rod to the crank, while the other arm is attached to the treadle rod. The driving pulley turns in a plane at right angles to that in which the treadle rod swings, and a link is employed for connecting the bell crank with the rod attached to the crank, to allow the former to vibrate in two directions.

Improved Devices for Preventing Children from Falling Out of Windows.

Gabriel Konigsberg, New York city.—Horizontal rods are placed across the lower part of the window, and supported in wooden blocks. Each block has a central perforation for the rod, which is cut exactly to the width of the window, the blocks being placed between the sash-guiding strips. A sufficient number of blocks and rods are arranged in the window to prevent any possibility of accident or danger to the children looking out. The uppermost block is secured, so as to bind firmly the whole series of blocks together. By detaching the fastening device or sash, the uppermost blocks may be raised and carried on the rod toward the center, so that the upper rod may be readily taken out of the sash strips, and then the other rods with their blocks raised from their connecting blocks and detached from the window.

Improved Call Bell.

Samuel G. Levey, New York city.—This invention consists of a movable rack for holding advertising cards or bills, connected with a call bell for hotels and the like places, and provided with mechanism for moving it, so arranged that each time the bell rod is operated for sounding the bell it will cause the rack to shift the breadth of one or more of the cards or bills, to change them about and present different ones to view, in a manner calculated to attract attention.

Improved Telegraph Insulator.

Chas. L. Le Baron, Pensacola, Fla.—This invention consists in a peculiar construction and mode of fastening telegraph wire insulators, whereby security and facility of appliance may both characterize the same device.

Improved Cooking Lamp.

George P. Houston, Washington, D. C.—This invention relates to and consists in means by which alcohol may be utilized as fuel upon excursions, hunting, or other expeditions, and in localities or seasons where but little fire is desired. This is accomplished by means of a folding stand, constructed to receive the cooking vessel and heater in a novel and convenient manner.

Improved Tool for Charging Piles of Railroad Rails and other Iron into Furnaces.

Smith W. Kimble, Springfield, Ill.—This invention relates to and consists in means for charging railroad rail piles into heating furnaces with convenience, facility, and economy of human labor.

Improved Piano Sound Insulating Attachment.

Wm. R. Miller, Baltimore, Md.—This invention relates to a novel mode of applying a non-conductor of sound to a piano, so as to prevent its diversion and partial escape by way of the legs.

Improved Pipe Mold Drying and Casting Pit.

Benj. S. Benson, Baltimore, Md.—This improvement relates to the floor of the oven and casting pit, and consists in providing the plates or sections which compose the same, with a series of apertures, peculiarly arranged for the upward passage of the hot blast to act on the pipe mold, both interiorly and exteriorly.

Improvement in Metal Pipe Manufacture.

Benj. J. Benson, Baltimore, Md.—The object of this invention is to provide an improved pit or oven for drying pipe molds and casting pipe therein, together with improved appliances or apparatus connected therewith for hoisting, carrying, adjusting, supporting, and locking or fastening the mold flasks.

Improved Combined Looking Glass and Photographic Frame.

Isaac N. Shatto, Newport, Pa.—An inner frame is hinged to the outer frame. The hinged frame has the glass inserted in it, and is provided with a back, which is covered with velvet. The main frame is also provided with a back and with a glass, between which and the back photographs or records are to be placed. By this construction, the device, when closed, presents no appearance of being anything but an ordinary looking glass.

Improved Mill Burr Dress.

John D. Miner, Moffett's Creek, Va.—This invention relates to means whereby a mill burr may be dressed so as to prepare the grain for flouring at the eye of the stone, and thus save a large percentage of the power ordinarily required under like circumstances, as well as permit the mill to be operated by twenty-five per cent less water.

Improved Cream Suet Compound.

John Hobbs, Boston, Mass.—This invention consists in a novel and valuable process, by which tallow may be so prepared and intermixed with partially churned cream that the product will subsequently granulate and assume a waxy appearance. It will then have the odor and flavor of cream, while it possesses the property of remaining solid up to a temperature of 90°, and of allowing a clean cut at all times.

Improved Low Water Indicator.

Charles N. Myers, Chicago, Ill.—A float controls the valve by which the whistle or alarm is sounded when the water becomes too low. The valve rod is extended horizontally, and supported in a socket formed in one side of the float case, and in the fork of an arm of an elbow lever connected with the float. This forked arm moves or slides the valve rod, when the float rises or falls, by engaging fixed collars on projections on the rod. The rod is also adapted for application of a device for turning it and grinding the valve to its seat.

Improved Surface Planer.

William C. Margedant, Hamilton, Ohio.—This invention relates to surface planers, and consists in causing the apron, which prevents the collection of shavings on the rollers, and the bonnet, which catches the shavings and throws them on the apron, to serve as an upper table.

Improved Vehicle Rein Guard.

William Levy and William H. Christian, Ashland, Pa.—This invention relates to harness, and consists in means whereby the entanglement of driving reins with swingle trees, and many other accidents, may be effectually prevented.

Improved Machine for Molding Pipe Molds.

