SCIENTIFIC AMERICAN

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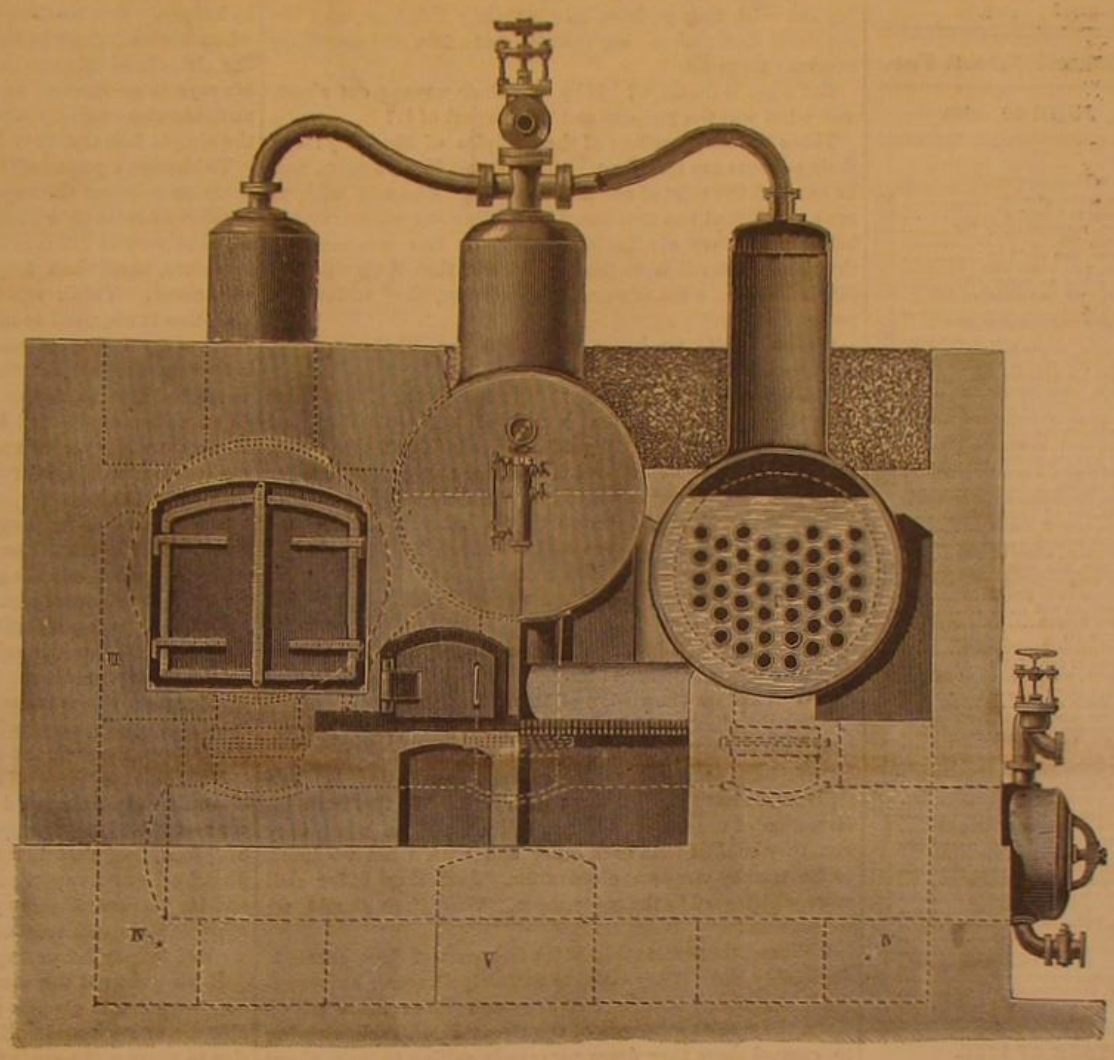
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IMPROVED COMPOUND STEAM BOILER.

In spite of the economy in fuel and in the space occupied by multitubular boilers, the crowding the interior with tubes, and so diminishing the steam space, is by many engineers looked upon as a serious disadvantage; and a method of combining ample steam room and large heating surface has long been a desideratum, especially in cases where the boiler is liable to be suddenly called upon for a large supply of steam. In such cases, the multitubular boiler (which must, of necessity, carry a high water level) is very likely to commence priming; and damage to the engine is almost certain to ensue.

Mr. R. Wolff (of Buckau, Magdeburg, Germany) has succeeded in constructing a triple boiler, in which the two side boilers are multitubular; while the central one is plain, affording ample space for steam and water. Moreover, the tubes of the two outer boiler can be removed to allow them to be easily cleaned out. All three boilers are connected, by vertical tubes, with a feed water heater placed laterally below them; and communication between the three is maintained by compensating tubes, so arranged that live steam is taken from the central boiler only. The hot gases pass from the front to the rear of the boilers, then forward through the tubes, and back at the outside of the boilers, and lastly downward, around the feed water heater, and to the chimney, thus utilizing a large proportion of the heat, there being no conduction by walls of flues, etc.

The inventor states that experiments have substantiated his claims as to the efficacy of this heat generator, which deserves attention for its novelty and simplicity.

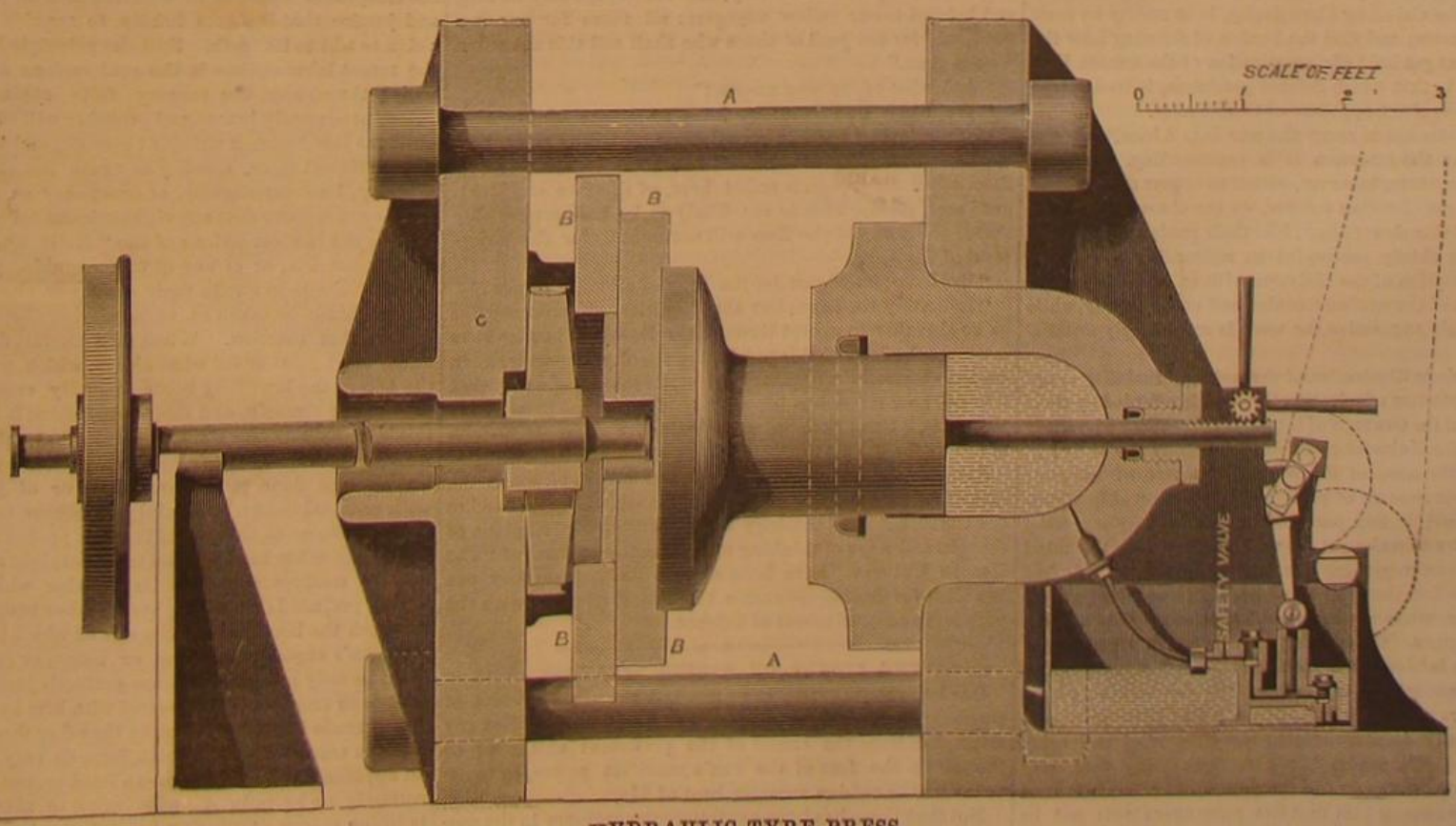


WOLFF'S TRIPLE STEAM BOILER.

DRIVING ON TYRES BY HYDRAULIC PRESSURE.

A correspondent of the *Engineer* has designed the hydraulic tyre press which we herewith illustrate. We cannot do better than permit him to speak for himself, only adding that the press appears to us to be well designed and likely to perform its work very satisfactorily. "Much," he writes, "has been said with reference to the breaking of tyres, and of the different modes of fastening them to the wheels. As no cure is so good as prevention, it will be the best policy to adopt a system for putting on the tyres, the safety of which is to depend on the strength of the tyre more than on any particular fastening. At present the plan most generally adopted is that of shrinking them on, but this seems rather an unsatisfactory way. If the tyre be much less than the diameter of the wheel, the strain in contraction would be very great. A tyre 10 feet in circumference and having a tensile strain of 11·5 tuns per square inch, equal to about one half its ultimate tensile strength, would extend 0·1164 of an inch; so that in shrinking on tyres the greatest care is necessary, or else they may be strained almost to the point of rupture. I think the most satisfactory way would be to turn or bore the tyres to a tight fit and force them on by hydraulic pressure. If the circumference of the wheel be 10 feet and the circumference of the tyre be 0·0437 of an inch less, and it be pressed on, it will have a strain of 4·5 tuns per square inch, which would be quite safe; the usual fastening could still be employed. The engraving shows an arrangement for putting on tyres; any slight modification could be made to suit local circumstances. The bars, A A, are fitted with slots or openings that they may be brought nearer or put further from the center, and the pieces, B B B B, can be changed for the larger wheels. There is an opening in the plate, C, to admit the axle, and by short temporary rails the wheels can be rolled into position."

The action of the press will be understood at a glance; and although the common use of solid cast iron wheels, as practised in this country, will prevent a very extensive demand for such machines, there are many uses, apart from rolling stock construction, to which they could be put. For driving wheels of locomotives, of course they could be employed and other uses will doubtless suggest themselves to our mechanical readers.



HYDRAULIC TYRE PRESS.

THE New York Board of Trade has a special committee of merchants and publishers, who have placed themselves in communication with all the large cities with reference to the objectionable law on the postage of small parcels and publications. It is intended to introduce a bill into the next Congress for its immediate repeal

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TWO VIEWS OF THE VOYAGE OF LIFE.

Taking the law of continuity as the basis of their argument, the authors of "The Unseen Universe, or Physical Speculations on a Future State"—the latest and one of the ablest of the many attempts to reconcile religion with Science—have endeavored to prove that the scientific view of the composition and government of the Universe is in the closest harmony with the view presented in the Christian records: that Science, legitimately developed, instead of appearing antagonistic to the claims of Christianity, is in reality its most efficient supporter; and that the burden of showing how the early Christians got hold of a constitution of the unseen Universe, similar to that which Science proclaims, is transferred to the shoulders of the opposers of Christianity.

It is a bold attempt to carry the war into Africa, and one well deserving the attention it is commanding. It lying without our province, however, either to oppose or to defend the claims of the Christian records, we can observe only that the authors of this clever essay, like their predecessors in the same field, are chiefly successful in reconciling a fanciful scientific conception of the Universe with an equally fanciful interpretation of the written records; and consequently, while it is exceedingly suggestive, the work is exceedingly unsatisfactory.

A characteristic illustration of the authors' inability to appreciate the position of scientific thinkers is afforded by their comparisons of the two sorts of investigators—those who study the How of the Universe and those who study the Why: in other words, the men of Science and the men of religious speculation—to two sets of passengers on a great ship plying between two well known ports. The one set, they say, keep on deck and try to make out, as well as they can, the mind of the steersman regarding the future of their voyage after they have reached that port to which they know they are all fast hastening, while the other set keep down below and examine the engines. Occasionally there is much wrangling at the top of the ladder where the two sets meet, some of those who have examined the engines and the ship asserting that the passengers will all be inevitably wrecked at the next port, it being morally impossible that the good ship can carry them further. To whom those on deck reply that they have perfect confidence in the steersman, who has informed some of those nearest him that the passengers will not be wrecked, but will be carried safely past the port. And so the altercation goes on: some who have been on deck being unwilling or unable to examine the engines, and some who have examined the engines preferring to remain below.

The work professes to regard the problems of the unseen Universe from the standpoint of Science, but the writers have been quite unable to divest themselves of their theological prepossessions: from first to last, as in the foregoing comparison, the theological bias is paramount. Science does not and cannot look upon the voyage of life, or the voyagers, in any such manner. Mankind are not all passengers in the same ship, though they may be regarded as sailors on the same sea. Each has a vessel to himself—the fragile craft he finds himself in possession of when his day of self-consciousness comes—and must guide it with such knowledge as he may gain by his own observation and the advice of those who have been longer afloat.

The sea is stormy, the winds conflicting, the currents baffling. Out of the mists on every hand, new crafts are constantly appearing: and on every side, at every stage of wind and weather, multitudes are disappearing: now in the calm noonday, now buffeted by midnight storms, now wrapped in fog and mist, they go down like so many Schillers, and the survivors drift on, knowing that the same fate will sometime overtake them also.

But what is that fate? Why was their voyage cut short, and what was the purpose and the purport of it?

These are the questions of the disciples of the Why: and their answers are confident. "The Great Pilot knows, and he has told the pilot of our fleet that those who sail with us are not wrecked but translated to another sea, where, with a better craft, they shall sail eternally in fair weather. If they have swerved from the right track, then their wreck is dire indeed: on a sea of storm and darkness, they suffer perpetual disaster."

"How shall we know the right way?" the anxious voyager asks.

"Sail with us," is the reply. "Long ago, the Great Pilot gave the captains of our fleet a chart of this sea and one of the seas to come. He still guides the winds and the waves for our good. If we follow his chart (or the leaders who remain in communication with him), we shall surely suffer no wreck, but shall be transferred to the halcyon sea, for the navigation of which we are now in training."

But the disciples of the How remain aloof.

"Whither are you going?" our voyager asks.

"We do not know."

"Do you not sail for the halcyon sea, or fear the sea of darkness and great storm?"

"We have no knowledge of them," is their reply.

"But the charts which the Great Pilot gave: have you not seen them?"

"We have seen many that claimed that title," is their reply: "we have studied them with care. We find little information of the sea we now are sailing, and in what they give they conflict with each other and with what we know to be true by our own observation. And they differ still more with regard to the seas unseen. Wherefore should we trust them?

"Worse: the seamanship of the followers of these charts is deplorably bad. They come to untimely disaster: and sometimes sanguinary battles occur between these fleets which claim the special guidance of the Great Pilot, each striving to compel those they deem perversely sailing to tack about and go with them. We cannot trust them."

"What seek ye then?"

"These things," the disciples of the How reply: "to learn the sea that surrounds us—the ways of the winds and the currents, the places of the quicksands and the reefs: to learn the nature of our fragile crafts that we may make them staunch and keep them from all avoidable risks; to perfect our seamanship as best we may, that our voyage may be long and helpful to our fellow voyagers: all these for our own good, and for the good of those who shall sail this sea when we are gone."

"And what of the seas unseen?"

"We know them not: we have no means of knowing them: no time to waste in speculations regarding their possible existence and character. If such there be, and we go to them when our voyage is ended here, of this we confident: good seamanship here is not likely to be bad seamanship there: the study of the Now will not unfit us for the enjoyment of the Then.

"But have you no care for the Why of all these things?"

"Indirectly we have; but the faculties we possess give us no clue thereto except through the How. When we have mastered the laws of this perplexing sea of phenomena, when we have learned the nature of this environment of ours, what it is and how it came to be, we may be prepared to consider Why it is. Until then we must wait; for there is no one to tell us for the asking."

Such are the real relations of the two orders of men—the men of Science and the men of religion—to each other and to the Universe. And theology will have to change its plane of thought and ways of thinking more than the authors of "The Unseen Universe" have been able to do, before they can establish for themselves even a theoretical oneness with the purposes and conclusions of Science.

THE SECRET OF SPRING WEATHER.

Our late erratic spring has provoked the usual amount of comment and discussion, yet we have failed to notice any attempt to trace the causes of the persistent chilliness of the air in the face of the sun's manifest power, or to account for the sudden summer heat of May.

Not that there has been anything extraordinary in the conditions of the weather this year. Spring in our climate is always an uncertain blending of winter and summer, each retaining much of its native peculiarity; so that it is no uncommon thing for a morning mild as June to be followed by a snowstorm in the afternoon, or for an icy wind, piercing as an arctic blast, to sweep the open country, while in sheltered places the sun burns with midsummer intensity. Such contrasts are tiresomely common, yet they never cease to strike us as something abnormal. In spite of our yearly experience to the contrary, we persist in thinking that winter's severity ought to let up gradually; that the transition from winter to summer ought to be as gentle and uniform as the change from summer to winter. Why it is not and cannot be may be worth a moment's thought.

It is well known that one of the chief factors of climate is the sun's altitude. The more nearly vertical its rays, the greater its power. The sun's position, however, is not the only factor. If it were, February would be as mild as October, April as hot as August. When under favorable conditions we experience the sweltering heat of the sun's untempered rays in spring time, we are apt to say that it must be through contrast with the winter's cold that we feel the heat so keenly. But we deceive ourselves. During the months when winter lingers in the lap of spring, the days are as long, the altitude of the sun is as great, and the heating power of his rays is as intense as in midsummer. Their failure to mitigate more rapidly the severity of the season is due to the simple fact that they have other work to do.

To change a pound of ice at 32° to water of the same temperature requires the expenditure of 143 units of heat, each capable of raising, when converted into mechanical motion, a pound weight 772 feet high. In melting a pound of ice, therefore, more than fifty-five foot tuns of solar energy is exhausted. Think what an incalculable amount of solar radiation is required to melt the millions of tuns of ice and snow every spring between this and Greenland!

During the fall months, immense amounts of water are converted into ice in the northern hemisphere, setting free an enormous amount of heat to reinforce the rays of the declining sun, giving us an Indian summer at a season when the weather would be coldest did the temperature depend upon the sun alone.

This year winter lingered unusually late, and summer came with a burst. The ice in the lakes and rivers was uncommonly thick, and the ground was covered deep with snow. To convert this snow and ice into water taxed the sun's power, so that it was not until after it had reached the northern tropic and was southward bound again that it began to gain on the wintry weather. It will be remembered also that the greater part of the snow was not merely melted, but evaporated. It disappeared while we were anticipating disastrous floods—not through the rivers, but into the air.

Had the snow gone off in the form of water, each pound of it would have exhausted 55 foot tuns of solar energy. To convert it into vapor required about seven times as much, or 372½ foot tuns, that being the mechanical equivalent of one pound of water vapor. In view of the vast amount of snow and ice evaporated this spring, it is not surprising that the approach of warm weather was so dilatory. It was the price we had to pay for exemption from floods and freshets.

Having cleared the ground of snow and snow water, the sun was free to give its full force to the earth, which, in the absence of the usual spring rains, was speedily put in condition to convert the sun's rays into heat for the warming of the air. Consequently the interval was brief between reports of ice floes in the harbor and sunstrokes in the streets.

THE RIGHT TO INTERFERE.

The right of every man to dispose of his labor as he sees fit, or to conduct his business affairs according to his own ideas, so long as the rights of the community in general are not trespassed upon, is so well founded in common sense and justice that it seems hardly to require a judicial decision to add to its truth. Still the principle is one which, as the recent labor strikes in the coal regions and in various trades throughout the country fully evidence, the trade unions persistently ignore, and probably will continue so to do until the law becomes stringent enough, and is administered with sufficient vigor, steadily to crush out any proceedings savoring, however slightly, of conspiracy or undue coercion. We do not believe that any right-minded laboring man will indorse the lawless actions of the "Molly Maguires" of the mining districts, or of any of the misguided people who resort to violence to obtain their ends; nor should the course of such bands be taken as exemplifying the usual mode of trade union coercion. When men commit deeds, no matter under what guise or for what object, which put them under the ban of the law, they become equally criminal with the thief or the assassin, and their punishment is identical. We think, or at least we want to think, that ruffianism is fast reaching a low ebb in our trade societies, and that misguided actions are done more through error of judgment than with criminal intent. Certainly we adhere to the belief that good intentions on the part of the men predominate over bad; but on the other hand it is not to be lost sight of that the very best of motives may underlie practice which in itself is highly prejudicial to the rights of other people. And here we reach the boundary, on one side of which lie those appeals to a man's cupidity, or sense, or honor, or any other sentiment he may possess, which are perfectly justifiable from his friends or from others interested with him in a common pursuit if made in one way, and on the other those same appeals made in another manner, which, from its very nature, includes an apparent conspiracy against a third person. Thus, there is certainly no harm in A endeavoring to show to B that B is losing money or injuring his interest by working for C, and that he could improve both the affairs of himself and

also of his brothers in trade by seeking labor elsewhere. But if A and his friends should post themselves in front of C's door, and tell B, D, and E, and every other employee of C's whom they met, that C would not accede to prices fixed by A and company, and that the shop was black-listed, and then should endeavor to make B and his comrades leave their work, not directly for B s benefit, but first to injure C, and thus coerce him into benefiting A: such is clearly wrong, since it is an invasion of the rights of C.

A recent case decided in England exemplifies this point very clearly, and at the same time adds another to the precedents which stand to mark how far trade unions can lawfully interfere with trade. Messrs. Jackson & Graham, a large upholstering firm in London, altered their system of paying per hour to that of piece work throughout their entire establishment. The operatives at once, with a few exceptions, struck, whereupon the firm promptly supplied their places with non-society men, and continued business. The strikers then through their association, stationed pickets in the vicinity of the shops, waylaid the workmen going and coming, and for the space of three months persistently labored, though with little success, to induce the new hands to join them. No physical intimidation was employed, and nothing but verbal persuasion used to discourage the men from their labor. Finally the proprietors caused five of the ringleaders of the pickets to be arrested on the criminal charge of conspiracy. The trial involved the services of very eminent counsel, and lasted two days. Baron Cleasby, the presiding judge, in his charge laid down the law clearly and emphatically, that it was an offense to offer any molestation or obstruction to a working man, to coerce him to quit his employment, or to a master, to alter his mode of carrying on his own business. Picketing, he said, might not be unlawful under certain circumstances; but it is when carried on in such a manner, and to such a degree, that it might be expected to influence other persons to the extent of annoyance, apprehension, or loss. The case went to the jury on a mere question of fact; the defendants were found guilty, and sentenced to brief imprisonment.

THE IRON HORSE.

On page 340 of our current volume, we published a letter from Mr. Flower, President of the West End Railroad Company, of Philadelphia, Pa., in which he offers a premium of $5,000 to the inventor of a substitute for horses, to draw street cars, on condition that he gives the company the control of the invention. It appears to us that, considering the difficulties of the problem and the immense value of a successful solution thereof to those having the control of it, the compensation is rather trifling. This practical problem has been occupying many minds for several years, and many others are working at it now; but the difficulties are scarcely realized unless we consider the great advantages possessed by the living horse, in case only the power of one, two, or three horses is required. When we need the power of ten, twenty, or more horses, no doubt the locomotive is preferable; but we doubt if locomotives of one or two horse power will ever be found to give satisfaction even when well constructed, as they can never compete with a living horse, the trouble of raising which is less than the labor of building a locomotive in a shop. And the horse takes its own water and fuel when needed, and needs no stoker; it also continually repairs itself, until it is entirely worn out. Even then, at its dissolution, there is no danger of bursting a boiler. It is always ready, and needs no firing up; and finally, having a sense of self-preservation, it will not blindly go ahead, and run in the river off an open drawbridge, as locomotives have often done. If it is objected that occasionally the control of horses has been lost by the driver, and that they ran off, it must be remembered that runaway locomotives are by no means uncommon. Taking all things into consideration, we believe that the ordinary horse is a good institution, which it will be very hard to surpass by labor in a machine shop.

GRASSHOPPER INVENTIONS WANTED.

The grasshoppers have appeared in the Western States in such countless throngs that the terrible devastation worked by them among the crops of last year bids fair to be repeated. In the neighborhood of St. Joseph, Mo., it is said the gardens are literally black with the insects, and that the land extending from that city southwest, across the Territories to the Rocky Mountains, is covered for miles in breadth. The size of the locust is from that of a flea to that of a house fly; but, in spite of its lack of growth, its inroads on vegetation are none the less severe. The Colorado journals think that the crops, not merely of that State, but of five or six States to the eastward, will be entirely ruined. This is certainly a very gloomy prospect, and the wholesale destruction of the wheat will make itself felt over the entire country.

It is getting high time that the extermination of this nuisance should engage more widely the attention of inventors. A machine, for example, which can be dragged over the fields before the crops are put in, and which will destroy the eggs deposited in the ground, is needed; or a device might be produced for killing the grown insects without injury to the crops. The Greeley *Tribune*, located in the midst of the ravaged district, says: "We want the same acuteness, the same nice observation applied to the grasshopper question, that is applied to abbreviating labor by mechanical contrivances and in constructing works of beauty and skill. Enough ingenuity is displayed in the sewing machine to catch every grasshopper in our valley and skin him into the bargain." There have been already several attempts made to invent the grasshopper out of existence. The apparatus last brought out is a fire machine, which is simply a grate on runners. The inventor says that "pitch pine is used for fuel, and our Colorado zephyrs fan it into a miniature hell." The fire is made on the grate, and a sheet iron cover directs the blaze downward. This machine is dragged by a team around in circles of large diameter, burning the hoppers which get under it and driving others before it, "corraling" them, in fact, in the scorched circumference. It keeps on its circuitous route in gradually decreasing circles until every insect within an extended radius is burned.

Ditching entirely around the fields, and filling the cut with water, is said to keep the grasshoppers out. This is probably of little use, however, after the insects are able to fly. Another plan is to keep the entire land wet (a rather difficult operation, we should imagine), it being found that the hopper prefers dry localities to damp ones. A farmer who has adopted this mode of protecting his fields combines it with the ditch system, keeping the ditches filled with running water, which is made rough by passing over a number of small dams. He cuts the ditch first around the plot, and then wets the enclosed area. The grasshoppers try to crawl off, and then tumble into the ditches where they are quickly drowned and washed away. If he finds an army marching in from a new quarter, he directs a stream of water on the threatened point and thus heads off the column. Another individual has saved a ten acre patch by putting a little kerosene oil just above the head gate which admits water to the enclosing ditch. The oil floats on the surface and is held in place by a board, the edge of which touches the water. Under this board it gradually leaks out, forming a film over the entire ditch, rendering the latter a river of death to the insects. We notice also another fire invention somewhat similar to that already described. It has wings on which fires are kindled, and a fan which blows the insects into the flame.

It seems to us that a good road engine, rigged with an extra boiler to make steam which could be directed in jets downward—something after the fashion of the numerous snow-melting inventions—might be usefully employed. It could go over the ground quickly, and one machine would serve to protect a large area. Or there is that apparatus we described a short time ago, which makes a fearful heat underneath it by a current of superheated steam entering ignited naphtha gas. This melts thick ice by merely passing over it at the rate of some four miles per hour. Judging from this effect, the machine would readily destroy grasshoppers.

The Governor of Missouri has appointed a day of prayer for relief from the scourge. If these supplications are as earnestly supplemented by products of our inventors, we have not the slightest doubt but that they will be answered. Meanwhile, we commend to the people of Missouri the old maxim: "Help yourself and God will help you;" in other words, invent first and pray afterwards.

CLIMATE OF THE ICE AGE.

The science of meteorology has, of late years, been growing more and more in popular favor. The revelations of the United States Signal Service, and the valuable practical deductions that have been made from them, have created an interest in the subject which will not soon die. And while the climatology of our own day has commanded the careful study of our best scientists, that of earlier times in the earth's history has received equal, if not more profound, consideration. The study of the plants and animals which previously existed on the globe—including the vexed questions relating to the development of organic forms—has largely to do with the climate and state of the atmosphere that prevailed in those earlier periods.

It has long been supposed, and taught by text book and teacher, that during the carboniferous age, when the sun's heat was stored up for us in the form of coal, petroleum, etc., the atmosphere was supercharged with carbonic acid gas; but recent investigations have rendered this extremely improbable, and some late experiments have demonstrated that plants are killed by a greater amount of this poison gas than is ordinarily found in the air. But doubtless the greatest intellectual capital has been invested in a consideration of the meteorological conditions of the glacial period; and the conclusions which have been reached on the subject are as widely apart as the antipodes. While all agree that the northern part of our continent, down to 40° of north latitude, was almost completely covered with a sheet of ice from one to three miles thick, during this period, some make it a season of intense cold, and others claim that it must have been a time of moderately high temperature. Many theories have been advanced to account for the climatic changes which brought the alternations of heat and cold to our earth during the past ages. One of these is the supposition that the solar system, in its translation through space, may have passed alternately through regions of extreme cold and great heat. Another is that the earth may have changed the position of its axis of rotation, because of some great mountain upheaval between the equator and the poles. Still another is the wild supposition that the earth's crust has gradually slipped on its nucleus, so as to bring the equatorial belt nearer to the pole than usual, and then away from it again. Lyell has attributed these changes to a supposed change of place between the land and the sea. He argues that, if the land were accumulated most in the tropics, the vast amount of solar heat which it would "soak up" would be carried by currents to the polar regions, and afford nearly or quite a summer climate to any islands that might be situated there. And if the land were accumulated about the poles, it would result in a great diminution of terrestrial heat, because the water, which is exposed, in this case, to the direct rays of the sun, has far less heating power than the land. Professor Shaler has advanced the idea that these changes may be explained on the supposition that our sun, like many other suns in the universe, is a variable star, and makes our earth warm or cold according as its brightness varies. Whether any one of these is the real cause of past cosmical climatic changes, we cannot say; but we can reasonably conceive that the first and the last two may each be considered a true cause.

Among those who believe the ice age to be one of extreme cold, stands prominently Mr. James Croll. His theory for explaining the cause of this cold is based upon the eccentricity of the earth's orbit, the precession of the equinoxes, and the obliquity of the ecliptic. The orbit of the earth is an ellipse, varying in eccentricity as the planets are variously situated in their orbits, being most elliptical when the planets draw it farthest from the sun. Its rate of variation is very variable. If a plane pass through the sun's center, parallel to the plane of the earth's equator, it will cut the earth's orbit in two opposite points, namely, at the vernal and autumnal equinoxes. The line between these points does not divide the earth's orbit into equal parts, on account of its eccentricity. The earth passes through the perihelion part of its orbit in seven or eight days' less time than through its aphelion part. Hence, now our winter is shorter than our summer, and *vice versâ* in the southern hemisphere. The action of sun and moon on the protuberant equatorial mass of the earth is constantly changing the plane of the earth's orbit, and hence, also, the position of the line joining its equinoctial points. These make a complete revolution in about 21,000 years. Now, when the earth had its winter in the northern hemisphere, while it was in aphelion, its winter was longer than the summer, hence extremely cold. In this case, the ice and snow of winter will not be entirely melted during the summer, because much of the sun's heat is taken up in melting ice, and therefore does not ameliorate the temperature. The result is that, during this long period, ice and snow are accumulating in the northern regions. The vapor from melting ice would obscure the sun with cloudy atmosphere in the summer, and thus make the air raw and cold. It is said by antarctic explorers that the summer there is even colder than summer in northern regions of the same latitude, though the latter are millions of miles farther from the sun.

Another consideration, Mr. Croll thinks, would make great difference with the cold at the north pole, when its winter occurred in aphelion. All permanent oceanic currents originate in the Antarctic Ocean. The chief one divides into two parts: one goes north to the East Indies; the other goes west through the Indian ocean, is deflected round the Cape of Good Hope, follows up the west coast of Africa for some distance, then crosses the Atlantic and forms two currents: the Brazilian, going south, and the Gulf Stream, going north. Now the sun causes the air at or near the equator to give place to cold currents from the poles, which rush in to produce equilibrium. During the long cold of the northern hemisphere, the north currents would be stronger than those from the south, where the climate is, at the time, warmer. He thinks this stronger current from the north might be able, by its friction on the water, to entirely stop the Gulf Stream, and leave the northern hemisphere to unmitigated cold. Croll's theory supposes that the time of the ice sheet in the northern and southern hemispheres was not synchronous, but distant by at least 10,000 years. He supposes that glacial time began some 240,000 years ago, and terminated about 160,000 years ago, that the most intense cold was about thirty or forty thousand years after the period commenced, and that there were several great changes of climate during its continuance.

Mr. Murphy claims that, if the climate at any given elevation is cold enough to form glaciers, no decrease of winter temperature will increase their magnitude, while, on the other hand, a low summer temperature is shown, by the facts of physical geography, to be eminently favorable to glaciation. He therefore concludes that the glacial age occurred when the earth's greatest distance from the sun was in summer rather than in winter.

Another theory, still more at variance with Mr. Croll's, is that held by Mr. Thomas Belt and many others. Savants of this school believe glaciation was not due to extreme cold, but to excessive precipitation. They hold that the ice was thickest over the American continent, because the great evaporating area of the Pacific lay to the southwest of it, and counter trade winds swept across it, and precipitated the moisture with which it was laden. While Mr. Croll makes the ice six miles at least in thickness at Greenland, it was probably thicker south of the poles than near the poles, because the water from warmer regions would be precipitated before reaching the poles. The glacial age probably existed on both continents at the same time, as traces of glaciation north and south of the equator nearly inosculate, and the character and appearance of the morains is the same in both. This supposition only could make correct Mr. Darwin's explanation of the fact that forty flowering plants of North America and Europe are also found at Terra del Fuego. He says that plants were driven to the equator during the ice age, and then followed the retreating ice sheet, both ways from the equator.

Agassiz considered the glacial period a cold time followed by a much warmer one. He thinks it not long and slow, else boulders would have been carried as far south as the ice sheet extended, but sudden and short, as is proven by Siberian elephants caught in the snow and frozen so that their flesh is preserved for recent dogs and wolves to eat.

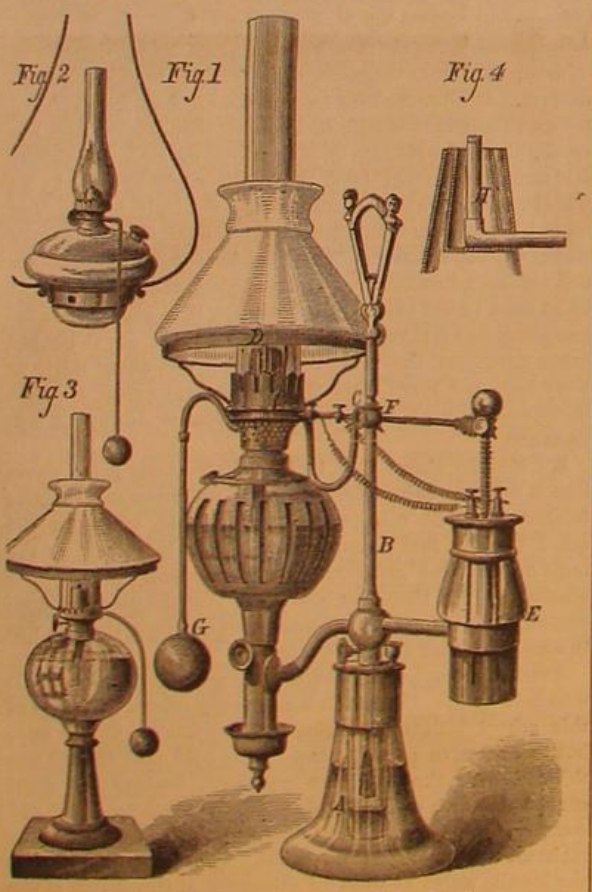
To harden a wooden pulley, boil it for about eight minutes in olive oil.

ZIMMERMAN'S HYDRO-ELECTRIC LAMP AND EXTINGUISHER.

We illustrate in the annexed engraving, Fig. 1, a curiously ingenious lamp, which has been recently invented by Professor Wm. H. Zimmerman, Vice President of Washington College, Chestertown, Md. The lamp is self-lighting, and this, although any form of burner, or wick, or any kind of illuminating fluid be used. To effect this, the inventor has arranged a combination of Professor Döbereiner's well known hydrogen lamp with a small galvanic battery, in a neat and even graceful design, so that the whole apparatus takes up no more room than the ordinary German student's lamp, which in fact, in exterior aspect, it somewhat resembles.

The Döbereiner lamp serves as the pedestal. A is the receptacle for the acid and water, and within is seen the inverted bell glass, in which the zinc is suspended. When the acidulated water attacks the zinc, hydrogen gas is evolved, which fills the interior bell glass, and forces out the water, until the latter, falling below the zinc, no longer acts upon it, and the evolution is arrested until, the gas being allowed to escape, the water again reaches its former level. This is the regular action of the hydrogen lamp, with which every student of chemistry is familiar, and regarding which nothing further need here be said. In the present instance the gas ascends the vertical tube, B, passes through the valve at C, when the same is opened, traverses a flexible tube, and finally escapes from a side orifice in the small vertical pipe, D, placed just beside the burner. Before leaving the hydrogen generator, it may be noted that the vertical tube is free to revolve in the metal cap which covers the glass pedestal, and may be secured, as desired, by the thumbscrew provided, also that said cap has a filling cup through which a fresh supply of acid and water may be poured into the pedestal. E is a small galvanic battery (bichromate of potash or otherwise), the zinc in which is attached to a vertical rod, a spiral spring on which keeps it raised, thus holding the metal out of the exciting fluid, and normally keeping the battery out of action. To the upper end of said rod is pivoted an arrow-shaped lever, F, which connects with the valve, C, in the hydrogen pipe, so that, when horizontal, or rather when its rod-supporting end is held up by the spiral spring above referred to, the valve, C, is shut. The conducting wires from the battery lead to binding screws on the chimney frame, and thence connect with two electrodes which stand vertically beside the hydrogen outlet, D. Between these electrodes is extended a fragment of fine platinum wire.

The automatic illumination of the lamp will now be readily understood. The operator simply pushes down the knob on the end of the battery rod. By so doing, he lowers the zincs, establishing a current which heats the platinum wire,



between the electrodes, red hot. As the rod descends the lever, F, tilts, and so opens the valve, C. A stream of hydrogen then escapes at D, strikes just above the incandescent wire, becomes inflamed, and so ignites the lamp wick toward which it is directed.

The inventor states that he has had the device in operation since last November, and that during this period he has renewed the solutions but once. The ignition, he states, is now instantaneous on touching the lever.

In connection with the apparatus described and applied to lamps of other patterns, in Figs. 2 and 3 we represent a novel device by the same inventor for extinguishing the light, the object being to avoid the danger resulting from the common habit of blowing down the chimney. A hollow rubber bulb, G, is connected by flexible piping to a metal tube, H, which passes up inside the burner, as shown in section in Fig. 4. Around the upper extremity of said tube are a number of small apertures, through which, when the bulb, G, is compressed, a number of radial jets of air are directed upon the burner, blowing the flame away from the wick and quickly causing its extinction. The lamps are provided with apertures for filling without necessitating the removal of the wick and chimney. As represented in Fig. 2, the device will prove particularly useful in lamps hung high and out of reach, as the flexible conducting tube may be of any length to render the bulb convenient to the hand.

These inventions were patented through the Scientific American Patent Agency, respectively March 9 and 16, 1875. For further particulars address the inventor as above.

THE DISEASES OF THE SILK WORM.

M. Pasteur, the distinguished French chemist, has recently published an exhaustive treatise on the above subject, the same being the results of his investigations conducted in the heart of the French silk-manufacturing district and under the auspices of the French Government. The enormous mortality which, during certain years, has happened among the silkworms, M. Pasteur ascribes to two diseases, each perfectly distinct. The first he terms *pébrine*, and it is characterized by the presence, in all the organs of the worm or butterfly, of small ovoid corpuscles, invisible except when magnified four or five hundred times, and then appearing under the microscope as represented in Fig. 1. The other disease, called *flachérie*, is an enfeeblement of the vital force of the worm, born healthy but subsequently contracting the germ, generally has time to make its cocoon before falling a victim. The disease is, however, transmitted to the offspring, which perish prematurely. The way to avoid the trouble is to raise only such worms as come from eggs deposited by healthy butterflies. The cultivator, although by no means sure that the worms will not become diseased during their lives, is, however, secure in ultimately having cocoons which will remunerate his labor.

Fig. 1.

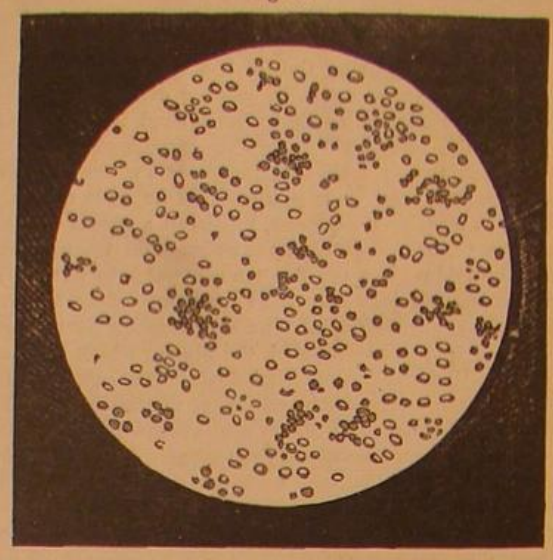


Fig. 2.

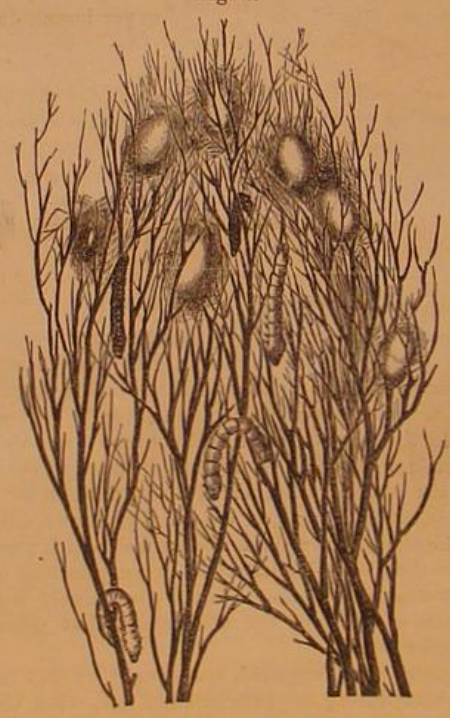


Fig. 3.

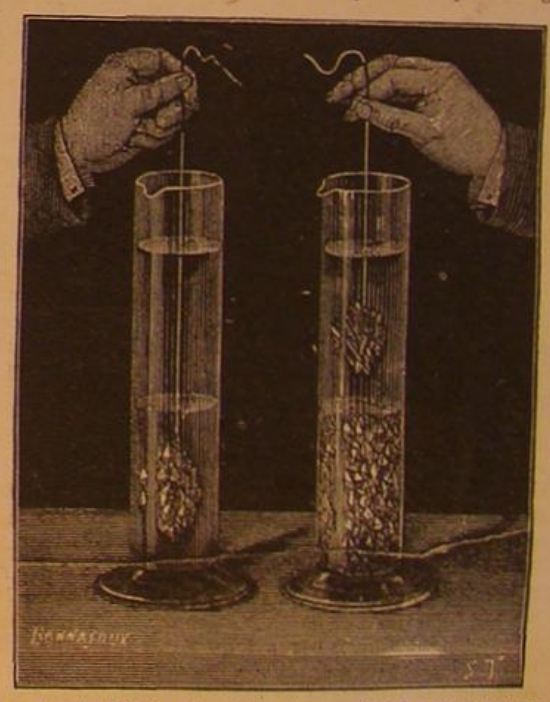


Flachérie is a disease more alarming than *pébrine*, because it attacks at the end of the fourth age, after the rearing is accomplished, and the cultivator expects soon to realize the fruits of his outlay of time and money. Within a few days every worm dies, leaving at the foot of the shrubs, which it had been hoped would be covered with cocoons, nothing but a mass of infected bodies. The effect of the disease is shown in Fig. 2. The malady is either accidental or hereditary, and may be caused by careless sanitary measures, in the conservation of the eggs, during the rearing, or more frequently by feeding on a leaf of bad quality. The heredita ry transmission is only to be guarded against by careful selection of the butterflies which are to furnish the eggs for the crop of the following year; and those attainted, after a little experience can easily be recognized by their lack of vigor and the slowness of their movements.