Benjamin S. Benson, Baltimore, Md.—This invention is an improvement on the machine for preparing the molds for casting metallic pipes, for which letters patent No. 33,178 were granted, September 3, 1861. The improvement relates to an adjustable counterbalance for the flask holder, whereby an equipoise is maintained during the vertical movement of the latter; also, to the arrangement of radial revolving fingers in the sand hopper, to act in regular succession, to throw a constant and equable stream of sand into the flask; also, to a revolving cone for equalizing the distribution of sand within the hopper; also, in a spring balance or weighing attachment for determining, in advance, the weight of the molds.

Improved Fertilizing Compound.

Benjamin G. Carter, Oatlands, Va.—This invention relates to fertilizing compounds that are intended to take the place of stable manure, yielding to the plant all those elements of its composition in which the soil is liable to be deficient. It contains, in a cheap and easily transportable form, all the ingredients which give value to stable manure.

Improved Combined Ventilator and Chimney.

Walter R. Hinkley and Charles J. Dibrell, Dallas, Tex.—This invention consists of an iron-lined inner flue, secured within an outer casing with suitable bottom and top perforations for establishing a ventilating air current around the flue. The casing is securely attached to the ceiling and roof, and supported on suitable hangers or straps. A detachable extension flue is set into the upper end of the inner flue, and provided with rain-protecting caps or sheds at its top and above the upper perforated end of the ventilator.

Improved Hot Air Register.

Edward A. Tuttle, New York city.—This invention consists of the moving device for operating the fans of a register. It forms part of the register front or top, and is fitted, arranged, and secured in the stationary part by lugs in front of and behind flanges on which the movable part slides to work the fans. The said lugs and the flanges are so contrived that the parts subject to wear are hidden from view. The said moving part is connected with the fans, so that, when all parts are adjusted in place, its escape through the notches, by which the lugs going behind the flanges are introduced, is prevented.

Improved Lid for Closing Gas Retorts, Sugar Filters, etc.

James Dunseith, New York city.—This is an improved lid for gas retorts, sugar filters, and other vessels that require to be closed airtight, and in such a way that they can be readily opened and closed, as required. By suitable construction, should tar, coke, or other substance get upon and adhere to the mouth of the vessel, a few turns of the lid back and forth will bring said lid to its seat, and the said substance, instead of doing any harm, will be a positive benefit by serving as a seat to the lid. Afterward by turning the lid in the direction to cause the rollers to roll up inclined beads, the lid will be forced firmly into its seat. This construction also enables the lid, should it become worn, to be readily ground to its seat, so as to always shut airtight.

Improved Corn Planter.

James W. Simpson, Dry Ridge, Ky.—The wheels carry the axle with them in their revolution when turning forward, and allow the axle to be stationary when the wheels are turned backward. To the axle are attached cams, which, as the said axle revolves, strike against a bar and push it forward. In the upper arms of bars, connected with the bar last mentioned, are formed holes to contain seed enough for a hill, and in such positions as to enter the hoppers to receive the seed as the bar moves back, and to pass out of said hoppers, and over holes in the platform as the bar moves forward. As the seed drops through the holes in the platform, it is received upon lower arms of the second bars, and held until the first bar moves back, when it drops to the ground. The driver, from his seat, by operating a lever, can raise the furrowing plows from the ground when desired. The covering plows are placed a little in the rear, and at one side, so as to fill the furrows opened and cover the seed. The covering plows may be raised from the ground with and by the furrowing plows. Small V-shaped harrows are drawn in the rear of the covering plows. The same movement of the lever raises all the plows and the harrows from the ground. By operating another lever, the axle may be turned by hand to adjust it with respect to the dropping device, and to the wheels; and by means of a third lever, the dropping device can be operated by hand, or held from operating, as may be desired.

Improved Cotton Press.

John H. Simonson, East Norwich, N. Y.—The followers are fitted to slide up and down inside of the case, the lower one having the long projections extending through slots, to be connected to racks for being raised and lowered by gears. The upper one has the short projections extending through slots, to be connected to racks which are also operated by the gears. The racks move the heads in opposite directions by one and the same movement of the wheels. The latter are geared with the driving shafts by a pair of eccentric toothed wheels, so adjusted that the leverage of the power increases progressively as the work progresses and the resistance increases. The driving shaft is worked by a hand lever, pawl, and a ratchet wheel. The ratchet wheel is made eccentric to increase the gain of leverage. The projections of the other follower connect with racks by sliding under hooks, by which the follower is pulled down. They have a hook projecting over the said hooks, by which the follower is raised when the racks are forced up. The racks also have a hook, by which they engage with the cross bars when raised up to be held properly for the projections to engage with them when the follower is moved back over the press when it is filled.

Improved Spring Rocking Chair.

Stephen Fallon, Brooklyn, N. Y., assignor to himself and Joseph A. Hodgens, of same place.—The base frame consists of two side frames connected at their upper middle parts, and at their rear parts by rounds. To the seat frame are attached two or more springs, which are coiled around, and their other ends are attached to the round, the ends of which work in sockets in the frame. Thus the springs form the only connection between the seat and frame, so that the seat is both supported and rocked on them. By withdrawing a pin and turning the round, the tension of the springs may be increased or diminished, as desired.

Improved Fluting and Smoothing Iron.

Benjamin F. St. John, Shelbyville, Ind.—The handle has a base with a flange, which latter surrounds the smaller upper section of the iron when the handle is attached. The upper section is cast on and forms a part of the iron. A spring hook, attached by a pivot pin to the handle, works through a hole in the front of the flange and enters a hole in the upper section. At the rear end, the handle is attached by means of a pin in the upper section and a hole through the flange.

Improved Sewing Machine.

John Speirs, New York city, assignor to himself and Henry F. Cox, same place.—This is a novel means for operating the looping hook of that class of sewing machines in which an under looping thread is used. It consists in the mechanism for imparting a rocking lateral movement to the looping hook, for moving the hook to and from the needle in a longitudinal direction.

Improved Paper Bag Machine.

Truman Hotchkiss, Stratford, Conn.—This machine is for making satchel bottom bags of various sizes. The paper is drawn down over the guide roller, and forced along under the movable shear, over the stationary one, to a table in front of the forming roller and the folding roller. One margin of the paper strip also passes under the pasting roller to receive the paste, by which the edges, joined in the forming of the tube, are pasted. It also passes between the former and folder and under the presser bar. As soon as the end of the paper strip comes to a gage, it stops and is cut off by the fall of a cutter. The folders then commence to turn, and at the same time the pressure bar springs down and presses the paper against the forming roller, so that it will be drawn in between the folding rollers and folded. By the same operation, the margin of the paper at the knife is drawn under the pasting roller on the cutter and pasted, for securing the folds of the bottom of the bag. When the roller folders have made one revolution and formed the tube and united the edges, they rest, while the sliding horizontal end folders go forward just in front of the end of the former, and fold in two sides of the extension of the tube beyond the former to form the bottom. Then the vertical sliding folders move forward and fold in the other two sides, and complete the bag. An ingenious device, lastly, flattens the bag down at the sides, and folds the bottom down flatwise on the upper side, so that it will pack into bales or boxes economically, without injury to the bottom.

Improved Corn Husking Machine.

Edward Ellison, Waverly, Md.—This invention relates to means whereby corn may not only be denuded of the shuck, but at the same time relieved of the stem, and whereby the ear, the leaves of the shuck, and the excised stem may be discharged separately, the leaves being left in a state ready to be used for mattresses and kindred purposes.

Improved Floor Clamp.

James Carlile, Springfield, Mass., assignor to himself and J. H. Haskins, same place.—This invention consists of a pair of griping levers pivoted to a hand lever, or to a pressure plate or board on it, for acting upon the edge of the flooring. It is arranged in connection with cam grooves in a plate also attached to the lever, so that the gripers being placed on the joist with the points near the lower edge, and the hand lever above, with the pressure plate against the flooring, and the hand lever being pressed forward in the direction to clamp the flooring together, such action will cause the gripers to bind firmly against the joist, and hold for a fulcrum for the hand lever, and will let go and release the hand lever when the latter is moved back after pressing the flooring.

Improved Staging Clamp.

Charles E. Richards, Orange, Mass.—The clamps are made of iron rods one half inch, more or less, in diameter. The bodies are of a length equal to the breadth of the ledger boards, and are bent at right angles to pass across the edges of the same and the sides of the poles. They are bent again at right angles to overlap the outer side of the poles, and their ends are bent inward at right angles, and are made sharp so as to be driven into the said outer side of the poles. They are also arranged diagonally across the inner side of the poles, and their ends are bent inward in opposite directions to overlap the outer side of the poles from the opposite sides, so that the strain will come against the said poles. The ledger boards are kept from slipping in the clamps by wedges. By this construction, the scaffold is put up without the use of nails.

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Business and Personal.

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

Telegraph Inst's. M. A. Buell, Cleveland, O.

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

Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

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Lathes, Planers, Drills, Milling and Index Machines Geo. S. Lincoln & Co., Hartford, Conn.

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Best Philadelphia Oak Belting and Monitor Stitched. C. W. Arny, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for new circular.

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Answers to Correspondents

J. E. H. will find results of experiments on the tensile strength of steel in Trautwein's "Engineer's Pocket Book."—F. C. B. will find directions for making pickles on p. 181, vol. 27.—H. W. C.'s queries as to elevator belts and mill gear are incomprehensible.—J. M. E. will find descriptions of pontoon and other bridges in Mahan's "Civil Engineering."—W. P. D. will find directions for preserving entomological specimens on p. 404, vol. 29.—W. P. can repair his damaged looking glass by the process described on p. 203, vol. 30.—G. L. H. will find a recipe for paraffin varnish on p. 91, vol. 31.

E. H., Jr., asks: What is the proper length of the inside of a link for an engine of 3¼x4 inches, whole throw of valve being ¾ of an inch? A. There is no general rule. Make it of such a length that it seems well proportioned to the other details.

C. H. C. asks: What is the theory or philosophy of the improvement of a violin by age? Is it the use of the instrument, or its age, or both, that produces the improvement? A. Violins doubtless improve by age, as they become better seasoned; and the superiority of a few very old violins is due to their excellent manufarture.

G. I. E. asks: Will a siphon pump answer the same purpose as a steam pump? Will a siphon pump lift the water 28 or 30 feet and deliver it 20 feet? Will it take as much or more steam to run the siphon as a regular steam pump? We use a steam pump, 300 feet from mill, to draw water from well and through it to mill, sufficient to make steam for a 20 inch cylinder engine. We take steam from mill to steam pump. A. We think that your present arrangement will be more satisfactory than the one that you propose.