M. Pasteur gives the following instruction for obtaining eggs which are almost sure to yield a remunerative harvest In selecting the cocoons, preference should be given to those from a healthy stock, which are appear to be the finest. After the butterflies emerge, those which seem at all diseased should be carefully eliminated, and the others coupled and deposited on little squares of linen or calico suspended so that the insects cannot crawl from one to the other. As soon as the fecundation is terminated, the male is imprisoned by closing with a pin either one corner of the cloth or a little tuck previously made at the lower edge. (See Fig. 3.) After the deposition of the eggs, the female should be shut up in like manner, and the whole should be kept in a dry, well ventilated place, submitted to all the variations of the exterior temperature. Nothing remains further than to examine the butterflies for corpuscles, a proceeding to which the entire winter may be devoted, as it can be done just as well when the butterflies are dried. The examination is accomplished by grinding one or both of the insects on a cloth, in a mortar, with the quantity of water necessary to obtain a thick paste. A minute drop of this is placed beneath the microscope and examined rigidly. If any corpuscles characteristic of *pébrine* are recognized, the whole batch of eggs on that cloth are at once destroyed, and so on through all, keeping only such eggs as are entirely free from infection.

CURIOUS EXPERIMENT IN INSTANTANEOUS CRYSTALLIZATION.

It is well known that various salts dissolve in water in different proportions, and that the solution usually takes place more readily when the water is warm. After cooling, crystallization of the fluid takes place, but this may be prevented by leaving the solution in absolute quiet and protecting it from contact with the air. It is then said to be supersaturated, and the least shock, or the addition of a minute crystal of the salt, is sufficient to cause instantaneous crystallization of the whole. A curious experiment, based on the above, has recently been devised by M. Peligot: 150 parts, by weight, of hyposulphite of soda are dissolved in 15 parts of water, and the solution is turned into a large test tube, previously warmed, so as to half fill the same. Another solution of 100 parts, by weight, of acetate of soda in 15 parts of boiling water is made, and this is carefully poured in on top of the first solution, so as to float on and not mingle with the latter. To the above two solutions is then added a little boiling water, and the whole is left in quiet to cool.



After the cooling is accomplished, a little crystal of hypo sulphite of soda may be let down into the liquid. The fragment will traverse the acetate solution without effect thereon; but on its reaching the solution below, instant crystallization of the same will take place, as shown in the figure on the left of the illustration. As soon as the reaction in the hyposulphite is finished, a crystal of acetate of soda may be caused to produce a similar result in the acetate solution

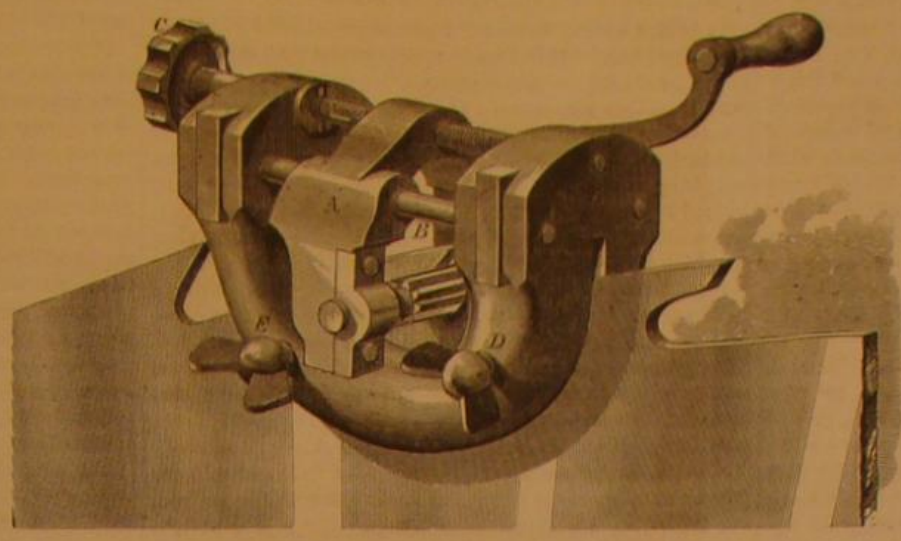
IMPROVED SAW GUMMER.

The inventor of the device illustrated in the annexed engraving states that, after an experience of eighteen years in using various kinds of saw gummers, as the result of such experience, he has produced the present machine, which he believes to be the best yet invented. It is a very strong apparatus, as will be seen from the heavy semicircular iron frame with which it is provided, the ends of which are cast solid. The cutter is journaled in the carriage, A, which slides on guides, B, and is fed to its work by the hand wheel, C. The cutter is rotated by the crank shown. The thumbscrews, D and E, hold the gummer upon the saw.

It is stated that any gullet can be started without filing or without danger of breaking the cutter by slacking the thumbscrew, E, on the lower part of the frame, until the circle of the cutter is formed.

The same is done to direct the cutter toward the center of the saw and to make a large gullet, the feed screw being operated during the turning of the crank. The screw, D, then holds the gummer upon the blade, and at the same time serves as a center about which the instrument works. There are no boxes liable to get out of order, and the bearings can be easily Babbitted. Finally, the inventor claims that the saving in cutters alone will soon cause the device to pay for itself.

For further particulars address Mr. Walter B. Noyes, Three Rivers, P. Q., Canada.



NOYES' IMPROVED SAW GUMMER.

SPAR TORPEDO WARFARE.

Mr. A. Sedgwick Woolley, Associate and Secretary of the Institution of Naval Architects, England, recently read before that society an able *resumé* of the torpedo system of attacking the enemy's vessels, by means of boats specially constructed for this submarine warfare, which carry their deadly bombs on the ends of spars, extending usually from the bows of the boat. We give a condensed abstract of the paper, illustrated by a series of engravings selected from the pages of *Engineering*:

Spar torpedo launches are being so generally adopted at present into the service of all foreign nations that a short sketch of the origin and history of this form of submarine warfare may be interesting, before discussing the merits and demerits of the plans now in vogue.

The first idea of an offensive attack by means of a boat, specially constructed to carry a torpedo, seems to have originated with Captain David Bushnell, of Connecticut, about the year 1775, but it had little in common with the boats now used for the same purpose. This boat, an account of which was read by the inventor before the American Philosophical Society, in 1798, was only intended to accommodate one person, who sat in a watertight chamber capable of containing sufficient air to support him for thirty minutes, and who could cause the vessel to descend and ascend at will, by letting the water into a chamber below him, or expelling it therefrom by means of two brass force pumps, at the same time letting fall about 200 lbs. of the lead, by which the vessel was ballasted, at the bottom. An attempt was made with this boat to blow up the English 64-gun ship Eagle, during the campaign of 1776; but the operator, from some reason or other, was unable to fix in the screw, and had to desist from the attempt.

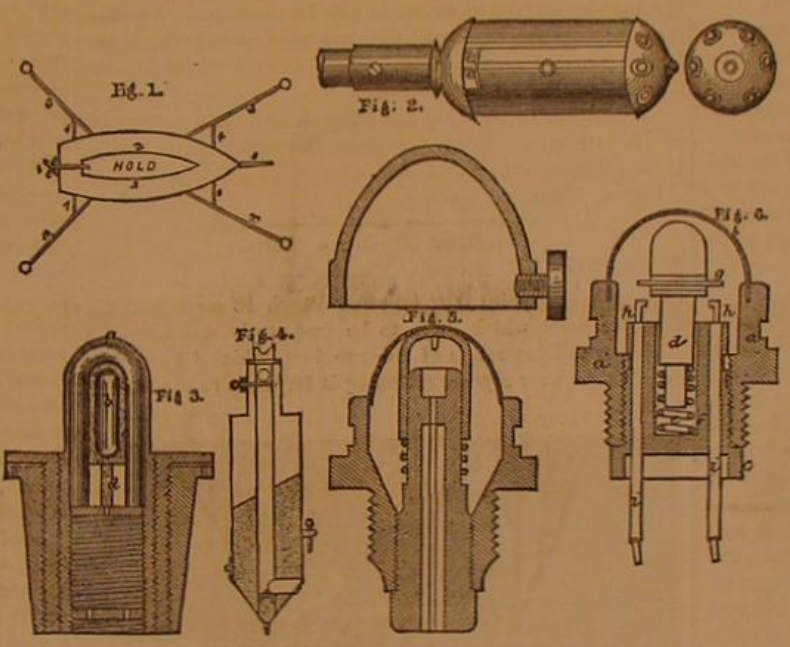
The next step in the same direction was made by the celebrated Fulton, who proposed a similar diving boat to the French Government about the year 1801, and made several successful experiments in the harbor of Brest, blowing up a small vessel by means of a torpedo, which he placed under her bottom. In this boat Fulton seems to have employed a screw, operated by a crank, as a means of propulsion. The French Government, however, would not adopt his invention, and Fulton forthwith withdrew to England, in 1804, where, under the assumed name of Francis, he obtained the support of Mr. Pitt. A commission was appointed to examine into and report upon his invention, which they at once pronounced to be impracticable. Fulton then returned to America, where he also gained the ear of the minister, and had a commission appointed; but he met with great opposition, and was so unfortunate in his experiments that he gave up the attempt to introduce a system of torpedo warfare in order to turn his attention to steam navigation, which he may be said to have introduced into that country. It may be remarked, however, that, during the course of his torpedo experiments, he developed the first notion of the torpedo steam launches of to day. This idea, which never got beyond the state of a model, consisted of a vessel of 300 tuns, shown in Fig. 1, with sides 6 feet thick, designed to be cannon-proof, and musket-proof decks six inches thick. She was to be propelled by a scull wheel, and was intended to carry two torpedoes on each side, fixed on the end of spars 96 feet long, supported by guys from the masthead.

It was not, however, until, during the civil war of America, the Southern States, being overpowered by the force and resources of their adversaries, resorted to a most extensive employment of torpedoes, that the power of this species of attack was developed.

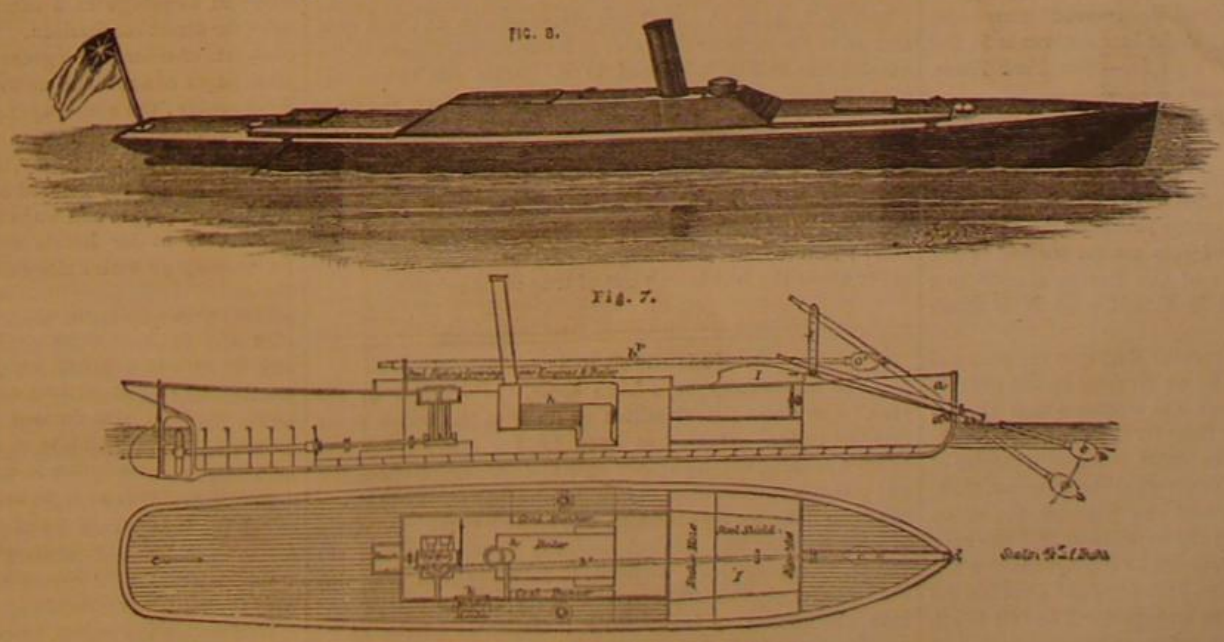
The first of these attacks was made off Charlestown, against the United States war vessel Ironsides, by a cigar-shaped boat under the command of Lieutenant Cassell, with a crew of three men, carrying a torpedo containing 60 lbs. of powder at the end of a spar. Not knowing the action of the explosion, and thinking that their boat would probably be sunk by it, her crew jumped overboard before ramming. The explosion, though severe, failed to effect any hole in the bottom of the Ironsides; the boat was also uninjured, and was found drifting, half full of water, by her engineer, who climbed into her, made up his fires, and steamed back safely to Charlestown. The next attempt was also made off Charlestown, with a plunging boat, against the United States steamer Housatonic, which was sunk by the explosion, the torpedo boat, however, going down as well. This boat had already drowned sixteen men during the trials made with her in Charlestown harbor, the last time going down with a crew of nine persons, and not again appearing till she was fished up and put in order; and a fifth crew of six persons, under a Captain Dixon, undertook the attack on the Housatonic. She was propelled by means of a screw worked by a crank, which required the six men, sitting three and three opposite each other, to turn it.

The confederate ship Albemarle was sunk by a torpedo launch, commanded by Lieutenant Cushing. The launch, however, was also sunk by the explosion; and out of a crew of fourteen persons, only two saved themselves by swimming. Both sides were employed in preparing special spar torpedo boats when the war terminated. Just before the close of it, however, a remarkable attack was made, in the James River, on the merchant vessels which had brought supplies to Grant's army, by the confederate fleet of three ironclad rams and seven gunboats, all armed with torpedoes, fixed on the end of spars, 30 feet or 40 feet long, which projected from their bows, and could be raised or lowered by a tackle. This fleet was stopped by a boom, and two of the ironclads got aground, where they remained all night, under fire from the banks; but although their torpedoes were completely riddled with rifle shot, not one was exploded, as it so happened that the fuses were in no case struck. The Southern States had throughout employed percussion fuses, which were exploded on contact, the shape of their torpedoes being cylindrical with hemispherical ends, into which seven fuses were inserted, as shown in Fig. 2; these fuses (shown in Fig. 3) consisted of a cap of lead, *a*, containing a glass tube, *b*, filled with sulphuric acid, and surrounded with a mixture of chlorate of potash and white sugar, *c*, communicating with a primer, *d*, of mealed powder; on contact, the lead cap being crushed, the glass bottle was broken, and the sulphuric acid ignited the chlorate of potash and sugar, and fired the torpedo. The danger of a torpedo, furnished with these fuses, being exploded by contact with any floating log of wood or boom, before reaching the enemy's ship, and the extreme caution required in handling it, led the Federals to adopt a torpedo made as shown in Fig. 4, which could be detached from the spar, and having an air chamber provided to keep it nearly vertical when so detached, a tube being placed in its center, at the upper end of which an iron ball was kept in position by a pin; this pin was released by means of a rope, leading into the boat, and dropped on to a cone of fulminate.

Captain McEvoy, of the London Ordnance Works, invented the mechanical fuse, A, shown in Fig. 5, provided with the safety cap, B; but being afterwards impressed with the advantage arising from the use of electric communication, he invented, in 1871, the plan shown in Fig. 6. This consists of a metal bushing, *a a*, having its upper end closed by a thin metal dome, *b*, and a metal plug, *c*, screwed into its lower end. A metal spindle, *d*, is supported on a spiral spring, *e*, inserted in a recess, *f*, in the plug, *c*; a thin insulated bridge, *g*, is attached to the spindle, *d*, under which are two terminals, *h h*, of insulated wires, *i i*; one of these wires is connected with the battery, and the other, to which is attached the electric fuse, has either an earth or other connection with the battery. When the torpedo, with this closer attached, is projected against a vessel or other body, and receives a shock sufficient to crush in the thin metal dome, *b*, the spindle, *d*, is forced down until the metal bridge, *g*, is brought into contact with the two terminals, *h h*, thus completing the circuit of the electric fluid, and firing the fuse The wires would, of course, only be connected to the battery just before the action of ramming. It is, however, evident that the thin metal dome might be crushed in through some accident beforehand, and that then, as soon as the wires were connected, the torpedo would be fired at once. To overcome this difficulty, there has been substituted for the metal dome, *b*, one made of india rubber, fixed in a peculiar manner, which would always retain its form and allow the spring, *e*, to keep the circuit uncompleted. The torpedo is shaped as shown in Fig. 7, in order to



VARIOUS TORPEDOES.



SPAR TORPEDO LAUNCH.

insure the contact of the fuse with the vessel. The system of firing shown in Fig. 6 is that generally adopted with the torpedoes to be used with the launches which are being at present built for foreign countries. The launches may be divided into two classes, namely, those intended for river service, and those meant for ocean purposes. Fig. 7 represents a river launch similar to those constructed by Messrs. Yarrow and Hedley, of Poplar. The one shown is 45 feet long and 7 feet 6 inches beam, calculated to have a speed of 14 knots, built either of iron or steel, the plating being ¼ inch at the keel, and $\frac{3}{16}$ inch at the gunwale.

The draft is 3 feet 6 inches, and the freeboard 2 feet. There is a steel turtle-back shield, *g*, forward, ¼ inch full thick, to afford protection to the men and steering wheel, and throw off the water which might come on board from the explosion of the torpedo. The engines and boilers are also provided with steel sliding covers. The boilers are locomotive, with a total heating surface of 140 feet, the barrel plates being of ¼ inch. Lowmoor iron throughout, with ⅜ inches butt straps inside and out, double riveted; and the engines are non-condensing direct-acting, of 55 horse power, working up to 140 pounds pressure. The diameter of cylinders is 6½ inches and length of stroke 7½ inches. The frames are made of 1 inch angle irons with ⅜ inch reverse irons.

The spar, *c*, for the torpedo is shipped amidships, and can be run out over a roller. A pocket, *a*, suggested by Captain Davidson, is provided to allow the spar to have a greater depression than in the old plan of running it out over a roller on the top of the stem. Two stanchions, *f*, provided with pinholes, allow of the spar being depressed through an angle of 35°, a noiseless exhaust chamber, *k*, preventing the approach of the boat being heard. In this chamber the condensing is effected against a portion of the skin of the boat, the plates there being increased in thickness. It is surprising what a small effective surface is required to condense the steam in cases where the object is simply to condense it in order to avoid the noise, or to get the fresh water back into the boiler, and not with the object of obtaining a vacuum.

Fireless Locomotives.

It will be interesting to know that fireless locomotives are in constant and successful operation on a city and suburban railway in New Orleans, namely, the New Orleans and Carrollton Railway, under the able management of General G. T. Beauregard, who is a skillful engineer, and yet who is is alive to, and keeps pace with the improvements of the age. This success has been achieved, too, under the most adverse and unpromising circumstances. The road under other running arrangements had become nearly valueless, its stock having gone down to 7 cents; but it is now a paying and valuable road. The road is about six miles in length. From the center to the outskirts of the city it is operated by mule power; there the mule is taken from the car, and the little fireless locomotive is attached, which is accomplished in less time than would be occupied in attaching another mule. The train is then off like a rocket, the driver still on the platform of the car working the engine, managing the brakes, and making change, as usual; there is no other person on the train to attend these duties. The car is started and stopped quicker than when drawn by the mule. The railway (double track) is in the middle of a very wide street, and is a little raised, so that it cannot be crossed by carriages except at the street crossings; thus, being somewhat isolated, high speed is admissible. The locomotive is simply a cylinder of boiler iron, perhaps 3 feet in diameter and 10 feet long, mounted on four wheels, and partly filled with water. The engine—a double vertical—is attached to the end of the cylinder next the car, being within reach of the driver. The cylinder is then filled with steam at a proper pressure, from a stationary boiler at Carrollton, when the locomotive is ready, and it will run to the city and back without care or expense. There is no fire, no ashes, no pump, no danger, and less noise than from the hoofs of horses. The expense of this means of propulsion, General Beauregard assured me, is less than by mules. The cost of the locomotives is $1,250 each, which includes the builder's profit.—*New York Times.*

Responsibility for Employees' Injuries.

It has been established that failing to make reasonable provision for the safety of employees is a negligence employers are liable for; but judges and juries have failed to uniformly determine just what is a "reasonable provision." The nearest approach to the settlement of this matter we find in the court news of a recent number of the Boston *Herald*, in a case in the Supreme Court, of M. F. Avilla *vs.* N. C. Nash *et al.*

"The action was brought to recover damages for personal injuries resulting from the fall of an elevator in the defendants' refinery. At the trial there was evidence that the defendants had given directions to their foreman to forbid workmen riding on the elevator. The court ruled as a matter of law that, if the defendants had so directed the foreman, then, even in case he had not informed the plaintiff, the action could not be maintained against the defendants, for the accident was the result of the carelessness or negligence of a fellow workman, the foreman. The jury returned a verdict for the defendants, and the plaintiffs excepted. The full bench have now sent down a rescript sustaining the exceptions, and have ordered a new trial."

The point turns upon the fact as to whether Messrs. Nash had cautioned their foreman and directed him to forbid the workmen using the elevator.

It is hardly proper to surmise what the results of a new trial will be, but the decision already secured by Messrs. Nash will have an important bearing to all manufacturers, and the case as above cited should be placed in the hands of all superintendents and foremen, that they may be fully apprised of the responsibility they assume in not enforcing a strict compliance with orders for the security of life and limb.

Correspondence.

Hard Rubber Thermometers.

To the Editor of the Scientific American:

In 1852, I noticed the electric properties of hard rubber or vulcanite; and in 1853, I made arrangements with the owners of the patent for the manufacture of insulators for telegraph wire from this substance. The first orders for them were received from California; and as transportation was very expensive on the Isthmus route, they were made very light, weighing but half an ounce each. On arrival they were heated to about 300° Fah., by which they were expanded; and while in this condition, they were placed upon iron pins, to which they were held firmly by contraction.

My attention having been thus called to the dilatability of hard rubber, several thermometers were made from it. One was made by riveting it to a thin strip of steel, about a foot in length, and one fourth of an inch in width. The bottom of this was held fast, while the top was free to move, and so to indicate the temperature on a graduated arc. This one, now in use, has a range from zero to 90° Fah., and is as sensitive as the common mercurial thermometer. It is well adapted for the ordinary range of the atmosphere, but is not suitable for indicating high degrees of heat, as the rubber softens at about 200° Fah. One of them was made by perforating a thin strip of steel, at intervals of an inch, and placing upon it a strip of rubber compound when in a plastic state. This was coiled, with an intermediate strip of metal, which forced the rubber through the holes. It was then vulcanized in the usual manner; and when cold, the intermediate strip was withdrawn, leaving an open space between the coils. This saved the trouble of riveting, and gave to the rubber an unbroken and smooth surface. The coil is held fast at the center, and the outer end is left free to move. Another thermometer was made of glass and hard rubber, the latter in the form of an arc, being riveted at both of its ends to a glass plate, which formed the chord.

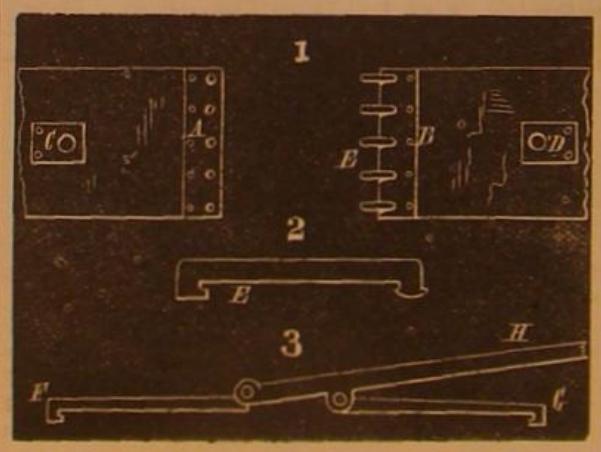
Instruments of this kind are much better than mercurial thermometers for making electric connection with alarm bells to indicate excess of heat.

Boston, Mass. J. M. B.

Coupling Machine Belts.

To the Editor of the Scientific American:

Seeing a query in your issue of March 13 about putting together belts which have to be frequently uncoupled, I send you an illustration of a 6-inch belt, which I have been running for over a year, reversing it from one to four times a week.



In Fig. 1, A, B, C, and D are pieces of No. 16 sheet iron, riveted to the ends of the belt; E E are hooks, shown in the natural size in Fig. 2, riveted to B. After the belt is laid over the pulleys, the hooks, F and G, of the lever, shown in Fig. 3, are placed in the holes at C and D. Now the two ends of the belt are drawn together by the lever, H; and the hooks, E, are put in their places at A. Then the lever is taken out, leaving the joint finished.

By this method, two men can set and couple a belt in the least possible time, obtaining an effectual joint, which will never allow the belt to run out of true or to reverse.

W. KAPP.

HOUSEHOLD HINTS.—I.

"The melancholy days have come, the saddest of the year," ejaculates paterfamilias as he lugs the stove down into the cellar. There has been for the last twenty-four hours a reeking atmosphere of soap and soda and step ladders and moist scrub women pervading the house. Rest, there has been none for him indoors, and so he has made a virtue of necessity and has worked manfully at taking down the stoves, wrapping them, we hope, in old carpet, and fastening the legs and pipe together so that they cannot escape and hide themselves in ingeniously inaccessible places, as he vehemently affirmed they did, when he found them in the garret and under the coal and in the chicken house last fall. Materfamilias, we trust, has fully perused the recipes we have been publishing for the last six months, and the knowledge thus gained has been practically applied in cleaning the paint and the windows, destroying vermin, and putting the house in "apple pie" order generally. At last it is all over, the rooms are "painfully clean," and the bright sunlight pouring into the open windows is revealing the threadbare spots in the carpets, and the cracks and knocks on the furniture only too plainly. A high court of inquiry has been held, and the superanuated veterans which have done long and faithful service on the floors, or have survived many a year's hard usage about the rooms, are at last condemned. Then the heads of the family, who, like sensible people, have waited for the high prices peculiar to Mayday to subside, prepare to sally forth on visits to carpet and furniture stores, and paterfamilias figures up his check book or draws his winter's savings from the savings' bank ready to withstand the coming financial strain.

("I don't see nuthin' about Science in all that. What's it got to do with masheens?" interrupted the practical man who happened into our sanctum just in time to hear us read over the foregoing paragraph to ourselves. "Nothing, excellent and anti-theoretical friend," we reply, "nothing about 'masheens' is therein contained; but as to Science, it relates to the science of home, the science of making one's life something more than one "demnition grind" for existence, by—as you will perceive if you continue looking over our shoulder as we proceed with our writing—rendering that home more attractive, more cheerful, and so making for yourself and yours a sanctuary, at the doors of which the cares of labor may be laid aside." He said that it must have cost "an awful lot to polish that 'ere model with the file," from which we inferred that our previous remark was lost upon him, so we resumed our pen, oblivious to his further presence.)

We were about to observe that, before buying furniture and carpets—if we may venture to intrude upon the family discussion which is taking place previous to the exodus to the shops above mentioned—there are several facts well worth remembering, which may assist one in selecting goods, and besides tend to save money; and at the same time there are a few more hints which we have to offer which mainly relate to simple decoration, and which, we think, may result in making the rooms which are to be renovated look perhaps a little more tasteful and pretty. Let us suppose that a sitting room which also does duty for a parlor is to be newly furnished. The walls are now either plain white or else the old paper has been scraped off and new hangings are required. The first question is of a carpet. Some people believe that the English article is the best; so it is we think, as a general rule, so far as colors are concerned, but if durability is considered a first requisite, then the American goods, if of first quality, are fully equal to those of foreign make. A good carpet is thick, pliable, and well woven, and it is better economy to buy a good article like a real Brussels at the outset. Ingrains are now made to go with Venetian borders, but these do not wear equal to Brussels, and besides with the border costs nearly as much. In this city the best body Brussels costs from $1.75 to $2.50 per yard, and the lining (which consists of layers of stout brown paper with cotton batting between, and which saves carpets wonderfully, particularly if the floor be at all uneven), is easily made, or costs when bought 10 cents a yard. For those who can afford a little extra expense, it may be well either to mat the floor or else plane it very smooth, putty up all the cracks, and stain brown, finishing with a coat or two of shellac dissolved in alcohol. Then cover the middle with a large rug, leaving a yard of uncovered space around the walls. Handsome druggets can be bought very reasonably for this purpose; or two Turkish rugs (each about 4x6 feet, such as are sold for $15 to $18 a piece), placed side by side, would be large enough for a good-sized apartment, though costing more than the drugget. These can be easily taken up and shaken, or in summer can be removed altogether, leaving the cool matted or painted floor. Turkish rugs, besides, are like camel's hair shawls; they will accord with any color of furniture or wall, and are almost indestructible by wear.

To return to the carpet: supposing such to be the choice: we should advise the selection of that and the wall paper at the same time. It is a good plan to procure a roll of the intended hangings as a sample, and carry it to the carpet store for direct comparison. This will save many awkward contrasts of color. If a green carpet be decided upon, then a plain paper of a rose tint, or with that shade prevailing, accords handsomely; the same paper goes well with the unobtrusive gray-patterned carpets now very much in fashion. If the walls be tinted French gray, in kalsomine or paint, this shade will suit almost any colored carpet, especially red or crimson. Big-figured papers and huge medallion carpets are abominations only fit for hotels and steamboats. Bright tinted papers may go with a rich-toned carpet, or with one in which the colors are mingled; but we never should select hangings printed with impossible birds and animals, or a carpet covered with gaudy flowers, hideous designs in red and yellow which look like a petrified firework explosion, or incomprehensible and huge scroll work. A neat, small, quiet figure is by far the most genteel and appropriate, while it is much more economical, as none of the stuff is ever wasted in matching.

Before laying the carpet, if moths are suspected, it is well to rub the boards over with turpentine; sprinkling with very dilute carbolic acid, about a tablespoonful to a gallon of water, is also a good precaution. This last should be rubbed over the walls before the paper is put on.

Now comes the matter of furniture. Do not buy the so-called "cottage" stuff. It has no merit save that of cheapness, and our own experience in its use has left us with the firm conviction that glue was too expensive and it was stuck together with gum arabic. A hearty sneeze from a stout person is ordinarily sufficient to completely disorganize the chair he may be sitting on. Besides, it is usually of pine wood, for which bedbugs have an extraordinary predilection. Do not buy veneered furniture, especially if there be furnace

heat, for the veneering, generally after short wear, manifests a strong desire to part company with the wood. Buy good substantial solid work, not machine-made, as it is termed in contradiction to hand-made. Machine furniture is sold by the cheaper dealers, and it is put together with wooden dowels. It is, besides, turned out in large quantities of the same pattern at a time, and too often hastily glued together. It looks well enough at the start, but its lasting qualities are poor. Hand-made furniture, though its integral parts are of course machine work, is produced with greater care. The wood used is thicker and more carefully selected, and iron dowels are used as fastenings. It is well to look carefully to this difference, as it much more than compensates for the disparity in price.

In our next issue we shall have something further to say about furniture, before passing to the other subjects to which, in these papers, we propose to allude.

ARCTIC NOTES.

Captain Nares, who is in command of the new British arctic expedition, recently made an address at Winchester, before the college boys, in which he gave a variety of interesting particulars connected with his previous experience in the frozen regions.

ICE WATER AS A HEATER.

Speaking of sledge expeditions, he said they always made it a point to encamp on the level snow, over the water, the heat given off by the water underneath warming them considerably, and the tent was warmer when spread over the ice than over the snow.

BOOTS AND OTHER CLOTHING.

He next described the interior of the tent, the clothing, etc., and stated that their footgear was the only thing they took off. When they took their boots off, they were necessarily damp, and unless they put them under their beds they would freeze; so they lay on them all night to keep them warm for the morning.

While on board the ship, taking short walks and retiring to a dry cabin, sealskin clothes, he said, were very good; but as soon as they started on a traveling expedition, having only a common light tent to which to retire, they could wear nothing but flannel and cloth clothes, covered with a light, outer duck suit, which caught the snow. They started wearing their skin dresses, but though they were limp enough the first evening, in the morning they found them frozen as hard as boards. It was impossible to put them on, and they were left on the ice for the bears.

FREEZING OF WATER BOTTLES.

Captain Nares next referred to the water bottle, which was worn inside the dress next the skin. Though the inner side of the bottle was warm, the outer skin froze. A layer of ice collected on the outer side of the bottle, and day by day gradually became thicker, and in a week they were all thrown away. For the present expedition they were trying to cover the bottles with flannel, but these would be just the same.

He called attention to the fact that they gradually became reconciled to the want of water, and they merely had half a tumblerful in the middle of the day when they stopped for lunch. This was exactly the experience of all arctic travellers. He mentioned that when the men in his party, on leaving the tent, were offered an extra quantity of either tea or grog, they all chose the tea.

ARCTIC TEMPERATURE.

On the 4th of November, Captain Nares's party saw the sun for the last time until the 5th of February, after an absence of 93 days. He stated that the coldest temperature of all was 62° below zero, which was equal to 92° of cold, or the same amount of cold as would balance a hot temperature of 126°, and this agreed with the highest heat ever registered. As long as they were on board the ship in calm, they could walk about, but immediately there was the slightest wind they were frostbitten.

AIMS OF THE NEW EXPEDITION.

Captain Nares said, in conclusion, that in the present expedition it would all depend on the favorable or unfavorable state of the ice how far they got north, and where they should leave the depot ships. Should they be fortunate enough to reach latitude 82°, as Hall did easily (to which they knew the land extended), they would have every prospect of being able to journey the 500 miles still cutting them off from the pole. Of course, if there were land there, they could only skirt round the shores. If there were water, one of the ships would be taken up as far as possible. The previous expeditions in this direction had never been sufficiently equipped for traveling. In the last voyage, by the Polaris, no traveling, to speak of, was attempted, and they merely knew that the land extended to some 50 or 60 miles further on without any appearance of its coming to an end. Of course, in the present expedition, they would push as near the pole as possible; but after the first week in September one ran the risk of the ship never being actually stationary in a harbor, and unable, therefore, to be made the base of departures for sledge journeys. She might even be drifted by the current ignominiously and helplessly to the southward, perhaps passing the consort, who would necessarily be snugly posted in a protected harbor. However, with God's help, they would do their best, and the meeting might depend on it they would not fail through want of perseverance.

ARCTIC AMUSEMENTS.

A sick man in the arctic circle would not only be a burden to himself, but so handicap his messmates as probably to put in jeopardy the success of the undertaking. Absolute health has, therefore, been made a *sine qua non*; and it may be assumed that all truly healthy men are of a cheerful disposition.

But the expedition is provided with artificial aids to good fellowship. The Admiralty have not made it a condition that the officers should be able to sing a good song or dance a hornpipe, but such like accomplishments are of great importance under the circumstances, and measures will be taken to encourage the histrionic powers of the ships' companies.

Mr. Clements Markham remarks that the "most valuable" qualifications for arctic service are aptitude for taking part in those "winter amusements which give life to the expedition during the months of forced inaction," and in his arctic navy list he has recorded the part which each officer took in the polar theatricals. Captain Nares, while mate under Kellett, sustained the character of Lady Clara in the historical drama of *Charles II.*; and he will probably see that the stage of the Alert does not lack novelties. Admiral Sherard Osborn was manager of "the Arctic Philharmonic Entertainments," on board the Pioneer; Admiral Ommanney was manager of the "Royal Arctic Theater," on board the Assistance, and acted the part of Mrs. Crank in the farce of *Did you ever Send your Wife to Camberwell?* Admiral Nias performed Sir Simon in *Miss in her Teens*, Perriwinkle in *A Bold Stroke for a Wife*, and other parts; General Sir Edward Sabine was also a member of the now historic "Arctic Theater," and acted Lord Minnikin in *Bon Ton*.

In fact, the majority of our most noted arctic navigators were, from the exigencies of their position, admirable amateur performers; and in furnishing a theatrical wardrobe and appurtenances, the government are contributing in no mean degree, and, perhaps, to a much greater extent than they suppose, to the success of the arctic expedition of 1875.

Patent Rights.

Among the many improvements in commercial law recently advocated in England, one of the most remarkable is the demand for the abolition of patent right. Not only, it is said, is the advancement of the nation in material prosperity hindered by the protection hitherto accorded to inventors, but those unfortunate persons are themselves injured by the laws intended to preserve to them the fruit of their time and labor. It is urged that the inventor cannot be restrained from inventing; and that there should be a system of national rewards for conspicuous improvements, and that purely honorary distinctions should be liberally bestowed. Interference with the freedom of trade is, moreover, declared to be only one of the evils arising from the protection of the inventor, and a whole catalogue of difficulties is assigned to the same source. English manufacturers are said to be put at a disadvantage compared with those of other countries where there is no patent law. A patent once granted bars the way for further improvements in the same direction; patents are granted for useless things, and for already old contrivances. In addition to these disadvantages, the existence of patents gives rise to expensive and tedious litigation; and to sum up, patentees are themselves, in the gross, great losers.

In a paper "On the Expediency of Protection for Inventions," recently read before the London Society of Arts, these objections, not to the present patent law prevailing in England, but to all patent laws whatever, were very ably combated, and the rights of the poet, even, if his creative faculty take a mechanical turn, were vigorously maintained. Those who peruse the history of inventions can hardly lay aside the sad narrative without a feeling of pity for the melancholy destiny of the men whose patient thought has enriched the world. Palissy burned the bed from under him to feed his furnace; Dud Dudley was ruined by the sheer brute strength opposed to him; and Crompton, the inventor of the spinning mule, who, to protect his unpatented invention, commenced a secret manufacture at his house, called the "Hall in the Woods," found it besieged, and ultimately broken into and rifled by those who were destined to profit by his labors. Over and over again occurs the same dreary story of hope deferred, resources exhausted, and health broken. For it must be remembered that the contriver of a great improvement in the machinery of an important industry, although a benefactor of his species, by no means appears in this enviable light to those whose work he designs to improve. The wealthy manufacturer doing a profitable business dislikes to stop his costly and extensive works to test a new invention, and his work people resent any attempt to teach them new ways. Hence the poor inventor is often regarded rather as a nuisance than a benefactor, and finds himself opposed instead of encouraged.

The charge that the growing strength of foreign competition in departments of industry over which England has been accustomed to reign supreme is due to patent rights can hardly be sustained. The practical answer lies in the fact that Great Britain, the United States, and France all have efficient patent laws, and yet in no other countries are manufactures so vigorous and improvement so rife. Few countries claiming to be civilized are without patent law. Switzerland has none, but the only manufactures for which that country is famous are alpen stocks and long hotel bills.—*Inter-Ocean*.

WHEN it is not convenient to take a lock apart to fit a new key, the key blank should be smoked over a candle, inserted in the keyhole, and pressed firmly against the opposing wards of the lock. The indentations in the smoked portion made by the wards will show where to file.

An Old Prophecy.

One of our New England exchanges has come across an old almanac, dated 1755, edited by Dr. Nathaniel Ames, who lived in Dedham, Mass., published in Boston, and in one of its articles Dr. Ames made use of these prophetic words:

"There lie buried in all this vast region materials for the art and ingenuity of man to work upon—treasures of immense worth, concealed from the poor, ignorant, aboriginal natives. The curious have observed that the progress of human literature, like the sun, is from the east to the west; thus it has traveled through Asia and Europe, and now has arrived at the eastern shore of America. As the celestial light of the Gospel was directed here by the finger of God, it will doubtless finally drive the long, long night of heathenish darkness from America. So arts and science will change the face of nature in their tour from hence over the Appalachian Mountains to the western ocean; and as they march through the vast desert, the residence of wild beasts will be broken up and their obscene howl cease forever, instead of which the stones and trees will dance together at the music of Orpheus, the rocks will disclose their hidden gems, and the inestimable treasures of gold and silver be broken. Huge mountains of ore will be discovered, and vast stores reserved for future generations. This metal, more useful than gold and silver, will employ millions of hands, not only to form the martial sword and peaceful share alternately, but an infinity of utensils, improved in the exercise of art and handicraft among men. Nature through all her works has stamped authority on this law, namely, 'that all fit matter shall be improved to its best purposes.' Shall not, then, those vast quarries that teem with mechanic stones—those for structure be piled into great cities, and those for sculpture into statues to perpetuate the honor of renowned heroes, even those who shall now save their country? Oh! ye unborn inhabitants of America, should this page escape its destined conflagration at the year's end, and those alphabetical letters remain legible, when your eyes behold the sun after he has rolled the seasons round for a century to come, you will know that in Anno Domini, 1755, we dreamed of your times!"

The Electric Light.

Dr. Wilde, of the Academy of Sciences of St. Petersburgh, and Director of the Central Physical Observatory, has recently made a report to the Academy upon the new mode of producing the electric light proposed by M. Ladiguin, of that city, and mentioned on page 227 of the SCIENTIFIC AMERICAN, present volume. Since the discovery of the voltaic arc in 1821 by Davy, many attempts have been made to utilize it practically for illumination. But in spite of the regulators devised for the purpose, it still remains variable and inconstant; being too intense, used at a single point, it is yet incapable of division. Since the improved magneto-electric machines have reduced the cost of the electric light to only one third that of coal gas, these efforts to utilize it have been redoubled. And, as a result, M. Ladiguin has made an invention which, in a very simple way, resolves both problems, rendering the light steady, and at the same time capable of division. It has long been known that the electric light proper comes from the intensely heated carbons which the current traverses, the resistance of the air between them developing this heat. So the resistance of a platinum wire placed in circuit causes it to be highly heated; but the light thus obtained, though constant and entirely controllable, is too feeble for practical use. M. Ladiguin has conceived the idea of replacing the platinum wire in this experiment with a thin rod of gas carbon, and with complete success. Carbon possesses, even at the same temperature, a much greater light-radiating power than platinum; its calorific capacity is less than one half that of platinum; it is, moreover, a sufficiently good conductor of heat; so that the same quantity of heat elevates the temperature of a small rod of carbon to nearly double that of a wire of platinum of the same size. Again, the resistance of the carbon employed is 250 times greater than that of platinum; hence it follows that a rod of carbon may be fifteen times as thick as a wire of platinum the same length, and yet be heated by the same current to the same degree. Finally, the carbon may be heated to the most intense whiteness without the danger of fusion, to which platinum is liable. These are some of the advantages of carbon; its only disadvantage is that heated in air it burns, and so gradually wastes. But M. Ladiguin has happily obviated this difficulty by enclosing the rod of carbon in a glass cylinder containing no oxygen and hermetically sealed. Dr. Wilde asks, in conclusion, that the Academy recognize the fact that M. Ladiguin has resolved the grand problem of dividing and rendering steady the electric light, in the simplest possible manner, and that they award him, in consequence, the Lomonossow prize.

White Ants at St. Helena.

White ants were introduced into the island in 1840 in some timber from a slave ship. Mr. M'Lachlan has identified the species *termes tenuis*, Hagen, peculiar to South America. The mischief which it has done is almost incredible, and it appears to have simply gradually destroyed the whole of Jamestown. A considerable portion of the books in the public library, especially theological literature, was devoured by them, and the whole of the interior would be destroyed without the exterior of the volumes seeming otherwise than intact.