W. H. asks: How is the common governor of a horizontal stationary engine made to govern the steam as it goes through the pipe to the cylinder? A. Either by closing or opening the throttle valve, as occasion may require, or by changing the period of admission of the steam to the cylinder.

How many lbs. of coal would be required to reduce 40 tuns of $2\ Fe_2\ O_3,\ 3\ HO$? A. It would depend somewhat upon the process. You should consult a good work on metallurgy.

C. F. S. asks: Can I use a round belt to run at quarter twist from a 24 inch pulley (running at 100 revolutions per minute) to a 16 inch pulley? A. Yes. As to your other question, consult a manufacturer.

W. R. H. asks: When is it 12 o'clock, when the clock strikes the first stroke, or when it strikes the last stroke? A. At the commencement.

A. Z. says: I made a tin blower, 10 inches in diameter, with 4 fans, square at ends; the fans measure 9 inches from end to end. I have a 2½ inch pulley on fan shaft, and a 48 inch fly wheel on foot lathe, from which I take the belt. I run the fan as fast as I can, but it does not blow worth a cent. The opening in side is 8 inches, outlet is ¼ of an inch. What is the matter with it? A. Probably you have made the fans so that, instead of forcing out the air, they just keep it in motion within the case.

S. says: 1. I have a hydraulic press, the pressure on the ram being 2½ tuns per square inch. How much pressure is there on the walls of the cylinder? Does the pressure vary on the walls of the cylinder as the ram is being pushed out? A. The pressure per square inch on the side of the cylinder at any time, is approximately the same as that on the ram. 2. By what rule do you ascertain the necessary thickness of cylinder to withstand any given pressure? A. You will find rules for proportioning thick cylinders in the SCIENTIFIC AMERICAN for June 21, 1873.

S. & M. say: We have a 6 inch pipe in a 60 foot well. Can we attach a 2½ inch cylinder and pump water as easily, as if we used a 1¼ inch pipe? A. Yes, under ordinary circumstances.

A. A. J. says: In a large steam saw mill, we have to take water from a swamp, and a great deal of mud is pumped into the boilers and fills the gage cocks and steam gage with finely powdered earth, which also gets into the cylinder and completely fills the ends up, notwithstanding that we have a pipe leading from the main pond to a large wooden tank, which the water goes into and from which we take the water. What is the best means of purifying the water? Do you think it could be filtered. and what would be the best kind to make? We use about 2.000 gallons per day. A. You could readily filter that amount by means of a filter bed composed of gravel and sand. By having two tanks, from which to draw on alternate days, the water might be purified sufficiently by simply allowing the heavy particles to settle at the bottom.

A. P. A. asks: Is it possible to store up motive power in compressed air? How far can atmospheric air be compressed by mechanical power? What amount of power can be evolved from compressed air, proportionally to the size of receptacle containing it? A. Air can be compressed and used as a motive force, in exactly the same manner as any other permanent gas. We have heard of its being compressed to 300 atmospheres.

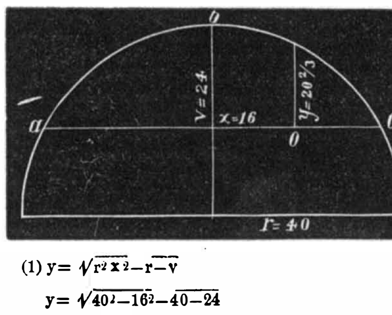
What is the name of the metal whose existence in the sun was discovered, through the spectroscope, before its discovery in our planet? A. We never heard of it.

W. S. B. asks: What force can be resisted with a lever 4 feet long, placed upon a shaft 6 inches in diameter, with a pinion 12 inches in diameter? It is to work similarly to a sawmill carriage, only to be applied vertically. A. Neglecting friction, the pressure produced by the pinion on the rack will be 8 times as great as that applied to the lever.

M. J. B. asks: Is six inches of air space, lined with two coatings of heavy manilla paper, between the double wooden walls of a refrigerator room as efficient as a non-conductor as the same space filled with hair? Is it equal to three inches of hair? A. Dry air will be the best.

T. McK. says: I desire to construct a kaleidoscope in such a manner as to enable me to photograph the numerous designs therein produced. I propose to make it 26 inches long between the object or design, and the plate holder, the photographic lens to be midway between the ends and enclosed in the case. 1. Can I obtain light enough through the ground glass of the object end, to take a good picture? A. Yes. 2. What kind of lens must I use? A. A good achromatic glass of about 13 inches focus. 3. Is it necessary, in taking photographic pictures, to expose the lens of the camera to all the light possible, or can a picture be taken with the lens enclosed or shielded from all light, except that from the object photographed, if that object be well lighted? A. No light should fall on it except that from the design.

J. B. S. asks: What is the best practical method of finding the lines for a curved rib, when the radius is 100 feet? A. By ordinates, as follows:



$$(1)\ y=\sqrt{r^2-x^2}-\overline{r-v}$$

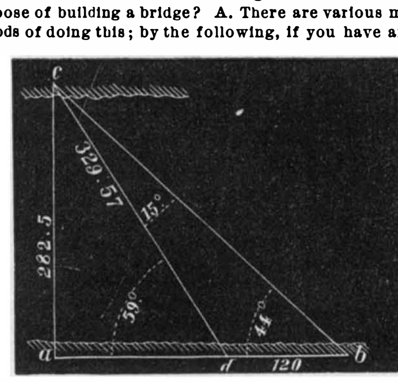
$$y=\sqrt{40^2-16^2}-\overline{40-24}$$

$$y=(\sqrt{1344}-16)=36{\cdot}66-16=20{\cdot}66$$

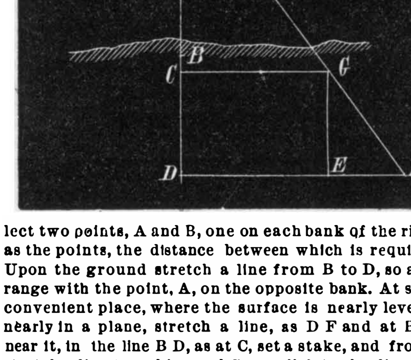
In the segment $a\ b\ c$, the hight at the center, or the versed sine, is 24 feet, and to trace out a curve whose radius shall be, say 40 feet, take any point, as o, and draw an ordinate, y, at right angles to the chord, $a\ c$. The length of this ordinate depends upon the distance, x, that it is from the center of the segment, and is equal to the square root of the difference between the square of the radius and the square of the distance, less the difference between the radius and the versed sine, as expressed by the formula (1). Thus the length of any number of ordinates may be found, and the curve traced; and in the same relative manner the curve for the segment of a circle of any radius may be found.

What is the best method of saw-kerfing a piece to fit any required circle? A. No good work of this kind can be made by saw-kerfing; but the best will be when the saw is held radial to the curve.

How can I measure across a large stream for the purpose of building a bridge? A. There are various methods of doing this; by the following, if you have an instrument to measure angles, you may obtain either the direct or the oblique span:



Stake out the line, $a\ b$, parallel with the course of the river, and measure $d\ b=120$ feet, the angle $c\ b\ d=44°$, and the angle $c\ d\ a=59°$. Place a stake, a, at a point observed to be where a line at right angles to $a\ b$ will cut c. Then $59°-44°=15°=$ angle $d\ c\ b$. Then as the sine of 15° is to 120, so is the sine of 44° to $329{\cdot}57=d\ c$. And as radius is to 329 57, so is the sine of 59° to $282\ 5=a\ c$. If you cannot command the use of surveyor's instruments capable of measuring angles, the problem may be solved by the following method, which has the merit of being very simple: Select two points, A and B, one on each bank of the river,



as the points, the distance between which is required Upon the ground stretch a line from B to D, so as to range with the point, A, on the opposite bank. At some convenient place, where the surface is nearly level or nearly in a plane, stretch a line, as D F and at B, or near it, in the line B D, as at C, set a stake, and from it stretch a line to and beyond G, parallel to the line D F. The angle C D F need not be a right angle, but the distances C D and G E must be equal, so also the lines C G and D E must be equal. Now select the point F in the line D F, so that it will be in range with G and A. These points definitely established by stakes set in the ground, they afford homologous triangles, by a comparison of which the desired distance from A to B may be ascertained. For example: The triangle E G F is homologous with the triangle D A F, having all its respective lines and angles in proportion. Therefore, E F : E G :: D F : D A; and from this, $D\ A=\dfrac{D\ F\times E\ G}{E\ F}$ or the distance D F multiplied by the distance E G, and the product divided by the distance E F, the quotient will equal the distance D A. Having this, and deducting the distance B D, the residue equals the distance A B. Example: Let C D=55 feet and D E=80 feet, and upon trial let it be found that E F=40 feet; then, 40 : 55 : : 120 : 165=A D, and 165—55=110=A C. Also, as the triangle A B G is proportionate to the triangle G E F, therefore, 40 : 55 : : 80 : 110=A C.

Is the annexed rule correct for finding the radius when the chord and versed sine are given? Rule: Add the square of half the chord of the arc to the square of the versed sine, and divide this sum by the versed sine. A. No; there is an error in your statement of the rule. You must divide by *twice* the versed sine.

F. S. C. says: Sidney Whiting, describing the royal carriages in the sun. says: "In form, too, the carriages were conchial, and were furnished with wheels without tyres; for by a peculiar contrivance, each spoke possessed an elastic spring just at the point of its articulation with the nave, so that at every evolution an onward motion was imparted, independent of any power the driver himself might exert." Can such a thing be arranged so as to be practicable? A. We cannot answer for what takes place in the sun; but on the earth, we are confident that no peculiar contrivance will enable power to be utilized without the expenditure of power

E. W. St. J. says: I am running an engine and I have been troubled about the pump in raising water. I have been pumping about as high as the pressure of the air will raise it, and had no trouble until I tried to pump from a barrel that was supplied with water from another well by means of a steam jet pump. Now the barrel is placed in the old well, some two or three feet higher up than where I pumped from before; but I cannot make the suction pump raise the water from the barrel to the engine room. It seems as though it ought to pump better now, as the water is two or three feet higher up than it was before. The water from the new well is not pure it is of a light color, and gets this from the blue clay in the well, and the water from the jet pump is warmed by the steam. What is the trouble with the water or the pump? A. The warm water seems to be the cause of the trouble.

S. H. C. asks: At what part of the stroke of the piston should the steam be cut off, in a Corliss engine, to be the most economical? A. Let your engine do the required work, and then set the cut-off as near the beginning of the stroke as possible.