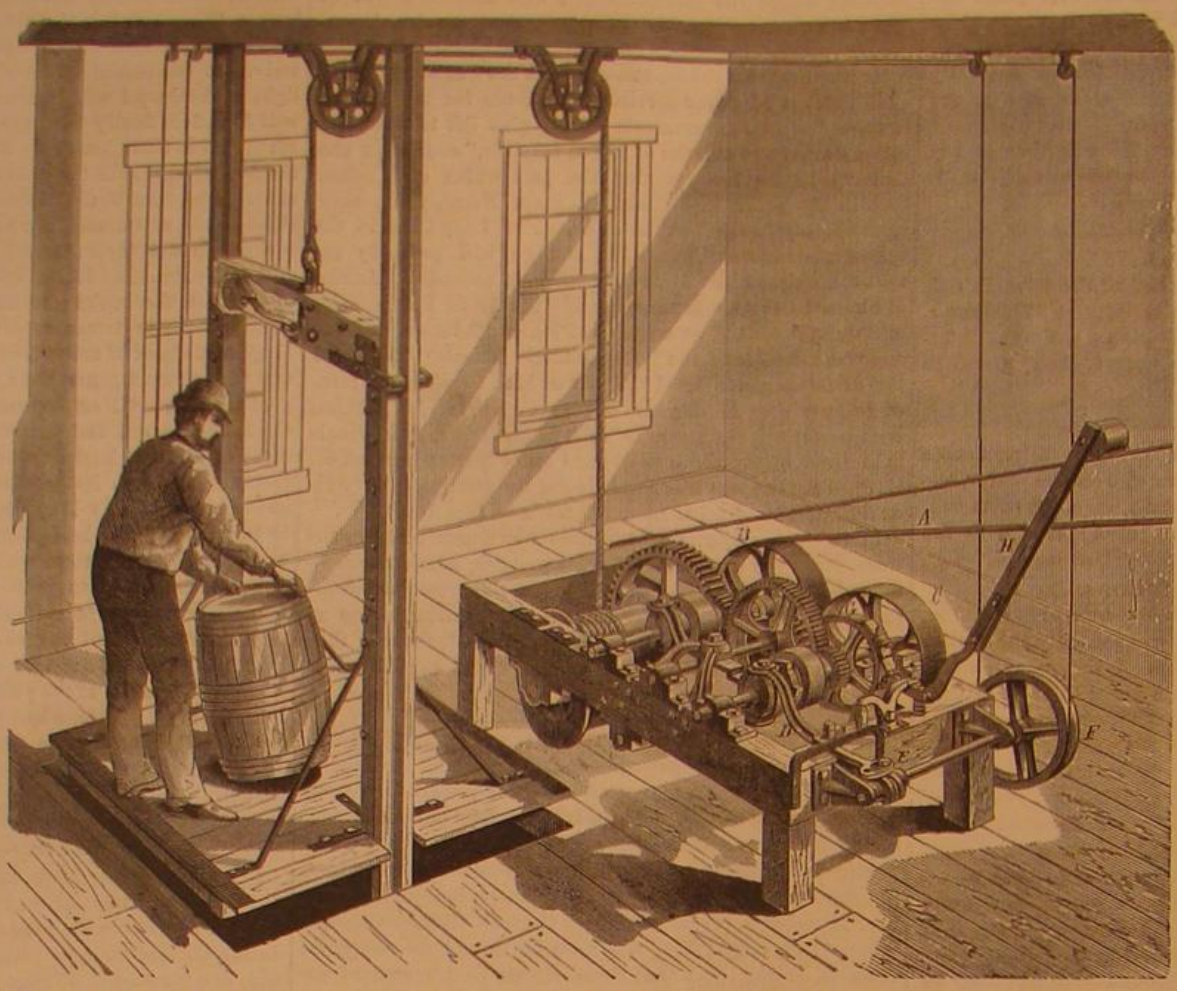
A GOOD cement for chemical and electrical apparatus may be prepared by mixing 5 lbs. resin, 1 lb. wax, 1 lb. red ocher, and 2 ozs. plaster of Paris, melting the whole with moderate heat.

IMPROVED ELEVATOR.

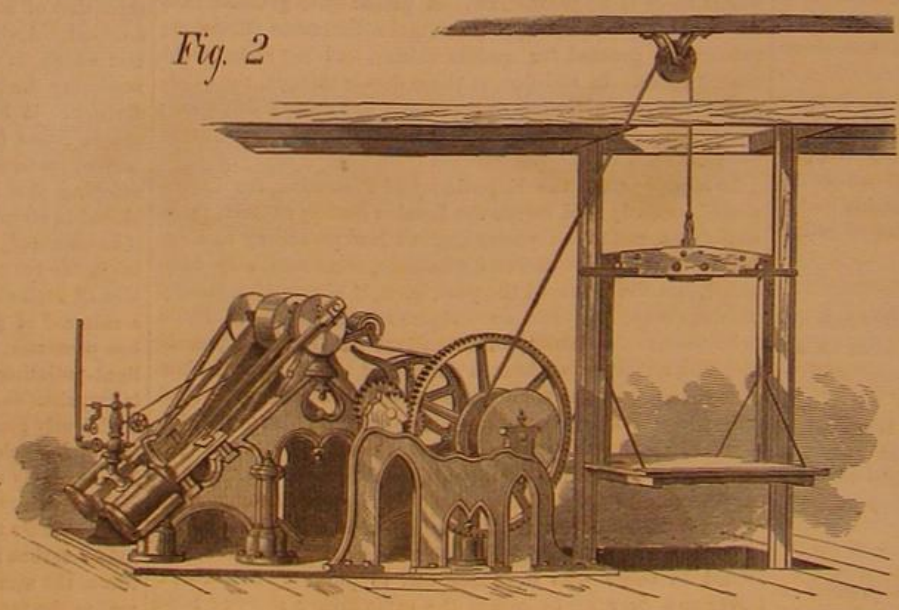
We illustrate herewith improved mechanism for elevators, in which will be found combined several novel devices, tending to simplify the apparatus as well as to render the same strong and safe. Among the new features are the means for holding the platform should the hoisting rope break, the use of a single belt running in one direction to actuate the hoisting gear, an improved clutch, and a simple arrangement of an idler on the belt, in connection with a brake lever, which last, on the breaking of the belt, at once throws the brake into action, and so stops the machinery.

We also illustrate, in Fig. 2, the direct application of a steam engine to the hoisting gear, in cases, for example, where power cannot be obtained from some main source in the building. The engine is built by the same manufacturers, and is of neat and compact pattern, well adapted to this special purpose.

Referring to Fig. 1, it will be seen that the driving belt, A, is caused to lap over both pulleys, B and C, thereby rotating the same in contrary directions, and, through its application to a large pulley surface, communicating an increased amount of power without slipping. D is a bar pivoted to the center and provided at each side of its pivot with clutches which engage with pulleys on the shafts of wheels, B and C. It is obvious that but one clutch can be thrown into action at a time, and this is done by the end of the bar, D, at E, being provided with a projection which enters a worm on a shaft, at the extremity of which is a pulley, F. Cords from this pulley are led down alongside the elevator carriage. By means of said cords the pulley, F, may be turned in one or the other direction, so moving correspondingly the end of bar, D, and thus throwing into action one or the other of the clutches. The latter are of novel construction, and consist essentially of cones which, on entering the pulleys, expand movable pieces which enter V-shaped grooves and tightly bind. The effect of operating the clutches is, as will be obvious from the gearing represented, to transmit motion to the hoisting drum in one or the other direction, and so to hoist or lower the carriage. In order to hold the mechanism during the instant when, in shifting the clutches, both are thrown out of gear, a bell crank lever, connected with the end of the bar, D, is provided. This, when the bar is moved either way, pulls down the brake on the brake wheel, G. The same, of course, serves as the means for stopping the carriage at any desired point. Connected also with the brake is a long lever, I, which terminates in an idler which rests on the belt. Should the latter become ruptured, the lever falls, and its weight, applying the brake at once, prevents accident by arresting the motion of the mechanism. This arrangement obviates the necessity of the governor usually provided.



HOLSKE'S ELEVATOR.



An inspection of the standards in which the platform travels will show that the rack, ordinarily placed on the inner sides, with which pawls engage, and so prevent the fall of the platform in event of the breakage of the hoisting, is here done away with. The safety mechanism substituted is much simpler and, at the same time, cheaper. It is shown in the broken away portion of the upper crossbar of the platform, and consists of a reversed T-shaped piece of iron, the vertical portion of which passes through the bar and serves as a point of attachment of the hoisting rope. The horizontal part of the T underneath connects with a leaf spring, and this with a toothed pivoted eccentric. When a strain is on the T piece, the spring is held out of action; but on the breakage of the rope the T piece falls, the spring is thrown outward, and the cam turned so that its widest portion becomes jammed, and the teeth bite in the wood of the standard, thus holding the carriage securely. The same arrangement is on each side of the crossbar, which is also steadied and held in place by the guide rollers shown at I.

The mechanism generally is of excellent construction, and, judging from practical trials which we have witnessed, appears to show that the claims of its manufacturers are fully substantiated.

For further particulars address the Holske Manufacturing Company, 279 Cherry street, New York city.

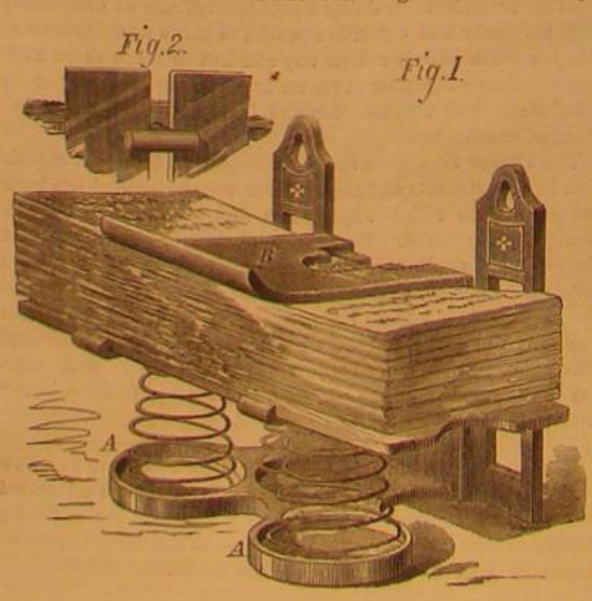
IT is said that a few drops of oil of anise or oil of rhodium, placed upon bait, will entice animals into a trap.

Vulcanizing of Caoutchouc.

Professor Böttger states that Gaulthier de Caulbry has established by experiment that, upon mixing flowers of sulphur and dry chloride of lime in a porcelain mortar very intimately, a decided odor of chloride of sulphur soon becomes noticeable, accompanied by an elevation of the temperature of the mixture, while the sulphur softens, and a plastic mass is formed. If the sulphur is largely in excess of the chloride of lime, and they are mixed without hard grinding, the product, with or without the addition of chalk, zinc white, etc., when added to caoutchouc softened in bisulphide of carbon or oil of turpentine, causes so-called vulcanization at the ordinary temperature, or upon slightly warming. With chloride of lime in excess, the mass remains pulverulent, instead of becoming pasty.

IMPROVED BILL FILE.

The device herewith illustrated is designed to hold firmly, and without punching or mutilating in any way, all kinds of papers, such as bills, statements, deeds, manuscripts, etc., of any size, either folded or open, and in such a manner that any heading can be found at once, and so that one or several papers may be removed or inserted easily and quickly, without disturbing those not wanted. It adapts itself to any uneven thickness which may exist in the folds of the papers. When the file is full, the papers are already partially compressed and in proper shape for tying up and putting away in bundles.



In the bed are shallow cups, A, holding conical spiral springs, which bear upward with a constant pressure against a piece on which rests a table. The piece beneath the table has on its under side small cups for confining the upper ends of the springs, and on its back edge a cross, Fig. 2, which works in a slot in the upright portion of the bed, and holds the table in proper position. The table is of wood; the balance of the file is metal. The papers are inserted at a single movement by being taken at both ends between the thumbs and fingers and introduced between the table and the top plate, B.

The file can be suspended on a wall by the ears, as shown, but ordinarily it will rest upon a desk or writing table. The conical shape of the springs allows them, when the file is full, to be received entirely into the shallow cup, thus giving the entire space (about three inches being a convenient size) for the reception of the papers. There is not a screw, rivet, nor fastening of any kind used in the construction of the file, all parts being neatly fitted together.

Patented through the Scientific American Patent Agency, March 2, 1875, to Richard H. Hoffman, of Keyser, Mineral county, West Va. The exclusive right to the patent is offered for sale. For further information, address the patentee as above.

Improvement in Music Printing.

For printing music it is necessary to have, first of all, the composition lightly sketched on sheets of tin, after which it is engraved on the plate by a workman, who holds a punch in his left and a hammer in his right. As the design has to be transferred, it is engraved reversed, which requires both an experienced eye and a steady hand.

M. Lourdel, the well known photographer, of Paris, thought it would be a great saving to suppress the sheets of tin, which cost generally about 82 cents. To do this a piece of transfer paper is taken, which has been previously lined and spaced. The workman has before him a composition case like a printer's, which contains in each division a tool, at the extremity of which is a musical sign. Beside him is a pad impregnated with transfer ink. He lays the ruled transfer paper before him, and with the right hand he takes the musical signs, notes, etc., inks them, and prints the paper without the slightest effort. It is simply a matter of regularity and rapidity, speed being easily acquired after a little practice. The music is then transferred to the stone and proofs taken at will.

Penikese School.

It is certainly a misfortune that the Penikese school, after so promising a start and with its usefulness so well demonstrated by its work during the two summers which it has been in existence, should now be compelled to suspend for lack of funds. Mr. Alexander Agassiz states that the Anderson donation has sufficed to equip the school in an inexpensive manner and to support it up to the present summer; but that this is now exhausted. As an attempt to levy a charge upon the pupils has proved fruitless, nothing remains but to close the doors.

The usual class of scholars who have hitherto taken advantage of the summer session have been principally teachers and students of natural history, of straitened means, and who, although enthusiasts in study, are as a rule unable to contribute toward any educational project, however beneficial, out of their scanty earnings. Consequently, when it was announced that the Penikese school was no longer free, a few individuals responded and the large majority stayed away; and hence the suspension of operations. An excellent opportunity is here offered by some friend of Science to revive the school by means of a liberal endowment, and to avoid the scandal that must certainly be caused if Mr. Anderson's generosity is allowed to be nullified fo want of a few dollars.

ENGLISH GARDENS.

Carclew House, Cornwall, England, the residence of Colonel Tremayne, has a high renown among the horticultural establishments of the West of England, a district enjoying a very mild climate, even for that country, and peopled by a race who are, like the Scotch, gardeners by instinct and inherited disposition. "In this favored spot," says a recent visitor, "rhododendrons of all kinds seem quite at home, and the same may be said of the camellia and Indian azalea, noble examples of which were every now and then to be met with. A Loquat tree, *eriobotrya japonica*, was 10 feet high, as much through, and in the most robust health. The same may be said of *escallonia pterocladon*, quite 15 feet high, having white flowers, and more tree-like in character than the other species. The singular *colletia Bictoniensis* was also here in the shape of a dense bush quite 7 feet in diameter; and there were specimens of *fabiana imbricata* quite as large. I noticed a fine mass of *hedychum flavum* or *flavescens*, which, to all appearance, had not been disturbed for many years, and was flowering most abundantly. I noticed a rhododendron of the true *arboreum* section, or one very near akin to it, with a clear bole more than 6 feet high without a branch, and stout enough to form a gate post for a carriage road. The general character of the place must be extremely rich at the time these shrubs are in flower; and when it is understood that some of them flower in winter, accompanied by camellias, the effect must be gorgeous. Intermixed with these rhododendrons, etc., were magnolias of the deciduous class, assuming the character of timber trees, and there was no lack of flowers, on open standard trees, of *m. grandiflora*."

Although these various semi-tropical shrubs grow freely in the open air, Nature is liberally supplemented by every improved appliance in the way of hot and forcing houses. Orchids of the tropics and all other exotics are grown in great profusion; and the vineries and orchard houses are of great extent, and are renowned for the handsome fruit of nearly all kinds grown in them.

We give herewith a view, showing one portion of the gardens, with the fountain and basin in the center. The garden is geometrical, consisting of twelve beds with borders at the sides, etc., on gravel, the beds edged with box. The four beds through the center in line with the basin are carpet-bedded; four others, flanking the basin, are all planted alike with geraniums, calceolarias, perilla, and lobelia. Outside these, and, as it were, surrounding them, are four other large beds, which are planted with herbaceous plants, etc., and a row of dahlias down the center. In front of the hothouse can be seen a mass of belladonna lily, myrtle bushes, etc. Besides the pampas grasses, in the angles of four herbaceous beds stand *colletia Bictoniensis* and *hypericum oblongifolium*. In the fountain basin are *limnocharis Humboldtii* and *aponageton distachyon*. The terrace above is also a geometrical garden of twenty-seven beds, with borders, on gravel, with box edging, and planted miscellaneously with annuals, violas, etc.; the violas, with a bed of *lobelia cardinalis* (St. Clair), being a great success. Behind the pampas grass, to the right, can be seen the spreading head of *linus patula*.



GARDEN AT CARCLEW, ENGLAND.

If any of our readers journey towards the Land's End in the course of this summer, we recommend them to visit these gardens, which have been under the highest cultivation for many centuries past.

Tough Glass.

An inventor, Mr. Charles Pieper, has devised a way of toughening glass, which the German papers pronounce superior to that of M. de la Bastie, recently described in these columns. The Pieper glass is fully as strong as that of the latter inventor, and its appearance is much purer and clearer. Extended experiments upon it have been begun in Germany. The Association of German Glass Makers have already entered into negotiations with Mr. Pieper for the use of his invention, suspending similar dealings with M. de la Bastie, on account of the immense price asked by him, over eight million dollars.

THE BIRDS OF BRAZIL.

Our engraving exhibits two remarkable ornithological specimens from Brazil, domesticated in the gardens of the Royal Zoölogical Society, Regent's Park, London.

The first is the bell bird, the celebrated *campanero* of the Spaniards, called *dara* by the Indians. He is about the size of the jay. His plumage is white as snow. On his



THE BRAZILIAN BELL BIRD AND THE BANDED COTINGA.

forehead rises a spiral tube, nearly three inches long. It is jet black, dotted all over with small white feathers. It has a communication with the palate, and when filled with air looks like a spire; when empty, it becomes pendulous. His note is loud and clear, like the sound of a bell, and may be heard at the distance of three miles. In the midst of Brazil's extensive wilds, almost out of gun reach, you will see the *campanero*. No sound or song from any of the winged inhabitants of the forest, not even the clearly pronounced "Whip-poor-Will" from the goatsucker, causes such astonishment as the toll of the *campanero*.

With many of the feathered race he pays the common tribute of a morning and evening song; and even when the meridian sun has shut in silence the mouths of almost the whole of animated nature, the *campanero* still cheers the forest. You hear his toll, and then a pause for a minute, then another toll, and then a pause again, and then a toll, and again a pause. Then he is silent for six or eight minutes, and then another toll, and so on. "Actæon would stop in the mid-chase," says Waterton, "Maria would defer her evening song, and Orpheus himself would drop his lute to listen to him, so sweet, so novel, and so romantic is the toll of the pretty snow-white *campanero*. He is never seen to feed with the other *coti·gas*, nor is it known in what part of Guiana he makes his nest."

The second specimen is a relative of the bell bird, and is known to ornithologists as the *cotinga cincta*. Of these, in their natural state, even less is known than of the bell birds. The *cotingas* are distinguished by the brilliancy of the coloration of the males. In the species at present under notice, the under parts are of a deep plum color, while the upper parts, with the band or cinctus across the breast, are of a magnificent ultramarine blue. In size this *cotinga* equals a blackbird. Their food consists of fruits, which their wide gape enables them to swallow with ease. Like their allies the bell birds, they are solitary in their habits, keeping to the topmost branches of trees, and generally residing in the dense forest, though at times they approach the cultivated grounds in search of their food.

Useful Recipes for the Shop, the Household, and the Farm.

According to Niedling, a beautiful orange-yellow tone, much admired in a chest at the Vienna Exhibition, may be imparted to oak wood by rubbing it in a warm room with a certain mixture until it acquires a dull polish, and then coating it, after an hour, with thin polish, and repeating the coating of polish to improve the depth and brilliancy of the tone. The ingredients for the rubbing mixture are about 3 ozs. tallow, ¾ oz. wax, and 1 pint turpentine, mixed by heating together and stirring.

The following is said to be all there is of the cook's secret for producing those world-renowned potatoes served at Moon's Lake House, Saratoga Springs, every summer: Peel good-sized potatoes, and slice them as evenly as possible; drop them into ice water. Have a kettle of lard, as for fried cakes, and very hot. Put a few at a time into a towel, shake them about to dry them, and then drop into the hot lard. Stir them occasionally; and when of a light brown, take them out with a skimmer. If properly done, they will not be at all greasy, but crisp without, and mealy within.

A French journal says that, of the score of fireproof compositions that have been brought forward within as many years past, there is scarcely one that possesses superior or even equal adaptation, to the purpose, to the following: Dissolve, in cold water, as much pearlash as it is capable of holding in solution, and wash or daub with it all the boards, wainscoting, timber, etc.; then, diluting the same liquid with a little water, add to it such a portion of fine yellow clay as will make the mixture of the consistence of common paint, and then stir in a small quantity of paperhangers' flour paste to combine both the other substances. Give three coats of this mixture, and, when dry, apply the following composition: Put into a pot equal quantities of finely pulverized iron filings, brickdust, and ashes, pour over them size or glue water, set the whole near a fire, and, when warm, stir them well together. With this liquid composition, or size, give one coat, and, on its getting dry, give a second coat. It resists fire for five hours, and prevents the wood from ever bursting into flames; that is, it so resists the ravages of fire as, at most, only to be reduced to coals or embers, without spreading the conflagration by additional flames. It is found that a quantity equal to twenty pounds of finely sifted yellow clay, a pound and a half of flour for making the paste, and one pound of pearlash is sufficient to prepare a square rood of deal boards.

Mr. James Hinton, in his "Physiology," affirms that the passage of the ear does not require cleaning by us. Nature undertakes that task, and in the healthy state fulfils it perfectly. Her means for cleansing the ear is the wax, which dries up into thin scales, and peels off and falls away imperceptibly. In health the passage of the ear is never dirty, but an attempt to clean it will infallibly make it so. Washing the ear out with soap and water is bad; it keeps the wax moist when it ought to become dry and scaly, and makes it absorb dust. But the most hurtful thing is the introduction of the corner of a towel screwed up, and twisted around. This proceeding irritates the passage and presses down the wax and flakes of skin upon the membrane of the tympanum, producing pain and inflammation and deafness. Washing should only extend to the outer surface, as far as the finger can reach.

An ink composed of copper 1 part, dissolved in 10 parts nitric acid, 10 parts water being afterwards added, is useful for marking on tin or zinc plant labels.

A simple mode of keeping butter in warm weather is to set over the dish containing it a large flower pot or unglazed earthenware crock, inverted. Wrap a wet cloth around the covering vessel, and place the whole where there is a draft of air.

Rats detest chloride of lime and coal tar.

White horn buttons may be made to imitate mother of-pearl by being boiled in a saturated solution of sugar of lead and then laid in very dilute hydrochloric acid.

The following is a simple way of obtaining copies of writing without the use of a copying press: Mix white sugar with the ink, 1½ drams sugar to 1 oz ink. Use this with an ordinary pen, and place over the writing a moistened sheet of unsized paper. Lay both leaves between two layers of carpet; put the whole under a piece of board large enough to cover. Then stand on the board for a few seconds. An excellent impression will be found on the copying paper.

To extract rust from steel, immerse the article to be cleaned in a solution of ½ oz. cyanide of potassium to a wine glass full of water until the dirt and rust disappear. Then clean by means of a tooth brush with a paste composed of cyanide of potassium, Castile soap, whitening, and water.

Awnings can be rendered waterproof by plunging the fabric into a solution containg 20 per cent of soap, and afterwards into another solution containing the same percentage of sulphate of copper. Wash, and the operation is finished.

The best pine wood evaporates 5 lbs. of water per lb. wood consumed in a steam boiler furnace. One cord of wood can be consumed per hour on 60 square feet of grate. One pound carbon burnt to carbonic acid requires the oxygen of 153 cubic feet of atmospheric air.

Iron filings in a weak solution of sal ammoniac, mixed with Portland cement, are said to double the strength of the latter

The following compounds are useful for soldering or tinning: Tin, 1 part muriatic acid with as much zinc as it will dissolve; add 2 parts water and some sal ammoniac. Brass and copper, 1 lb. muriatic acid, 4 ozs. zinc, 5 ozs. sal ammoniac. Zinc, 1 lb. muriatic acid, 2 ozs. sal ammoniac with all the zinc it will dissolve, and 3 pints of water. Iron, 1 lb. muriatic acid, 6 ozs. sperm tallow, 4 ozs. sal ammoniac. Gold and silver, 1 lb. muriatic acid, 8 ozs. sperm tallow, and 8 ozs. sal ammoniac.

For silvering metals, 10 parts nitrate of silver, 10 parts common salt, and 30 parts cream of tartar may be used. Moisten the powder with water when ready to apply.

Hardening Glass.

This is a process that has been patented by Mr. Macintosh, of Westminster, a civil engineer who has devoted much time and attention to the hardening of iron, steel, and alloys. Starting on the broad ground that, the lower the degree of temperature of the liquid in which certain heated bodies were plunged, the harder such bodies became, Mr. Macintosh has found that glass, graphite, uncrystallized carbon, slag, and other analogous substances may be rendered exceedingly hard by means which are usually indicated for metals. Colored glass may, by this treatment, be rendered so hard as to be effectively used as a substitute for gems, and, what is curious, may be pulverized and used in the same way as diamond dust or emery powder.

In hardening the substance, the method pursued by the patentee is to place a small quantity of fused or nearly fused clear or colored glass in iron or other molds to shape the glass, and the substance is taken out of the molds and placed in platinum molds, and fused or nearly fused, and suddenly deprived of its caloric by frigorific mixtures of iced water and salt, or any of the freezing compounds that produce extreme cold; the sum and substance of which is that the glass is heated to a very high degree of temperature and then rapidly cooled in a very frigid fluid. A startling statement is made by Mr. Macintosh when he asserts that, when the component parts of gems are treated by the above process, he is enabled to produce thereby fictitious gems even harder than real diamonds.

Velocity of Light.

Professor Cornu, of the *Ecole Polytechnique*, Paris, has put into successful use a new instrument for measuring the velocity of light between two stations, in which an electrical registering apparatus is used, giving, it is believed, more accurate measurements than the well known toothed wheel arrangement of Fizeau. Foucault fixed the velocity of light, by his instrument, at 185,157 miles per second Professor Cornu, by his new instrument, fixes the velocity of light at 186,660 miles per second, or 1,503 miles faster per second than Foucault.

An Engineer on Boilers.

"Then there's the boiler; that takes a heap of watching all the time. We have steam enough ordinarily, might say, when we don't want it; but there are times when we can't get it to save our souls; no more than enough to get along with. She fires hard. I never saw a boat yet that had too much boiler; nor no other man. Yet tell the owners that, or the makers of the engines, and they will say: 'Oh, big boilers take up too much room;' and then they go and put in a little kettle with not enough fire surface in it, and burn coal enough in a year to pay for a decent boiler. The best made boilers in the world will bear a heap of watching. You know the engine pumps water into them all the while to keep up the supply. Well, the pumps will work all right for months at a time; first thing you know of, sometimes when you are in trouble about other things, the pumps will stop working, and you can't get a drop of water in her to save you, then you have got to look sharp. What *makes* it act so? What makes everything go wrong in this world? That's what I want to know; when it's once set right, it ought to go right, but it don't. Sometimes the check valves get held up, and the water don't go down in the boiler at all, but just surges back and forth from the pump pressure and the boiler pressure alternately; sometimes dirt gets under them, chips and things; then, again, joints will blow out in the hand hole plates, and make a heap of trouble. No matter how trifling a thing is to us, it is sure to make a disturbance with the passengers, and that's what we have to avoid as much as possible, for they are easily scared."—*New York Sun.*

The Coke-Manganese Galvanic Cell.

The well-known Leclanché's cell is now in use for many purposes, giving a very constant current, but which, however, is much decreased by the resistance of the tar covering the top of the porous cell, and by the decomposition of the manganese dioxide, which is transformed during the action of the cell into oxide; the latter oxide closes the pores of the cell. Sergius Kern's cell is a modification of Leclanché's one, and the experiments proved it to act very constantly.

Two parts of cleanly washed coke, and one part of manganese dioxide in the state of powder, are well mixed together with a small quantity of water acidulated with some drops of nitric acid; the mixture then is strongly pressed into brown paper cartridges 5 inches high and 1¼ inches diameter. The resulting coke-manganese cylinders are dried in a warm place, but not over a fire, because the heat, as it is known, decomposes the manganese dioxide.

The dried cylinders are placed in glass jars containing concentrated solution of ammonium chloride, and surrounded with zinc plates curved in the usual manner. By this arrangement the use of porous cells is avoided, and a battery of such elements acts more constantly; besides this, the construction of it is cheaper. Instead of having glass jars, Kern uses wooden boxes, the size of the glass jars; the internal parts of the boxes are covered with the following mixture, melted in an iron cup:—2 parts of wax, 10 parts of common resin (colophony), 2 parts of red lead, and ½ part of gypsum.

The zinc of the element is the negative pole; the coke, the positive pole.

Recent American and Foreign Patents.

Improved Steam Boiler Furnace.

Walter Dawson and James Hughes, Scranton, Pa.—This invention consists in the formation of the side sheets of the furnace to protect the corner joints and flanges from the intense heat of the fire. In ordinary boilers, the side sheets, which lap on to the flanges of the front and tube sheets, are straight sheets, which leave the flanges and rivets exposed to the full heat of the fire. The furnace consequently fails at the corners from the heat and corrosion caused by the increased thickness of iron at those points. The object of the improvement is to prevent this, and to make the corner joints as durable as any portion of the furnace; and for this purpose the side sheets bulge inward throughout the entire width, where the central portion of the sheet is on the same plane as the joints, with bulges adjacent to the flanges to protect the joints. By this means the joints are protected from the intense heat of the fire, and are preserved and rendered as durable as any part of the furnace.

Improved Mechanical Movement.

James R. Devor, Goshen, Ind.—This invention relates to a new mechanical device, by means of which belt pulleys, cogged gearing, and other mechanisms may be made to run on shafts which are not parallel to each other. Balls are fastened tightly on the shafts. A portion of the ball sockets consists in two disks, having each a broad slot through which the shaft passes. These slots allow the shaft to turn in either direction. The inside pulleys form the box, and are made concave to fit the ball, having flanges which lap on the disks. The pulley is carried or revolved by the pins through the pulley, and the slots in the ball on opposite sides. Attached to the disks on each or opposite sides of the ball are yokes connected together by a rod, which support the belt guide. The spaces inside the disks are for allowing the box lateral play on the ball.

Improved Construction of Watch Movements.

James H. Flynt, Duluth, Minn.—This is a watch movement in which motion is communicated from the mainspring barrel to the escapement wheel through a single pinion and wheel, said wheel being of nearly the circumference of the pillar plate, and arranged between the face and the pillar plate.

Improved Milk Cooler.

Henry S. Murray, Andes, N. Y.—The outlet tube consists of an annular socket with a shoulder, which is soldered around a bottom perforation of the milk pan, and seated on a circumferential collar of an exit tube of the tank. A top flange of the exit tube extends into the socket, forming, in connection with the shoulder of the socket, the seat for the circumferential flange of a short tube, which screws into the threaded part of the exit tube so as to bind the socket, exit tube, and connecting tube firmly together. Intermediate packing rings produce the water and milk tight connection of the pan and tank, so that the milk may be drawn off without leaking, or mixing with water from the tank. A screw cap is screwed into the binding tube of the faucet, for closing the same, in the same manner as in the water exit tube, and retained until it is necessary to draw off the milk, in which case the screw cap or plug is withdrawn.

Improved Seed Sower.

John W. Talley, Paxton, Ill., assignor to himself and Thomas W. Buell, of same place.—The invention consists of a vertical lever for working the slide, which is moved in one direction by a vertical lever at the end of the roller, so as to be operated by tappets thereon. It is connected to the slide lever by a rope going around a guide pulley at one corner of the machine. In the other direction the slide lever is worked by a spring, which is forced as the tappets escape from the lever. A stop cord is connected to the tappet lever to prevent the spring from throwing it and the slide lever too far. The machine is designed for sowing grass, flax, and other small seeds, and will generally be used with a roller for smoothing the ground at the same time; but it may be used with wheels.

Improved Milking Tube.

Sylvester A. Smith, Muscatine county, Iowa.—This invention consists in a tube provided with a grooved head in which is a slide valve, while the body is tapered to an open end that enters the teat and udder of the cow.

Improved Hod Elevator.

William Murphy, New York city.—This invention consists in rods attached to the framework of the elevator in such position as to be over the inner part of the side bars of the base of said elevator frame. These receive hooks attached to the handles of the hods. Hooks are attached to said handles to adapt the hods to be hung upon and supported by the rods attached to the frame work of the elevator.

Improved Mode of Inlaying Jet with Metal.

William Stephans, New York city.—This invention consists in a mode of inlaying jet with metal, by burning a recess of the proper size and form in the jet, by means of a recessed die and a sheet metal guard plate. In this way pieces of metal of any desired form, no matter how irregular or complex, may be easily and quickly inlaid in jet, and the work may be done without danger of cracking or chipping the jet. When the pieces are large, pins may also be applied to their ends to assist in securing them in place.

Improved Cloth-Measuring Machine.

Joseph S. Gold, Washington C. H., Ohio.—The cloth roll is turned by the cloth, which is drawn through the machine by winding it on cloth rollers with a crank, and the cloth is pressed on the cloth roll by a roll with sufficient force to cause it to turn the machine. A tape shows, by the marks upon it, the measure of the cloth.

Improved Gang Plow.

Thomas M. Nichol, Sparta, Ill.—By suitable construction, by operating levers, the axles may be adjusted to cause the machine to run level upon sliding ground, or when one of the wheels is running in a furrow. The points of attachment of the plow beams may be raised and lowered to adjust the plows to run deeper or shallower in the ground, as may be required. This manner of attaching the plow beams allows their rear parts to have a free vertical movement. The plows are held at the same distance apart, and each plow may be allowed to rise independently of the other.

Improved Reversing Pulley or Gear Wheel.

Henry W. Sherrill, New York city.—This invention relates to an improvement in pulleys or gear wheels, whereby the same pulley or gear is used for reversing the motion of the shaft or arbor. The advantages of the arrangement are found in the small space occupied by the single pulley or gear, and in a single belt to serve in the place of a number of belts and pulleys for producing the same effect, and in the facility with which a greater speed can be obtained in the reverse motion.

Improved Twister for Making Thread, Twine, etc.

Lavancia M. Sutherland, Catskill, and Thomas Groves, Brooklyn, N. Y., administrators of James Sutherland, deceased.—This invention consists of a slitted bent pipe, hinged or jointed to a water pipe, and interposed between the fliers and the tension rollers for wetting the strands while being twisted; also the combination of the cock of the water pipe that supplies water to wet the strands, with the ordinary belt shifter of the machine, so that the flow of the water through said pipe may be stopped and started, and by the same operation.

Improved Locking Device for Machinery.

Timothy D. Marsh and Franklin M. Crane, Jersey, Ohio.—A hub on the shaft carries a slotted arm which receives the pin of a reversing lever connected with the hub. Extending in opposite directions from it are two loose arms, the outer ends of which are fitted into slots of two friction shoes. In the cap plate are two pins for each of the arms, arranged to give the arms a little play and allow the shoes to bind against the frictional surface and hub. In reversing the action of the device, a lever is moved, by means of a pin, from one side to the other of the stud on the cap plate. When the lever is moved over the stud, the action is reversed; and when the lever is left on the stud, the arms bind when the shaft is turned in either direction and prevent all motion, from the fact that, when the shaft is turned either way, the movement of the square hub causes the arms to bind and the shoes to catch against the frictional surface.

Improved Wagon Jack.

William Henry Horn, Santa Cruz, Cal.—In using the jack a lever is turned up to lower the bar to its lowest position. A block is then adjusted to the hight of the axle to be raised, and the jack is adjusted to bring the block beneath said axle. The lever is then turned down to rest upon a stop. This movement raises the bar and block raising the axle. As the lever is lowered, a loop or link passes back of the axis of the hinge of the said lever, and the various parts of the jack are locked, supporting the axle in its raised position.

Improved Nursery Chair.

Calvin A. Watson, New York city.—This is a nursery chair constructed of a seat board with central aperture, supported on hinged legs, and provided with hinged side boards held open by a removable brace piece. It may be readily folded into a small compass for packing, etc.

Improved Draft Equalizer.

William Snow, Waverly, Ill., assignor to himself and Joseph H. Challen, same place.—This is a draft equalizer, formed by connecting a single tree directly to a double tree by means of a clevis, and with its ends projecting past the inner ends of the single trees, which form part of the double tree proper.

Improved Steam Boiler Furnace.

Walter Dawson and James Hughes, Scranton, Pa.—This invention relates to the fire boxes or furnaces of steam boilers, and consists in the formation of the side sheets of the furnace to protect the corner joints and flanges from the intense heat of the fire. The side sheets are bulged or projected inward.

Improved Milk Cooler.

Daniel Gurnsey, Watertown, N. Y.—This invention is intended to remedy the unequal distribution and cooling capacity of the water in ordinary milk coolers, which enters at one side and is gradually warmed up on its passage through the cooler, so that the temperature at one end of the pan, where the cool water enters, is considerably lower than at the other end. The uneven temperature of the milk retards the progress of raising the cream and decreases the yield of butter. The apparatus consists of devices for admitting the cool water simultaneously at the end and at central points of the bottom of the cooler, and drawing it off by suitable channels and regulating devices at the opposite end.

Improved Refrigerator.

August F. Bronner, New York city.—This invention consists of an ice box with double unfilled walls, of which the side walls are employed for conveying the ice water from the central and upper part to the bottom part, for utilizing the cooling effect on the air passing in the same direction. The drip water is conveyed by inclined troughs of the side walls to a front channel, and then through perforations of the same over the inclined bottom to the rear exit aperture.

Improved Carbureting Gas Machine.

Elon Foster, New York city.—This improved gas machine, for carbureting air or gas, is so constructed that it will operate equally well whether a large or small quantity of the hydrocarbon be in the tank. The air or gas is brought into contact with the hydrocarbon twice before it escapes through the outlet pipe.

Improved Gas Burner for Heating Purposes.

Anatole Ehret, San Francisco, Cal.—This consists of a chamber in the standard on which the burner is mounted, into which the gas pipe leading to the burner discharges, and into which there are air pipes entering from the base of the stand, so as to draw in an abundant supply of air to mix with the gas. The invention was described and illustrated on page 290 of our current volume.

Improved Portable Toilet Waters and Extracts.

A. Gibbs Campbell, Paterson, N. J.—This is a compound for the production of toilet waters or extracts by lixiviation with alcohol, the compound consisting of a mixture of carbonate of magnesia with one or more fragrant attars.

Improved Pitman Connection for Pumps.

James M. Langley, Double Bridges, Tenn., assignor of one third his right to James C. Sawyer, same place.—To the end of a piston rod is pivoted the end of a pitman, the other end of which is pivoted to the crank pin of the crank. To the pitman, at a little distance from the crank, is rigidly attached a short stud, to which is pivoted the end of another pitman. The outer end of the second pitman is pivoted to an arm rigidly attached to a rock shaft. To the rock shaft are attached one, two, or more cranks, to the pins of which are pivoted the ends of the piston rods of the pumps, so that the pumps may be operated by the rocking of the shaft.

Improved Steam Pumping Engine.

Charles H. Hudson, Chicago, Ill.—The valve is composed of three disks of like diameter, keyed on a stem. The steam which has acted on the piston and filled the cylinder space is allowed to act on the valve and move it into the alternate position necessary to cut off steam from the right hand end of the cylinder, and admit it, by the corresponding ports, to the left hand end of said cylinder, to move the piston in the reverse direction. Simultaneous with the above described action of the steam on the valve, it exhausts into the outer air. The regular exhaust from the cylinder into the valve chamber is always through the ports by which the steam entered the cylinder at the previous stroke of the piston. The openings between the passage and the valve chamber are closed alternately by the end disks forming part of the valve, the thickness of the disks exceeding the diameter of the openings, and the projecting ends of the valve stem governing the position of the valve, so that one of the disks always comes directly opposite, and thus covers, the nearest opening each time the valve is moved and comes to rest. By a suitable arrangement of water valves, the supplementary chamber, requisite in pumps whose valves close by gravity, is dispensed with, and space and material are economized.

Improved Car Coupler.

W. H. Adams, Mount Gilead, Va.—This invention relates to automatic couplers where a spring catch is pushed aside by a link hook or arrow head, behind whose shoulders it then closes. The invention consists in four features of improvement whereby cars may be coupled and uncoupled with great facility, without complication or expensive mechanism, and is self-detachable when a car runs off the track.

Improved Hydrant.

James W. R. Fisher and William H. Fisher, Martinsburg, W. Va.—This invention consists of a case made in sections, a lever-held pipe, valve chamber, and chamber for the inlet pipe, together with an elastic cup, the whole so jointed together as to be readily separable without removing the inlet pipe chamber.

Improved Furnace.

Smith W. Kimble, Springfield, Ill.—This invention consists in connecting the combustion chamber and ash pit of a furnace by a throat, provided with a drop door, and also in flues that connect on one side of the combustion chamber, pass over it, and are attached on the other side to a pipe resting loosely in brackets.

Improved Sash Fastener.

Ira David Woolf, Oneonta, N. Y.—This consists of a spring bolt, which works through a hole in the sash and enters the casing, the bolt having a peculiar stop lug, which passes with the bolt through the slot in the plate. A spiral spring is attached to and surrounds the bolt, which spring bears against the plate and has a certain degree of tension, which serves to force the bolt inward with a constant pressure. When the bolt is withdrawn from the casing, the end of the stop lug may be made to rest on the outside of the plate by drawing the bolt downward, which renders the bolt inoperative. The bolt may be attached to either of the sashes of the window, and will hold them in any desired position, and fasten them so that they cannot be moved from the outside.

Improved Magazine Fire Arm.

Frederick M. Shinn, Leroy, Kan.—The gun has two magazines under the barrel, discharging into a revolving chambered cylinder, by which the cartridges behind the barrel are to be shoved out of the chambers of the cylinder into the barrel by a breech rod. When the breech rod is drawn back it pulls the shell back into the cylinder by its spring catch; and as soon as that takes place the ejector is forced up by a projection of the guard, which presses it up at the bottom. The ejector engages the shell under the rim of the base and lifts it out of the chamber of the cylinder. As soon as the shell has been lifted out, a pawl on the ejector engages the cylinder by a notch in the rear end, and turns it sufficiently to bring a cartridge into range with the barrel. Then the guard is pulled back and the breech rod thereby pushed forward to push the cartridge into the barrel. The ejector is at the same time pulled back by its spring, and the gun is then ready for firing again.

Improved Horse Yoke.

Rufus Stratton and George Olmsted, Hazardville, Conn.—The hames are fastened at the upper end by a screw, and have projecting ears, which are slotted horizontally to receive the outer ends of the yoke, where they are jointed by pins or screws. The yoke is made in two parts. Horizontal bars project from the side bows and lap past each other, and work on the draft pin, which pin passes through both bars. The ends of these bars play up and down to accommodate the position of the horses.

Improved Umbrella Support for Vehicles.

Alexander J. Hood, Warren, Ill.—This device is designed for supporting umbrellas in vehicles; and consists of a stand attached to the seat, having an adjustable grooved arm and band for holding the staff of the umbrella.

Improved Clothes Pounder.

Chauncey B. Hart, Fairport, N. Y., and George W. Hart, Medina, Mich.—This is a device for washing clothes by forcing the water out of them by atmospheric pressure, and then allowing them to be again saturated. There is a disk of wood or metal, to the outer side of which is attached a handle. To the under side is attached the end of a coiled spring. The last coil at the other end of the spring is attached to a metallic ring. The head and the ring are also connected by a strip of canvas, the edges of which are attached to the edges of the said head and ring. In the head are formed holes which are covered by valves opening downward. In using the device, it is placed upon the clothes in a tub, and the head is forced downward by means of the handle. This compresses the air and forces it into and through the clothes, driving out the water. As the head is raised, the valves are opened by the pressure of the atmosphere, which enables the device to be raised and again operated upon some other part of the clothes.