E. asks: Is glass a conductor or a non-conductor of heat? A. Glass is one of the poorest of heat conductors.

J. S. asks: Is there a patent instrument by which the correct distance of an object can be told without measuring? A. We know of no such machine.

J. G. H. says: I have been running an engine; and to get speed to thresh wheat, I had to increase the driving pulley, which I did by putting on wood, from 24 inches in diameter up to 47 inches. The engine is rated at 4½ horse power, and works very well while attached to the thresher, and runs steadily; but in running alone it runs very irregularly, and sometimes will stop. The governor seems to act freely, and the engine works well when attached to or doing work. Why will it not run as well when doing nothing but pumping? A. The trouble may be either with the governor or the pump. We could not give a positive opinion, from your account.

H. asks: What are meant by the following, viz.: engine lathe, Monitor lathe, friction pulley, and blowing cylinders? A. An engine lathe is a lathe having a face plate and generally a short bed, being suitable for chucked work. A Monitor lathe is one with a revolving rest, having several tools fastened in it at the same time; it is generally used for small work. A friction pulley is a pulley which drives or is driven by the friction caused by its face being forced against another face. A blowing cylinder is the air compressor in blast engine, used in iron-smelting, etc.

T. H. W. asks: How can I best anneal iron boiler tubes, so as to make necessary flanges on the ends when inserting them? A. Heat them to a red and allow them to cool in fine ashes or slaked lime. 2. Would not some method by which the tubes of locomotive boilers could be removed or replaced more readily than by the present system, be valuable? A. Yes.

1. Can fulminate of mercury, about an ounce in quantity, be safely sent through the mails? A. It would be highly dangerous and criminal to send it by mail. 2. How is it made? A. See p. 90, vol. 31.

When small brass work is finished in a lathe or with a file, with what should it be coated to preserve its polish? A. With lacquer.

J. B. says: I have no appetite, and am quite weak, with cold sweats every night. What should I do? A. Take a 1 grain citrate of iron and quinine pill every night before retiring.

C. R. asks: Can boiled starch be kept fresh for some time, without getting sour? A. Yes, from two to four days, by adding sulphate of copper.

F. C. K. asks: Is there any process for rendering woolen cloths impervious to water? A. Cloth is rendered waterproof by simply passing it through a hot solution of weak glue and alum. To apply it to the cloth make up a weak solution of glue; and while it is hot add a piece of alum (about 1 oz. to 2 quarts), and then brush it over the surface of the cloth while it is hot, and then dry it. Cloth in pieces may be run through this solution and dried. By adding a little soap, the goods will feel softer. Woolen goods are prepared by brushing them first on the inside, and then with the grain or nap of the cloth. It is best to dry this first in the air, and then in a store room at low heat. Cloth thus prepared is impervious to water, but pervious to air.

C. B. N. asks: What do brewers use to make beer sparkle when filled into the glass? It is evidently due to carbonic acid gas; but what is the process by which beer is charged with this gas? A The effervescence you speak of is due to carbonic acid generated by fermentation.

G. J. E. says: Conch and similar shells, when held close to the ear, produce sounds similar to that of the Gulf heard from a distance. What is the philosophy of this? A. It is caused by irregular concentration and reflection of sound.

N. A. W. asks: What is the resulting compound from mixing an acid and an alkali, and its known or probable effect on the human system? A. A complete answer to your question would require too much space. The compound resulting from the combination of an acid with a base is what is known as a salt, of which there are many hundreds. Their effects on the human system are as numerous and as varied; for instance, muriatic acid and soda combine to form common table salt, comparatively harmless, while hydrocyanic acid and potash forms one of the most deadly poisons known.

Is light bread, made by using an acid and an alkali, wholesome? A. The utility of yeast, baking powder, etc., as used for the leavening of bread, is due to the quantity of carbonic acid gas generated by them under certain circumstances. That amount of gas taken into the stomach is not injurious. The small quantity of the alkaline salt formed seems to aid rather than retard the digestion of the food containing it.

J. S. asks: What is the color of the pure juice of lovage? A. "*Ligurticum levisticum* (lovage) is an umbelliferous plant, growing wild in Southern Europe, and often cultivated in gardens. The whole plant has a strong, sweetish, aromatic odor, and a warm, pungent taste. When wounded it emits a yellow, opaque juice, which concretes into a brownish, resinous substance, not unlike opoponax. The roots, stems, leaves, and seeds have all been employed, but the last have the aromatic properties of the plant in the highest degree.' —*United States Dispensatory.*

E. F. B. asks: When will a balloon rise more easily, when the air is heavy or when the air is light? A. The ascending power of a balloon does not depend upon the state of the atmosphere; for, as the barometer sinks, the gas expands or increases in volume in exactly the same ratio as the air.

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

G. W. J.—It contains no silver. It is a flint coated with oxide of iron.—H. D. B.—We cannot spare the time to make an organic analysis. Your specimens resemble buttons made of pressed paper, and a hard, gummy substance, with a waterproof black varnish upon the outer surface.—A. M. B.—Nos. 1 and 2 contain no silver; they are principally silica and iron. No. 3 is red jasper; No. 4 is mica, hornblende, and iron. No. 5 gives every indication of an ore containing a good percentage of manganese; also iron. No. 6 is felspar. No. 7 is carbonate of lime, silica, and traces of iron. No. 8 is a variety of fine blende, with sulphide of iron. No. 9 is iron silica, alumina, etc. No. 10 is hematite.