Improved Hat.

John Case, Alexandria (Frenchtown P. O.), N. J.—This hat is composed of an outer conical portion attached to a hat of the ordinary shape, so that a space is left above the crown and at the sides between the two parts. The outer conical hat is supported on the crown of the inner hat, with its lower rim extending down to about a level with the brim of the inner hat. The two parts are joined or connected at the crown angle of the inner hat. The object is to leave an air space.

Improved Horse Detacher.

Amos Barker, Nebraska City, Neb.—This consists in the application, to the single trees, of an armed vibrating rod, operated by cord or chain, in connection with pivoted hooks for attachment of the traces. The traces are released by pulling a cord which withdraws curved arms for the pivoted half circle hooks. The neck yoke then moves forward upon the tongue, the cord will turn the rod, withdrawing the curved arms from the pivoted half circle hooks, and allowing the neck yoke to drop, and the horses will be entirely free from the vehicle.

Improved Middlings Purifier.

Simeon Crittenden and James Waters, Chatfield, Minn.—In the bottom of the hopper is placed a roller, which distributes the middlings and feeds them in a thin sheet to the bolt, which is hung in a slightly inclined position from the casing by pivoted arms. The bran escapes from the tail end of the bolt, and the flour passes through the bolt cloth and falls upon zigzag plates, the ends of which are inserted in grooves in the side bars of the frame, which last is agitated by a pitman. As the flour from the bolt falls upon the plates, it slides down upon said plates, passes through the narrow slits between their lower edges, and falls into the upper carrier trough. A number of plates are placed between the zigzag plates and the upper carrier trough. The upper edge of each successive plate rises above the preceding plate from the head end of the machine toward its tail end, to prevent the flour passing in that direction. In the head end of the machine, between the zigzag plates and the upper carrier trough, is placed a fan blower, the wind from which is discharged into the machine below the zigzag plates. The blast from the fan blower is directed upward by the inclined plates, and is divided by the graduated hights of said plates, so as to be about equally distributed from one end of the machine to the other.

Improved Binding Attachment for Sewing Machines.

Hamilton C. Jones, Brooklyn, N. Y.—This is an improved binding attachment to sewing machines, by which the binding is fed in an even and regular manner with the material to the presser foot and needle, so that the upper and under folds are simultaneously stitched to the goods, and the binding laid neatly in proper width on turning angles or abrupt circles. The invention consists of a spiral adjustable rear guide, and a double tapering front guide, with extension arm or tongue at the lower guide scroll for the under fold, and a serrated spring arm at the upper scroll for the upper fold for feeding the double folded binding and intermediate material to the presser foot and needle.

Improved Butter Package.

Henry R. Scott and Dennis W. Granger, Franklin, N. Y., assignors to themselves and Andrew J. Dibble, of same place.—The body of the package is made rectangular, with slightly flaring sides and ends. To the ends are attached short upright bars, which are flush with bars attached to the cover. Tenons formed upon the ends of the latter bars enter mortises on the upright bars. Spring catches enter holes in the edge of the cover, and thus lock the cover in place upon the box. In the catch holes are placed small sliding bolts, which, when pushed outward, push the catches outward, and thus release the cover.

Improved Plaster Sower.

Frank Charles Moder, Hortonville, Wis.—The box is provided with a crooked stirrer and reciprocating distributor, the one keeping the plaster thoroughly stirred up and the other sprinkling it over the plants.

Improved Thill Loop.

Frank S. Berry and George F. Alexander, New Sharon, Me.—This is an improved thill loop for single harness for supporting the thills, which is so constructed as not to wear the thills or their patent leather covering, when covered.

Improved Table.

Louis Postawka, Cambridgeport, Mass.—This is a fastening for table standard legs. The stand consists of a headed and end-threaded bolt, and a tubular filling, which is let into and adhesively secured to a socket.

Improved Device for Forging File Blanks.

Theodore L. Grover, Brooklyn, E. D., N. Y., assignor to Bertrand Clover, N. Y. city.—The dies are made with reduced or contracted parts for drawing the bars down to form the blanks. There are also smoothing faces for smoothing and finishing the wide sides, and a recess in the upper corner of the stationary die, in which to taper or otherwise shape edges or narrow sides or the tang.

Improved Cultivator.

Amos B. Colver, Albany, Oregon.—This invention consists mainly in the mode of raising and lowering the entire plow frame and attaching it to the wheel frame. When a main lever is lifted by the driver from a seat on the rear axle, the whole plow frame is acted upon by the connecting front and rear links, and lowered toward the ground for the work of the plows. By pressing the main lever down, the plow frame is raised to sufficient length above the ground.

Improved Churn.

Benjamin F. Price, Mount Sterling, Ill., assignor to himself and A. A. Hill, of same place.—A coupling enables the dasher shafts to move up and down in vertical lines while the upper ends of the connecting rods move through the arcs of circles. The dasher shafts pass down side by side through the churn cover. The dashers, which are placed the one directly above the other, are attached eccentrically to the lower ends of the shafts. In the dashers are formed a number of holes, which flare upward and downward from the central plane, so that more milk may enter said holes than can pass through freely, which subjects the milk to great friction, and brings the butter very quickly.

Improved Lamp Burner.

James Pigot, Brooklyn, N. Y.—A prolongation of the lower portion of the air tube, in the form of a flat partition plate, separates the flat portion of the wick tube into two parts. Springs are employed in connection with the partition and ratchets, for pressing the wick into the ratchets with uniform effect for thick and thin ones.

Improved Car for Elevated Railways.

Roy Stone, Vandalia, N. Y.—This is an improved car for that class of elevated railways which are constructed on three rails supported on a longitudinal girder stretched from column to column, the car being placed thereon in the nature of a saddle bag, with symmetrical parts at both sides of the girder. The car is surrounded by platforms, and provided with end and central staircases, to give ready access to all the seats.

Combined Blotter, Paper Cutter, and Ruler.

Frank R. Angell, Los Angeles, Cal.—This is a paper cutter rule having two cross slots at one end and a single cross slot at the other to admit of receiving blotting paper.

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Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light Scroll Sawing. See adv't, page 285. Trump Bro's, Manufacturers, Wilmington, Del.

Hearing Restored. Great invention. Book free. G. J. Wood, Madison, Ind.

Gold Solution—Will plate 18 K. color, without battery. Send for circular. Warner Bro., Syracuse, N. Y.

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Notes & Queries

R. J. can dye cotton goods by the process described on p. 405, vol. 29.—A. J. B. can proportion his safety valves by the formula given on p. 363, vol. 29.—R. N. can make lard oil by the process given on p. 283, vol. 30.—R. S. T. will find a good recipe for furniture polish on p. 315, vol. 30.—R. N. S. can blue steel by the method detailed on p. 123, vol. 31.—N. T. will find, on p.58, vol. 24, descriptions of various processes for molding.

(1) J. W. R. says: I have a boiler 16 feet by 40 inches, with 2 flues of 14 inches each and a 30 foot stack. My engine is 8 by 16 inches, running at 180 revolutions, and it does good work at 50 to 80 lbs. of steam. But it costs me all I make to pay for wood for fuel, burning 2 cords per day. I think my work ought not to take over ¾ of a cord per day. Is there really that difference between a two-flued boiler and a tubular or locomotive boiler? A. We do not think that the amount of fuel burnt is excessive. Measure your feed water, if possible, so as to get some idea of how much water is evaporated.

(2) F. S. S. asks: Will the flesh or grain side of a belt give the most friction? Which will wear the longest? A. A belt should be run with the grain side next the pulleys for both reasons.

(3) C. M. asks: Is there any cement that will answer to cast hot metal in, which would last for a long time? The metal runs at about 1,300° Fah., and it is necessary that the mold should get very hard, have a good polish, and not contract or expand more than iron. A. No. Iron is best. Use plaster of Paris for light castings.

(4) G. B. P. asks: What is saleratus? A. It is bicarbonate of soda.

(5) W. P. says: In your issue of April 10, 1875, C. H. P. asks: What is the difference between one square mile and one mile square? You answer: None. You are wrong. There is as much difference as between a circle and a square. A mile square is a square surface having sides each a mile in length. A square mile is a unit of area, and may be of any shape; and although it may be a mile square, it is not necessarily so. A. You are wrong. The difference between two quantities is found by subtracting one from the other. If nothing remains, what is the difference?

(6) J. H. F. asks: In building an ice house, I constructed a dumb waiter which I can lower to same level as bottom of house. I am told that whatever is put therein, as meat, milk, butter, will taste of the new wood lining down which the waiter slides. What is the best plan to overcome this? A. Try two coats of paint without turpentine.

(7) A. F. says: I have had the walls in my house painted with oil color, and find that those parts from which the light has been excluded (by the hanging of pictures or other articles) have changed color to a yellowish tint. Is there a way of removing these stains? A. Peroxide of hydrogen and ozone have been recommended in such cases, but their application is difficult.

(8) O. P. asks: How many pounds to the square inch is atmospheric pressure? A. About 15. Is it possible to distinguish the electricity of iron, copper, brass, etc.? A. No.

(9) G. L. S. J. asks: 1. Which contains the most electricity, air or water? A. There is no practicable means of ascertaining. 2. What number of insulated copper wire would you use to wind magnets for a line of 3½ miles? A. No. 24 B. W. G. 3. What form of battery would you recommend for such a line, with ground plate for the return circuit? A. The gravity or Callaud.

(10) F. P. asks: 1. Will winter apples keep as well if grafted upon the stock of a fall apple as they will upon the stock of a winter apple? A. Yes. 2. I set the graft with the end of the grain of the graft meeting the side of the grain of the stock, or with the end of the grain of the graft meeting the end of grain of the stock. Which is correct? A. The latter.

(11) C. S. C.—Your boiler is too small. Plumbago and gas carbon are infusible.

(12) A. P. F. asks: If two engines and trains of equal weight and resisting power, both moving at the same speed, should approach each other upon a level track and collide, would either train prove a greater wreck than if, running at the same speed, it had impinged upon an immovable object? A. Either train would have the same effect upon the other as an immovable body; for the reason that, at the time of collision, the motion of each train would be instantaneously arrested. At all events, we are confident that the wreck would be quite as complete in one case as in the other.

(13) Inquirer.—The solid column of iron will support a greater load than the hollow column, both being of the same diameter.

(14) S. asks: 1. What are the dimensions of the dry dock at the Brooklyn navy yard? A. It is 286 feet long and 90 feet wide at bottom; 307 feet long and 98 feet wide at top, with a lock chamber by which the length of the dock can be increased 52 feet. The bottom of the dock is 26 feet below mean high tide. 2. How long does it take to empty it? A. The dock, when filled by the tide, contains about 600,000 cubic feet, and the pumping engine can remove the water in 2 hours 10 minutes.

(15) J. F. M. asks: How much steam ought a horizontal boiler, shell ⅜ and heads ½ inch thick, single riveted, length 3 feet, diameter 22 inches, with a number of pipes connected to boiler for grate bars, and a dome 1 foot in diameter and 2 feet long, to carry? A. You can carry 130 lbs. steam; and then you can find out how fast your boat goes.

(16) R. B. C. says: I am building a propeller boat for towing, 60 feet long, 14½ feet broad, and 7 feet deep. I am going to put in a 16x16 inch cylinder, and want to make 150 revolutions per minute. What pitch ought I to have on a 6½ feet wheel? A. Make a true screw, pitch 8½ to 9 feet. We shall be glad to receive particulars of the performance of the boat.

(17) S. B. McC. asks: 1. What kind of coal is used in the foundery business? A. You can use charcoal, anthracite, soft coal, or coke. 2. How much iron would 1 tun of good coal melt? A. With hot blast, about 1 tun.

(18) C. M. B. asks: 1. What is an oscillating engine? A. One in which the cylinder swings during the revolution, the piston rod being connected directly to the crank pin. 2. What is the meaning of back lash in an engine? A. The striking of one connection against another, due to a stoppage or change of motion of one of the connections. 3. Why do all tugs use upright engines instead of horizontal ones? A. On account of the economy of space and the facility of arrangement, together with considerations of cost, weight, and durability.

(19) L. D. L. asks: What is the water pressure per square inch at the bottom of a pipe 100 feet in perpendicular hight? A. About 43 lbs.

(20) J. K. asks: Please give me a rule for finding the wearing line of a saw tooth. What is the radius to be taken, in proportion to the diameter of saw? I want to lay it off for gumming the saw, and to have no further trouble. A. It will depend upon the form of teeth. Make a diagram of the saw, and continue the backs of the teeth, which will give you the lines required.

(21) E. S. M. says: I have a yawl 24 feet long by 5 feet beam, which I wish to propel at the rate of 6 or 7 miles an hour. What should be the dimensions of boiler, engine, and screw? A. Engine 3 by 5 inches, propeller 20 to 24 inches in diameter and of 2¾ to 3 feet pitch. Boiler 24 to 30 inches diameter, 3½ feet high.

(22) G. E. R asks: In screwing gas or steam pipe, what number of threads are used for pipes of different sizes? A.

Inside diameter.	Threads per inch.	Inside diameter.	Threads per inch.
⅛	27	1½	11½
¼	18	2	11½
⅜	18	2½	8
½	14	3	8
¾	14	3½	8
1	11½	4	8
1¼	11½		

Taper of threads, $\frac{1}{16}$ per inch of length. These inside diameters are only estimated, as they vary for pipes of different strength, the thickness varying for the different grades, and the outside diameter remaining the same.

(23) P. R. says: 1. A friend states that the top of a chimney about 400 feet high will, in a severe storm, swing from 2 to 3 yards out of perpendicular. I say it is simply impossible. Which is right? A. It would be possible, but improbable. 2. My friend also says that, somewhere in Europe, there are very tall towers or chimneys considerably out of perpendicular. Is this so? A. You doubtless refer to the leaning towers of Pisa and Bologna. The tower of Pisa is 315 feet high, and a plumb line from the top of the inclined side will meet the ground 12 feet 4 inches from the base. The tower of Bologna is 134 feet high, and a plumb line falls 9 feet 2 inches outside the base.

(24) G. L. R. L. asks: What would be a safe pressure for a boiler 9 inches high by 1 foot in diameter, with four 1 inch tubes, made of sheet copper $\frac{1}{32}$ inch thick? A. From 15 to 20 lbs. per square inch.

(25) A. M. G. asks: What is meant by "a twin screw propeller?" A. Twin screw propellers are two propellers side by side. These propellers are commonly called twin screws. For information in regard to your other questions, you should consult some good treatise on the screw propeller, as their discussion would occupy too much space for these columns.

(26) H. K. asks: 1. Will a boiler 24 inches long, 15 inches in diameter, with 5 two inch return flues, produce steam enough to get the full working capacity out of a 1½x3 inches engine? A. Yes. 3. If the boiler were made of ⅛ inch copper, would it be strong enough to sustain 50 lbs. to the inch with safety? A. Do not run it above 40 lbs.

(27) R. A. P. asks: 1. I claim that the shorter an exhaust pipe is, the better for an engine running at 95 revolutions per minute; others claim that an exhaust one hundred feet high of 4 inches diameter to an engine 12x24, making 95 revolutions per minute (slide valve cutting off at ¾ stroke), would be beneficial. They claim that the steam passing through that length of pipe would produce a vacuum, and the steam would rush from beneath the valve to fill the same. Is this so? I claim that, if there be a partial vacuum, the exhaust produces it; and if we can produce a vacuum in that length of pipe, without loss of power, why not make use of all the exhausts that are puffing outside of our numerous manufactories? A. We doubt the formation of a vacuum in such a case.

(28) R. S. E. says: I want to make a piston to work inside a sheet copper cylinder, for holding oil, and I wish to have the piston move easily. What is the best material? A. Make it either of wood or metal, and pack it with hemp.

If I put a coiled cast steel spring in connection with a steam boiler, in the steam space, but not where the water can touch it, shall I run a risk of drawing the temper? A. The spring will retain its temper for some time under these circumstances, but not as long as under ordinary temperatures.

(29) C. B. D. asks: For an engine of 3 inches stroke and 2 inches in diameter, what size boiler will be necessary, and of what metal should it be? A. Make the boiler of wrought iron, 20 inches in diameter and 3 feet high.

(30) H. G. H. says: A steam gage is found by a test gage to show a pressure of but 130, when it should have shown 185 lbs. per square inch. Is it correct to say that the gage is 55 lbs. light or 55 lbs. heavy? A. The former would be the more correct of the two.

(31) S. M. asks: We run a 4½ horse power upright engine and boiler. Last winter we inserted a pipe to convey steam for heating purposes, and from it connected another pipe to heat water in a tank. We found it impracticable to run the engine and admit steam in this heating pipe at the same time, by reason of the water rising in the boiler and into the cylinder. What is the cause, and what the remedy? A. Either the steam room in the boiler is too small, or the connections are improperly made.

(32) A. P. asks: How can I deodorize kerosene oil? A. Digest the oil with a quantity of chloride of calcium reduced to a fine powder, at a temperature not exceeding 140° Fah. for several days. It should then be drawn off from the limey sediment and treated with a little carbonate of soda. The alkaline sediment should next be drawn off, and the oil washed with water.

How is dammar varnish made? A. It is formed by dissolving gum dammar in oil of turpentine.

Can the coloring matter called reginine be obtained? A. Yes, in the shops.

(33) T. M. C. asks: What is the best remedy to prevent unpleasant odors from the feet caused by perspiration? A. Use carbolic soap.

(34) R. B. N. says: We cut muriatic acid with zinc, then dilute with ⅔ water, to solder tin. Are the fumes, arising from soldering with this production by the application of hot copper, injurious to health? A. Yes.

In canning lobsters, we do not use the bodies. Can they be utilized by being converted into guano or manure? A. They may be used directly as a manure.

I have replaced the copper used in soldering tin, with cast steel; can I tin the steel to stand heat permanently? A. Use a coppered iron.

(35) F. B. G. asks: What can I use as a solvent for marine glue which has become hard with age, so as not to destroy its adhesive properties? A. The proper solvent for this is ether containing little alcohol, in which it dissolves with the aid of heat and agitation. The operation should not be conducted in the vicinity of any flame.

(36) J. C. R. asks: 1. What are the analyses of oxide of zinc, red lead, litharge, and raw and boiled linseed oil? A. Oxide of zinc is composed of zinc 65 parts, oxygen 16 parts, litharge of lead 207 parts, oxygen 16 parts. Red lead consists of lead 621 parts, oxygen 64 parts. Linseed oil consists of 76 parts of carbon, 11 of hydrogen, and 13 of oxygen. The boiled is the raw oil heated with litharge. 2. Why does litharge dry so much faster than oxide of zinc, when mixed with linseed oil? A. Because drying results from the absorption of oxygen from the air, and this result is more promoted by the litharge than by the oxide of zinc. 3. What pigment is of a nice orange color, suitable for striping? A. Try chrome yellow. 4. How can linseed oil be refined and bleached? A. By successive treatment with acid, alkali, and water. 5. What is oxychloride of zinc? A. It is a combination of zinc, oxygen, and chlorine, made by union of the oxide of zinc and the chloride of zinc.

(37) L. K. Y. asks: Is the band saw patented? A. No.

What does 1 oz. of pure sheet silver cost, and 1 oz. gold? A. One oz. of pure gold will cost about $25; of silver, about $1.50.

In what kind of oil or solution should I harden my steel burnishers? A. Any fatty oil will answer.

(38) A. M. H. asks: Considering iron pyrites as $Fe S_2$, what would be the formula for the residue when as much sulphur as possible has been driven off by heat? Some of the books say $Fe_2 S_3$, others say Fe S. Which is right? A. When iron pyrites have been subjected to roasting, it has been found that it has assumed magnetic properties, and, according to Berzelius (who investigated the matter), its composition is $Fe_7 S_8$. This has been confirmed by Rammelsburg.

(39) C. L. says: For soldering and other blowpipe work, alcohol at $3 per gallon is too expensive, and we have no gas. What can I burn in place of alcohol that will burn freely, be clean, and get up heat enough to melt gold or silver on a piece of coal? A. Rape seed oil.

(40) O.U. asks: 1. Of what cloth are artificial leaves made, and how is the gloss put on them? A. Usually of the fine glossy silk stuff known as taffeta. The taffeta is dyed of the proper green in the piece before cutting out. It is then stretched out to dry, and afterwards further prepared with gum arabic on one side, to represent the glossy upper surface of the leaves, and with starch on the other, to give the velvety appearance of the under side. The latter preparation, colored to suit the exact shade of green to be given to the leaf, must be just of the proper consistence, making the leaf neither too stiff or too limp, while it gives the proper kind of under surface. Where the leaf requires a marked degree of this velvet texture, it is given by the nap of cloth, reduced to a fine powder and properly tinted. A little gum is lightly passed over the surface, and when partly dry this powder is dusted over the surface, the superfluous portion being shaken off. 2. Are the veins and coloring done by hand? A. For giving to the leaf the appearance of nature, by representing the veins and indentations which they always exhibit, various gauffering tools are made use of.

(41) J.B. H. asks: 1. Can I correct my clock by the aid of the almanac? A. Find the moment that the sun is on the meridian, by the sextant. An almanac calculated for that meridian will give you how much the sun is fast or slow for that day, which will be the correction required. 2. How is it that the almanacs differ as to the time of sunrise, etc., at any given place? A. They should not if properly calculated for the meridian of the place.

(42) T. G. B. asks: Can kalsomining be done on a papered wood ceiling, and how should it be mixed and put on? A. Yes; use a large proportion of glue.

How can I clean up an old gilt window cornice to make it look like new? A. Use a very soft sponge and tepid water.

If a body in motion strikes another body of equal weight at rest, which receives the greatest shock? A. The shock will be mutual and equal.

How is dry steam made? A. By superheating.

(43) W. T. G. asks: Please give me a recipe for making a gold ink. A. The ordinary gold writing ink is made by simply mixing gold powder with some mucilaginous liquid, in which the very finely divided powder is held in suspension.

(44) D. W. S. says: I have made a mixture of equal parts of strong lye and water, saturated with sulphate of copper, and obtained a green mass of the consistence of cream. What is it? A. The addition of an alkali to a solution of sulphate of copper is always accompanied with a precipitate of hydrated oxide of copper, which is insoluble. This body is of a green color, and has simply rendered the solution turbid.

How is verdigris made? A. Verdigris is a subacetate of copper, and is formed by placing plates of the metal in contact with the fermenting mass of the grape, or with cloth dipped in vinegar.

What is glass etching, and how is it done? A. It is the art of producing designs, etc., on glass by the corrosion of its surface by means of hydrofluoric acid. The glass is first coated with a thin film of wax, through which, to the surface of the glass, the lines of the drawing are cut with fine steel instruments. On submitting the plate so prepared to the action of the acid, the surface of the glass only, immediately under the lines cut through the wax, is reached and acted upon by the acid.

How can I make a small hand stamp? A. There are several methods that accomplish this; one of the best is that known as the Woodbury process, which consists in first photographing the object on a plate prepared with a solution of bichromate of gelatin, the action of light on which is to render the bichromate insoluble. Upon immersion in water, the parts of the plate not affected by the light dissolve out, leaving the picture standing in relief, which, on drying, becomes very hard. It is next placed upon a smooth, even block of zinc, and submitted to great pressure in a hydraulic press. The zinc die thus produced is used for printing.

How can I transfer engravings on to plate glass? A. Fix the engraving to the glass with ordinary paste. Etch with hydrofluoric acid, specific gravity 1·14. At the end of a few minutes, wash off the paper, and the design will be found reproduced upon the glass, the printer's ink having protected it.

(45) A. Z. asks: What will neutralize tartaric acid in sugar or candies? A. Freshly precipitated chalk will answer, or carbonate of soda; but it will be necessary for you to experiment with small quantities of the sugar until the proper proportion is determined. Care should be taken that the acid should always be slightly in excess of the alkaline substance used.

(46) H. S. asks: To what degree must water be heated to become steam? If there is a certain degree, why does not water in a vessel (as it necessarily is all of the same temperature) all go off into steam at once? A. The specific heat of water is found to be the highest of any known substance, and is taken as unity. If we take an ounce of water at 170° Fah., and an ounce of ice at 32°, and put them together, we shall have, when the ice is melted two ounces of water at 32°. The ounce of water has therefore parted with 142° of its heat in melting, the ice, which heat is said to have become latent. Water, at the normal atmospheric pressure, boils at 212° Fah., which is its maximum of temperature. Here again this apparent anomalous phenomenon occurs. As the temperature of the water reaches 212°, it becomes stationary; any further addition of heat is absorbed in converting the water into steam, which has the exact temperature of the water that produced it. Here also heat has been rendered latent, with an accompanying change in form of the water. As from ice to water, so from water to steam; or, from solid to liquid, so from liquid to gaseous. On condensation of the steam, and recongelation of the water, the exact amount of heat absorbed by the body is given out. A certain weight of steam condensed, at 212°, gives out 950° of latent heat. In its descent from 212° to 32° it gives out 180° of sensible heat, and again in its recongelation it restores 142° of latent heat, amounting together to 1,272°. Pressure influences the boiling point of water, and for that reason water may be heated (with the application of an adequate pressure) so as to melt lead. Likewise as the pressure decreases, the boiling point is lowered. At the hospital of San Bernard, in the Swiss Alps, which is 8,400 feet above the sea, water boils at 184° Fah

(47) G. A. F. asks: How can I tell if a piece of quartz polished on one side is artificially colored? A. By seeing whether rubbing with benzine affects the color, also whether, on careful heating as near redness as can be done safely, the color changes or blackens.

(48) A. H. W. G. asks: I intend making small quantities of nitrate of silver. What kind of furnace would you advise, to burn coal or wood? A. A stove of suitable form will answer the purpose.

In making a swimming belt, what weight of cork is necessary for supporting a man of 170 lbs. weight, and what kind of cloth should be used for covering? A. About 10 to 12 lbs. cork. Use canvas, a light duck.

Have photographs ever been taken with the natural colors of objects? A. No.

What is a good work on founding and casting, etc., and on beet root sugar? A. Ure's Dictionary is an excellent authority on all the subjects you mention.

(49) F. C. asks: How can I detect adulterations in claret wine? A. Such tests are too complicated for description here, and require a considerable knowledge of chemistry to be at all satisfactory.

(50) S. G. asks: Can you tell me of an easy way of separating water into its parts, and burning the gas? A. Water is decomposed when it is made part of a galvanic circuit of an adequate electromotive force, the oxygen being freed from the positive pole, while the hydrogen is found at the negative. The gases may without difficulty be collected separately, and burned in a compound blowpipe; but the experiment is a costly one.

(51) J. A. H. asks: What is burnt lead? A. When metallic lead is exposed at a high temperature (above 612° Fah.) to the action of the air, it is rapidly converted into the oxide, which has the appearance of small beautifully colored yellow flakes or leaves. This is readily soluble in weak acids.

(52) W. S. asks: What tests are used to detect acids in oils? A. You do not state what kinds of oils. If free acids be present, the addition of a little concentrated solution of carbonate of soda to a sample of the oil will immediately cause an effervescence to take place.

(53) F. H. Jr. says: I have drawn some portraits in pencil on common drawing paper, and a few of them became soiled by handling. I want to go over them again with India ink. In what can I dissolve the ink so that it will not blur when I clean them? A. Good India ink, rubbed up with water, will not rub off when dry.

Is not the earth about as heavy now as it was at its creation? A. Probably heavier, on account of the constant falling of meteoric masses from the depths of space upon the earth's surface.

What are the two specimens enclosed? A. Iron pyrites.

(54) J. B. B. asks: What is decarbonized steel? A. It is a fancy name given to the material of which cheap gun barrels are made.

(55) T. S. S. says: We wish to run a millstone by a belt. There is not room enough between the timbers to use a 12 inch belt. I say that we can use two 6 or 7 inch belts, one on top of the other, on the same pulley, and get the same power that would be given by one 12 or 14 inch. My partner says we cannot. Which is right? A. The driving power of a belt depends upon the friction between it and the pulley; and this, in turn, depends upon the pressure or tension of the belt. Two belts being twice as strong as one, the tension can safely be doubled. Hence you may do the work of a 12 inch belt with two 6 inch belts, one above the other. There are some practical difficulties in the way, however, and you can readily put in an angular belt, which will do the work and take up less room.

(56) S. says: 1. I am building a small engine of 4 inches stroke and 2½ inches diameter. How large should I have the ports? A. Make the port area from $\frac{1}{10}$ to $\frac{1}{15}$ the area of the piston. 2. Which would be the best packing for the piston? A. Thin rings without springs will answer for piston packing.

(57) W. B. M. says: In reply to the question: What power (as usually rated on steam engines) is required to drive a 15 inch circular saw in 6 inch soft wood? You answer: "From 12 to 15 horse." I differ with you on this point, as I know of a 9 horse power engine which drives a 48 inch circular saw. A. By reading our reply again, you will see that the power was given for driving the saw up to its full capacity, that is, at the greatest speed and with the largest feed that could be safely maintained.

(58) H. L. K. says: A friend says that the pressure of steam has nothing to do with calculating the power of a steam engine, provided the engine has a governor on it; he contends that an engine working at 20 lbs. pressure will do as much work as it would working at 90 lbs. pressure. I claim that the power is calculated by the pressure of steam, length of stroke, and diameter of piston. Which is right? A. You are.

If a heavy weight were let fall into the deeper parts of the ocean, would it reach a point where it would remain stationary before it comes to the bottom? A. Yes, if the water is deep enough.

It is said that a ship on the ocean draws less water as it recedes from the shore, and that in fresh water a boat will gradually rise as it removes from the shore. Will the saltness of the water in the former case, and the warmth in the latter, account for these facts, provided they are true? A. Yes.

How do you account for this apparent inconsistency: A meat diet shortens life, yet life may be prolonged by food which supplies the waste of the system? A. Who is responsible for the statement that a meat diet shortens life?

(59) J. R. E. asks: I would like to know the best way of transmitting power from a water wheel on nearly level land to a distance of 1,000 feet? A. The most economical system under ordinary circumstances will be by means of a wire rope.

(60) H. H. C. asks: Is there anything less expensive than alcohol that will be as safe and clean for making steam in a small boiler fitted in a boat 3½ feet long? My lamp uses about a pint of alcohol in two hours. I have tried kerosene and found it too smoky. A. There are lamps for burning kerosene that do not smoke and are quite effective. We doubt, however, whether you can find anything that gives so little trouble, and is so generally satisfactory, as alcohol.

(61) M. G. asks: In a steam boiler, with the steam up, is the pressure more or less below the water level? A. The pressure is least at the top of the boiler, and increases towards the bottom, by the weight of the steam and water above.

(62) J. W. M. asks: Having occasion to open the steam chest and cylinder of my engine, neither of which had been examined for more than a year, I found the flanges under the rubber packing eaten into hollows about half way across. When cleaning I found the metal in these places would cut like, and had all the appearance of, plumbago. The joints thus affected were all below the tallow cup. The cylinder (on the upper side principally, and close to the covers) had hollows eaten into it; from one of these hollows I scraped the enclosed sample. The interior of the piston was nearly solid; and in cleaning away I found the face of the piston with hollows nearly quarter of an inch deep. Can you tell me the cause of the corrosion? Is the enclosed simply rust and grease, or has the iron undergone some chemical change? A. It was no doubt caused by impurities in the tallow. The iron is chemically changed, being converted into an oxide, which resembles plumbago. The use of tallow is becoming less common, as engineers discover its effects. Pure tallow is an excellent lubricant for cylinders, but little of the tallow that is sold is pure.

(63) R. C. asks: How can I mend the broken glass of an aquarium? A. Fasten a strip of glass over the crack, inside the aquarium, using for a cement white shellac dissolved in ⅛ its weigh of Venice turpentine.

(64) W. E. C. asks: What is the shortest method for finding the amount of water in a plain cylinder boiler when partially filled? A. Find the area of the cross section of that part of the boiler which is filled with water, and multiply by the internal length of the boiler. You will find rules for this area in any good treatise on mensuration.

(65) A. F. H. says: In a communication about tides, it was claimed that the Hudson river was 25 feet lower at New York city than at Troy, N. Y. Is this so? A. No. The fall from Albany to New York city is only 5 feet.

If a steamboat going at 20 miles an hour has occasion to back, how is sufficient power applied at the dead centers to overcome the resistance of the water against the paddle wheels? A. The power is exerted at other parts of the stroke, and the wheel is generally counterbalanced.

Can an ordinary rifle ball (60 to the lb.) be dropped from a hight sufficient to perforate a two inch oak plank, upon striking the earth? A. We think not.

(66) E. N. B. asks: How fast should a ¼ inch twist drill run to drill common iron? A. From 150 to 175 revolutions a minute.

(67) A. S. says: I have a steam engine, of which the lid of the steam chest has a hole about ¼ inch in diameter, probably the result of bad casting. I have poured melted Babbitt metal into it, but it will not last. I cannot put a screw tap into it. How can I plug it? A. Braze a plug in.

My cold water pipe is of lead, and it is very troublesome to keep the joints tight. I always used wrap joints made of thick cloth, with a coat of white lead, and wrapped tight with string. Can you tell me of some other means of closing these joints? I cannot get at them to solder them. A. The plan you follow is the best under these circumstances, if you cannot solder the joints; but if you can get at them to wrap them, they would seem to be accessible for soldering.

Can I find the horse power of a machine when the pressure of steam in the boiler is known? A. Not without more particulars than this.

(68) J. H. P. asks: Will a coil of steam pipe heat a kiln any higher than the heat of the steam? A. No.

(69) C. W. M. asks: 1. How can I remove a lime deposit or scale that has formed on the bottom of the boiler, and how can I prevent its formation? A. Try some of the scale preventives that have been noticed in our columns. 2. Should a boiler be refilled immediately after being blown off, or allowed to cool? A. It should be allowed to cool. 3. In what manner is it best to treat a boiler that is not going to be used for a long time? A. Either dry it thoroughly and give it a coat of oil, or leave it full of fresh water.

What is the best method of grinding a spindle valve? A. There are several machines for refitting valves and seats that seem to give very satisfactory results.

(70) W. says: 1. I want to run a 58 inch saw at 600 revolutions. It will be run from a shaft, which also runs several other, smaller saws. Engine is 15 inches diameter x 3 feet stroke, with a wheel 10 feet in diameter. Saw pulley is 2 feet in diameter. What is the best practice as to speed of engine? A. If the engine is in good order, you can run it at 75 revolutions a minute. 2. What should be the size of the pulley on shaft? A. You can drive the main line of shafting at 250 revolutions a minute. This will give you an idea in regard to the size of pulleys.

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

W. J. W.—It is a micaceous hematite. It is useful for iron ore, and for making a sparkling paint, for dusting fancy signs.—C. A. P.—It is magnesian limestone, and does not indicate the presence of a water-bearing stratum.—G. M. F.—They are lead, zinc, and antimony.—R. G. V.—It is a decomposed magnesian mica, of no value.—W. L. K.—It is plumbago, but not entirely pure.—A. M. G.—No. 1 is not iron; it is a magnesian limestone containing a small percentage of iron. No. 2 is a highly bituminous coal.—J. F. W.—It is not kaolin; it is sulphate of barytes, sometimes used to adulterate white lead paint.—P. F.—It is bronze mica. See *Science Record* for 1875.—J. D. P.—It is plumbago, but very impure. It should be experimented upon to see whether it could be used for polishing or for crucibles, etc.—E. B. K.—It is black tourmaline, a hexagonal crystal. It is a compound of boracic and silicic acids with alumina, lime, magnesia, soda, and potash.—S. D. M.—These disks are not fossils. They are marks of structure which are sometimes developed in anthracites as well as bituminous coals. The disks are frequently 1½ inches in diameter, as may be seen in some of the Pennsylvania anthracites and in Wigan coal of England. These structural markings appear to have arisen from a partial attempt at crystallization or from a tendency to develop planes at right angles to the direction of pressure, subsequent to the formation of the coal, and at a time when it was being consolidated under an increase of pressure and heat.—J. H.—It is an impure steatite or soapstone. The brown specks are coatings of oxide of iron.—J. F. W.—It is galena.—G. B. C.—Both specimens contain iron pyrites.

COMMUNICATIONS RECEIVED.

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

On the Locomotive. By J. F. J.
On the Use of Mosquitoes. By S. J. W.
On Gas Lighting. By J. D. P.
On the Trevelyan Rocker. By R. S.
On the Earth's Aerial Motion. By D. L. C.

Also enquiries and answers from the following:
E. C.—J. F.—R. J. S.—F. C. W.—N. J. K.—R. F.—N, —J. C. W.—J. G. A.—G. C.—W. T. D.—H. D.—J. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who sells gas machines? Where can pure iron for chemical experiments be obtained? Whose is the best oil can? Where can box corner grooving machines be found? Whose is the best pump for mine purposes?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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May 11, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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8,315, 8,316.—CASSIMERES.—F. S. Bosworth, Providence, R. I.
8,317.—TYPE.—J. M. Conner, Greenville, N. J.
8,318 to 8,320.—EMBROIDERY.—E. Crisand, New Haven, Ct.
8,321.—MONEY BOXES.—C. Ferguson *et al.*, Derby, Conn.
8,322.—FORK SHANKS.—J. W. Gardner, Shelburne, Mass.
8,323.—WAINSCOTING.—J. Milne, Philadelphia, Pa.
8,324.—MEDAL.—J. H. Schreiner, Philadelphia, Pa.
8,325.—PEDESTAL.—W. Tweeddale, Brooklyn, NY.
8,326.—CASSIMERE.—W. B. Weeden, Providence, R. I.
8,327.—COFFIN HANDLE.—G. Rogers, W. Meriden, Conn.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, APRIL 29 to May 18, 1875.

4,705.—E. W. Grant, Ypsilanti, Mich., U. S. Step ladder. April 29, 1875.
4,706.—J. Doman, Owen Sound, Ont. Snow plow. April 30, 1875.
4,707.—J. W. Elliott, Toronto city, Ont. Fuel saver. April 30, 1875.
4,708.—S. Sherwood, Independence, Iowa, U. S. Water wheel. April 30, 1875.
4,709.—B. A. Higgins, New Portland, Me., U. S. Bending wood for shovel handles. April 30, 1875.
4,710.—J. B. Camyré *et al.*, Montreal, P. Q. Manufacture of cigars. May 6, 1875.
4,711.—J. Marin, St. Hyacinthe, P. Q. Planing and graving machine. May 8, 1875.
4,712.—D. Spinelli, Montreal, P. Q. Making soaps from mineral oils. May 8, 1875.
4,713.—S. Hall, Toronto, Ont. Concavo-concave-convex churn dasher and handle. May 11, 1875.
4,714.—E. G. Scovil, St. John, N. B. Charging iron into heating furnaces. May 12, 1875.
4,715.—L. Goddu, Boston, Mass., U. S. Machine nail rod. May 15, 1875.
4,716.—Wm. Brown, Easton's Corners, Ont. Swing gate hanger. May 15, 1875.
4,717.—S. M. Barré, Montreal, P. Q. Ironing board, etc. May 15, 1875.
4,718.—J. P. Bass, Bangor, Me., U. S. Photograph burnisher. May 15, 1875.
4,719.—R. B. Palmer, Chicago, Ill., U. S. Earth auger. May 15, 1875.
4,720.—J. D. Brewer, Muncy, Pa., U. S. Fishway. May 15, 1875.
4,721.—P. W. Hart, Camden, N. Y., U. S. Clothes pounder. May 15, 1875.
4,722.—J. Outerson *et al.*, Windsor Locks, Conn., U. S. Filter. May 15, 1875.
4,723.—H. A. Payne, Adams, N. Y., U. S. Wheel hub. May 15, 1875.
4,724.—W. R. Barton, Georgetown, Mass., U. S. Welt knife. May 15, 1875
4,725, 4,726.—A. L. Corey *et al.*, Ypsilanti city, Mich., U. S. Chain pump bucket. May 15, 1875.
4,727.—B. and A. Tolton, Eramosa, Ont. Pea harvester May 18, 1875.
4,728.—P. P. Mast, Springfield, O., U. S. Feeding mechanism for grain drills. May 18, 1875.
4,729.—W. R. Barton, Georgetown, Mass., U. S., *et al.* Peg cutter handle. May 18, 1875.
4,730.—D. McDonald, Hamilton, Ont. Door fastener. May 18, 1875.
4,731.—S. I. Robertson, N. C., U. S. Box clamp for tobacco presses. May 18, 1875.
4,732.—J. Abell, Woodbridge, Ont. Reaper cam. May 18, 1875.
4,733.—J. B. Jones, Montreal, P. Q. Automatic railway signals. May 18, 1875.
4,734.—Wm. J. Copp, Hamilton, Ont. Cold air duct stone. May 18, 1875.
4,735.—J. H. Ashdown, Renfrew, Ont. Barrel stand and filter. May 18, 1875.
4,736.—M. Johnson, Lockport, N. Y., U. S. Hoe. May 18, 1875.
4,737.—W. Warren, Chicago, Ill., U. S. Center piece May 18, 1875.
4,738.—D. Renshaw, Cohassett, Mass., U. S. Steam generator. May 18, 1875.
4,739.—C. W. Sulzbach, Virginia City, Nev., U. S. Boiler protector. May 18, 1875.
4,740.—J. Best, Chicago, Ill., U. S. Self-heating flat iron. May 18, 1875.
4,741.—H. Baughman, Doran Gold Mine, S. C., U. S. Saw gummer and sharpener. May 18, 1875.
4,742.—P. C. Ingersoll, Greenpoint, N. Y., U. S. Bed bottom. May 18, 1875.
4,743.—J. Ash, Montreal, P. Q. Compound for bites of insects, etc. May 18, 1875.
4,744.—R. Dudley, Erie, Pa., U. S. Wagon tongue support. May 18, 1875.
4,745.—A. W. Olds, Green Oak Station, Mich., U. S. Fence. May 18, 1875.
4,746.—D. S. Cornell, Warwick, Ont. Washing machine. May 18, 1875.
4,747.—R. Daine, Dartsmouth, N. S. Portable damper. May 18, 1875.

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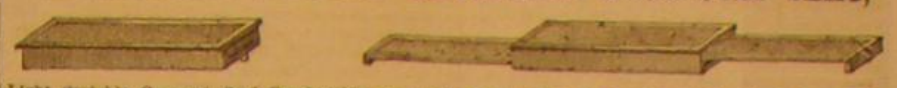
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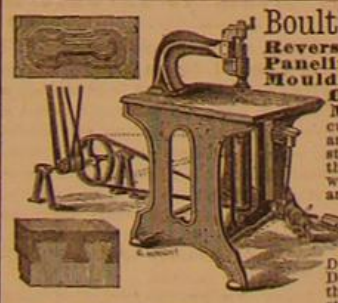
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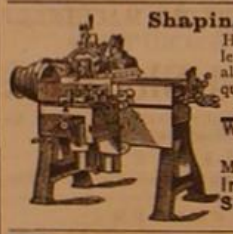
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NEW YORK, JUNE 19, 1875.

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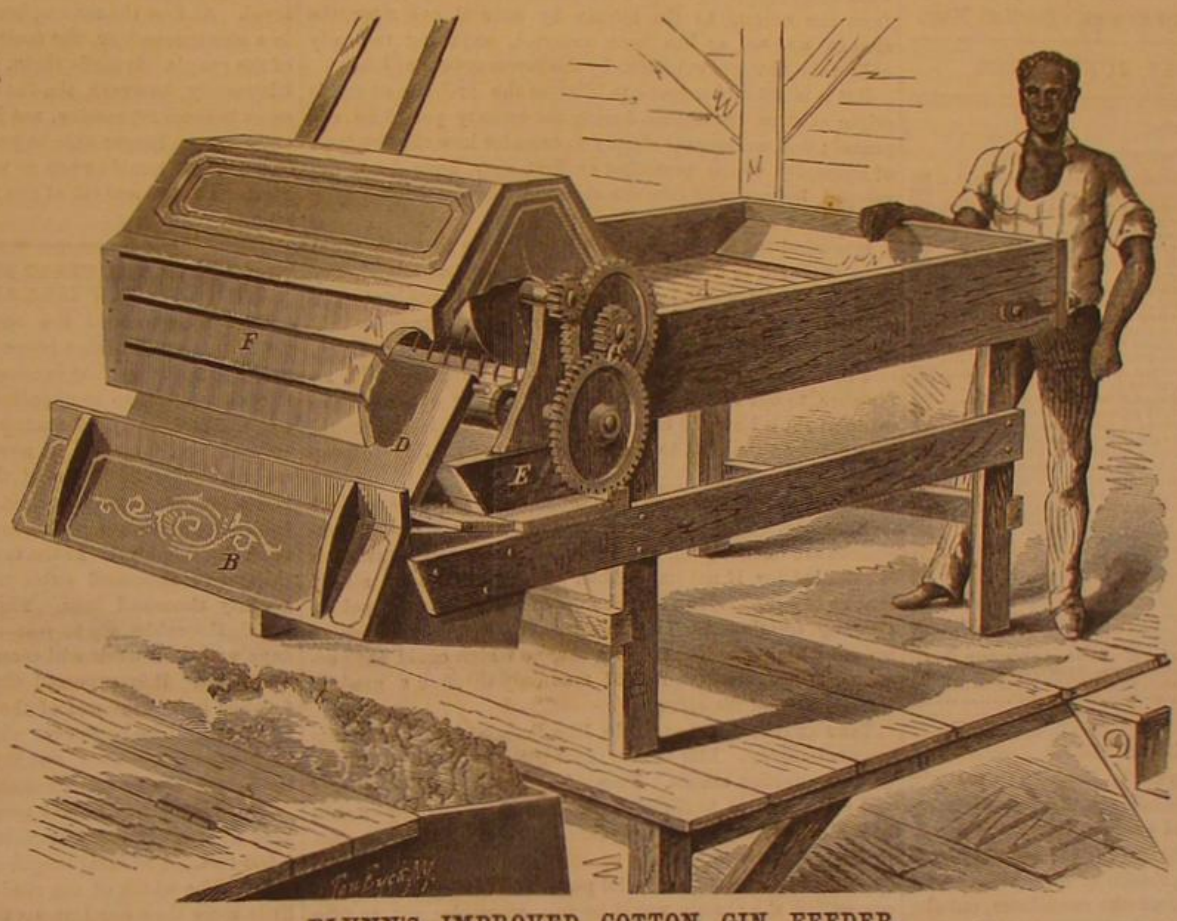
IMPROVED COTTON GIN FEEDER.

The principal difficulty found to exist in inventions of the class to which that illustrated herewith belongs is that, as a rule, they are too complicated for ordinary laborers to understand their workings, while, in addition to this, in many cases the mechanism is troublesome to repair. The cotton gin feeder shown in the engraving, it is claimed, possesses the advantages of simplicity, durability, and adaptability to the labor common to the cotton plantations of the South.

A is an endless belt which conveys the cotton to the toothed drum which, in turn, feeds the material to the breast, B, of the gin. The shafts of the drum and of the roller over which the belt, A, passes, are geared together by the train of wheels and pinions, C, in order to cause them to turn relatively to each other at the proper rate. On the opposite side of the apparatus the drum shaft, by suitable mechanism, is geared to a band wheel, so that the feeder may be driven by a belt from the gin. These gears are so contrived that they may be readily interchanged, so that the driving gear may be placed on either side, as may be required by the gin, which cannot always be arranged in the same relation to the feeder. This adapts the machine for application to any gin.

The driving pulley shaft is arranged on a slide, not shown, which is shifted by a lever for throwing the feeder in and out of gear. D is the apron which delivers the cotton to the gin breast. This is arranged a little in advance of the bed on a pivot, so as to turn freely to accommodate itself to the position of the breast, which has to be raised and lowered at times; also to make a space through which the trash may fall, and sand and dust may be blown by the drum into the trough, E, below. At F are the ventilating slots in the hood for the escape of the light dust caused by the blast of the drum.

Patented through the Scientific American Patent Agency, April 20, 1875, by Mr. F. W. Flynn. For further information address Messrs. W. H. Lockwood & Co., 130 Poplar street, Memphis, Tenn.



FLYNN'S IMPROVED COTTON GIN FEEDER.

Straightening a Tall Chimney.

A high factory chimney in Havre, which during the process of building had, owing to the sinking of one side of its foundation, been thrown out of perpendicular, was recently straightened in the following manner: The earth on the side opposite to that toward which the chimney inclined was dug away to the foundation bed, and for a width of six feet. On the wide lower course, pillars of masonry were erected, which supported a heavy staging, on which some 30,000 paving stones were piled. The effect of this immense load was to cause a sinking of the structure beneath, which, in six weeks, resulted in the straightening of the chimney the, top having passed through an arc of 31 inches.

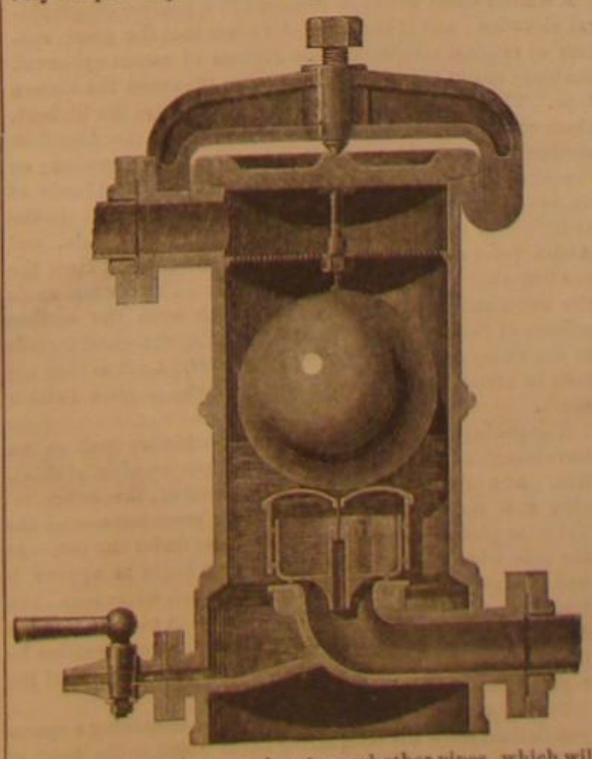
Figures Printed by Lightning.

Persons who are killed by lightning stroke are frequently found marked about the body in a peculiar manner, the lines being grouped into semblance of the trunk and branches of a tree. In case the casualty actually happens anywhere in the vicinity of a tree, the ramifications are attributed to some mysterious property of the lightning, which reproduces on the body (as was stated in a published instance) "the fibers, leaves, and branches with photographic accuracy."

Mr. C. Tomlinson, in a communication to *Nature*, states that the trees have nothing to do with the figures, which are produced directly by the lightning. The same markings may be found in sheets of crown glass by passing over them the contents of a Leyden jar. The writer, however, mentions a variety of curious phenomena in which horseshoes, metallic numbers, etc , have been found reproduced on the persons of people struck in their neighborhood. Mr. C. F. Varley throws light on these last mentioned cases in giving the record of an accidental observation made during the working of a Holtz electrical machine, the poles of which were furnished with brass balls about an inch in diameter. Noticing some specks on the ball of the positive pole, Mr. Varley tried to wipe them off with a silk handkerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibits a glow; and if in this state three or four bits of wax, or even a drop or two of water, be placed on the negative pole, corresponding non-luminous spots appear on the positive pole. Hence it is evident that lines of force exist between the two poles, by means of which we may telegraph through the air from the negative to the positive pole. And in explanation of the above cases, in which the lightning burn on the skin is of the same shape as the object from which the charge proceeded, all that is necessary is that the object be + to the horse shoe, brass number, etc., the discharge being a negative one.

CONDENSED WATER TRAP.

Mr. A. L. G. Dehne, of Halle, Germany, has patented a very simple trap for removing automatically the water of



condensation from steam heating and other pipes, which will be understood at a glance on our engraving. When the water has accumulated sufficiently to raise the globular float, the pin attached to the float is lifted from the valve, which is formed of two cup-shaped vessels (one in the other, as shown) kept normally in equilibrium by the steam pressure; but the raising of the pin releases the pressure on the interior cup, and allows the water to flow off till the balance of the valve is restored. The action appears to be very easy; and the valve will, no doubt, work continuously so long as condensation takes place.

The Mechanical Force of Light.

It may not be altogether premature to take a survey of the possible applications of the new power which Mr. William Crookes has shown to be derivable from light. Seeing that, by means of the sun's direct rays, he has been able to cause the vanes of his small radiometer to revolve four times in a second, it becomes evident that, with larger and improved appliances, we may hope to obtain motive power cheaply from a practically inexhaustible source, namely, the sun itself. The fact that luminous undulations are capable of exerting a motive force, of a nature so gross as that required to turn the vanes of a poised cross, will also render the comprehension of the chemical disturbances which are often effected by light, and which are exemplified in the union of chlorine with hydrogen when exposed to sunlight, in the production of the photographic image, etc , a matter of much less difficulty than it was heretofore.

The discoverer of these extraordinary phenomena confesses that he himself is unable to account for them by any satisfactory theory, and wishes to avoid proposing any until a sufficient number of facts have been accumulated. The facts will then tell their own tale.—*English Mechanic.*

Importance of Crocodile Study.

Professor Huxley has undertaken the duties of the chair of Natural History in the University of Edinburgh for the present summer session, and lately gave his introductory lecture to a large audience. He expressed at the outset a hope that at this time next year Professor Thomson would be among them again, full of health and vigor, laden with the spoils of many climes through which he had traveled, and a sort of zoölogical Ulysses, full of wisdom for their benefit. He then took a general view of his subject, and put before the class the considerations which resulted from the careful study of a single animal, the crocodile; an animal which was worthy of attentive study, as it might be said that a knowledge of its organization was the key to the understanding of a vast number of extinct reptiles, and the key to the organization of birds; while it helped them to connect the higher with the lower forms of vertebrate life, upon the globe. There might be asked respecting this animal, as respecting every other living thing—first, what was its structure? second, what did it do? third, where was it found? and fourth, in virtue of what chain of causation had this thing come into being?—this last having only been recently recognized as one of those questions which might legitimately be put. He then proceeded to describe the organization of the crocodile—its morphology, physiology, and distribution; and remarked that there were few animals about the palæontological history of which they knew so much, as they could carry back its history through the tertiary and secondary epochs. The answer to the last question constituted ætiology, or the science of the causes of the phenomena of morphology, physiology, and distribution. Here, as in all cases where they had to deal with causation, they left the region of objective fact and entered that of speculation. With their present imperfect knowledge, the only safe thing they could do in attempting to form even a conception of the cause of this extraordinary complex phenomenon was what a wise historian would do—stick by archæological facts. He pointed out that palæontological facts showed that there has been a succession of forms of that animal to the present day, the oldest being something like the lizard.—*Nature.*

Scientific American.

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NEW YORK, SATURDAY, JUNE 19, 1875.

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PATENT POLITICS IN OHIO.

At the recent State Convention of the Republican party in Ohio, for the nomination of State officers, the following resolution was unanimously adopted as the policy of the party

"SIXTH.—*We demand such a revision of the patent laws as will relieve industry from the oppression of monopolies.*" By the acceptance of this resolution, all the candidates, on the Republican ticket in Ohio, now stand publicly pledged to use their best endeavors to deprive the citizens of that State, and other States, of their existing rights to obtain patents. This may be a good way to gather votes, but to us it looks like egregious folly.

If there is any one law that gives more satisfaction than another, to working men, mechanics, inventors, and the public in general, it is the patent law, which secures to the humblest individual limited rights and property in new thoughts or inventions; and the attempt of these politicians, to legislate these rights away, will, we are confident, be scornfully rebuked by the masses of the people.

The existing patent laws of the United States secure to every man, woman, or child, who makes a new and useful invention, the exclusive monopoly thereof for the period of seventeen years; after which the invention becomes public property, and all persons may freely enjoy its use.

Under the stimulus of these beneficent laws, hundreds of new arts and occupations are yearly added to the national industries, contributing marvelously to the development and prosperity of the country. The great State of Ohio has long been prominent for the number and usefulness of the new inventions made by her citizens; while her remarkable growth in population, manufactures, and wealth is very largely due to the encouragement she has always given to the extension of patent monopolies within her borders. Many of her towns and cities are largely dependent upon, and in some cases have been nearly built up by, patent industries.

Indeed, it is questionable whether Ohio could to-day harvest her crops or carry on ordinary industrial operations if her citizens did not make use of hundreds of these monopolies which her astute Republican politicians now join in denouncing as disastrous to industry. We think they must know better. But if they are in earnest, if they really believe that industry is oppressed by patents, we advise them to commence at home and clear them out of their State.

Let them begin, for example, at Springfield, Ohio, a thriving town brim-full of patent monopolies. Let them take, first, the Champion Harvester concern, where they turn out reapers and mowers at the rate of one complete machine every four minutes. The great West is supplied with these splendid machines, they have a world-wide reputation, the farmers think they cannot get along without them; while hundreds of families at Springfield live in comfort by industriously engaging in their manufacture; and the founder of the concern, once a poor, struggling, inventive mechanic, after years of exertion, has made himself comfortable, if not rich, by his monopoly. But this sort of thing, say the politicians, is oppressive, and ought no longer to be tolerated To be sure, the patent will expire before long, by its own limitations; but if we are to believe the politicians, it ought to be broken up forthwith, and the industries of Springfield and other Ohio towns should in future be strictly guarded, by legal enactment, against the introduction of any more of such prosperity breeding, but oppressive, industrial patent monopolies.

CIVILIZATION BY UPHEAVAL.

The observations of Professor Marsh touching the cranial capacity of extinct animals show that the tertiary period of geology was peculiarly a period of brain development. What the determining condition of this remarkable increase of brain bulk and capacity for intelligence may have been, it is impossible to say; all we know is the fact that, at the time when, as the evolutionists hold, man was developing from the higher primates through the acquisition of some twenty or more cubic inches of brain, the entire animal world was favored by a similar though less remarkable increase of brain bulk and brain power. If there was a transition at that time from the animal to the human by natural evolution, the change was not, as has been asserted, anything radically unlike the changes exhibited by the lower orders of life.

But it is not our purpose to discuss the problem of man's origin as man. Sometime during the tertiary period he appeared; and we propose simply to consider how the low type of humanity which prevailed at first may have been developed, by means of climatic changes, into the higher type with which human tradition begins.

It is admitted by all schools of ethnologists that man must have appeared in a warm climate; on a tropical island, say men like Wallace and Darwin, for there only would his naked skin be no disadvantage, there his physical weakness would not be overtaxed before he could devise means of defense, and there food would be abundant and unfailing. In no instance, to our knowledge, however, has any attempt been made to show how the inhabitants of such an island could be started on the road to civilization, and compelled to keep it.

The inhabitants of tropical islands do not improve of their own accord. The conditions of life under such circumstances are unchanging, and therefore progressive variation is uncalled for, if not impossible. There must be a steady change of environment, and change of a nature to compel increasing forethought and industry, to insure progression toward a higher order of life: a change which could have occurred to the primitive race of man only through a gradual refrigeration of the climate.

Take an island, for example, like Borneo. Its inhabitants are unchanging. Life is easy, food abundant, and all incentives to exertion absent. Peopled by a low race of savages and stationary as to climate, the history of one day would be the history of a thousand years. But suppose the climate to become cooler at the rate of one degree a century, as by the slow approach of a glacial period. From generation to generation the change would be imperceptible; yet in fifty centuries the tropical island would become an Iceland. Its fauna and flora would be entirely changed, and man would of necessity change with them. Clothing and shelter would gradually be called for. The spontaneous products of the soil would become less abundant, and less uniformly distributed throughout the seasons. Cultivation and care would become more and more requisite to secure sufficient food. From generation to generation the race would be compelled to study thrift, to protect their animal and vegetable possessions to aid them in the struggle for existence; and thus by slow gradation they would creep upward to a higher life.

A similar effect would be produced by a gradual geographical elevation; and it is a suggestive fact that the great centers of original civilization are regions of recent upheaval: the more recent the upheaval, the more advanced the human type. The youngest highlands of the world are the highest, those of the Andes and the Himalayas; on the one American civilization reached its earliest and highest development; on the other the white race originated. To the highlands of Thibet—the "roof of the world," as the natives call it—the traditions of all the great civilizations of Europe, Asia, and Africa point as the birthplace of the human race. Here the earliest white civilization had its origin. There were made the astronomical observations on which even the earliest science of the Egyptians was based: the most ancient records in the valley of the Nile figuring the heavens, not as they are seen in Africa, but as seen in Bactria, many degrees further north.

The geology of Upper India records a history such as we have imagined necessary for the development of a civilization. At a late period, geologically speaking, the entire region now occupied by the Himalaya mountains—and the Thibetan plateau so far as explored—was under the sea. At the time when the earliest traces of man begin to appear, it was a country of sub-tropical plains and fresh water seas. The recent river and pond shells of the Thibetan plateau are the direct descendants of warm water species, whose remains lie in the deeper strata, an evidence that the vast upheaval of the region was a gradual, not a sudden, change.

From this region, now barely capable of sustaining a sparse population, came the conquering herds which, at the dawn of history, overran the plains of Europe and Asia. In this region arose the race whose development is recorded in the Vedic hymns and the religious books of subsequent ages, and whose early traditions come down from the time of the gigantic turtles whose remains are buried in the deposits of those ancient fresh water seas.

It is altogether improbable that the earliest civilization was developed by an immigrant race after the country had reached its present altitude. Men do not leave fertile lowlands for sterile mountain regions except under compulsion, and they are not likely to improve by the change. Besides, the region is now too high to sustain, much less to breed, an energetic race, such as the men of Upper India must have been when they set out to subdue the world: and by their own account, they were driven from their native home by cold—the inevitable result of excessive upheaval.

Another proof that the country was at a lower level than it is now, when it served as the great hive of the white race, is found in the fact that high altitudes are as incompatible with a vigorous development of man as they are with the agricultural requisites for the sustenance of a dense population. Within moderate limits, uplands are conducive to health and vigor; but above four or five thousand feet, the rarefied atmosphere is incapable of sustaining man at his best. This is specially noticeable in all Alpine regions and on high table lands like those of Mexico. To a still greater degree is it seen on the Peruvian plateau, where the Spaniards found a highly civilized but degenerate race. At a period geologically recent, that whole region lay at a lower level. At first the slow upheaval must have pushed forward, in a continuous line, the social and intellectual development of the people. It made them, in a double sense, a rising race. Ultimately, however, the limit was overpassed: the environment became repressive, not helpful; the people lost vigor and were no longer able to push on their civilization. Later they became unable even to maintain it, and for some time previous to the arrival of the Spaniards they had been losing ground.

PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

By a recent act of the legislature of the State of New York, this great bridge property, which was commenced as a private enterprise, has become a public work, and the money to complete it is to be supplied from the treasuries of the two cities. The early finishing of the structure is therefore assured, and the work is now progressing with all possible rapidity. The last stone of the Brooklyn pier or tower was laid a few days ago—the last that can be placed until the cables are stretched. The tower now stands 271½ feet high from the tide level. In the tower as it stands, there are about thirty-five thousand cubic yards of stone, weighing about seventy thousand tons. The "saddles"—the things upon which the cables are to rest—will be put in place in a few days, and then work will cease for the present on the Brooklyn tower. It is expected that the New York tower will be finished before the end of the present season. It is over 200 feet high. The engineers also hope to finish the Brooklyn anchorage this season, and it is thought that before next fall the cables will be stretched across the river.

This bridge will have a greater span than any work of the kind now existing. The distance between the river piers is 1,600 feet. The total length of the bridge will be about one mile. The width of the roadway will be 85 feet, which is a little more than our famous thoroughfare of Broadway.

It is believed that one of the immediate results of the bridge will be to turn the current of increasing population to Brooklyn, and ultimately cause the annexation of that city to New York, in which case the latter will take rank in population next to London.

REFINEMENTS IN MODERN ASTRONOMICAL OBSERVATIONS.

The tools used by the modern astronomer are clocks to measure time, graduated circles to measure degrees and their subdivisions, telescopes to magnify distant objects, photographic apparatus to make permanent records of ephemeral phenomena, photometers to measure the comparative intensity of light, polariscopes to reveal the nature of certain luminous rays, and spectroscopes to reveal the chemical composition of the heavenly bodies.

The invention of the clock is of great antiquity; but it is to the wants of modern astronomy and other sciences to which it is applied (navigation, for instance) that the perfection with which they are now made is due. So with the graduated circles, which are applied to quadrants, sextants, octants, and astrolabes.

The telescope, invented by Janssen in Holland, about 1609, was successively improved by Galileo, Herschel, Dollond, Fraunhofer, and others, while lately Lord Rosse and our own Alvan Clark have surpassed all former efforts. But who can say what improvements the future has in store for the telescope, especially as liberal monetary compensation has become a stimulus to the ablest opticians, and the making of million dollar instruments has been discussed?

Photography is now largely used in astronomy, and the work done by it during the recent transit of Venus, in different parts of the earth, has enriched astronomical science with records of the highest value and permanency. One amateur astronomer, Mr. Rutherford of New York city, has for several years past applied this science to making records of the position of the stars, so as ultimately to obtain knowledge of their distances from us, and their motions in space; and in connection with this branch of the subject, he has invented instruments of measurement, to be applied to the photographic impressions, which have already given results superior in precision to the measurement by direct observation of the stars represented.

Photometric observations on heavenly bodies, comparin their relative luminosity and determining changes in thei

nature or distance, have been brought to a high degree of perfection, especially by Zöllner, who used for this purpose the following apparatus: The polariscope, an ingenious tool invented by Malus in France in 1808, is based on certain peculiar properties of reflected light, by which it may be ascertained what light or portions of light belong to a luminous body itself, and which are borrowed from other sources; while it also shows the direction whence the borrowed light arrived before it was reflected by the body under investigation. Zöllner applied to this instrument several ingenious devices, making it the most perfect measurer of the intensity of light, and has thus founded a new branch of astronomical research, called astro-photometry.

The spectroscope, based on a discovery made in 1790 by Fraunhofer, and in 1840 by John W. Draper of New York city, is the invention of Bunsen in Germany, and, next to the telescope, is the greatest gift astronomy has ever received. By means of this instrument, Secchi, in Rome, has so successfully investigated the light of the stars that he has classified them by their temperatures, which may be distinguished by the number of dark lines or bands in their spectra; the hottest stars show the least number, the next class (to which our sun belongs) showing a greater number, and the third class having so many dark lines, obscuring portions of their spectra, that a peculiar color prevails in them; while a fourth class, of a still lower temperature, are still more obscure. Next come the dark globes, so cool that they have no light of their own, and cannot be seen except when they are so near to a luminous star as to shine by reflected light. This is the case with most of our planets, as well as with we do not know how many, perhaps much larger, darker bodies, floating in the infinity of space, and to which the disappearance and reappearance or changes in luminosity of some stars are ascribed, these phenomena taking place when their light is intercepted by an intervening dark body.

Secchi has just published some of his recent observations on Coggia's comet. He combined the spectroscope and polariscope with his telescope; the spectroscope showed that there were two spectra, one continuous, and the other consisting of luminous bands, agreeing with those of oxide of carbon; while the polariscope showed that the latter spectrum was original light, while the continuous spectrum was reflected light, also showing that the latter came from the direction of the sun: consequently that the continuous spectrum was reflected sunlight. He proved thus that this comet shone not only with reflected sunlight, but by its own light also, thereby revealing the nature of its original luminosity. This is an instance of the highest degree of refinement as yet obtained in modern astronomical research.

SAMSON OR SOLOMON?

This is the muscular period of the year, the time at which the collegian suddenly wakes up to the fact that poring over books, or the clerk to the idea that too close a confinement in the counting room, is resulting in flaccid biceps and a general depreciation to physical tone. One cannot pick up a newspaper now-a-days without being informed that this or that college crew is busily preparing for a coming regatta, or that some enthusiastic individual is training to walk an incredible distance in an equally incredibly brief space of time; while there is even an *on dit* fluttering about that the elegant Mr. Blank, so refined and so gentle in society, actually nightly pummels a professional pug, or stands manfully up and allows his sconce to be soundly rapped or his nose to be painfully abraded by his short-haired tutor.

They say abroad that we Americans make the pursuit of pleasure an elaborate business transaction; we do even more in the way of athletic culture, for we contrive to convert such sport not merely into a business, but too often into a kind of martyrdom.

"Well!" we can hear the reader exclaim, "does this paper, which fairly bristles with health axioms, and which preaches sanitary measures year in and year out, propose to take ground against healthy exercise? Does it argue that gymnasiums are pitfalls, and race boats and ball grounds only so many roads leading to bodily destruction?"

No! not by any means, gentle reader; on the contrary, we think physical exercise a physical necessity—but, in moderation. And there's the point which, it seems, can never be rendered keen enough to penetrate the brain of the average "muscular Christian." Let us illustrate: Suppose two men of equal strength enter for a contest—say a race with single sculls—to take place a year hence. One individual depends on future training, and lets the subject escape his attention until three months or so before the appointed time. Then he abandons books or business and goes to work. He radically changes his diet; from lazy inactivity, he subjects his body to severe strains, and, in brief, endures all kinds of privations in order to work himself into fit condition. The other person starts at once with a little gentle exercise, which in nowise interferes with his regular pursuits; he maintains his generous diet, and in general, save, perhaps, a slight augmentation of muscular work as the time grows short, his mode of life is the same at the end as at the beginning. In the hour of trial it would be found that the first could make "spurts"—momentary efforts of herculean strength—but that the second would show that steady uniform labor which would tell in the end. We should expect to see one man leave his boat collapsed, and in "condition" fit only for the sick room; but the other, we are certain, would step ashore, warm and tired to be sure, but with eye as bright, nerves as steady, pulse as regular and head as clear as when he took up the oars. From the result, any one would say that the first man's course had been wrong, and yet it is precisely the course of thousands of young men just at the present time

It is the same with mental labor. The merest tyro of a scholar knows that no information is so fleeting as that acquired by cramming for some special occasion; while none is so enduring as that gained by slow plodding, inch by inch. Moreover, these sudden transitions from inactivity—for there is hardly any period when the body is more sluggish than in the spring—to intense activity are hurtful, permanently so in some cases. It is well understood that one set of muscles cannot be developed by excessive work without a general weakening of the rest; and if feeble hearts or lungs be included in the organism, this weakening cannot be withstood, and irreparable injury may easily result. A strong frame does not imply a strong constitution; and nothing is truer than that the ultimate strength of the human system, like that of any mechanical structure, is only equal to that of its weakest part. The early deaths of Heenan the prize fighter, Renforth the oarsman, and of a dozen other magnificent specimens of physical development, which we might name, are common examples in point.

A well known professor told us, not long since, that every man of a college crew, which had covered itself with the laurels of victory in a great race, had failed in his studies. The time, in that particular instance, necessary for the severe training was taken from the hours of scholastic work, and the natural result followed. This only adds further proof to the assertion that there is a metaphorical antagonism between brains and muscles; and it leaves open to us the question of which we propose to consider the better type of humanity, him of big muscles or him of well balanced, powerful brain. We once saw a renowned athlete strip, and we looked with admiration on the great knotted fibers which lay beneath an unblemished skin, soft as any woman's, and on the feats of strength impossible to ordinary men. We admired that man's muscles; we thought of them as beautifully made mechanism; we simply admired them. But it was with a very different feeling that we listened to the eloquent words of a great lawyer summing up a great cause the other day. The highest triumph of one man had been to move vast weights; of the other, to stand as the representative of a nation molding the judgment of the loftiest tribunal the world has ever known. Which is the higher ambition?—and yet this renowned lawyer would physically be classed as of the lowest grade. The stooping shoulders, the contracted chest, and the spare muscles have offered no obstacles to his ascent of the topmost pinnacle of that temple of human fame wherein the strong man has but an instant's and the lowest place.

We do not argue against physical culture; but we say that it never should displace or rise superior to that of culture of the mind. It is not to the smith who wields the massive hammer, or handles great bolts of metal, that the world is indebted for the grandest results of inventive skill; but to the quiet, patient student who thinks, and whose thought brings forth that soul which animates arms of steel and iron, to do his bidding. Victory does not now perch on the banners of the nation whose army is composed of the strongest men or whose hosts are the most numerous; but on the standards of that land among whose children the genius of invention, the power of thought, most widely dwells. Brains rule this world—not muscles.

SCIENTIFIC AND PRACTICAL INFORMATION.

DISCOVERY OF THE PHYLLOXERA REMEDY.

M. Dumas recently announced to the French Academy of Sciences that a mode of treating vines attacked by the phylloxera had been discovered, which is certain in its results in destroying the insect and in restoring the vine to health and fecundity. The remedy is the combined employment of sulpho-carbonate of potash, which kills the insect at any depth, to the soil, and of potassic, ammoniacal, and sulphureted manures. *Les Mondes* states that M. Dumas himself is the fortunate discoverer, though his announcement to the Academy was not made until after his process had been tried by exhaustive experimenting by the commission appointed to examine into the various plans submitted. This being the case, M. Dumas becomes the possessor of the $60,000 reward, beside the numberless other prizes of smaller sums offered throughout France.

A NEW SOURCE OF MAGNETISM.

M. Tommasi states that, when a current of steam under a pressure of 5 or 6 atmospheres is driven through a tube of copper 0·08 to 0·12 of an inch in diameter, rolled in a spiral about an iron cylinder, the latter becomes so highly magnetized that an iron needle, placed at a fraction of an inch from it, is strongly attracted and remains magnetized during the passage of the current.

HOW TO KEEP MEAT FRESH A LONG TIME.

We have for authority the *Inter-Ocean* for saying that the following recipe is worth the subscription price of any newspaper in the land:

As soon as the animal heat is out of the meat, slice it up ready for cooking. Prepare a large jar by scalding well with hot salt and water. Mix salt and pulverized saltpeter in the proportion of one tablespoonful of saltpeter to one teacupful of salt. Cover the bottom of the jar with a sprinkle of salt and pepper. Put down a layer of meat, sprinkle with salt and pepper, the same as if just going to the table, and continue in this manner till the jar is full. Fold a cloth or towel and wet it in strong salt and water, in which a little of the saltpeter is dissolved. Press the cloth closely over the meat and set in a cool place. Be sure and press the cloth on tightly as each layer is removed, and your meat will keep for months. It is a good plan to let the meat lie over night after it is sliced, before packing. Then drain off all the blood that oozes from it. It will be necessary to change the cloth occasionally, or take it off and wash it—first in cold water—then scald in salt and water as at first. In this way farmers can have fresh meat the year round. "I have kept beef," says the writer, "that was killed the 12th of February, till the 21st of June. Then I packed a large jar of veal in the same way during the dog-days, and it kept six weeks."

INSECT AESTHETICS.

L. G. Fellner states that the large red ants of Arizona Territory adorn their dwellings with stones, shells, etc. "I have often disturbed their piles in order to find garnets, etc. The ant on guard would then regularly call out an army of miniature warriors, whose attacks I had to avoid. As I stirred one pile with a stick, the guard ran inside; but instead of returning with a number of angry ants, he brought out a large clear garnet and rolled it down towards me; I kept stirring until he had brought five, when I thought the sagacious animal had been taxed sufficiently."

LAND DRAINS.

An excellent subsoil drain may be made by digging a trench and filling in the bottom with sticks of wood, compressing them together with the feet and then covering them with the mold. The effectiveness of such a drain will endure for several years, and the final decay of the wood will serve to enrich the soil.

MAGNETS FOR ELECTRO-MOTORS.

Magnets or armatures for electro-motors may be softened as follows: Heat the iron to an even dull red heat all over; and if the surface of the iron has not been faced off in a machine, lightly file it to remove the scale, and then immerse it in common soft soap, allowing it to remain therein until it is quite cold. Then reheat the magnet to an even red heat whose redness is barely perceptible, and bury it in pulverized lime, wherein it must also remain until quite cold, when the metal will be found as soft as it is possible to make it, and the blade of an ordinary penknife will cut it. At the second heating the iron will emit a light blue flame, showing the effect of the immersion in the soft soap. The conductibility of the magnet may be, by this process, very much increased.

Siam at the Centennial.

His Majesty the King of Siam, having accepted the invitation of the United States Government to take part in the International Exhibition at Philadelphia next year, has appointed J. H. Chandler, Esq. as Royal Commissioner. Mr. Chandler is a native of Pomfret, Conn. He has resided in Siam about thirty-two years past, and is well acquainted with the productions and resources of the country. His early labors in that country were devoted to type-founding, printing, bookmaking, and the introduction of various improvements. He has the honor of having introduced steamboats, and also steam machinery for manufacturing purposes, beside numerous labor-saving machines to facilitate and improve the mechanic arts. Nearly all the early improvements which have done so much for the country were introduced by him. For the last twelve years or so, he has devoted himself mainly to the language, teaching, etc., and has for a long time held the position of chief government translator in the foreign office. He was tutor to His Majesty before his first coronation. With Mr. Chandler for Commissioner, and the readiness with which the King and his ministers have entered upon the work of preparing and forwarding the productions of the country, it may be expected that the kingdom of Siam will make a good display at the International Exhibition.

Sailing of the New Arctic Expedition.

The new British arctic expedition, for polar discovery, comprising two vessels, sailed from Portsmouth on the 29th of May. The expedition is commanded by Commodore Markham, in the Alert, while Captain Nares, navigator, sails the Discovery. Both vessels were prepared and equipped in the best possible manner, with all the appliances for safety and success which arctic experience could suggest.

The route is up the west coast of Greenland, on the same track as the Hall expedition. Special preparations have been made for sledge expeditions, and the explorers are bound to reach the north pole this time, unless ice or other obstacle prevents.

Adulteration of Linseed Oil with Cod Liver Oil.

According to the foreign pharmaceutical journals, linseed oil is now frequently adulterated with cod liver oil. To detect this adulteration, 10 parts by weight of the oil is mixed with 3 parts by weight of commercial nitric acid in a glass cylinder, and well mixed by stirring with a glass rod. It is then left quiet until the oil and acid separate. If cod liver oil is present, the layer of oil will have a dark brown or black color, and the acid will be orange yellow or yellowish brown. Pure oil treated in the way is at first a water green, then a dirty yellowish green, and the acid takes on a brighter yellow color.

RAPID TRANSIT IN LONDON.—Recently, during one day, Whit Monday, 246,547 passengers were carried on the Metropolitan Underground Railway, London, being at the rate of ninety millions of passengers per annum. The stations are half a mile apart. The trains run every two minutes; they consist of twelve cars each, and are drawn by locomotives weighing forty-five tuns each. They discharge and take up a load of passengers, run to the next station, and stop, all within the space of two minutes.

MR. JAMES T. GARDNER, Chief Geographer of the Geological and Geographical Survey of the Territories, with his staff, left New York on May 26, and will have head quarters until October at Denver, Col. Ter

THE FIRELESS RAILWAY SYSTEM IN ENGLAND.

We publish herewith engravings of a new form of fireless car, the design of an engineer named Todd. It is a "dummy," or combined car and locomotive; it is styled the Harmless, and is constructed thus: There is a main lower frame 22 feet 6 inches long over the buffers, 7 feet wide over all, and 3 feet high from the rail to the top; and on this frame is placed the 14 feet body of an ordinary car. In the center of the frame are two receivers, each containing 30 cubic feet of water. Below the buffer beams are screw couplings and stop valves with perforated pipes running right through the receivers. The wheels are 24 inches diameter, placed 4 feet 6 inches between centers. Cylinders, 9 inches diameter and 8 inches stroke, surrounded with large jackets open to the water of the receivers. At each end of the car, outside the dash plate, is placed a brake handle, and on either side of this a regulator and reversing handle, all arranged as shown. These latter handles fit into spring sockets, so as to be changed from one end to the other, principally to prevent any one from behind moving the car. There are four sand boxes, with handles brought to the foot boards. There are two exhaust pipes, the end of each projecting slightly upwards from the edges of the curtains over the foot boards; and by a cock the waste steam is turned into whichever pipe happens for the time to be at the following end of the car. All the working motion is quite protected from dirt by light boxes which have hinged doors at the sides.

The inventor proposes to start the engine on its journey with an initial pressure of 200 lbs. to the inch; and the *Engineer* states that, owing to the jacketing of the cylinders, the loss by radiation will not exceed 5 lbs. pressure per hour, allowing the engine to run 40 miles on level lines at one charging of the boiler. This is rather a large idea of the capabilities of the system; and we hope that it may be realized.

Fig. 1 is a transverse section of the car, showing the boiler and steam dome, and the position of the engine; Fig. 2 is a longitudinal section of the same; and Fig. 3 is an exterior elevation, also showing the stationary boiler from which the apparatus is charged.

Fig. 1.

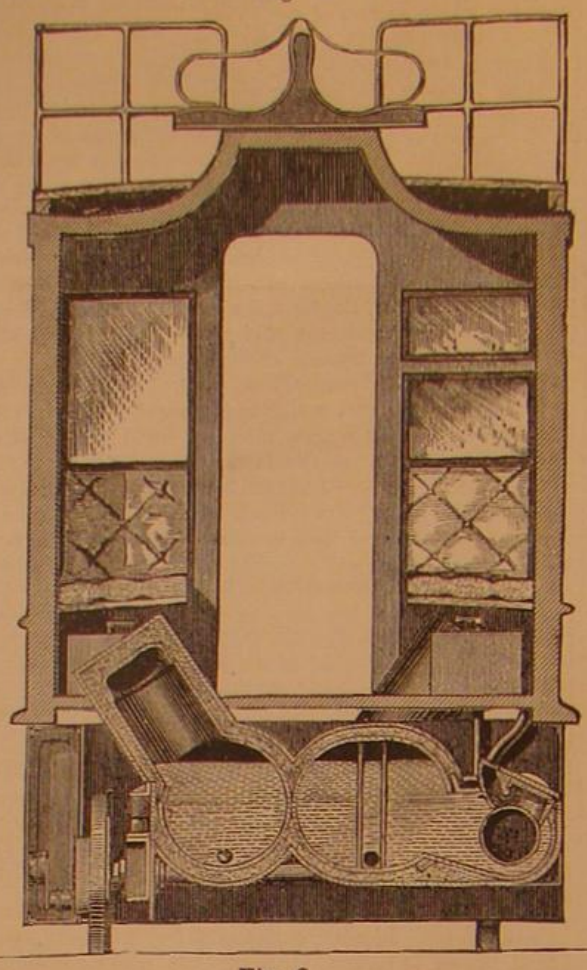
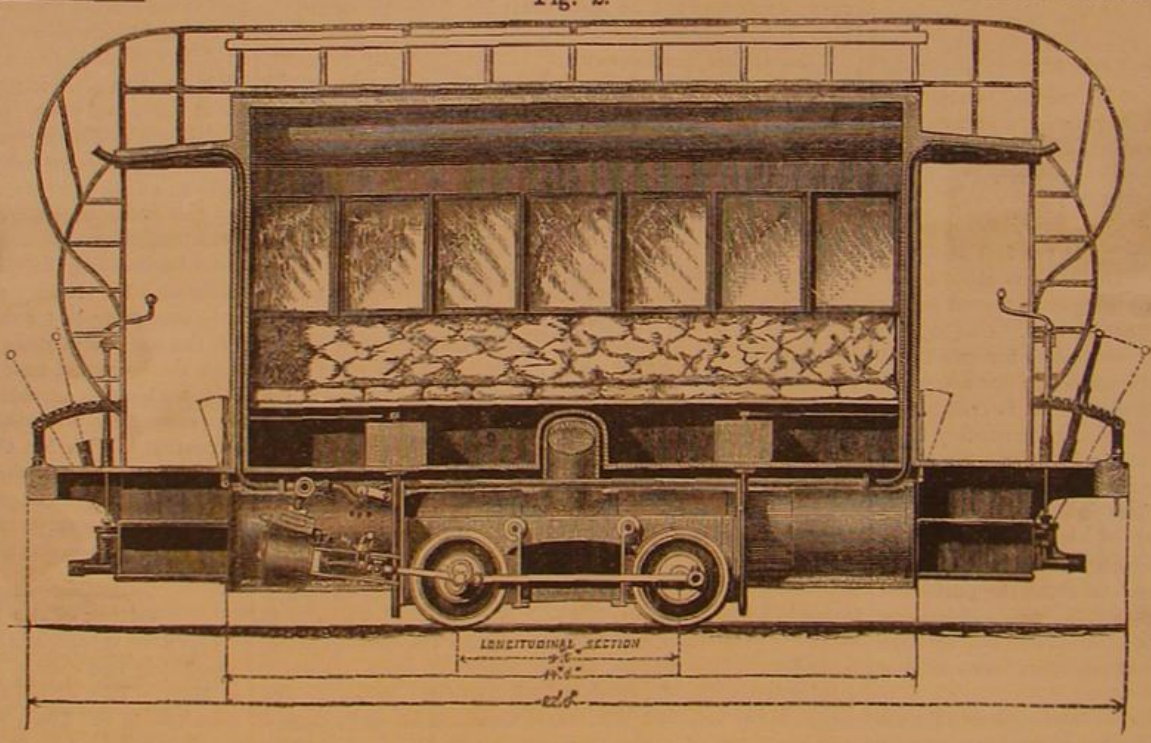


Fig. 2.



Lightning.

There are indications that we may anticipate severe electrical disturbances during the coming summer. The winter has been unusually long and severe. Abnormal weather has occurred over most parts of the globe. Reports of severe thunderstorms reach us from the Cape and the antipodes. Exceptional conditions of this kind abroad usually presage similar conditions in England. "Coming events cast their shadows before." But whether the coming summer be above or below the average, we are bound to call attention to the fearful apathy and gross carelessness evinced in not protecting buildings from atmospheric electrical discharges.

During two severe storms in England, in June, 1872, there were ten deaths and fifteen cases of injury to human beings; sixty houses struck, and fifteen burnt down; and twenty-three horses and cattle, and ninety-nine sheep, killed. Those accidents that are not recorded are innumerable. In large towns damage to property is more frequent than destruction of human life; but in the open country, destruction of life is perhaps more frequent than destruction of property, unless we except trees, which are ruined in thousands every year, and unfortunately—from their size and growth—the finest suffer.

Lightning protection is therefore not only a necessity, but it is a source of satisfaction and comfort. It is difficult to comprehend the reasons why it is not more largely adopted. It is not its inutility—for the beneficial effect of lightning conductors among our buildings and our shipping is incontestible. It is not its expense—for a house can be protected for a less sum of money than is required to bed out a parterre. It is not its difficulty—for any skilled workman or energetic landlord can do it with ease.

Dr. Mann, the President of the Meteorological Society, has done good service in reading an exhaustive and able paper on the subject before the Society of Arts, and an admirable notice of it was given in the London *Times*. Dr. Mann has supplemented this notice with an excellent letter to the leading journal on the precautions to be taken, especially with the tall zinc tubes now so largely used for chimney tops. Mr. Preece had previously called attention, in the *Times*, to the danger of chimneys, lined as they are with soot, filled with ascending currents of heated air and smoke, and terminated in grates, acting as lightning conductors. If all such chimney pots be connected with the water pipes by galvanized iron ropes, and if all these pipes make good earth (that is to say, have a large metallic surface in contact with the earth), a house is as safe from lightning as a collier in a mine.