COMMUNICATIONS RECEIVED.

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

On Storms. By S. A. M.
On Perpetual Motion. By F. V. F.
On Mesmerism. By G. H.
On an Ice Box. By C. E. K.
On Beveled Arrow Heads. By A. E. D.
On a New Motor. By D. D. P.
On Some Magnetic Experiments. By A. F. O.
On Steam Cars. By F. G. W.
On Steam Locomotion. By M. G.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mucilage? Where can I buy the best style of windmills?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States

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August 11, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

30,651.—HARVESTER.—S. W. Tyler. October 28.

EXTENSIONS GRANTED.

29,694.—CLOTHES DRYER.—D. K. Hickok.
23,707.—CULTIVATOR.—T. W. McDill.
29,727.—SHAPING AND MOLDING MACHINE.—H. D. Stover.
29,728.—PLANING MACHINE.—H. D. Stover.

DESIGNS PATENTED.

7,627.—OIL CLOTH.—J. B. Virolet, Paris, France.
7,628 & 7,629.—ROSETTES.—A. H. Austin, New York city.
7,630.—COFFIN HANDLE TIP.—G. W. Bunnell, Meriden, Ct.
7,631.—DOOR BOLT.—A. W. Hirschfeld, Meriden, Conn.
7,632.—VEIL.—S. M. Meyenberg, Paterson, E. J.
7,633.—BOOT JACKS.—M. E. Nichols, Clarksville, Mo.

TRADE MARKS REGISTERED.

1,925.—GROUND CORN.—Pearl Hominy Co., Baltimore, Md.
1,926.—TERRA COTTA.—R. Ellin & Co., New York city.
1,927.—SODA WATER.—Harrison *et al.*, Davenport, Iowa.
1,928.—GAS MACHINES.—Keystone Safety G. M. Co., Phil.
1,929 & 1,930.—SUGARS.—F. O. Matthiessen *et al.*, Jersey City, N.J.
1,931.—DYE STUFFS, ETC.—Weeks *et al.*, Boston, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat **$10**
On each Trade Mark **$25**
On filing each application for a Patent (17 years) . **$15**
On issuing each original Patent **$20**
On appeal to Examiners-in-Chief **$10**
On appeal to Commissioner of Patents **$20**
On application for Reissue **$30**
On application for Extension of Patent **$50**
On granting the Extension **$50**
On filing a Disclaimer **$10**
On an application for Design (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
AUGUST 3 TO 13, 1874.

3,735.—P. J. Devlan, Jersey City, N. J., U. S. Improvement on treating sponge, called "Devlan's Process of Treating Sponge, for Different Purposes." Aug. 3, 1874.

3,736.—H. Bolton, Elizabethtown, Ont. Improvements on washing machines, called "Bolton's Improved Washer." Aug. 3, 1874.

3,737.—C. C. Kinney, Dereham Township, Oxford county, Me., U. S. Improvements on sash holders and fasteners, called "Kinney's Sash Holder and Fastener." Aug. 3, 1874.

3,738.—H. Woodward and M. Evans, Toronto, Ont. Improvements on the art or process of obtaining artificial light by means of electricity, called "Woodward and Evans' Electric Light." Aug. 3, 1874.

3,739.—W. Lockwood, Elfrid Township, Middlesex county, Ont. Improvements on using platforms and hoisting machines, called "Lockwood's Improved Rising Platform and Hoisting Machine." Aug. 3, 1874.

3,740.—S. H. & D. W. Davis, Detroit, Mich., U. S. (Extension of Patent No. 252, New Brunswick). Freezing and preserving apparatus to be used in freezing and preserving fresh fish, fresh meats, and other like articles. Aug. 3, 1874.

3,741.—B. Sloper, New York city, U. S. Improvements on gas machine, called "Sloper's Automatic Water Gas Generator." Aug. 4, 1874.

3,742.—D. S. Cornell, Warwick Township, Lambton county, Ont. Extension of No. 64, for a self-cleaning and adjusting gate hanging. Aug. 13, 1874.

3,743.—J. B. Brown, Philadelphia Pa., U. S., assignee of R. W. Wetherill, Chicago, Ill., U. S. Improvements on burglar alarms, called "The Keystone Portable Burglar Alarm." Aug. 13, 1874.

3,744.—D. C. Grant, Houghton, Mich., U. S. Improvement on ice plow and ram attachments for vessels, called "Grant's Ice Plow and Ram Attachment for Vessels." Aug. 13, 1874.

3,745.—D. E. Cooke, Brantford, Ont. Improvements on refrigerators for preserving meat, butter, etc., called "The Goold Refrigerator Trussed Rack." Aug. 13, 1874.

3,746.—H. Vandewater, Phelps, N. Y., U. S. Improvements in turbine water wheels, called "Vandewater's Improved Turbine Water Wheel." Aug. 13, 1874.

3,747.—Wm. Miller, Boston, Mass., U. S. Improvements on methods for equalizing or distributing pressure, called "Miller's Method of Equalizing or Distributing Pressure." Aug. 13, 1874.

3,748.—G. W. Millner, Charlottetown, Prince Edward Island. Improvements on pipe vises, called "Millner's Pipe Vise." Aug. 13, 1874.

3,749.—A. L. Trudel, St. Antoine de Tilly, P. Q. *Nouveau système de propulsion des chaloupes, bateaux, etc., dit "Le Propulseur Trudel."* (New system of propelling boats.) Aug. 13, 1874.

3,750.—C. Buchner, Tilsonbury, Ont. Improvements on a machine for washing clothes, called "Buchner's Improved Champion Washer." Aug. 13, 1874.

3,751.—R. Gadonas, Montreal, P. Q. Improvements on gage for center bits, called "Gadonas' Bit Gage." Aug. 13, 1874.

3,752.—L. S. Colburn, Oberlin, O., U. S. Improvements on files, called "Colburn's Improved File." Aug. 13, 1874.

3,753.—E. Caswell, Lyons, N. Y., U. S. Improvements on a carriage and wagon hub borer, called "Caswell's Hub-Boring Machine." Aug. 13, 1874.

3,754.—T. A. Savard, Quebec, P. Q. *Amel'orations aux horloges ordinaires, dites "Le Cadran Universel Savard."* (Improvements in clocks.) Aug. 13, 1874.

3,755.—T. Burns, Anamosa, Iowa, U. S. Improvements on well-boring machines, called "Burns' Well-Boring Machine." Aug. 13, 1874.

3,756.—H. G. Thompson and B. T. Bergh, Milford, Conn., U. S. Improvements on tack-driving machines, called "Thompson and Bergh's Tack Driving Machine." Aug. 13, 1874.

3,757.—R. Scott and S. L. Cook, Cote St. Paul, P. Q. Improvements on the manufacture of spades or shovels called "The Patent Socket Spade." Aug. 13, 1874.

Advertisements.

Back Page - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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By order of the Board of Water Commissioners.
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A GOOD NUMBER.—THOS. A. SCOTT, portrait, character, and biography; Alexander M. Ross, M.D.; The Naturalist; James Lick; School Girl of the Period; In the Toils of Fashion; Ruined by Good Luck; Jeremy Bentham; Telescopes; Government and Training of Children; Oberlin College; Resolution and Appetite; Compulsory Education, and much other "rich reading" in PHRENOLOGICAL JOURNAL for September, 30c. or $3 a year. Newsmen have it. Sent first post by S. R. WELLS, No. 389 Broadway, New York.

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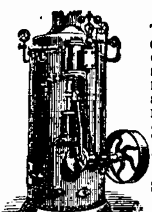

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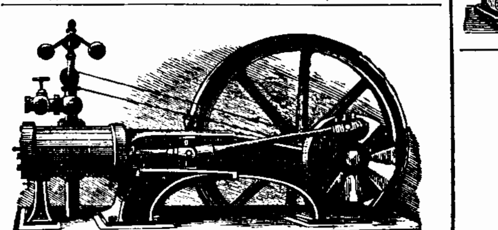

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GEO. PLACE & CO., 121 Chambers street, N. Y.
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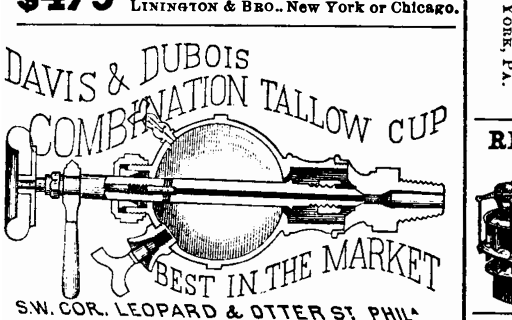

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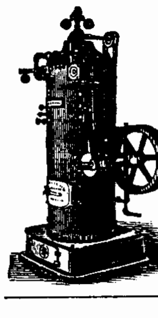

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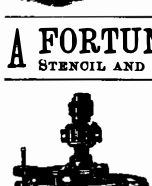

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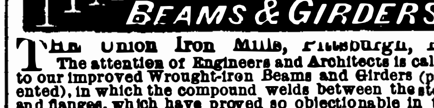

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Permission to examine the vessel, and to inspect the premises, may be obtained (by intending purchasers) on application at the Dry Dock, where the ship now lies, or to the Consulting Engineer to the Commission, who will be prepared to exhibit drawings, to explain the structure of hull and machinery, and to give any other information respecting the vessel.
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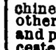

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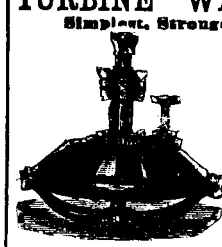

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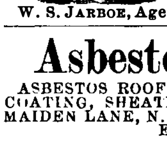

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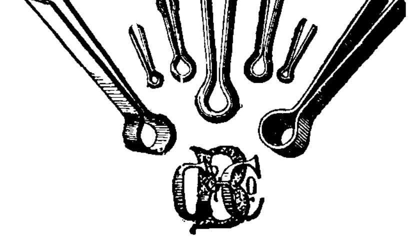

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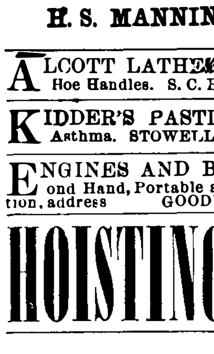

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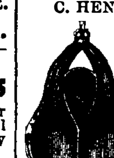

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