All lightning protectors should be constructed on proper scientific principles, and we have published in our columns many valuable papers on the subject. The great desiderata to be urged are the employment of perfectly continuous metallic ropes or rods, the use of good earths, and the termination of the conductors in the air in points. A great fact to be remembered is that joints, and earths, and points deteriorate, and lose their efficiency; they therefore require frequent examination and frequent renewal. Lightning conductors require annual inspection and a careful overhauling. It is needless to point out to telegraphists the necessity of a good earths, for they all know that their circuits are unworkable without them; but it is lamentable to see the condition of the earths to the lightning protectors of the steeples of some of our cathedrals and churches. The splendid new spire of Llandaff cathedral is positively in a dangerous condition from this cause. Nine out of every ten churches are in the same condition. Earth wires are plunged into the interior of cisterns; they are leaded into stones; they are bedded in dry sand. One was carefully put into a glass bottle buried in the dry earth; another was coiled carefully into the interior of a wooden pail, in the basement floor of the house it was meant to protect. Every case of the inefficiency of lightning protectors that has been examined has been proved to be due to gross ignorance of the principles of electrical science.—*Telegraphic Journal.*

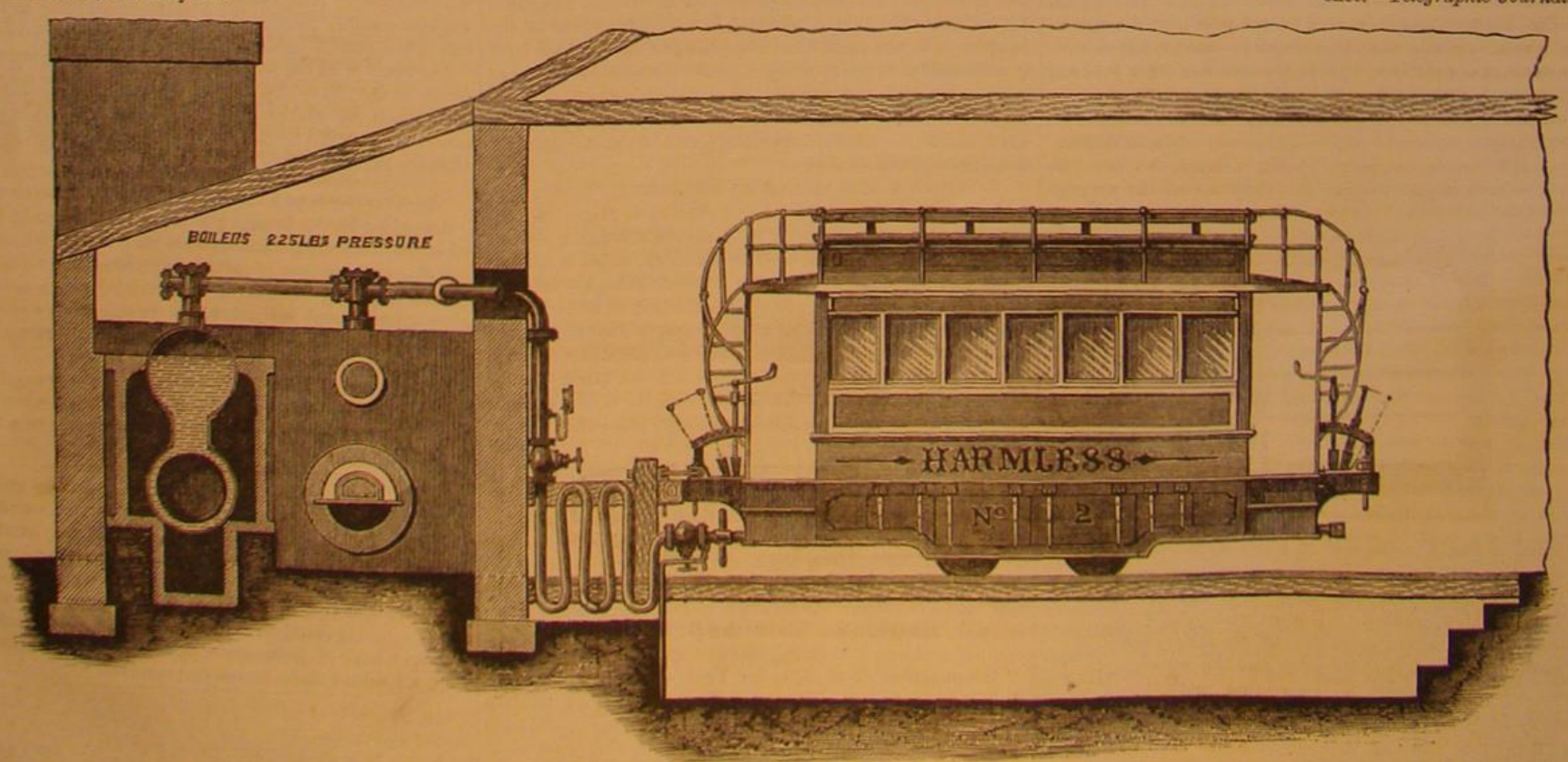


Fig 3.—TODD'S FIRELESS STEAM CAR SYSTEM.

STENOGRAPHY BY MACHINERY.

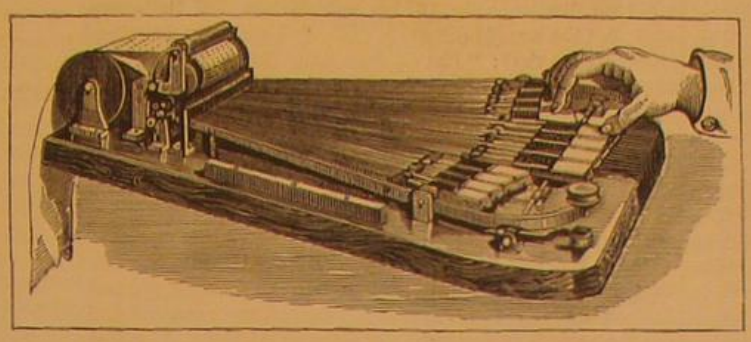
A curious apparatus has recently been invented in France, by the aid of which stenographic writing may be accomplished at the rate of from 200 to 250 words per minute, which is probably as fast as the language can be spoken by the readiest speaker. The device, an engraving of which is given herewith, consists of a keyboard operated as shown by the hand of the reporter, and composed of twelve black and an equal number of white keys. On each side of the instrument is a large key moved by a pressure of the wrist, and serving to give supplementary signs which simplify the reading of the characters printed.

All the keys, when operated, produce indications in ink on a roll of paper, which is taken from a reel in manner similar to that on the Morse telegraphic apparatus. The black keys, however, give long marks, while the white ones cause simple dots to be transcribed. At each pressure of the fingers on the keyboard, the paper is automatically unrolled for about 0·02 of an inch, so that on each line any combination of twelve double signs may be imprinted, and these signs are arranged in three groups of four each, and read from left to right in the ordinary manner.

The number of characters which may be made on each division of four is more than sufficient to to require a single movement to form a single letter. In other words, with practice, three letters or less can be written at once. If the useless letters be suppressed, such as double letters, e mute, etc., frequently a single movement will produce an entire word. In case, however, the word is to be continued to the next line, a movement of one of the wrist keys makes a character indicating the fact.

The manipulation of the keyboard requires great skill. Learning to read the characters is very easy, but at least six months' practice is necessary for one to become an expert operator capable of following every word as it is uttered in a large assembly.

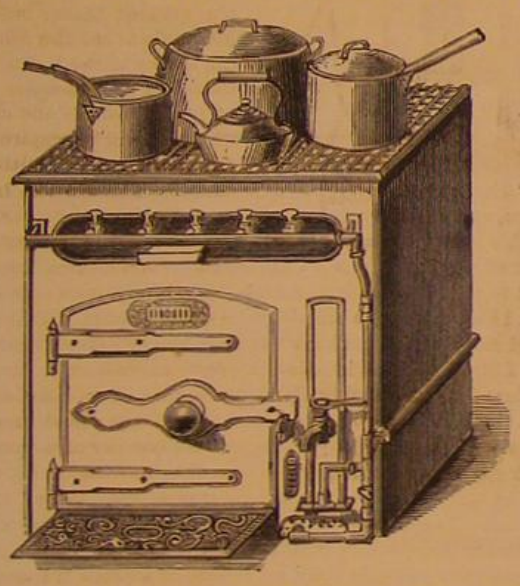
The paper roll is of no great length. About sixty or seventy feet, four inches in width, is required for an hour's continuous writing.



STENOGRAPHIC MACHINE.

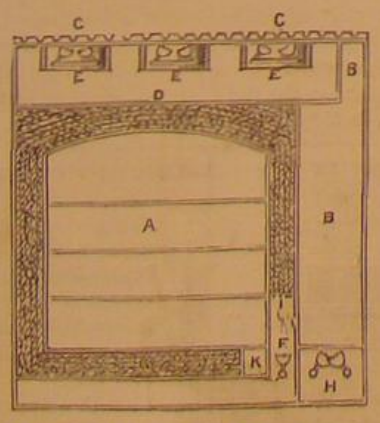
COOKING BY GAS.

We publish herewith engravings of a gas-burning cooking stove, the invention of B. Giles, Blackheath, England, who



claims to have succeeded in cooking the most delicate dishes without their imbibing the slightest flavor from the products of combustion.

Fig. 1 is an isometrical view of the small sized apparatus, in which, it will be seen, great attention has been paid to compactness and neatness in working out the design. The outside dimensions are 22 inches in width, 16 inches in depth, and 33 inches in hight. By a refe-



rence to Fig. 2 (a diagram of a transverse sectional elevation of the whole kitchener), it will be seen that the oven, marked A, is surrounded by a chamber. This chamber, marked G, is filled with coils of thin iron, except where room is left for the burners, marked F, which heat the oven and the water in the boiler, B. Over the burners, F, is a grating, marked I. This grating, which supports the coils of thin iron, is placed at a hight sufficient to allow of the gas burning to advantage for developing heat. The heated products of combustion from the burners, passing through the grating, circulate freely among the coils of thin iron, and pass out at the point, K, after the coils of iron have absorbed and utilized the greater part of the excess of temperature of the products over the atmosphere. By the adoption of this system the heat is kept uniform, and is the more equally distributed over the whole surface of the oven. The space, D, constitutes a most effective plate warmer. Over the oven gas burners, E, are placed in sets of four, for the purpose of heating digesters (for making soup), fish kettles, saucepans, etc. Each set (as with those for heating the boiler and oven) is so arranged as to thoroughly consume every particle of gas, and generate the maximum amount of heat possible. Each set of these burners for heating saucepans consumes about eight cubic feet per hour when the gas is turned full on; the heat thus evolved will raise the temperature of a gallon of water from that at which it is usually delivered to that of the boiling point of water (212° Fah.) in about thirty minutes, with a consumption of about four cubic feet of gas.

THE ALEXANDRA.

The launch of the twin screw ironclad Alexandra on April 8 adds to the British navy the finest and most powerful broadside ironclad in the world.

The principal dimensions are: Length between perpendiculars, 225 feet; breadth, extreme, 63 feet 8 inches; depth in hold, 18 feet 7⅛ inches; tunnage, 6,049; displacement, 9,492 tuns; draft forward, 26 feet; draft aft, 20 feet 6 inches; indicated horse power (intended), 8,000; speed, 14 knots.

Like all her predecessors of modern type, the Alexandra has her water line protected by a belt having a maximum thickness, over the water line, amidships, of 12 inches, a thickness which, in masted ironclads, has been equaled as yet only in the French vessel Redoubtable, in the Independencia (Brazilian ironclad, whose launch was so unfortunate), built in England from Mr. Reed's designs, and in the Kaiser and Deutschland, built and building there—also from Mr. Reed's designs—for the German government. Towards the ends the belt tapers to a much less thickness, an inevitable defect of the belt system, to which it does not appear to be customary to attach much importance, though its existence is to our mind the great argument in favor of making the ends into coal tanks, which, being penetrable with absolute impunity to the ship, solves all questions of thickness of armor by enabling the designer to dispense with it altogether.

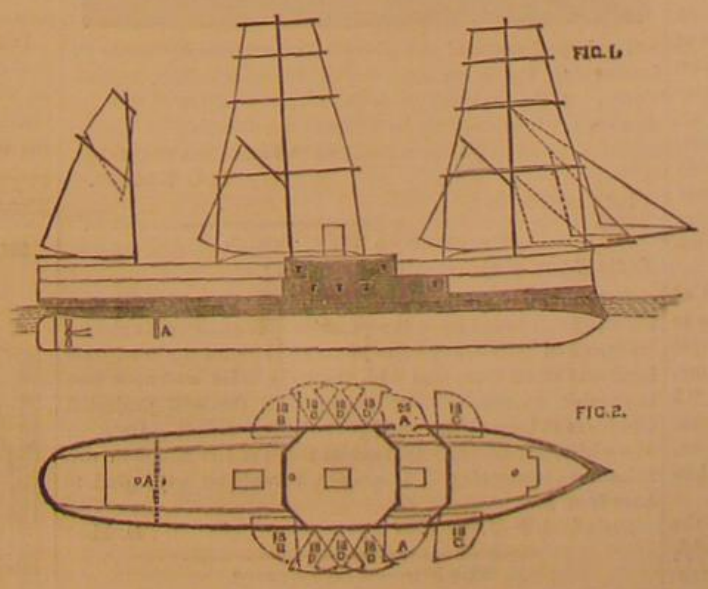
The Alexandra is a central battery ship in the best sense, that is, she needs no bow or stern batteries to give her end-on fire. For the first time the English navy really has a masted ship with satisfactory all-around fire (which even the Monarch turret ship has not), for out of twelve guns the new ironclad can fire four (including the two heaviest) straight ahead, and two straight astern. On each broadside from four to six guns can be fought, according to the bearing of the enemy. The Alexandra, by virtue of her two-gun decks with end-on fire from both, thus approximates very closely, as regards range of fire, to an ideally perfect broadside ship.

Splendid ship as she is, and advantageously as she compares with other broadside ships in the English or any other navy, the Alexandra shows in places, says *Engineering*, that deficiency of protection which is always observable in vessels of her type. Thus the batteries are armored with only 8 inch and 5 inch armor—the latter a miserable defense against the guns of other ironclads The reason of course is that the ship must, before all things, be kept above water. There is much to be armored, and not much to do it with; and when the waterline is fairly secured, the batteries are left, to say the least, very unequally protected.

It should be noted that in the Alexandra, as in previous ships built on the two-deck battery system, the upper battery serves as a conning tower, and enables that weight to be dispensed with. It will be seen by Fig. 1 that the armor forward is carried down over the ram, both to strengthen the latter, and to guard the vitals of the ship from injury by raking fire from ahead, at times when waves or pitching action might expose the bows. The magazines, engines, etc., are similarly protected against a raking fire from abaft by a hanging bulkhead, A, across the hold, plated with 5 inch armor.

The sills of the main deck ports are 9 feet, and those of the upper deck ports more than 17 feet, above the water. The total weight of armor and backing is 2,350 tuns, and of guns and ordnance stores about 660 tuns.

The only defect of the Alexandra appears to us to be that she is too good. She is too large a version of the type. A small Alexandra, that is, an improved Audacious, would appear to us a valuable addition to the navy, well fitted for certain necessary services for the discharge of which such masted broadside ships are probably as well fitted as, or even better fitted than, masted turret ships. But if so much money was to be spent, it should have been spent upon an Inflexible, or even upon a Devastation.

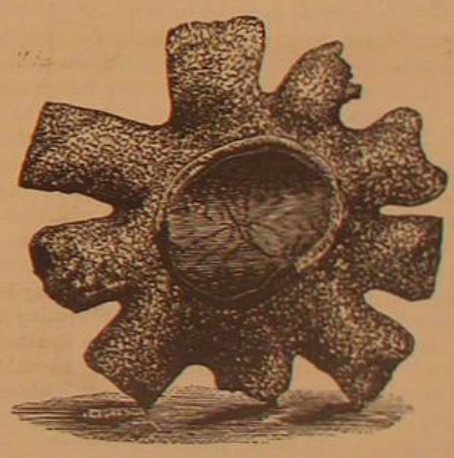


THE ENGLISH IRONCLAD ALEXANDRA.

BRACHIOSPONGIA.

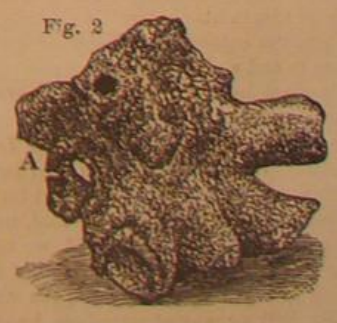
"During a geological trip in 1855, I discovered a new genus of fossil sponge, which may be worthy of a brief notice. My first specimen was exhibited to Professor L. P. Yandell, of Louisville, Ky., and while in his hands it was seen and described by Professor D. D. Owen. (Second Report of Geology of Kentucky, page 111.) He styled it an amorphozoon, and suggested the name of *scyphia digitata*. I doubt if he ever saw the fossil in place, though he correctly refers it to the birdseye group of the lower silurian. It was again described and imperfectly figured by Professor R. Owen. (Indiana Geological Survey, 1859–60. pp. 362, 363). He changed the name to *syphonia digitata*, and he recognized it as a sponge. The specimen thus described, having nine arms, I claim as my discovery, and it should be acknowledged as typical of the genus. Professor S. S. Lyon afterwards found one with eleven arms, of which casts have been

Fig. 1.



widely distributed. In 1867 I placed my original specimen in the hands of that accomplished naturalist, Professor O. C. Marsh, of Yale College, for a more careful examination. The result was the rejection of the former unsuitable names and the substitution of *brachiospongia* (the arm-bearing sponge), with the specific name of *Roemerana*, in honor of Professor F. Roemer, the leading authority on palæozoic sponges. Over fifty additional specimens, complete or fragmentary, were obtained by me on a subsequent visit to Franklin county, Ky., and a map of the sponge region was prepared. Specimens have also been found in the same geological horizon

Fig. 2



in Tennessee. Allied forms were likewise found, but they were so highly silicified and distorted as to make an accurate description impracticable. Professor Marsh's notice appeared in the *American Journal of Science and Arts* (vol. 44, p. 88), and it was afterward corrected and elaborated in the form of a paper read before the American Science Association in 1868. Fig. 1 represents *b. Roemerana*.

The general appearance of the *brachiospongia* is vasiform; a central cup, oval, with a rim one or two inches high, being surrounded by tubular arms or fingers, hollow at the base, and closed at the extremity. These arms vary in number,

from five to twelve; and on this variation specific distinctions are founded. The smallest sponge of this kind thus far found is three inches in diameter, and the largest twelve inches. Frequently the fingers were found detached from the body; and in one case two large ones were found near each other, having so grotesque a resemblance to a pair of diminutive feet that for a time my assistants positively refused to aid me further!

The exterior of the *brachiospongia* is silicified, while through the interior characteristic silicious spicules are distributed. Near the center of the base, and opposite the mouth of the cup, is a small papilliform cone, which others have regarded as the point by which the sponge was attached to its support. But, in my opinion, this is a hasty conclusion; and I think it can be shown that this basal protuberance is the remnant of a partially absorbed arm. In a specimen of *b. Hoveyii* (Marsh), having twelve arms, only six of which appear in the illustration (see Fig. 2), there is evidence that the sponge arms, though constant in their specific numbers, were at intervals liable to alternate absorption and reproduction. The arm, A, seems to be the youngest in a series of which the basal cone, B, is the retiring member. A more careful study of these curious and highly interesting fossils may serve to throw light upon the mysterious laws of spongoidal growth."—*Rev. Horace C. Hovey, M. A.*

Correspondence.

The Blair Direct Process.

To the Editor of the Scientific American:

From a proof copy of the very interesting paper read on the 6th of May last before the British Iron and Steel Institute by their distinguished late President, Mr. Isaac Lowthian Bell, upon his visit to the mines and iron works of the United States in the fall of 1874, I make the following extract. Mr. Bell says, on page 47:

"My friend Mr. T. S. Blair, in company with other gentlemen, has erected a work near Pittsburgh for carrying his mode of making steel into practice. * * Mr. Blair's method consists in deoxidizing iron ore and melting the iron sponge so obtained in an open hearth with pig iron." On page 48: "Mr. Blair claims great advantages for his apparatus in saving of fuel. * The difficulty which besets this and all other modifications of dealing with iron in so fine a state of division as it exists in the sponge is its proneness to oxidation. Hitherto, it seems to me, the direct process, as it is termed, has met with the most success at Landore. The pig iron, after being melted, has blocks of ore thrown in; the carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal. Very different must be the action on sponge, which, when thrown into the furnace, will float on the melted pig, and, being exposed to carbonic acid at a very high temperature, will to some extent infallibly be re-converted into oxide. So far as I was able to learn, 2 parts of pig iron and 1 of sponge lost about 20 per cent in the furnace. Now if it be true, as I have heard it stated, that a mixture of wrought and pig iron can be fused in an open hearth with a loss of 6 per cent, it follows that a considerable portion of the sponge used in Mr. Blair's process must be re-oxidized. The specimens of steel I had the opportunity of examining indicate entire success so far as a mere question of quality in the product is concerned. There seems to be no doubt that, in obtaining the sponge iron, Mr. Blair has made a notable step in advance of M. Chenot; and I am far from wishing to be understood as expressing an unfavorable opinion on the future commercial merits of the scheme."

As one interested with Mr. Blair from the beginning in the carrying out of the mode of making iron and steel by the direct process, I would respectfully ask that you publish this communication, which seems necessary as an explanatory appendix to that portion of Mr. Bell's paper which relates to the Blair process. We had the pleasure of a long visit from Mr. Bell in October last, nearly all of his time, during his three days in Pittsburgh, having been spent with us. Our books, showing the exact amount in pounds of every component of each charge, and the resulting product in pounds of every cast of steel made by us from the beginning, were thrown open to him and were freely and fully inspected, as well by himself as by his son, Mr. Charles Bell, who assisted him in his observations. Every facility which any of ourselves enjoyed for seeing or knowing what was being done in and about every department of the works was cheerfully given him, our object (aside from showing deserved courtesy to so distinguished a stranger) being to enable him to criticize our operations with full knowledge of their details. While Mr. Bell says "so far as I was able to learn," his means of knowing the exact facts were as ample as Mr. Blair's or my own. He saw that, never at any time, even for experimental purposes, had we made a cast of "2 parts pig and 1 part sponge." In point of fact, as we never did use pig in anything approaching the above proportions, neither Mr. Bell or any of ourselves know what the loss would be.

For the week in which Mr. Bell's visit took place, the average quantity of pig metal used (in 11 casts) was $25\frac{11}{100}$ per cent of the total weight of material charged into the furnace; and the last cast inspected by Mr. Bell, and made on the Saturday, was composed of $19\frac{3}{4}$ per cent pig, $53\frac{4}{10}$ per cent sponge, $18\frac{3}{4}$ per cent scrap steel from our own steel, and 9 per cent spiegeleisen. A tabular statement was taken off from the books, which Mr. Bell took with him, of casts made from the beginning (inclusive of the time when we were battling with the difficulties incident to working a new and different melting furnace from that of Mr. Siemens, Mr. S. having at that time refused to allow us to use his furnace unless we abandoned iron sponge, which he himself was then trying to make). This statement shows that, of 691,883 lbs. of the different metals charged into the furnace, $33\frac{35}{100}$ per cent consisted of pig metal; and the amount of steel made was 589,070 lbs., showing a loss of $14\frac{85}{100}$ per cent.

The direct process at Landore, to which Mr. Bell refers, is that of Dr. C. W. Siemens. Dr. Siemens uses the ordinary open hearth furnace (not the rotator), and the steel is good enough for railway rails, and is used for that purpose, 1,000 tuns of rails per week being about the average product.

The materials consumed in making 2,240 lbs. of steel in the ingot amount to 2,961 lbs. on the average, and consist of 1,517 lbs. Bessemer pig, 197 lbs. spiegeleisen, 706 lbs. scrap steel, 541 lbs. ore (60 per cent). Mr. Bell correctly describes the operation thus: "The pig iron, after being melted, has blocks of ore thrown in. The carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal." He, however, adds: Very different must be "the action on sponge, which, when thrown into the furnace, will float on the melted pig; and, being exposed to carbonic acid at a very high temperature, will, to some extent, infallibly be re-converted into oxide."

When Mr. Bell was at our works he witnessed the fact that the iron sponge, when thrown into the furnace, did not float on the melted pig; and as it plunged and remained under the surface protected by the covering of the slag, it was not exposed to the highly heated carbonic acid, and was therefore not oxidized to an undue extent. This remarkable and interesting fact was noticed and commented on with much pleasure by Mr. Bell at that time, as it had previously been a source of satisfaction to ourselves, controverting, as it did, the theory of all and the experience of most parties.

If you will permit me, I will remark that, if Mr. Siemens would first convert his 60 per cent ore into iron sponge, and make it the principal ingredient of his charge (instead of the highly priced and more deleterious pig metal), his ingots would cost him less per tun; and instead of being useful only for rails, it would command $25 per tun more and could be used (as the Blair steel is) for all purposes, from homogeneous metal up to tool steel.

My object being, however, to make some necessary corrections of errors in the document of Mr. Bell, I ask you to give this communication the same publicity you do that paper.

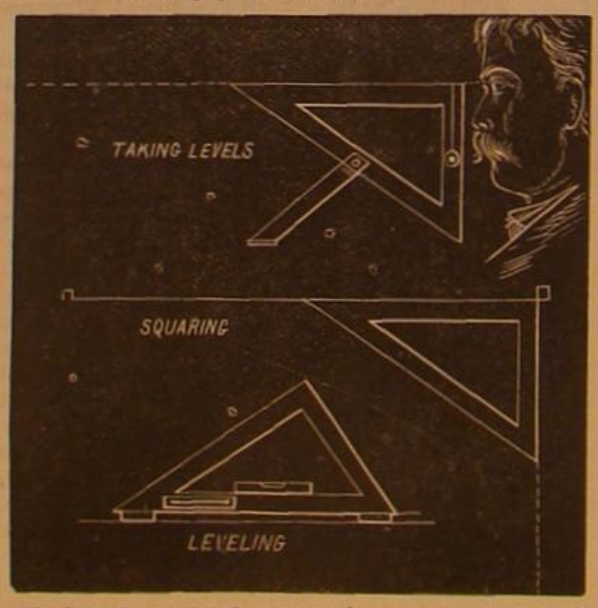
MORRISON FOSTER, Vice President.

Blair Iron and Steel Company, Pittsburgh, Pa.

A Simple Surveyor's Instrument.

To the Editor of the Scientific American:

I send you a diagram of a cheap and useful instrument, for the use of those who have ditching and leveling to do. Farmers and builders often need a ready means of taking levels and adjusting perpendicular and horizontal surfaces.



The hypothenuse of the triangle is conveniently made $7\frac{1}{2}$ inches long, the other sides being $4\frac{1}{2}$ and 6 inches, respectively. A plummet indicates the correct position of the instrument. It can readily be adapted for leveling horizontal surfaces, by adding a spirit level, as shown in the engraving.

H. C. NAYLOR.

Indianapolis, Ind.

Parasites in Wasp Stings.

To the Editor of the Scientific American:

The other day while I was dissecting a wasp, I took out his sting and found upon it a parasite. It was oval in shape. Its legs had hairs around the joints and around the feet. Its head was small compared with the body. Its *antennæ*, two in number, consisted of two joints; from the end projected two hairs as long as the other part of the antennæ. Its color was white. If among your readers there is any one who can inform me concerning this parasite, I would be very glad to hear from him.

Plainfield, N. J. W. D. M.

The Miner's Respirator.

To the Editor of the Scientific American:

As a respirator for miners, I propose a thin rubber mask, which would cover the nose and mouth, fitting so as to exclude all external gases. I further propose to have on the mask, in place of a nose, a rubber tube which would communicate with a leathern vessel, resembling in appearance a knapsack, to be strapped to the shoulders. This leather vessel should contain a mixture of the gases oxygen and nitrogen, which would be conducted to the nostrils by the tube. The mask should contain a second tube, to let the exhalation from the lungs escape; and this second tube should have a valve, so that vapors could escape, but nothing enter. In a short time, these gases would be consumed by the miner; and to remedy this, I propose to have large receivers in the vicinity of the workmen, so that the leathern vessels might be replenished with air. ANNA BLUNT.

58 East 9th street, New York city.

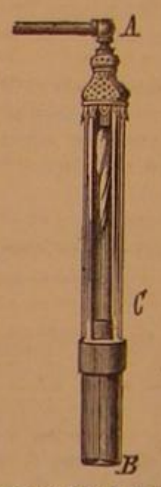
How to Take Observations at Sea during a Fog.

To the Editor of the Scientific American:

Referring to the Schiller disaster, it strikes me that observations could readily be taken from a captive balloon allowed to ascend above the strata of a dense fog. SUBSCRIBER.

NOVEL GAS APPARATUS AT THE PARIS GRAND OPERA

The magnificent opera house lately completed in Paris, probably the finest structure of its class in the world, contains a number of ingenious and novel improvements in the stage mechanism. The usual mode of illumination by gas in theaters is attended with many disadvantages and considerable danger, from the light scenery catching fire from the exposed flames. The foot lights also are a constant source of peril to ballet dancers wearing inflammable gauzy dresses, while the current of heated air which they generate is especially distressing both to vocal organs and to the eyes. The gas flames in the French opera house are so arranged that the heat is entirely conducted away, while the flames themselves are inclosed in a glass chimney so constructed that, should it break, the gas to the burner is immediately shut off. We give herewith an engraving showing the construction of the burner, in which it will be remarked that the flame burns downward. A is the supply pipe, and B a supporting tube beneath for the chimney, C. Through the tube, B, there is a blast of air driven, which draws down the flame, and, at the same time, effectually prevents the heating of the glass. Should the latter break, the end section of the tube, A, which is hinged, falls, thereby closing a valve and shutting off the supply.



The footlights thus arranged are formed in sets of twelve, and number in all one hundred and twenty. Apparatus is provided whereby any one set or all may be lifted to the level of the stage or lowered beneath.

The Occlusion of Hydrogen by Palladium.

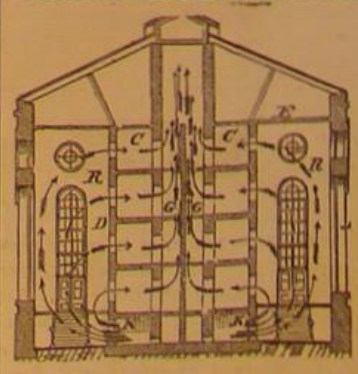
"The well known result of Graham's experiments on palladium, and the large volume of gas absorbed when thin strips of this metal are made the terminals of a rather strong current of electricity, are familiar to all. To demonstrate this fact to an audience or class has only lately been attempted, and I have devised a simple piece of apparatus, which I have used many times and have found to be correct and reliable, if the following directions are carefully carried out: Pure palladium foils, measuring about one eighth of an inch in width and three inches long, are attached to stout pieces of copper wire with hard solder; these are passed through pieces of cork cut square, according to size of tank used.

The strips are first heated in a Bunsen burner and allowed to cool. They are then coated with a thin shellac varnish (ordinary negative varnish thinned with alcohol answers the purpose) on one side only, by means of a camel's hair brush. Care should be taken to prevent the varnish from flowing on the opposite side. The strips are then placed in the lantern tank, about one and a half inches apart, with the varnished sides towards the sides of the tank and parallel to the light. The tank is filled with dilute sulphuric acid, and the wires from a battery of about four one-quart Bunsen cells are connected with the strips.

Decomposition immediately takes place; hydrogen is occluded, producing a powerful contraction in the palladium. By reversing the current, the hydrogen is discharged, and the phenomenon is repeated in the other strip. By these means the strips undergo wonderful contortions. This simple experiment demonstrates the peculiar properties of this metal."—*L. H. Laudy, in the American Chemist.*

IMPROVEMENT IN THE CONSTRUCTION OF PRISONS.

Mr. Alfred B. Mullett, late government architect, has patented an improvement in the construction of prisons, shown herewith, which consists in combining two ranges of cells, C C, with a partitioned or double corridor, G. The heating apparatus is below, and the arrows show the courses of the the air, which passes through each cell, and out through the ventilators, over the corridors, as shown. The arrangement appears to be an excellent one.



ALUM and plaster of Paris, well mixed in water and used in the liquid state, forms a hard composition and is a useful cement.

PRACTICAL MECHANISM.

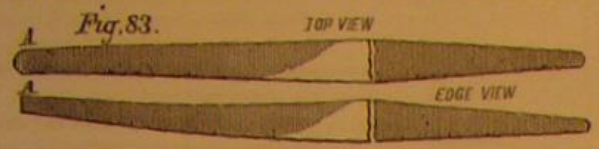
BY JOSHUA ROSE.

NUMBER XXV.

HAND TURNING—BRASS WORK.

For roughing out brass work, the best and most universally applicable tool is that shown in Fig. 83, which is to

Fig. 83.

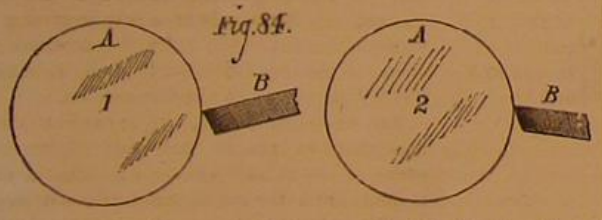


brass work what the graver is to wrought iron or steel. The cutting point, A, is round-nosed. The hand rest should be set a little above the horizontal center of the work, and need not be close up to the work, because comparatively little power is required to cut brass and other soft metals, and therefore complete control can be had over the tool, even though its point of contact with the rest be some little distance from its cutting point. The best method of holding and guiding is to place the forefinger of the left hand under the jaw of the hand rest, and to press the tool firmly to the face of the rest by the thumb, regulating the hight so that the cutting is performed at or a little below the horizontal center of the work. The tool point may thus be guided with comparative ease to turn parallel, taper, or round or hollow curves, or any other desirable shape, except it be a square corner. Nor will it require much moving upon the face of the lathe rest, because its point of contact, being somewhat removed from the rest, gives to the tool point a comparatively wide range of movement. The exact requisite distance for the rest to be from the work must, in each case, be determined by the depth of the cut and the degree of hardness of the metal; but as a general rule, it should be as distant as is compatible with a thorough control of the tool. The cutting end of this tool should be tempered to a light straw color.

SCRAPERS

To finish brass work, various shaped tools termed scrapers are employed. The term scraper, however, applies as much to the manner in which the tool is applied to the work as to its shape, since the same tool may, without alteration, be employed either as a scraping or a cutting tool, according to the angle of the top face (that is, the face which meets the shavings or cuttings) to a line drawn from the point of contact of the tool with the work to the center line of the work, and altogether irrespective of the angles of the two faces of the tool whose junction forms the cutting edge. To give, then, the degree of angle necessary to a cutting tool, irrespective of the position in which it is held, is altogether valueless, as will be perceived by considering the following illustrations (Fig. 84), A being in each case a piece of work,

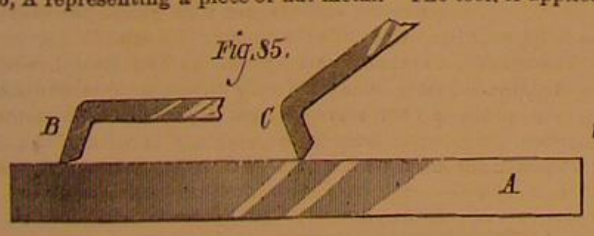
Fig. 84.



and B, a tool. The tool edge, as applied in No. 1, will act as a scraper; whereas in No. 2 it will act as a cutting tool.

Now let us take a tool applied to flat surfaces, as in Fig. 85, A representing a piece of flat metal. The tool, if applied

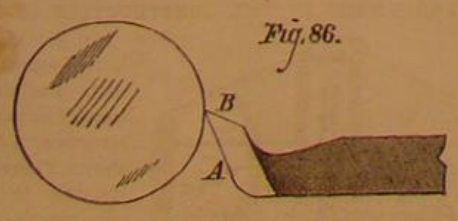
Fig. 85.



as shown at B, would present a cutting edge, and as shown at C, a scraping edge, to the work, the tool being the same in both cases. The result of attempting to present the cutting edge, as at B, is that it would jar in consequence of the springing of the tool.

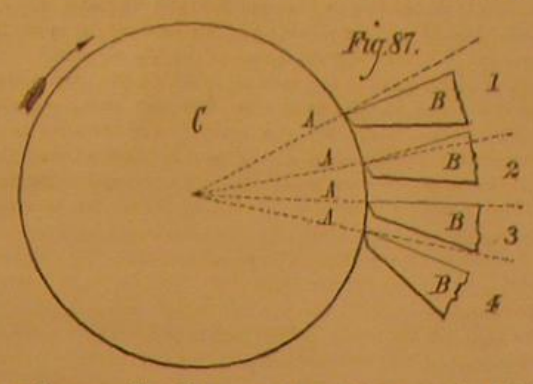
The angle of the back or side face of any tool (that is, the face, A, in Fig. 86), either to the top face, B, or to the work,

Fig. 86.



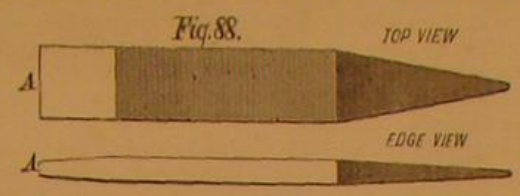
does not in any case determine its tendency to cut or scrape, but *merely* affects its capability of withstanding the strain and wear due to severing the metal which it cuts. Nor is there any definite angle at which the top face, B, to the work converts the edge from a cutting to a scraping one. A general idea may, however, be obtained by reference to Fig. 87, the line, A, being in each case one drawn from the center of the work to the point of contact between the tool edge and the work, C being the work, and B, the tool. It will be observed that the angle of the top face of the tool varies in each case with the line, A. In position 1, the tool is a cutting one; in 2, it is a scraper; in 3, it is a tool which is a cutter and scraper combined, since it will actually perform both functions at one and the same time; and in 4, it is a good cutting tool, the shapes and angles of the tools being the same

Fig. 87.



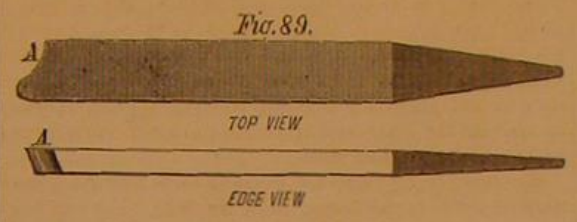
in each case. Fig. 88 represents a flat scraper for finishing brass, A being in each case the cutting edge. Since the tool may be turned upside down, the end of this tool may be and

Fig. 88.



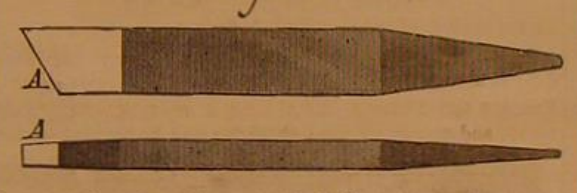
frequently is ground at an angle, especially in those cases where, for some required purpose, the tool is made of a particular shape, such, for instance, as in the case of the tool shown in Fig. 89, the angle being shown at A. On all brass

Fig. 89.



work, it is, however, better to dispense with any angle. Fig. 90 represents a scraper (A being the cutting edge) designed

Fig. 90.



for operating close down to the lathe center or in a square corner such as is formed at the junction of a head or collar upon a shaft or bolt. This tool may also be turned upside down, so as to form a right or left hand tool.

Scrapers will cut more freely if applied to the work with the edges as left by the grindstone; but if they are smoothed, after grinding, by the application of an oilstone, they will give to the work a much smoother and higher degree of finish. They should be hardened right out for use on cast iron, and tempered to a straw color for brass work. If the scraper jars or chatters, as it will sometimes, by reason of its having an excess of angle, as shown in Fig. 89, or from the cutting end being ground too thin, a piece of leather, placed between the tool and the face of the rest, will obviate the difficulty.

Round or hollow curves may be finished truly and smoothly by simply scraping; but parts that are parallel or straight upon their outer surfaces should, subsequent to the scraping, be lightly filed with a smooth file, the lathe running at a very high speed to prevent the file from cutting the work out of true. The file should, however, be kept clean of the cuttings by either using a file card or cleaner, or by brushing the hand back and forth on the file, and then striking the latter lightly upon a block of wood or a piece of lead, the latter operation being much the more rapid, and sufficiently effective for all save the very finest of work. If the filings are not cleaned from the file, they are apt to get locked in the file teeth and to cut scratches in the work. To prevent this, the file may be rubbed with chalk after every eight or ten strokes, and then cleaned as described. After filing the work, it may be polished with emery paper or emery cloth. The finer the paper and the *more* worn it is, the better and finer will be the finish it will give to the work; for all metals polish best by being rubbed at a high speed with a thin film composed of fine particles of their own nature, as ivory is best polished by ivory powder, and wood by shavings cut from itself. To facilitate the obtaining the film of metal upon the emery paper, the latter may be oiled, to a very slight extent, by rubbing a greasy rag over it, which will cause the particles it at first cuts to adhere to its surface. Emery cloth is the best for highly finishing purposes, because it will wear longer without becoming torn. It should be pressed hard against the work, and reversed in all directions upon it, so as to wear all parts of its surface equally, and to distribute the metal film all over; and the work should be revolved at as high a speed as possible, while the emery cloth is, during the first part of the polishing, kept in rapid motion upon the work backward and forward, so that the marks made upon the work by the emery cloth will cross and recross each other. When fine finishing is to be performed, the emery cloth (or what is better, crocus cloth) should be pressed very lightly against the work and moved laterally very slowly.

Round or hollow corners, or side faces of flanges, of either wrought or cast iron or brass, may be polished with grain emery and oil, applied to the work on the end of a piece of soft wood, the operation being as follows: The end of the wood to which the oil and emery is to be applied should be slightly disintegrated by being bruised with a hammer; this will permit the oil and emery to enter into and be detained in the wood instead of passing away at the sides, as it otherwise would do, thus saving a large proportionate amount of material. The wood, being bruised, will also conform itself much more readily to the shape of curves, grooves, or corners. The hand rest is then placed a short distance from the work, and the piece of wood rests upon it, using it as a fulcrum. The end of the wood should bear upon the work below the horizontal level of the center of the latter, so that depressing the end of the wood held in the hand employs it as a lever, placing considerable pressure against the work; and the distance of the rest from the work allows the end of the piece of wood to have a reasonable range of lateral movement, without being moved upon the face of the lathe rest. The method of using the wood is the same as that employed in using emery cloth, except that it must, during the earlier stage of its application, be kept in very continuous lateral movement, or the grain emery will lodge in any small hollow specks which may exist in the metal, and hence cut small grooves in the work. Another exception is that the finishing must be performed with only such emery as may be embedded in the wood, and without the application of any oil; especially are these directions necessary for cast iron or brass work. The work may then be wiped dry, and an extra polish imparted to it by the application of fine or worn and glazed emery cloth, moved slowly over its surfaces.

Genius vs. Capital.

The great misfortune which causes the failure of many industrious, hard-working, correct people, in their efforts to benefit themselves and the world, is not so much their poverty, as many would have us believe, as their inability to interest others in their plans of business and progress. They frequently present schemes for the advancement of the arts and sciences, for the perfection of mechanical appliances, which have merit of an extraordinary commendable character, but which they are not able to bring into practical use because they do not find patrons to recognize the value of their ingenuity. So, frequently, it occurs that much is lost because it is not made available at the time of its inception. It is simply a miscarriage, in a physical sense. It is not owing to the poverty of the inventor. It may be owing to the lack of means; but we hold that a man is not poor when he has a sufficient supply of energy and brains to illustrate fairly any new principle in the mechanic arts. Brains are two-fold more valuable than money. But the poverty exists on the part of those who are not able to see and apply the devices for progress which come up under this head. We do not censure a man for not entering enthusiastically into a scheme which he does not understand, but we do censure men who, being favorably situated, cannot understand and assist a scheme which has merit and brains in its conception and application.

Thus one man may be rich in devices, and another in material wealth; but they do not come together because the man of wealth, not having the brains of the inventor or projector of a scheme for progress, and not willing to inform himself, stands aloof and says to the inventor: "You are a poor fool—why should you bother me?—I've no time to spend with you. If you have something so good as you represent it, why don't you prove it practically before the world, and not trouble us capitalists for means to assist you?"

Here is where the most wealthy man—the one who furnishes means for capital to double itself—becomes poor, and where he is humiliated, and depressed and discouraged, may be to the extent of distress, simply because he has not the "almighty dollar" to aid him.

There is too much of this subject to be preached in one sermon, says the *Trade Review*, which we quote.

A New Method of Preparing Plaster of Paris for Casts

Not a very long time since, some lucky individual struck upon the happy thought that plaster of Paris would be improved by mixing it with a solution of alum, and such in reality proved to be the case. This induced a Frenchman named Landrin to study the action of the alum in this case, and he arrived at the conclusion that its principal *rôle* was to convert any caustic lime, of which there is always more or less present, into a sulphate. Starting with this idea, he attempted to accomplish the same result by the use of other sulphates, and in this he succeeded. Next he tried the effect of using just enough dilute sulphuric acid to effect this conversion into sulphate, and afterwards calcining it. Finally, he ascertained that the quickest and simplest way was to immerse the unburnt gypsum for 15 minutes in water containing 8 or 10 per cent of sulphuric acid, and then calcine it. Prepared in this way, it set slowly, but made excellent casts, which were perfectly white, instead of the usual grayish tint. The latter effect is due to the destruction of a small amount of organic matter by the slight excess of sulphuric acid

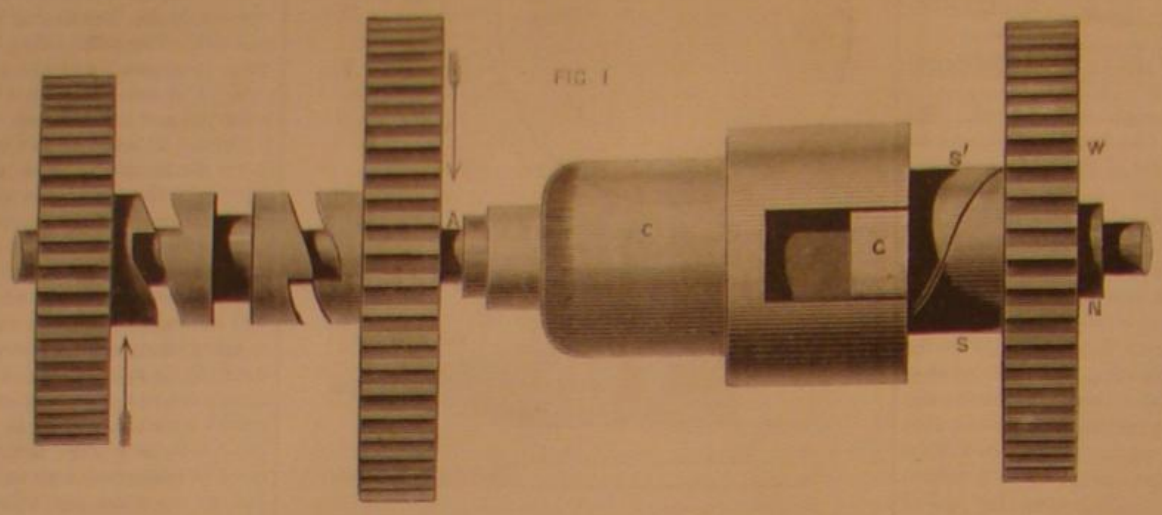
J. A. D. says: "A clerical error occurs in your report of Mr. Wells' address on the distribution of wealth, in stating the average amount of property for each inhabitant in this country to be $6,000, based upon a grand total of $25,000,000,000. A glance shows an error of one cipher, and the $6,000 should be $600."

IMPROVED POWER COUPLINGS.

At the recent meeting of the Iron and Steel Institute of Great Britain, a paper on power couplings for rolling mills and other machinery, the joint production of Messrs. F. H. Varley and Edward Furness, was read; and its chief point was a description of a new means of controlling and reversing mills which receive their power from a continuously and uniformly driven shaft, where the fly wheel picks up the accumulated momentum. This is accomplished by the means shown in our engravings, in which Fig. 1 shows the ordinary reversing gear, the shaft having an hydraulic coupling, the interior of which is shown in Fig. 2. The wheel, W, and the screw-shaped boss, S, is loose on the shaft, A; and the boss acts against a screw-faced cam, S^1, at the end of the ram working in an hydraulic cylinder, C, the packing, I I, being between the ram, shaft, and cylinder. The ram has lugs, G G, which move in slots which allow the ram to glide into the cylinder, but prevent the rotation of the ram. India rubber balls, F F, are placed in the water of the cylinder. Upon motion being communicated to the shaft, A, in either direction of the arrows, by the clutch, it causes the cylinder, C, and the ram, S^1, to revolve together and drive the wheel, W, by the screw-shaped faces acting against one another like the horns of a common fork clutch. Now, should there arise any sudden strain on the wheel, W, the shaft, A, and the attachments to it will not receive the shock, but will continue to rotate, and the screw-shaped face, S^1, of the ram, acting on the similarly screw-shaped boss, S, of the wheel, will force the ram into the cylinder, C, and compress the elastic material placed in the water, which will spread the force of the blow over a period of time and destroy its intensity; and when an equilibrium of power is established, the ram, S^1, will resume its original position by the screws gliding back over one another in proportion as the strain is reduced. It is preferred to make the pitch of the screws wide, so that the elastic material may be able to better overcome the resistance.

The action of the coupling may be briefly described thus: The screw-shaped faces, S and S^1, act against one another as a common fork clutch, and when the shaft, A, is in motion it carries round with it the cylinder, ram, and wheel; if the wheel be retarded the shaft will continue to rotate, but in so doing forces the ram into the cylinder until the elastic material is compressed with a force equal to the resistance opposing the rotation of the wheel; when the obstacle is passed, the pressure in the cylinder will be in excess of the work then doing, this accumulated pressure will be given out again and bring the wheel, W, which drives the mill, quickly to its original speed, and this is effected as gradually as the shock of the stoppage had been previously relieved by the form of the screw faces, S and S^1, so that there is neither concussion nor sudden strain in stopping or reversing.

Figs. 3 and 4 show forms of right and left-handed screws combined, which can be used for forcing the ram into the cylinder, supposing the shaft to be driven in either direction.



VARLEY AND FURNESS' POWER COUPLING.

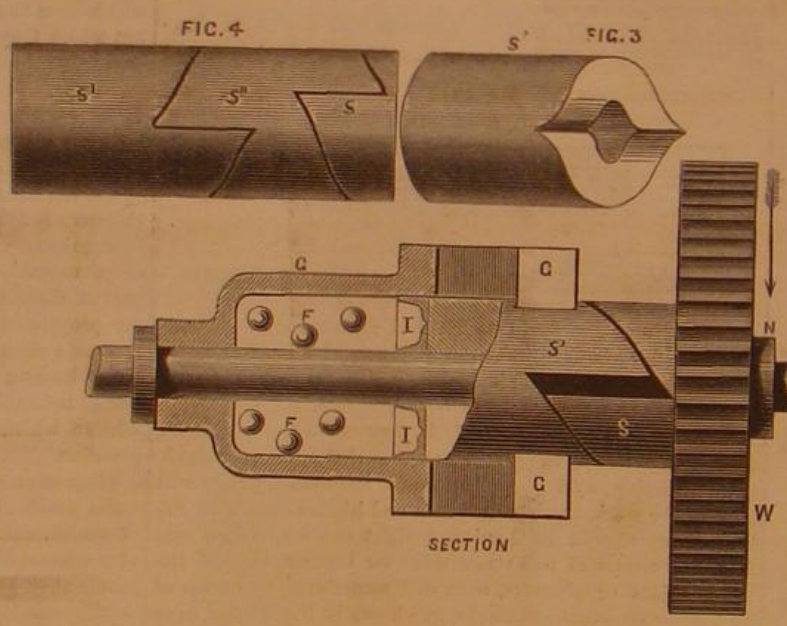
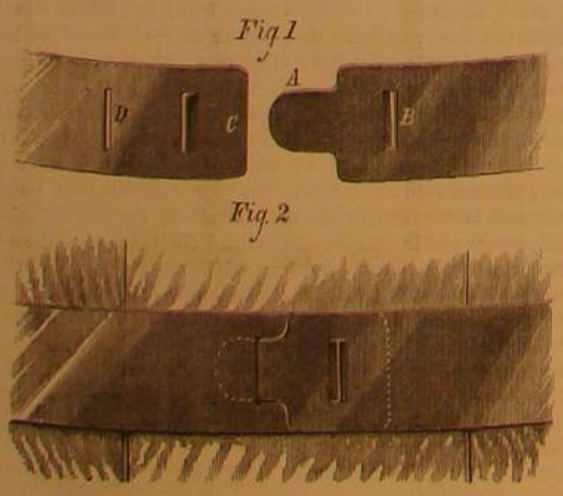


FIG. 2

IMPROVED BARREL HOOP.

We illustrate herewith a strong and cheap hoop for fastening on kegs, pails, tubs, and other similar packages. The device, which is both simple and ingenious, may be entirely made by machinery and placed in the cooper's hands complete in itself, no hammering being necessary to put it together for driving on the barrel. It requires no rivets; and hence the labor of making holes and of securing such fastenings is obviated, thus saving time and expense. Fig. 1 shows the manner in which the ends are formed, and Fig. 2 represents the extremities locked together. One end has a tongue, A, and a slot, B, the projecting piece caused by the cutting of said slot at three sides being bent to the rear. The opposite end has also a slot, C, similar to B, the piece being, however, turned to the front, and another opening, D, from the interior of which the metal is altogether removed. In locking the ends the tongue, A, enters the opening, D, as indicated by dotted lines in Fig. 2, and the projecting piece of slot, B, enters slot, C, and *vice versâ*. When the fastening is to be extra strong, for large packages, a series of two or more slots, like B C, can be made. This makes a firm, tight joint, with no ends exposed and liable to be turned back, the hoops being so broken in rolling the barrel.

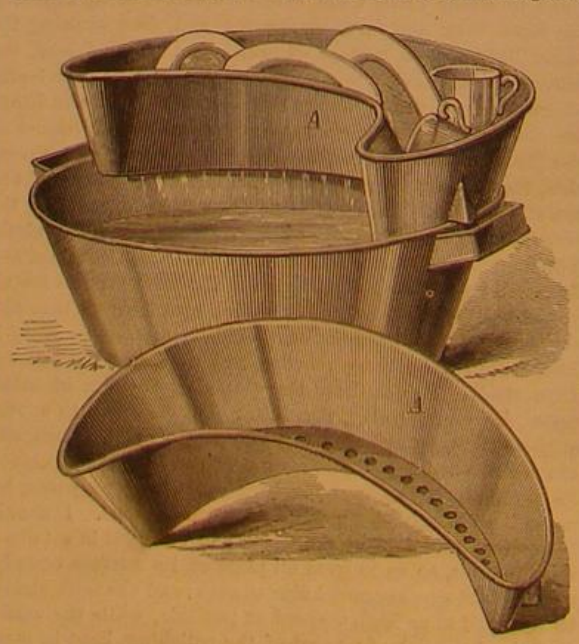


The device is claimed to be stronger than the hoop fastenings now in use, because it presents a greater surface to the strain. It may also be adapted to serve as a bale tie, and in many other cases where a fastening of the ends of bands is necessary If desired the hoop can be removed from the barrel and opened, when it is ready to be applied to another cask in as good condition as when first used.

Patented through the Scientific American Patent Agency, April 27, 1875. For further particulars address the inventor, Mr. Leopold Weil, 18 Market street, Chicago, Ill.

ABBE'S DISH AND VEGETABLE DRAINER.

Dishes, when laid aside to drain in a pan or sink, frequently slide one upon the other, and become chipped and cracked; while occasionally, even when carefully piled, an accidental blow may result in the overthrow of the heap and consequent wholesale breakages or injury to the china. The invention herewith illustrated is an attachment to the ordinary dish pan, into which the dishes are placed to drain as washed, the water dripping from them through the bottom of the receptacle and into the pan below.



The device consists of a crescent-shaped pan, A, which is supplied with suitable lugs by which it is attached on the edge of the dish pan, the bottom of which is perforated. As shown in the engraving, the articles are placed in this pan, where they drain quickly and thoroughly. The attachment may also be used as a colander for draining the water from vegetables. Three sizes of the invention are now constructed.

Patented December 15, 1874. For further information address the patentee, Mr. J. R. Abbe, Providence, R. I.

The Eagle Wing Propeller.

We recently witnessed a trial of Judge Patterson's new screw propeller the Eagle Wing, to which reference has lately been made in a letter of Mr. R. H. Buel, published in our advertising columns. The screw (of 12 feet diameter) was placed in the New York *Herald* steam yacht which vessel steamed about the harbor for some hours, in order that her speed might be tested over measured distances. The best time made was a distance of two and a half miles in ten minutes. The propeller worked with remarkable smoothness, the after part of the boat being almost entirely free from the vibration ordinarily noticeable under like circumstances.

FULLER'S COMBINATION PACKING.

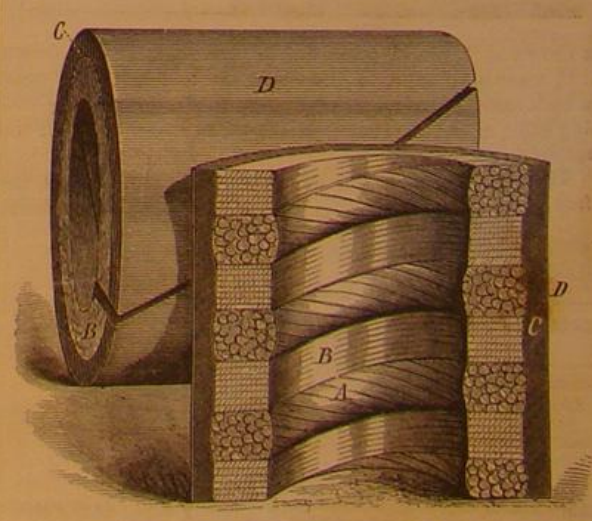
A new packing is represented in the annexed engraving, by the use of which fluted rods are prevented, and which may be employed on all kinds of steam engines, pumps, presses, etc. It is claimed to produce less friction on the rod or stem, and to be of much greater efficiency than any other packing now in the market.

It is composed of a coil of hemp rope, A, and a coil of rope, B, made of rubber cloth. The hemp is well filled with pulverized soapstone. Both ropes are wound around a mandrel of the size of the rod or shaft to be inclosed, and then surrounded by a casing, which consists of a rubber tube, C, enveloped in canvas or other flexible material, D. The piece is then cut off square so as to fill the stuffing box. The packing may be set in place by cutting it open longitudinally, either in parallel direction to its axis, or obliquely, as shown in the illustration.

The device is elastic, and is made to hug the shaft or rod by screwing down the gland. The rubber casing keeps the coils in place, and the soapstone combined with the hemp prevents friction. The inventor informs us that one set of packing has been used in freight and passenger locomotives for from four to six months, and in stationary engines for from eight to twelve months, requiring tightening but once a month.

The invention is simple and appears to be durable, while its friction-reducing qualities will probably render it, in large measure, a preventive of wear upon the moving mechanism.

Patented through the Scientific American Patent Agency, January 13, 1874. For further particulars address the inventor, Mr. C. H. Fuller, Akron, Ohio.

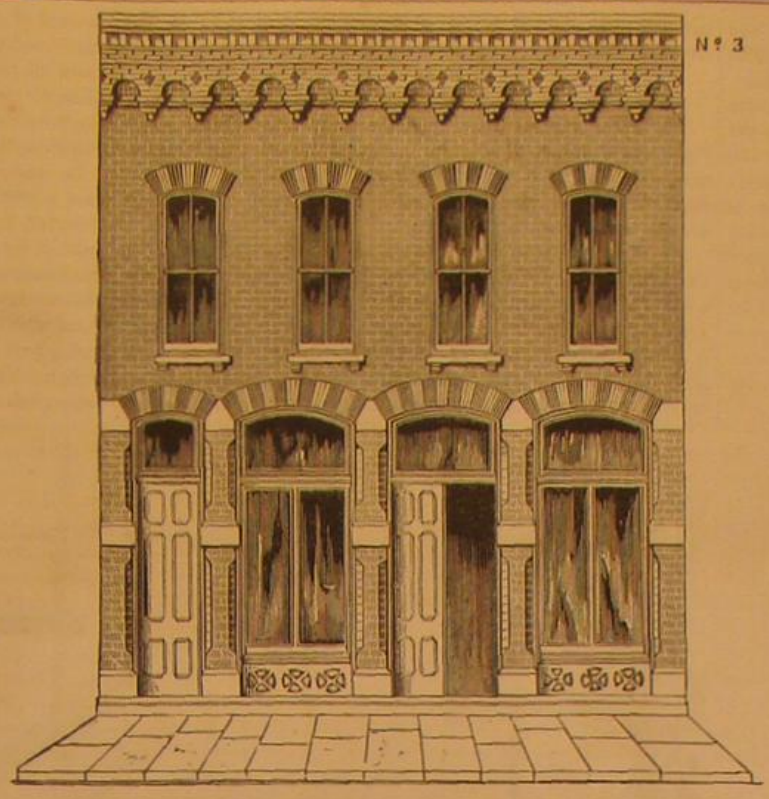


Twenty-four Hours at Sea in a Life Preserver.

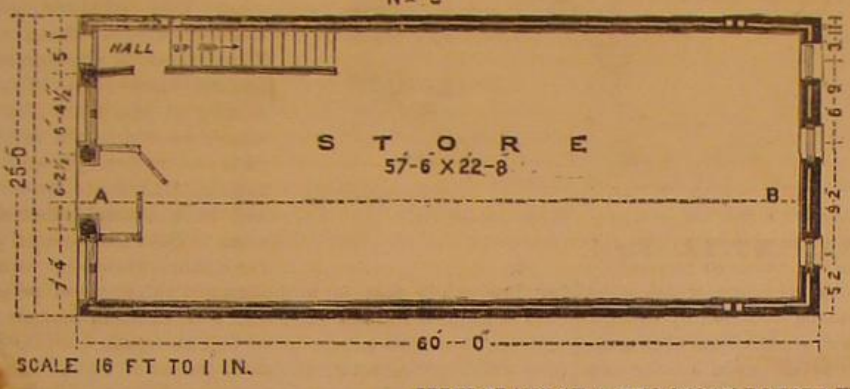
Captain Boyton, whose daring exploits as an exhibitor of the new life-preserving dress we have heretofore mentioned, lately accomplished a greater feat than ever before, namely, the crossing of the English Channel. He started from Boulogne in France at 2.30 A. M., and paddled himself across the sea, 25 miles, to Folkestone, England, in 24 hours.

THE HOMES OF THE WORKING CLASSES.

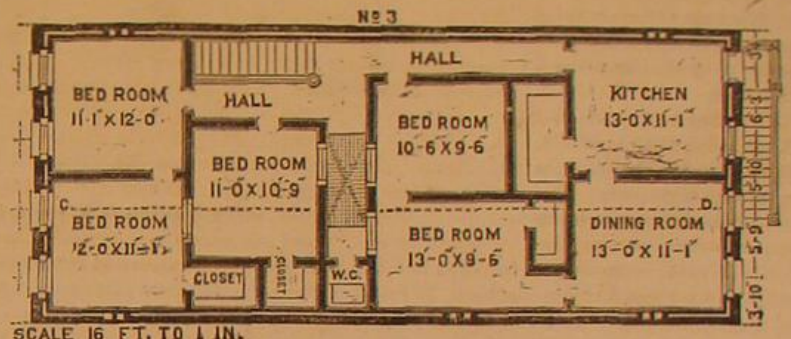
There is little doubt that, in many of our large cities, building houses for the wealthy has been overdone; and it would be fortunate for New York if the capital invested in hundreds of blocks of many-storied mansions, fit only for men of large fortune, could be recovered and devoted to the erection of dwellings for persons of moderate means. It is better to build houses worth $600 or $700 a year, and readily find tenants or purchasers, than to have a square mile of empty palaces on hand, and to mortgage them to pay the taxes. The city of Philadelphia is noticeable for the large number of convenient houses of moderate pretensions which are to be found in all its wards; and the mutual help principle has done much to encourage the development of such investments, the Quaker City having 500 or more building societies and loan associations. In 1874 there were built in Philadelphia 4,439 houses, under the auspices of the loan associations; and during the past four years 19,120 were put up—11,162 being two-story or less, 7,831 three-story, and 127 four-story. Boston, with half the population, erected in the last few years more than one fifth fewer than Philadelphia. But the separate home system, as exhibited in the buildings of the Quaker City, is being extensively copied.



No 3

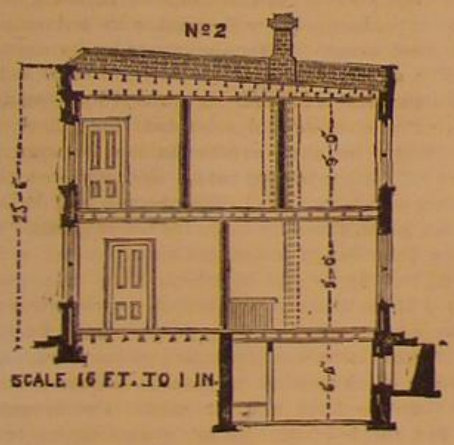


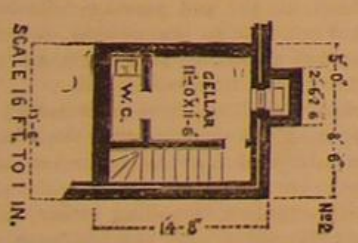
No 3



PRIZE PLANS OF A TWO-STORY DOUBLE FIREPROOF HOUSE, WITH STORES, TO COST $3,600.

No 2



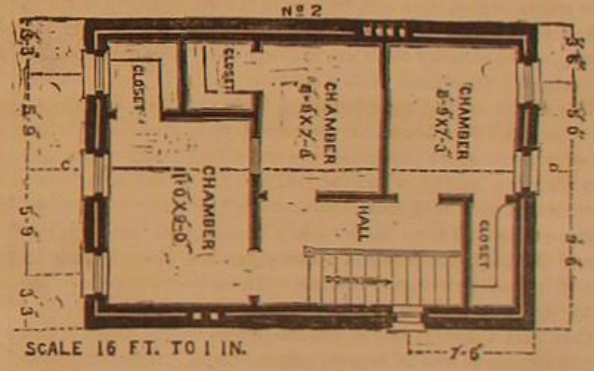


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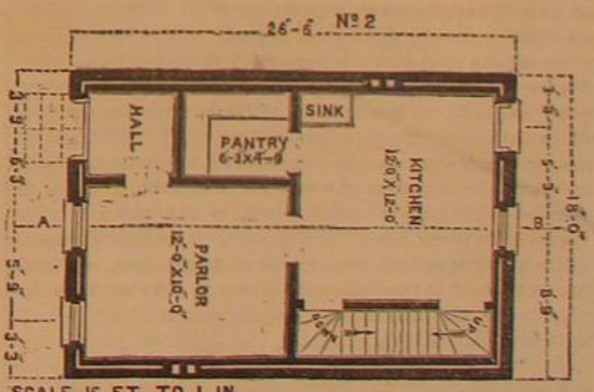


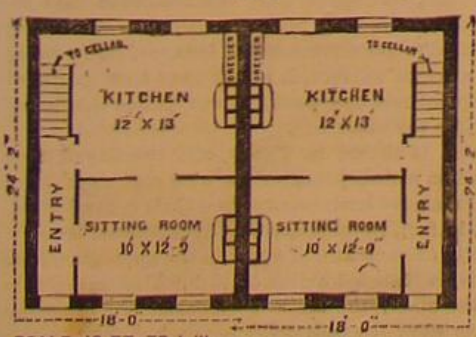
PLAN OF A TWO-STORY BRICK FIREPROOF HOUSE TO COST $1,700.

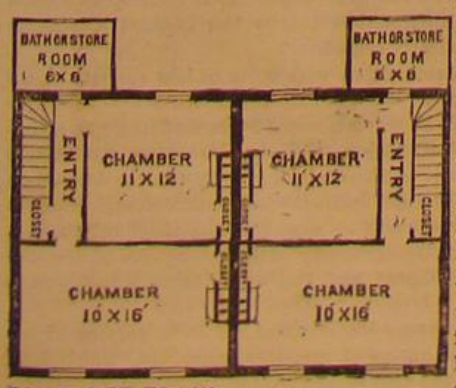
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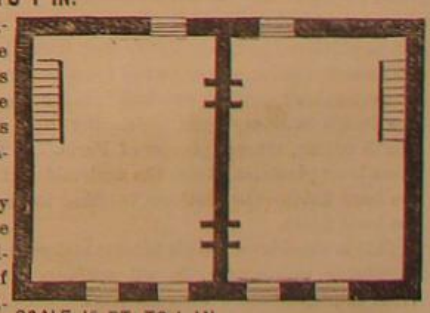


It will be well when every large city is fringed with such residences. During the last ten years the Merchants', Farmers', and Mechanics' Savings Bank of Chicago has had from a quarter to half a million of dollars constantly loaned out on mortgage in the city of Chicago. At the time of the great fire its loans in the city amounted to $240,000. Forty buildings, on which, with lots, it had made loans, were destroyed, but as the lots without the buildings were worth more than the amount loaned on each independent of the buildings, the bank did not lose a dollar. The loans were mostly to depositors in the bank, and the buildings were mostly cottages. After the second fire, a city ordinance was passed, prohibiting the erection of wooden buildings within the limits of the city. Many depositors in the bank found themselves possessed of lots which, by reason of the increased cost of building brick outer walls, they were unable to utilize. The

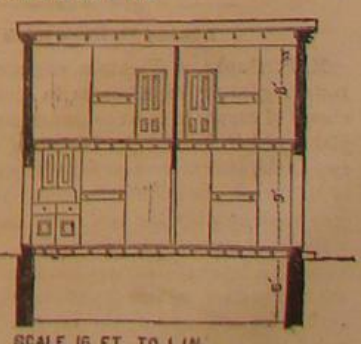


NEW STYLE PHILADELPHIA FIREPROOF HOUSE.

usual proportion of money loaned by the bank on lots was not sufficient to erect buildings of a construction permitted by the fire laws. Yet mere brick walls, without secure roofs, floors, ceilings, etc., were believed to be but little better as security for money loaned than the same buildings with wooden exterior walls. For the purpose of ascertaining how cheaply, approximately, fireproof buildings adapted to various classes could be obtained, the Merchants', Farmers', and Mechanics' Savings Bank, on the 15th of October, 1874, published a circular offering a prize of $1,000 for the best set of plans and specifications for a dwelling of not less than five rooms, and a capacity of not less than 5,500 cubic feet, and of a store and dwelling combined, for use on such thoroughfares as Archer and Milwaukee avenues, to contain not less than 30,000 cubic feet of space, with price and proposals to build one or fifty of either or both buildings. More than thirty sets of plans and communications were received previcus to January 1, 1875. A committee examined these plans and made an award of the prize to A. J. Smith, architect and contractor, of 338 West Randolph street, Chicago, for plans of a one-story house, 20x43, cost $1,200;, a two-story house, 18x26, cost $1,700; and a two-story store and dwelling, 22x57, cost $3,600. We have already described and illustrated some portions of Mr. Smith's system, but the importance of the matter induces us to give here complete details and illustrations.



The one story dwelling house is a brick building, 42x20, of five rooms, consisting of parlor, 13x12, dining room, 13 feet 5 inches x 16 feet 6 inches, kitchen, 10x10 feet 6 inches, and two bedrooms, 10x6 feet 6 inches each. The hight of each room will be 10 feet in the clear between floor and ceiling. An important feature in this plan is that,



MODEL FIREPROOF DWELLINGS FOR WORKING MEN

should a fire occur in the front room of the building, the rear portion may be preserved intact, and *vice versâ*. The outside walls are hollow from foundation to roof. The floor, beams, and rafters are wood, protected from fire by concrete one and one half inches on the ceilings and underneath the floors, and the roof is covered with tin on the top of the concrete. Thorough ventilation is provided by flues adjoining the fire flues, and topped out in the chimney. There is an air space ventilated underneath the ground floor, preventing dampness from arising; and there is also an air space ventilated between the ceilings and roof, to prevent the heat of summer from affecting the rooms. The fire flues will be lined with burnt clay pipes, eight inches square, to prevent fires from defective flues. There will be a drain pipe, connected with sinks and closets, and with main sewer, to carry off all surface water, slops, etc.

The two-story dwelling is a building 26 feet 6 inches x 18 feet, with five rooms, two on the ground or principal floor, and three on the upper floor, the sizes of which are: Parlor, 12 x 10; kitchen, 12 x 12. The three upper rooms are for bedrooms, the sizes of which are, respectively, 11 x 9, 8 feet 9 inches x 7 feet 9 inches, and 8 feet 9 inches x 7 feet 9 inches.

This building has a cellar for coal and wood, and fitted up with water closet. The size of cellar within walls will be 12 x12. The upper story will be 9 feet in hight, and the principal story 10 feet; the cellar 6 feet 6 inches.

The building with store and dwelling combined is 25x59. The entire principal story is occupied with store room. The upper story is divided into seven rooms, consisting of two parlors, 11x12 each, bedroom, 11 feet x10 feet 6 inches, bedroom, 13 feet x 9 feet 6 inches, bedroom, 10 feet 6 inches x 9 feet 6 inches, kitchen, 13 feet x 11 feet 1 inch, dining room, 13 feet x 11 feet 1 inch.

Four model brick buildings are now being erected on Sacramento street, and will be known as Sacramento terrace, besides seventeen others in very desirable sections of the city. The exterior walls are hollow, one being eight inches thick, the other four, with a space of three inches between. The shells are tied together with wrought iron bolts. All rafters and floor beams are protected from above and below by artificial stone plastering one and a half inches thick, and no wooden lathing or furring is allowed. Each house is furnished with a bath room, and also a white stone front stoop, stone sills, and terra cotta caps. The façades are painted, and the brick cornices and water pipes are brought into relief by having a darker coating. The purchaser is required to pay down a given sum at the time of purchasing, and can then give a mortgage for one half the entire amount, and pay the remainder in monthly instalments. Over fifty acres of ground have been bought near the West Side Parks, upon which houses of these general plans will be erected.

One of the most striking features of these buildings is the fireproof plastering, which is applied as follows: A twelve-penny nail is driven into bottom of joist, less say three fourths of an inch, every three or four inches; an endless strand of strong wire is then wound once around the head of a nail, and passes from one to the other. A movable platform is then built, the top surface of which is one and a quarter inches from lower line of ceiling joist. This concrete material is then put in from top of joist on to platform, say from one and a half to two inches in thickness. As soon as the plaster sets, the platform is lowered, moved along, and readjusted, etc. A man weighing two hundred pounds has walked and stamped on this plastering in thirty minutes after it has been put on. By a little different method of applying the wire, and arranging the strands half an inch apart, it can be plastered in the ordinary way from the under side.

The composition, when put in from the top, is as follows: About one half cinders, crushed furnace slag, or brick bats; one fourth ordinary good plastering hair mortar; and one fourth coarse, strong plaster of Paris. It will be observed there is no plastering from the underside, except putting on the hard finish—the platform forming the surface to receive the hard finish.

This is considered, to all intents and purposes, a fireproof plastering, and would, in all ordinary cases, prevent fire from communicating with the joist.

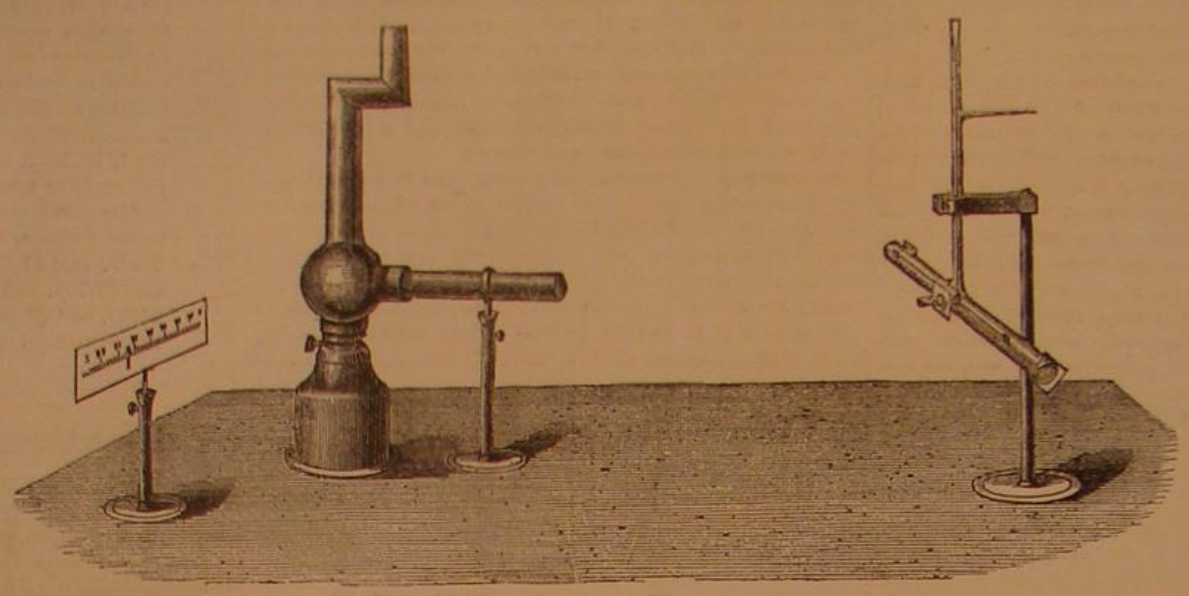
Lining Boilers with Copper.

M. F. Pupka, a Viennese engineer, gives the following facts regarding experiments in lining steam boilers with sheets of copper in order to hinder incrustation: Of the three plates which formed the bottom of a locomotive boiler, the two at the ends were covered with a sheet of copper 0·04 inch in thickness, the middle one being left bare. The machine was used steadily for two years and in districts where the water is of excessively bad quality. On removing the tubes recently a layer of incrustation 4 inches thick was found on the iron surface, while a deposit varying from only 0.08 to 0.12 inch thick appeared on the copper. The iron also was corroded in many places to a depth of 0·02 inch, but the copper had remained perfectly clean and bright. The texture of the incrustations showed larger grains on the iron than on the copper.

THE RADIOMETER.

We have already mentioned the important invention, by Professor Crookes, of a motor actuated by solar light radiation, exhibited at a recent *soirée* of the Royal Society, London. We give herewith illustrations of this wonderfully sensitive machine.

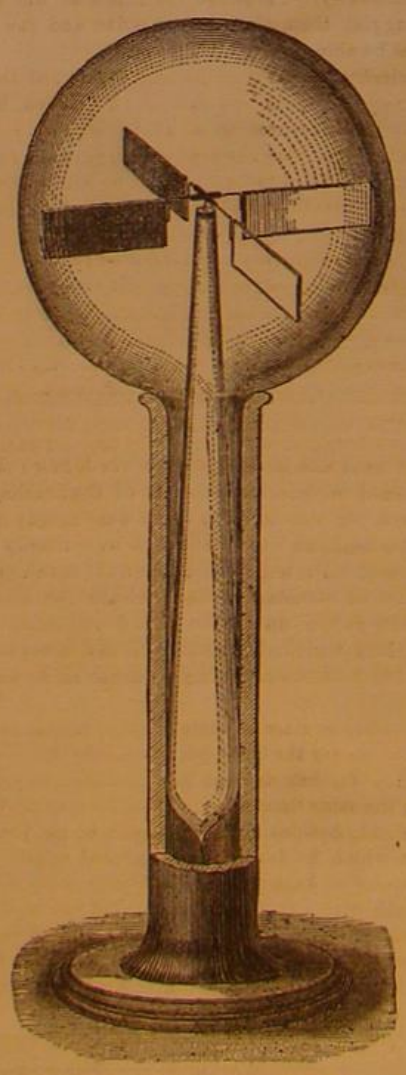
Mr. Crookes began by stating that, in the paper which he had previously read to the society, he had made known how a lever arm of pith, delicately suspended in a very perfect vacuum, was repelled by the impact of light or radiant heat. A great condition of success in the experiments was to work with the highest possible rarefication; consequently the lever arms were suspended in glass bulbs from which the air had been exhausted by means of the Sprengel pump, which gives a far more perfect vacuum than can be obtained by the use of any other apparatus. Until these experiments were made it was supposed that light had no action upon a lever arm of small ponderosity suspended in vacuo. Indeed, the circumstance that light could not turn a lever arm so suspended has been quoted in standard scientific text books, by Dr. Balfour Stewart and others, as one point in the long chain of evidence against the truth of Newton's emission theory of light.



PROFESSOR CROOKES' RADIOMETER.—Fig. 1.

Mr. Crookes has since exhibited a bar of pith suspended by a cocoon fiber in a large glass bulb very well exhausted. When a lighted candle was placed about 2 inches from this bulb, the pith bar began to swing to and fro, the swing gradually increasing in amplitude until the dead center was passed over, when several complete revolutions were made. The torsion of the suspended fiber then offered resistance to the revolutions, after which the bar began to turn in the opposite direction, and so on alternately. These movements were kept up with energy and regularity so long as the candle continued to burn. When instead of a candle a piece of ice was placed near the bulb, one end of the lever arm came toward it as if attracted; but the truth was, as explained by Mr. Crookes, that radiant heat was acting upon the pith bar from all parts of the room, and that the presentation of the piece of ice lowered the radiation on one side; consequently the movement was really caused by repulsion from the opposite direction.

Fig. 2.



In order to measure some of these effects, Mr. Crookes uses a piece of tubular glass apparatus in the shape of an inverted T, Fig. 1, containing a horizontal glass beam, suspended by a very fine glass thread. At the extremities of the beam were attached the substances to be subjected to experiment. In the center of the beam was a small mirror, from which a ray of light was reflected on to a graduated scale, just as in Sir William Thomson's reflecting galvanometer. Thus the amount of repulsion produced could be measured. The advantage which a glass thread possesses over a cocoon fiber is that the index always goes back to zero. The fiber used to suspend the arms are so excessively fine that, when the end of one of them is held in the hand, the fiber usually curves upwards like a cobweb until the other end of it floats almost vertically in the air.

As the vacuum becomes less perfect, the repulsion grows less, until at last the neutral point is reached, where there is no action at all. If still more air be then admitted, attraction instead of repulsion sets in. The barometric pressure of the neutral point varies with the density of the suspended substance on which the radiation falls; it varies also with the ratio of its mass to its surface and with several other conditions. Thus the neutral point for a thin surface of pith being low, while that for a moderately thick piece of platinum is high, it follows that, with a rarefication intermediate between these two points, pith will be repelled while platinum will be attracted by the same power of radiation. Mr. Crookes proved this experimentally, by showing simultaneous attraction and repulsion by the same ray of light.

When these experiments were first made known, some of the observers tried to account for the effects by the assumed action of feeble air currents or of electricity, but both these hypotheses were considered by Mr. Crookes to be abundantly disproved. Professor Osborne Reynolds suggested that the movement might be due to evaporation and condensation at the surface of the suspended body. Mr. Crookes had a thick and strong bulb blown at the end of a piece of difficultly fusible green glass, specially made for boiler gages. In it he supported a thin bar of aluminum at the end of a long platinum wire, the upper end of which wire was passed through the top of the tube and well sealed, for electrical purposes. The apparatus was sealed by fusion to the Sprengel pump, and the exhaustion was kept going on for two days, until an induction spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of the two days' exhaustion, the aluminum bar was found to behave in the same manner as, but in a stronger degree than, it would in a less perfectly exhausted apparatus, namely, it was repelled by heat of low intensity and attracted by cold.

The most remarkable of all the facts made known by Mr. Crookes was an apparent difference between the action of radiant light and radiant heat. At the highest exhaustions, dark heat appeared to act almost equally on white pith and on pith coated with lampblack, repelling either with about the same force; but strange to say, the luminous rays repelled the black surface with more energy than the white one. This is all the more remarkable because, light being reflected from a white surface, it might have been supposed that the consequent rebound would have repelled the white surface more than the black one.

The apparatus is shown in Fig. 2, and consists of four arms suspended on a steel point resting on a cap, so that the arms are able to revolve horizontally upon their central pivot, just the same, in fact, as the arms of an anemometer revolve. To the extremity of each arm of straw, in the apparatus made by Mr. Crookes, is fastened a disk of pith, white on one side and black on the other, the black surfaces of all the disks facing the same way; the pith disks are each about the size of a sixpence. The whole arrangement is inclosed in a glass globe, which is then exhausted to the highest attainable point and hermetically sealed.

This arrangement rotates with more or less velocity under the action of light. With one of the instruments, the arms revolved once in 182 seconds when a candle flame was placed at a distance of 20 inches. When the same candle was placed at a distance of 10 inches, one revolution in 45 seconds was the result; and at 5 inches, one revolution was given in 11 seconds. Thus it will be seen that the mechanical effect varies almost exactly inversely with the square of the distance, so that the theory and the experiment coincide as to their results.

In these experiments Mr. Crookes had to be very careful to guard against the effects of undesired radiation. The lighted sun burners of the roof of the hall of the Royal Society interfered with some of the results, and a candle placed incautiously near his bulbs would send the contents of some

of them spinning. As the velocity with which they spin varies with the intensity of the light, in these instruments we have a new form of actinometer. At present there is no good and scientifically exact method of making actinometrical measurements; but these discoveries may possibly result in the production of a more perfect instrument for this purpose.—*The Engineer.*

HOUSEHOLD HINTS.—II.

We have often wondered by what powers of designing the makers of moderate priced furniture contrive to make chairs and sofas, as a rule, in such outrageously uncomfortable shapes. Why, indeed, should chairs be constructed with seats inclining forward, or with backs hollowed in below and protruding above, so as to furnish support to but two points, and these exactly beneath the shoulder blades? It is a positive labor to sit in such chairs, and no amount of disguise, in the shape of fancy covering or upholstery, should ever beguile a person into purchasing one. The proper shape for a chair is a broad, moderately low seat inclined rearward, and the back should be just the reverse of the form above described—in other words it should conform to the natural curvature of the spine. The frame becomes a support and comfortable rest for the body, while otherwise its tendency is to push the shoulders forward while the lower part of the person slides in the same direction on the seat, the result is that the occupant must either sit back in a round-shouldered position, or else balance himself on the very edge of the seat; in both cases finding himself the reverse of comfortable. The same remarks apply to sofas, and especially to those made with straight backs and in the pretty gothic forms which are now so fashionable. Buying furniture for comfort and buying it for looks are very different matters—in fact, there is a distinct class of furniture which is gorgeous to the eye but simple martyrdom to the body. It includes pine or whitewood chairs, covered with plaster of Paris, gilding, and satin, which are meant to be admired but not to sit in; and an endless variety of brass-mounted tables, footstools, cabinets, and like objects the cost of which appears to augment in exactly invese ratio to their utility. With such, we have nothing to do here. We propose simply to talk about articles that can be used, and used comfortably.

For stuffing furniture, there is nothing equal to good white curled horse hair. It will last indefinitely, for it is susceptible to almost perpetual regeneration. There is no economy whatever in paying twenty or thirty dollars less for a set which is filled with tow, moss, excelsior, or any other of the numerous materials used as substitutes. To be sure, the articles look exactly as well in the beginning as if stuffed with hair; but a year's wear, evidenced by the sunken seats and cushions, will speedily show the difference. It is better to select furniture before it is covered, as then a small hole, surreptitiously, if need be, poked in the side of a seat or back, will soon prove whether the salesman's too frequent protestations that "we use only the best hair" are founded upon fancy or on fact.

While horse hair is most suitable for the inside, we have very little liking for the same material made into cloth as a covering for the exterior, although it is the most enduring of all materials. Hair cloth is black; and as the articles upon which it is used are the principal objects in the room, the general effect to our minds is funereal and depressing. The heavy deep shade cannot, when in such masses, be acceptably toned down by contrasts, nor can it be enlivened so that the general appearance of the room is rendered bright and cheerful.

Good stout woolen reps are among the best fabrics to wear. Silk rep is just the reverse, while not one person out of ten can tell the difference in the fabrics across a room. Plush is also very strong and lasting, though it is not suitable for a modestly furnished room. Satine, though not equal to rep in wearing qualities, showing spots and dirt much easier, is by some considered handsome, and probably is better suited than the latter for a parlor.

In regard to color, the hues of the carpet, unless Turkish rugs are used, and that of the wall paper are again to be taken into consideration. With a gray toned wall and carpet, crimson is the proper shade for the furniture. Blue looks nicely with a rich dark carpet having no green in it, or with a blue carpet of a harmonizing shade. Crimson or green furniture accords well with either brown or green carpeting. Brown upholstery requires a green carpet. Covering furniture with two distinct colors or shades is now quite common, and is preferred by many to a single shade or color throughout. The body of the piece is upholstered in gray rep, for example, and the edges surrounded with blue puffings. There is a variety of pretty combinations of colors, of which in such a case advantage may be taken. Deep blue and golden brown, chocolate and bright blue, gray and pink, maroon and warm green, claret and buff, are instances in which the tints make pleasing contrasts.

Wood work enriched with gilding is now extensively made, and even enters into the construction of the cheapest grades of furniture. We do not counsel its purchase, as the gilding, especially in cheap goods, wears off very easily, leaving the articles badly defaced. A few pieces of furniture about the room differing from the principal set will be found to give a pleasant and furnished look to the apartment. A very neat chair, made by the Shakers and at some of the penitentiaries, is now sold at from five to ten dollars. It has a light though stout wooden frame, of simple pattern; and the seat and back are made of plaited webbing of two colors, either red and blue, or green with gray or black. One red chair of this kind makes an attractive spot of color to a room furnished in green. Then there are the so-called oriental chairs, something after the camp stool pattern and having high backs. These may be purchased as low as ten dollars apiece, and may well take the place of the much more expensive stuffed easy chairs.

We prefer a wooden top covered with a handsome cloth, to a marble slab, for a table. There is something cold and uncozy about marble; it makes us think of a burial tablet, such as one sees in country churches.

About the cloth we shall have something to say in another paper; but just here we desire to remark that a number of small tables, on which one can place ornaments without fear of obscuring either inlaid work or fancy marble, can be arranged about a room so as to be much more ornamental than one large table deposited in the center. Stands of very pretty and graceful shape can be obtained, made of bamboo. These are quite cheap, and their light yellow color contrasts nicely with the darker wood of the heavier furniture. We have seen very tasteful home-made tables of cane, dried and varnished; also of white wood, ornamented with bracket saw carvings. Holly wood, if attainable, when smoothed can be painted upon in water colors and afterwards varnished; or the material may be even pine painted black, and have fall leaves arranged upon it in pretty designs, and then covered with two or three coats of copal varnish.

In arranging furniture about a room, bear in mind that it is not necessary to push every article primly out to the sides, so that sofas and chairs look as if they were glued to the wall. Pull them out; put a sofa across one corner; stand the big easy chair in the light, with a little table close by, handy for sewing or books; leave a chair or two in front of the sofa; and in general so dispose the articles that the room shall not appear as if its owners never entered it save on ceremonial occasions. Whether a room is pleasing and cosy or not does not depend upon the elegance or costliness of its fittings. The simplest furniture, if tastefully arranged as regards color and position, often looks better than the handsomest products of the cabinet maker's skill. In our next paper, we shall discuss a few simple styles of curtains and decorations.

Miniature Steam Engines for Light Work.

We have frequently stated our belief that there is a growing want in the community for small steam engines, machines of one horse power and under, which might advantageously serve as a source of power in a variety of uses. As no greater skill would be required in the generation of such power than in the boiling of a teakettle, it would seem that a simple steam engine, driven by a boiler thoroughly protected against explosion, might find employment both as a domestic motor and for light work in the shop. It could turn wringers, churns, washing machines, or ice cream freezers, run coffee mills, pump water through a house, actuate foot lathes, scroll saws, or light box-making machinery, run knitting or sewing machines, turn a grindstone or emery wheel, work ventilating fans, hand thrashing machines, cutters, meat or feed choppers, or sausage machines, drive small blowers for pneumatic dispatch tubes in a building, or for a blacksmith's forge, or compress air or work an air pump on a small scale in the laboratory. These are but a few of the applications which suggest themselves as we write, and the reader will doubtless be able to recall many more.

The principal obstacle to the employment of the steam engine hitherto, for such uses as above detailed, has been its cost. No manufacturer, so far as we are aware, has ere this prepared the necessary patterns and mechanism for producing small engines on a large scale, so as to allow of their sale at low rates, so that there has been no way of obtaining the machines save by employing workmen especially to build the same, a course involving considerable expense.

A couple of small engines have, however, recently been forwarded to us for examination, which, if we may take them as specimens of the general product of their manufacturer, abundantly prove that he has read our oft repeated assurance that such motors were in demand, and is taking proper steps to meet it.

The two engines submitted to us are certainly admirable pieces of mechanism. One would probably develop half a horse power, perhaps more, and the other, which is running at full speed on our desk as we write, is intended as a toy. The larger machine has a copper boiler, 10 inches in diameter by 18 inches high, with furnace and all necessary gages and fittings. The cylinder of the horizontal slide valve engine is 1⅜ by 2½ inches, and the fly wheel 12 inches in diameter. The small engine is of similar type and is furnished as perfectly and in as workmanlike a manner as if made entirely by hand.

The miniature sizes of engines are of course designed more as playthings for the boys; but the maker, Mr. George Parr of Buffalo, N. Y., has devised an ingenious way of rendering them at the same time a really valuable source of knowledge. To this end, besides finished machines, he prepares rough castings which he furnishes at reduced prices. These portions require no expensive nor elaborate tools to finish them. Any youth with a little mechanical skill can easily trim them, and then, putting them together, build his engine for himself. This we think an excellent plan, and one which cannot but result in the young machinist gaining ideas certain to be of much practical use to him in the future.

Mr. Parr's advertisement may be found in another column.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT TREMOLO.—GEORGE G. SAXE *et al.* *vs.* A. H. HAMMOND *et al.*

(In equity.—Before SHEPLEY, J.—January, 1875.—

SHEPLEY, J.:

This bill in equity alleges that the respondents infringe certain letters patent reissued to the complainants, as assignees of E. W. Carpenter, on the 5th of October, 1869, No. 3,365, for a "tremolo" attachment to musical instruments. The defendants deny infringement, and allege prior knowledge and use of the patented invention by La Fayette Louis and others more than two years before the date of the application of E. W. Carpenter; and also, that the same invention and discovery, and the same device described in said patent, and substantial and material parts thereof, were patented on the 13th day of November, 1866, to La Fayette Louis.

If the defendants could be held as infringers of the Carpenter patent, if it be a valid patent, and not anticipated by the devices which were made and used by La Fayette Louis at Chicago and other places, it would be necessary carefully to construe and decide upon the probative force and effect of the testimony in relation to those devices of Louis, which, if the testimony of the witnesses in relation to them is to be received with full credit, acted substantially as agitators to, or reflectors of, the waves or currents of air passing through the reeds of the musical instrument, and not as valves to interrupt the continuity of the musical notes. If they are operated in the way first described, they would seem to have operated in the same manner and with the like result as Carpenter's fan-tremolo, although Louis appears to have been ignorant of the philosophy of the operation—a want of knowledge which is imputable as well to Carpenter, and even to those who have the benefit of the theories (which are only claimed to be theories) of the most learned scientists who have testified as experts on this subject.

If, however, the evidence in this record is not sufficient to charge the respondents as infringers of the complainants' patent, it is not necessary to decide that question in this case.

The respondents are manufacturers of supplies of materials which are elemental parts of organs and other musical instruments. They sell to the organ manufacturers. It is not claimed that they have made any musical instruments or sold any in which the tremolo attachments of any kind are arranged, or to which they are applied in any manner. The complainants allege that they (the complainants) have licensed large numbers of manufacturers to put these fans in their organs, and proved that they agreed to license every reputable manufacturer who should apply. There is no evidence in this record of a sale to an unlicensed manufacturer of organs. The thing made by the defendants is shown by the exhibit produced in the case; a wooden structure of the simplest kind, which is in itself no infringement, and which, in order to constitute an infringement of the complainants' patent, must be placed by an unlicensed manufacturer in a musical instrument, and placed in a certain position in that instrument, external to the wind chest. A revolving fan is not new. All the respondents make is a fan capable of being made to revolve.

The complainants claim as their invention the application of any means to the musical instrument whereby the air may be agitated to produce a tremulous note "by agency external to the wind chest, which shall not check the flow of the air past the reeds," so as to give a continuous tremulous note, but not cut off the sound and make a succession of notes, instead of a continuation of one note. Whether the fan made by the respondents would infringe this claim when placed in the instrument depends upon the position and arrangement of it in the organ, whether or not it be placed external to the wind chest, whether it be placed so as to cut off the sound and produce a succession of notes, or merely to agitate the air and vary the musical notes without interrupting their continuity. Even if all these alternative conditions were on the side of infringement, there must be the additional element of a sale for use by an unlicensed manufacturer, which is not proved in this case.

The complainants rely upon the case of Wallace *vs.* Holmes, (9 Blatchford C. C. R., 65.) There can be no doubt of the soundness of the conclusions of the court in that case, or the cogency of the reasons given by the learned judge (Woodruff) in his opinion. But, without rehearing the facts in that case, it is sufficient to say that they were very different from the case now before the court; the gist of the decision in that case was that the actual concert of the makers of the different elements in the combination was a certain inference from the fact in that case, and the distinct efforts of the defendants to bring into use those elements of the combination which comprised the whole invention, although they could not be used without adding one other element, were found to be proved. No such state of facts is proved in this case, as has already been shown.

I must, therefore, repeat what I stated to counsel at the argument of the cause. As defendants only make one element of the patented invention, in order to hold them guilty I must find proof connecting them with the infringement. Different parties may all infringe by respectively making or selling, each of them, one of the elements of a patented combination, provided those separate elements are made for the purpose and with the intent of their being combined by a party having no right to combine them. But the mere manufacture of a separate element of a patented combination, unless such manufacture be proved to have been conducted for the purpose and with the intent of aiding infringement, is not, in and of itself, infringement. A patent is valid for a new combination of old elements. A person who uses one or more of the old elements is not an infringer, unless he uses the new combination. (Prouty *vs.* Ruggles, 16 Peters, 336, 341; Byam *vs.* Farr, 1 Curtis, C. C. R., 260, 265; Foster *vs.* Moore, ib. 279, 288; Eames *vs.* Godfrey, 1 Wall., 78, 79.) The use of a part less than the whole is no infringement.

I infer from the remarks of counsel at the argument that, although respondents deny infringement, and do not waive this defense, it is desired that the court should pass upon the question of the validity of the interfering patents for the respective inventions of Louis and Carpenter. If the court should find the complainants' patent to be valid, no decree could be made in their favor, as respondents do not infringe. To find the complainants' patent invalid in a case in which the defendants do not infringe, would partake too much of the nature of a moot case.

Complainants' bill dismissed.

[*Whitney* and *Betts*, for complainants.
B. E. Valentine and *W. W. Blackmar*, for defendants.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 14 to May 15, 1875, inclusive.

ASTRONOMICAL APPARATUS.—H. Allen, New York city.
BLAST FURNACE.—W. A. Stephens, Suscasuna Plain, N. J., *et al.*
BLIND REGULATOR, ETC.—J. T. O'Donoghue, New York city.
BLIND ROLLER.—E. Putnam (of Chicago, Ill.), London, England.
BREECH LOADING ARM.—E. Whitney, New Haven, Conn.
BUTTON HOLE CASING.—V. V. Balmforth, Oakland, Cal.
CARRIAGE SAFETY SHOE.—J. Tiffany, Chicago, Ill.
CHAIR SEATS, ETC.—C. Mason, New York city.
CONDUCTOR'S ALARM, ETC.—T. B. Doolittle, Bridgeport, Conn.
CORK SCREW.—W. R. Clough, Newark, N. J.
DAMPING PRINTING ROLLERS.—W. H. Woodcock, Brooklyn, N. Y.
DRAWING NAILS, ETC.—M. D. Converse, New York city.
ELEVATED RAILWAY.—R. P. Morgan, Jr., Bloomington, Ill.
EMBROIDERING DEVICE.—J. I. West, New York city.
EXCAVATOR.—O. S. Chapman *et al.*, Boston, Mass.
EXPANDING TUBES.—O. Pagan *et al.*, Philadelphia, Pa.
FERTILIZER HOLDER.—W. F. Wheeler, Dorchester, Mass.
FINISHING CLOTH, ETC.—I. E. Palmer, Middletown, Conn.
GOVERNOR.—D. L. F. Chase, Boston, Mass.
GRAIN-BINDING MACHINE.—C. L. Travis, Minneapolis, Minn.
HAMMER EYE MACHINERY.—L. Chapman, Collinsville, Conn.
HARVESTER.—W. Y. Selleck, New York city.
KNITTING MACHINE NEEDLES.—S. Peberdy *et al.*, Philadelphia, Pa.
LAMP.—G. H. Lomax, Massachusetts.
LAMP REFLECTOR, ETC.—H. Craighead, New York city.
LIFE-PRESERVING DRESS.—P. Boyton (of New York city), London, Eng.
LOCKING NUT.—F. L. Bates, Carrollton, Miss.
MAKING SWIVEL HEADS.—W. Edge, Newark, N. J.
MARINER'S COMPASS.—D. Baker, Boston, Mass.
OPENING WINDOWS, ETC.—J. T. Parlour, Brooklyn, N. Y.
PADDLE WHEEL, ETC.—N. T. Edson *et al.*, New Orleans, La.
PEAT FUEL MACHINE, ETC.—F. Dodge, New York city.
PRINTING FROM GELATIN.—E. Edwards, Boston, Mass.
PRINTING MACHINE.—W. H. Woodcock, Brooklyn, N. Y.
RAILWAY BRAKE.—A. Barker, Wyoming, Pa.
RAILWAY SIGNAL.—H. Flad, St. Louis, Mo.
ROCK DRILL.—C. Burleigh, Fitchburg, Mass.
ROTARY ENGINE.—B. T. Babbitt, New York city.
SCREW DRIVER, ETC.—A. Cummings, New York city.
SEWING MACHINE.—J. L. Follett, New York city.
SPOOLING MACHINE.—G. W. Paine, Pawtucket, R. I.
SURGICAL NEEDLE, ETC.—J. C. Holland, New York city.
THREAD-HOLDING DEVICE.—H. Sutro, New York city.
THREAD SPOOL MACHINE, ETC.—D. T. Lyman, Providence, R. I.
TRACTION ENGINE.—W. H. Milliken, Sacramento, Cal.
TREATING SUGAR.—F. O. Matthiessen, New York city.

Recent American and Foreign Patents.

Improved Sight Protector.

Marmaduke H. Mendenhall, Wabash, Ind.—This device is an improvement upon that for which letters patent No. 156,726 were granted January 12, 1875, to the same inventor. The lamp case is pivoted at the bottom to adapt it to rotate. It is also cut away on all sides, and a hinged flap or plate swinging vertically, and a door swinging horizontally, are so combined with the case that, when opened, the lamp may be readily inserted or removed, or the light allowed to diffuse itself freely into the room; or the flap may be turned up while the door remains closed to allow the light to strike the ceiling and illumine the upper portion of the apartment, while the eyes of the persons reading or otherwise employed are shaded and protected.

Improved Corn Plow.

Linus G. Clawson, Pleasant Hill, Mo.—This implement is of peculiar construction, consisting of two plows of similar form connected together at the forward part by an adjustable bow, which allows the plows to be reversed without being disconnected. They may, by simply turning, and without any adjustment, be made to turn the soil to or from a row of plants. The advantages claimed for this invention are as follows: It is adapted to more varieties of work than any other, possessing the very minimum of draft, is light, easily handled, convenient, durable, and is not liable to get out of order. Any kind of shovel may be used on it, straight, twisted, diamond, wide, or narrow; in addition to which, its reversibility renders it of universal adaptation. The draft is perfectly straight and direct, and as close to the horse as it is possible to get it. Each plow holds the other in an upright position, so that neither can upset, and has a perfectly free and easy side-to-side motion by the handles while in operation. Its entire weight is 65 to 80 lbs.

Improved Vehicle Seat Lock.

Albert E. Van Horn and Joseph Wideman, Sebewaing, Mich.—This consists of a pivoted dog or key of the side board, that is thrown against a T-shaped piece of the seat block, binding it securely into the recessed top plate of the side board, a pivoted pawl securing the dog in locked position by engaging the outer cleat of the same.

Improved Take-Up for Knitting Machines.

Ira Tompkins and Albert Tompkins, Troy, N. Y.—This invention consists, first, in combining the take-up rolls with a pair of gear wheels differing in size, and so connected with intermediate mechanism as that the operation of drawing the fabric from the needles or cylinder will take place at constantly varying points. The objection is thus avoided of having the draw of the take-up always at the same point relatively to the cam, or some similar device which never varies its position. The invention also comprehends an improvement in the means of connecting and disconnecting the take-up roll with the gear wheels that operate it.

Improved Horse Hay Rake.

Gould Platt, Colliersville, N. Y.—This invention consists in suspending a common revolving hay rake from a wheeled frame by means of a properly balanced and adjustable guide frame, for being readily governed by the attendant seated on the wheeled frame.

Improved Addressing Machine.

Charles W. Van Vleet, Waterloo, N. Y.—The type are placed in a galley, with the various addresses properly set up and inked, and paper wrappers are placed beneath a platen, which is pressed down by a weight and raised by the cam. After every impression, the galley is moved a short distance to bring the next address into proper position, and so on for the whole galley, when other prepared galleys may be introduced and printed from in the same manner.

Improved Bluing Case.

Sylvester W. Sheldon, New York city.—This bluing case is made in two parts, the upper part being externally, and the lower part being internally, tapered, to fit one within the other. The upper part is provided with a cavity for holding the bluing and a discharge opening with a covering plate.

Improved Adjustable Top for Carriages.

Almon Clarke, Sheboygan, Wis., assignor to himself and Charles A. Spencer, of same place.—The invention consists of a curved standard, which is attached to the body of the carriage and provided, at the upper end, with a pivoted pulley, operated by means of a turning spring knob and connecting cords. A canopy, with arc-shaped slide piece, is adjusted by a clamping device to the pulley, and set to any inclination thereon.

Improved Steam Engine Governor.

Thomas I. Walsh, Brownsville, Pa.—This is an improvement in the class of devices for indicating steam pressure in boilers, consisting of a piston provided with a central annular recess, and arranged to move freely in a vertical tube or pipe connected with the steam space of the boiler. If the steam pressure is below the regular fixed point to which the boiler is limited by the weighted piston, it will establish the communication of the pipe with the engine channel, so as to admit the unobstructed passage of the steam to the engine; but whenever the pressure in the boiler is increased, the piston is forced by the pressure of the steam on its lower part, which overcomes its weight in upward direction, closing the communication of the pipe with the engine channel, and establishing that with the blow-off pipe, so as to stop the engine and give the signal to the engineer.

Improved Bosom Pad.

John C. Tallman, New York city.—This is a bosom pad made entirely of thin sheet cork, molded or pressed into shape.

Improved Slide for Gas Pendants.

Samuel B. H. Vance, New York city.—This gas pendant is so constructed that the burners may be drawn down to light the gas without disturbing the globe, while it avoids the use of balancing weights or springs. It consists in an arrangement of sliding tubes, the friction between which and stationary tubes holds the former as adjusted.

Improved Box for Packing and Showing Goods.

Francis S. Kinney, New York city.—The invention consists of a box of rhomboidal shape, made with the upper part of its lower end cut away, and provided with a terraced or step false bottom and hinged flaps or false ends. The upper ends of the goods of each upper tier show above the goods of the lower tiers, and the forward side of the goods of the lowest tier may be fully seen through the open lower end of the box.

Improved Egg Tester.

James W. Van Arnam, Watertown, N. Y., assignor to himself and Charles T. Greene, of Newtown, Conn.—An egg-holding branch is arranged to open into a lamp chimney at the top of the flame, or thereabout, and to incline upward in an oblique angle with the chimney; and it flares a little from the lower end upward, in order to receive and hold eggs of different sizes. The simplest way of attaching the egg holder to the chimney is by soldering it; but when attached in that way, the solder is liable to be melted by the heat, making it necessary to apply a water holder, in which water may be kept in contact, so as to keep the heat down.

Improved Apparatus for Cutting Goods on Bias.

Salomon Mayer, New York city.—This invention consists of a feed table with a revolving disk, having a central bias slot and a treadle-acted and knife-grinding clamp piece applied thereto, which, in connection with an adjustable gage piece, is set with the disk plate to any angle, and locked in the required position for cutting the width and angle of the bias strips.

Improved Rotary Engine.

Hermon G. Wood, Sharon, Pa.—This rotary steam engine has movable abutments and two or more eccentric drums or wheels, with side wheels or flanges and a central dividing wheel or flange, revolving in an open cylinder on a central shaft.

Improved Locomotive Ash Pan and Damper.

Walter W. Beach, Escanaba, Mich.—The dampers are hinged to the bottom ends of the ash pan, and fold inwardly between sides or braces, thus always preventing escape of fire, while they are allowed to fold under the bottom, and permit the pan to be cleaned without removal.

Improved Ironing Machine.

George F. Perrenot, Rockport, Ark.—A reciprocating iron carrying frame is mounted on wheels running on rails, which are connected in a frame, one above another, by rods, and arranged to shift up and down in ways in the posts, for shifting the iron on and off the clothes. The iron is suspended from the arms by rods, which are adjusted by nuts for holding the iron the right hight, and they have springs for pressing the iron down and allowing it to rise for passing over seams and the like. The toggle bars, for raising and lowering the rails, are connected together to be worked in unison by a bar, which is connected to a lever and shifting lever, to be worked by the operator, said lever being arranged at the front of the table where the operator stands. It has a catch bar to hold it in the different positions.

Improved Reciprocating Churn.

Wilhelm Howe, Brooklyn, N. Y.—This consists of a swinging churn, provided on the inside with guide plates having inclined grooves, for adjusting therein the detachable perforated dash boards to the quantity of cream in the tub.

Improved Grapple.

George Conklin, Poughkeepsie, N. Y.—The chains for closing the jaws are connected to the ends of arms, and extend directly to and wind on the pulleys of the shaft, which is used to close the jaws. The jaws are pivoted to the frames to afford the requisite leverage to the arms. The guide rods are connected outside of the pivots, and serve only to regulate the opening and closing of the jaws. The frames are double, and have a space between them, in which the jaws are pivoted, and the closing chains and pulleys are arranged for operating them.

Improved Light House Lantern.

Oliver Cook, Darien (Rowayton P. O.), Conn.—The invention consists in a light house lantern provided with a glass dome or cover, having a concave ring reflector hung on gimbals and provided with clamping screw pivots. The pivots of the gimbal are made as screws to enable them to clamp the rings of the gimbal in place when the reflector is adjusted in the proper position to throw the light vertically or at inclination, as may be desired. By this construction the light may be thrown upward against the clouds, and will be reflected by said clouds so that it can be seen at a much greater distance than is possible when the light is thrown from the lantern in a horizontal direction.

Improved Folding Table.

Rudolph Sprigade and John Schnoering, Brooklyn, E. D., N. Y.—This invention consists of a table with longitudinal top sections, hinged to folding leg sections, and locked by hinged side boards, and a pivoted lateral piece for retaining the table sections when in open position.

Device for Setting, Filing, and Jointing Saws.

William Bryson, Unity, Wis.—The invention consists of a couple of blocks and a straight edge, contrived with the latter fastened between the former, so that they clamp on the saw by set screws. The straight edge rests on the points of the teeth of a straight saw to gage them as to length. In the top of the block is a filing notch and an adjustable gage for the file for jointing the teeth; and on each end of the straight edge are adjustable, detachable, and reversible gages, by which to gage the file for beveling and squaring the edges of the teeth. The set consists of an adjustable die in one of the blocks and a screw presser in the other by which to bind the teeth.

Improved Mail Bag Fastening.

James C. Franklin, Lena, Oregon.—In this improved fastening a slotted flap of one side of the bag folds over on hooks projecting from the other side, and a slotted hasp slide, for locking the hooks, folds over on them from rods below, on which it is pivoted, so as to slide under the hooks after receiving them through the slots, to engage with the staple in which the lock is secured.

Improved Combined Wash Bench and Wringer.

Orsemor S. Holden and John S. Corey, Felchville, Vt.—In this invention the wringing rolls and an inclined shelf are supported above or over the wash bench by a frame, which is joined to and forms part of the bench, so that, as the clothes are passed up between the rolls directly from the tub, they are deposited on the inclined shelf, and thereby conveyed to a basket or other receptacle.

Improved Sad Iron.

Thomas J. Ellyson and Aaron O. Askew, Jackson, Tenn.—Between the two faces of the iron is a hollow space, into which the burner extends, from a lamp attached to the heel of the iron for heating it, at the same time that it is being used to avoid the labor and delay of heating it by the stove, and to dispense in warm weather with the hot fires necessary for heating irons. The pivot at the heel of the iron is made hollow for the burner to enter the chamber in this way, and it is formed on the standard of the handle. The lamp is attached to the iron by the studs projecting from the standard and a slotted plate. It also has a latch which swings over and engages the standard, after the studs are adjusted in the slots, to prevent the lamp from becoming detached.

Improved Car Coupling.

Nathan G. Shelley, Stephen P. Bozarth, and David V. Spring, Austin, Tex.—This invention consists of a sliding block within the drawhead, having a plate to cover the lower hole for the pin, and to hold the pin in position for self-coupling. The plate also is acted upon by a spring to keep it in position for holding the pin, and to allow it to be pushed back by the entering link of the other car, to trip the pin and uncover the hole to let the pin fall through the link into the hole. The links are pivoted in the drawheads above the block, so that the one passing over the other when they come together will rise up over the block, while the end of the other hangs low enough to strike the pin-holding plate and push the block back. The links also have a spring over the pivoted end, to control the other end as to the hight.

Improved Exercising Apparatus.

William Arnold Knight, Worcester, Mass.—This invention consists of a table, provided with lifting handles, that are operated against an adjustable combination of spring and weight, that can be used singly or jointly. A graduated machine is thus obtained, which starts from a minimum strain, by gradual increase to maximum strain, and back again to the minimum strain, requiring no sudden effort to overcome a constant or fixed strain, but admitting, by a gradually increasing effort, a regular training and developing of the muscles.

Improved Snap Hook.

J. G. Eberle, Glasgow, Mo., administrator of John Eberle, deceased.—A snap hook is provided with a reverse rear hook, bifurcated to allow the tongue of a buckle to be easily inserted or removed, and shouldered at the rear to prevent the buckle from coming out by a slackening of the strap. This snap is thus adapted to any kind of buckle, is applicable without punch or rivet, and may be readily used by an unskilled person.

Improved Rag Cutting Machine.

William C. Harrison, Goshen, N. Y.—This consists of two revolving cutting rollers, which are adjusted by suitable mechanism in close proximity to each other, to cut the fabric fed thereto by the shearing action of their cutting edges. An adjustable guide regulates the width of the strips, while a square shaft of one roller assists the feeding of the same.

Improved Chair Base.

William T. Doremus, New York city.—This invention consists in a base plate cast with a socket to receive a pivot or screw, and with sockets to receive the legs. Upon the lower side of the top plate are cast pins or points, which enter holes in the legs, and thus further strengthen the connection. Upon the upper side of the top plate is formed a ring groove to receive a ring rib, formed on a plate secured to the chair seat. These devices serve to regulate and steady the movement of the pivot plate. This construction enables the base plate to be cast without using cores, so that it can be cast readily and with perfect accuracy.

Improved Press for Cider, etc.

Henry Krumsick, Nashville, Ill.—The principal difficulties encountered in interposing elastic blocks between the screw and follower of a press, for the purpose of supplementing the pressure of the screw by expansion of the blocks, have been lack of steadiness and directness of pressure. To remedy this and other defects, the elastic blocks in the present device are arranged between two parallel cross bars of the press frame, one of which is fixed, and the other vertically adjustable, its ends being tenoned and fitted in elongated mortises in the uprights of the frame.

Improved Moth Trap.

Washington Hollis, Pembroke, Ky.—This is a rectangular tin box in the upper part of which is formed a slot to receive the alighting board of a bee hive. Upon the inner end of the box is formed a shallow passage, deep enough for the passage of the bees, and directly over the entrance to the hive. In the top of the box, just in front of the passage, are formed slips, of such a size that the moth millers can crawl through them. In the outer end of the box are formed holes, in which are secured tubes projecting into the said box, and made tapering, the inner ends being made so small that the moth millers can only crawl through them. In the end of the box farthest from the slits is inserted a glass plate so that light can shine through. When once in the trap, the moth millers will be attracted by the light through the glass plate, and will be unable to find their way out.

Improved Ventilating Apparatus for Coal Mines.

Francis Murphy, Streator, Ill.—This apparatus is mainly designed for the purpose of removing deleterious gases, which can only be effected by means of strong currents of air applied directly in the particular localities where they accumulate. This is accomplished by exhausting the gases with an apparatus controlled entirely from the outside. The exhaustion is produced by the creation of a partial vacuum in a properly constructed chamber above the ground. A spiral exhausting fan revolves in close proximity to this chamber, from which airtight tubes extend down through the shaft and along the galleries to branch pipes and receivers at the extreme portions of the works.

Improved Ventilating Damper.

Anson Augustus Schroder, Warren, Ill.—This invention consists in a pipe made with a conical enlargement in its middle part, having openings formed in it. Two shoulders are made at the upper end of said enlargement. By moving a ring in one direction, the cams thereon will pass in beneath the stems of the dampers, and raise said dampers; and by moving the said ring in the opposite direction the dampers will be allowed to drop into their seats, where they will be kept in place by their own weight.

Improved Leather-Punching Machine.

Henry Mott, Pottsville, Iowa, assignor to himself and John C. Calbreath, same place.—This invention consists of a pair of horizontally swinging awl-carrying arms, with foot treadles and springs for swinging them forward and backward, in combination with an intermittingly reciprocating work-holding clamp, and mechanism for feeding it, all contrived for punching straps for harness work, and all other leather work to be sewn in straight lines by hand, easier and more regularly than it can be done with the hand punching awl. The clamp, by which the work is fed to the punches, serves to hold the work suitably for the workman to sew as the punch holes are made.

Improved Car Window.

La Roy S. Starrett, Athol Depot, Mass.—This invention consists of a car window that is applied by a combined hinge and lock mechanism at both sides to the car frame, in such a manner that it may be swung open at either end and retained in position, according to the direction of motion of the car. The window sash is provided with top and bottom and adjustable side weather strips for closing tightly, and the lock and hinge parts with suitable devices for carrying off any dust collecting therein.

Improved Organ Reed Board.

Wesley W. Walker, Brattleborough, Vt.—The object of this invention is to contrive an organ in a compact and simple form with large capacity for different combinations and varieties of music. It consists essentially in the manner of the arrangement of two or more reeds directly over or partly over and partly back of the lower reeds, on one or both sides of an air cell, through which the air is taken from the reeds into the common air cell above the valve through which it passes to the bellows.

Improved Wagon End Gate.

Benjamin F. Bulkley, Southport, Conn.—Cleats are attached to the outer side of the end boards to strengthen them. A rod extends longitudinally along the outer side of the end boards and through holes formed in the cleats to receive it. Upon each end of the rod is formed a hook for the links to be hooked. The links are placed in the eyes of eye bolts, which pass through outer cleats and the ends of the side boards, and have hand nuts screwed upon their outer ends, so that they can be readily loosened to enable the links to be detached from the hooks. With this construction the fastenings can be readily and quickly fastened and unfastened to secure and release the end boards.

Improved Farm Fence.

Stephen Stout, Tremont, Ill.—This consists in securing between the horizontal wires of a wire fence a board provided with spikes. Vertical wires are employed to fasten said board in a simple manner.

Improved Coal Holder.

Samuel M. Whiteside and Amos C. Holliday, Wheeling, W. Va.—This invention relates to a receptacle for coal to be placed in the grate or stove, to contain a supply of coal for the fire, and for dispensing with the objectionable coal bucket. The box turns forward on pivots to allow the coal to be removed, and closes back tightly with the cap when turned again to an upright position.

Improved Automatic Car Brake.

Fielding L. Kirtley, Cleburne, Texas.—The object of this invention is to provide a means for the automatic application of brakes to the cars of a railway train, and it consists in a loosely moving drawbar attached to the car by means of bolts passing through a central longitudinal slot, and having its sides wrought into two rack bars which mesh with pinions upon two windlass shafts, which arrangement, when the locomotive is slowed, causes the impact of the cars to drive up the drawbars, and wind up cords upon the windlass shafts, which cords communicate with and apply the brakes to the wheels. The invention also consists in the combination with the rack bar of a locking device to prevent the application of brakes in backing, and in a device for maintaining the brakes applied when stopping upon an incline.

Business and Personal.

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Hoadley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

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A few thousand dollars to invest in the manufacture of some good article, established or new. Address, with full particulars, C. Houghton, Batavia, N.Y.

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For Sale—Two thirds of Foundry and Machine Property, at Raleigh, North Carolina. Best business in the State, and one of the best openings in the South to build up a very large trade. Large lot, fronting on two Railroads and two Streets, with buildings, machinery, tools, patterns and stock. Only shop in the State where Engines are built, and the demand far exceeds the present capacity to manufacture. Also make Cotton Gins and Presses, Mill Gearing, Shafting, Iron Front Work, and 12 to 1500 Plows annually. At present, 35 hands are employed. The business can be increased, so as to be limited only by the capital and energy of owners. Satisfactory reasons given for selling. Address P. O. Box 267, Raleigh, N. C.

Single, Double and Triple Tenoning Machines of superior construction. Martin Buck, Lebanon, N. H.

Wanted—A reliable party to manufacture and sell the Best General Wood Working Machine in use on the Royalty plan. Address No. 59 E. 7th St., Covington, Ky.

The Best Wooden Pulley made; fastens without keys or set screws. Adjustable Dead Pulleys stop loose pulleys and belts when machinery to which they belong is not in motion. Cold Rolled Shafting, Improved Couplings and Hangers. A. B. Cook & Co., Erie Pa.

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

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

Pipe and Bolt Threading Machines. Prices from $80 up. Address Empire Manufacturing Company, 46 Gold Street, New York.

Johnson's Universal Lathe Chuck. Medal awarded by the Franklin Institute for "durability, firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

Machine Tools, 2d H'd, for sale: 1—20 ft. Lathe, 2—10 ft. Lathes, 1—9 ft., 1—12 ft., 1—6 ft.; several Speed Lathes, Crank Planer, 2 Upright Drills, 1 Planer, 1 Bolt Cutter, etc. For list, address Forsaith & Co., Manchester, N. H.

Engines, 2d H'd, for sale: Portables, as follows—2—25 h.p.; 1—35 h.; 1—8 h.p.; 1—6 h.p.; 1—4½ h.p.; 1—4 h.p. Also, 50 h. p. Chubbuck Engine, 50 h.p. Boiler, 18 h.p. Boiler, and several small Engines. For list, address Forsaith & Co., Manchester, N. H.

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For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Genuine Concord Axles—Brown, Fisherville, N.H.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Notes & Queries

F. J. will find Professor Böttger's recipe for a depilatory on p. 107, vol. 30.—F. R. S. can make a colorless varnish by the process described on p. 150, vol. 29.—J. T. W. will find that the field camera is described on p. 58, vol. 31.—A. J. T. will find that induction coils are described on pp. 215, 218, 363, 378, 379, vol. 30.—R. N. will find a full description of the process of lithography on p. 298, vol. 31.

(1) W. H. says: I have found in California a deposit of almost pure silicate of alumina. It is entirely free from any metal, and contains about 2 per cent of silicate of magnesia. Is there any use for it? A. It could be used for filling the walls of fireproof safes; and if it could be easily handled and cut into blocks, it might be employed in the lining of furnaces, or in similar cases where great heat is encountered.

(2) P. I. O. asks: If a ball of iron, or other substance of greater specific gravity than water, be placed in a vessel (of sufficient strength) full of water, and submitted to powerful hydraulic pressure, would the pressure cause the water in the vessel to float the ball? A. Yes, if the water were sufficiently compressed. It would, however, require a machine of extraordinary strength, as a pressure of 1 atmosphere only increases the density of water about 0·000033.

(3) W. H. R. asks: Will a mark on a tree indicating high water be permanent, or higher up by the growth of the tree? A. If the tree has attained its growth, the change in the position of the mark will be scarcely perceptible. In other cases it may change considerably. We have heard of "blazes" made on trees which were afterward found to be high above the reach of a "blazer" on the ground.

(4) J. T. H. asks: If a belt slips, does it slip on the driving pulley or the one driven? A. In most cases, but not always, on the driven pulley.

(5) H. C. S. says: I made a piece of leather hose 4½ feet long and 2½ inches in diameter, and put a water pressure upon it of 275 lbs. to the square inch. Would a length 50 feet long, all things being equal, stand the same pressure? A. Yes.

(6) W. J. F. asks: How many square feet of cooling surface are usually allowed per horse power in a surface condenser? A. It is a common rule to allow from ½ to ¾ as much condensing surface as the heating surface of the boiler.

(7) G. S. C. asks: What makes some steam boilers, if the water is cold when the fire is started, give a clacking and hammering noise internally? A. It is no doubt due to sudden expansion of parts of the boiler, caused by the circulation of the water as it becomes heated.

(8) W. R. H. says: I read that Lieutenant Hitchcock of the United States Coast Survey discovered what is apparently a spring of fresh water at sea. Are there any more localities in the ocean where fresh water can be obtained? A. Fresh springs in salt water are by no means uncommon. We remember to have seen one in a creek in North Carolina, the water of the creek being quite salt.

(9) J. B. says: We use salt water in a steam boiler. We have no condenser, and do not know how to make one. We can get sulphurous water, but think that will be as hard on the boiler as salt water. What would you advise? A. It will be necessary for you to blow off frequently, so that the saturation of the water in the boiler does not become very high. Even with this precaution, scale will form in the boiler, and should be removed every few weeks.

(10) J. E. H. says: Some time ago I saw a recipe in the SCIENTIFIC AMERICAN for cleaning guns by using quicksilver. It stated that the quicksilver would form an amalgam with the lead in the barrel of the gun. I have tried it and have signally failed. I then took some shot and put in the mercury to see if it would form an amalgam; and the shot still remain in it as perfect as when first put in. What is wrong? A. If you will melt the shot you allude to, and draw off the clear metal from the oil and plumbago with which they are covered, you will have no difficulty in combining it with the mercury. For the same reason you will see that it is necessary to first remove all the carbon, etc., from the interior of the barrel of the gun before the required action will take place.

(11) L. G. P. asks: What kinds of gums can be dissolved in sulphuric ether? A. Most gums are soluble in ether.

1. How can I color collodion? A. Use any of the aniline colors. 2. What will dissolve collodion after it is dry? A. Ether containing a little alcohol.

(12) J. H. S. asks: 1. To how many grains (by weight) of best rifle powder is one grain of good gun cotton equal? A. One part by weight of gun cotton is equal in projectile power to 4·5 or 5 parts of gunpowder. 2. How is gun cotton manufactured for use in fire arms? A. The cotton is steeped in a mixture of equal parts of strong sulphuric acid, specific gravity=1·84, and fuming nitric acid for about 15 minutes. Gun cotton has not been adopted in practice as a good substitute for gunpowder; its large bulk, coupled with the fact that the explosion is attended with the evolution of much water and nitrous acid, render it inconvenient as a substitute for powder. 3. Is it more dangerous than gunpowder? A. Yes; gun cotton is liable to spontaneous combustion. In some cases it has been known to ignite at a temperature of 43°. A small magazine filled with gun cotton in the Bois de Vincennes, Paris, was exploded by the sun's rays. The combustion of gun cotton, unlike gunpowder, takes place almost instantaneously, and for this reason it is liable to injure or rupture the fire arm in which it is used.

(13) F. W. B. asks: Are there any acids that will eat into or soften the surface of rocks? A. Most of the materials forming rocks are either partially or wholly soluble in acids, or mixtures of acids. They are not all soluble in the same acid. As you failed to state any particular variety of rock, we must omit giving you here a complete dictionary of solubilities.

(14) B. H. W. asks: What substance is used to cement the seams of gas bags? A. For this purpose a cement used is obtained by dissolving gum rubber in hot naphtha, which is then allowed to evaporate until of the consistence of a thick paste. The seams are cemented with this, and placed under great pressure for some time. They are then (usually) countercovered by a strip of the same material as the bag. This is fastened on by means of the above cement, so as to form a binding. When this is finished, it is again placed under pressure. A bag, so prepared, will stand 600 lbs. pressure, and is generally warranted to stand 1,000 lbs.

(15) E. E. asks: What would be the best to fill an ice box between the outside and inside of the box? A. Charcoal.

(16) W. C. asks: Is there a chemical that will dissolve gutta percha, and will dry as fast as bisulphide of carbon? A. Bisulphide of carbon is by far the best solvent for gutta percha, we believe, thus far discovered; but if the gum be digested for some time in hot naphtha, a solution in that liquid may be obtained. But as naphtha, like carbon bisulphide, is an extremely volatile liquid, and when its vapor is mixed with air forms a terribly explosive mixture, it follows that, to obtain the desired solution without a prodigal waste of the solvent and its accompanying danger, it is necessary that the materials be inclosed in a strong, airtight vessel, and heated over a water bath so as to insure a uniform degree of temperature, which should not be allowed to exceed 100° Fah.; and even then we should not consider the above method free from danger in inexperienced hands.

(17) C. G. H. says: On April 13 I was carrying an umbrella in a snowstorm. I touched the frame of the umbrella and received a spark of electricity. On presenting my finger, I could plainly see a spark ⅛ of an inch long. What is the cause? A. Occasionally, during a snowstorm such as you mention, or when for some reason the air is extremely dry and the atmosphere becomes very highly electrified, like strange electrical phenomena often occur. Your umbrella, in this case, probably acted the part of Franklin's kite, and your body formed the conducting link to the earth.

(18) E. W. P. asks: How can I make powdered charcoal into a porous cake for use as a filter? A. One method consists in pulverizing animal charcoal until reduced to an impalpable powder. This is mixed with a definite proportion of Norway tar, and a compound of other combustible substances. The combined materials are then properly amalgamated with liquid pitch, and the whole kneaded up into a homogeneous plastic mass which admits of being molded into slabs or blocks of any required dimensions and shape. These blocks, having been allowed to dry and harden, are subsequently carbonized by being subjected to a process of incineration by heat; and in this manner all the combustible ingredients are burnt out, leaving nothing behind but the anima charcoal in the form of a block of charcoal, permeated throughout by innumerable pores.

(19) W. H. says: 1. You say that, by coating a room with oxide of zinc and glue size, and when dry, coating with a solution of chloride of zinc, I can obtain a good gloss; must there be any glue in the chloride solution to bind it? A. It is not necessary. 2. What strength of solution of chloride is required? A. Use a strong solution. 3. Chloride of zinc is extremely dear here. Is there any substance that can be used to produce same results and be cheaper? A. We do not know of any substitute other than good varnish. 4. Does the above compound affect colors? A. Yes; some colors are apt to be partially bleached when mixed with it. 5. Is the chloride of zinc hard to make? A. No; dissolve metallic zinc or its oxide in a small quantity of hydrochloric acid until it will dissolve no more; this solution is then ready for use. When applied to the coating of zinc oxide, it combines with it to form a subchloride or oxychloride of zinc, which is neutral. 6. Is silicate of soda a strictly waterproof substance? A. It is not. 7. What can I add to its brittleness to keep it from becoming cracked and mealy when exposed to the air a short time? A. We do not know that you can better it at all. 8. Could I use this mixture on plastered walls to keep water from staining through kalsomine? A. It might be made use of for this purpose, but we do not think it would be very lasting. 9. Would it peel off in damp places? A. Yes.

(20) E. C. S. asks: When it is exactly noon at any given point on a given meridian, is it exactly noon at every other point on the same meridian? A. Yes. 2. I read that the variation in the length of the solar day is owing to two distinct causes, the inequality of the earth's motion around the sun, and the inclination of its axis to the plane of its orbit; and that from these two causes arises the difference between sun time and clock time. I can see how the earth's unequal motion may make the solar day more or less than 24 hours; and I can see how the inclination of its axis may affect the time of sunrise and sunset, and the length of day and night; but I cannot see how it affects the length of the solar day or makes sun fast and slow. A. If the books state that the variation of the length of the solar day is due to the inclination of its axis to the plane of its orbit, they can only allude to the variation in the duration of daylight from summer to winter; and if they speak of the inequality of the earth's motion around the sun, they mean the yearly motion, during which the earth recedes in spring time from the sun, and retards her velocity, while in the fall she approaches the sun, and accelerates. The daily rotation is perfectly uniform, as proved by observations of the stars, which show that the sidereal days, of which the length is only 23 hours and 56 minutes very nearly, never vary in length. The difference between solar time and the time of a well regulated clock would not exist if the earth's yearly orbit were a circle, and her yearly motion uniform. This difference, which is commonly described in the almanacs as "sun fast" and "sun slow," is caused by the inequality in the yearly motion of the earth, by which the apparent motion of the sun along the signs of the zodiac (and which, on an average, is 59 minutes and 3 seconds of a degree per day) becomes retarded or accelerated: the difference of this apparent irregular motion, with that of a sun whose apparent motion is regular, constitutes the difference between the so-called solar time and mean time. For instance, from June to September, the earth recedes from the sun, and its velocity is retarded, and the sun's apparent motion along the zodiac is also retarded, so that the statement in the almanac, "sun slow," is correct.

COMMUNICATIONS RECEIVED.

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

On Commercial Sponges. By S. H. T.
On Flower Growing. By W. H. M.
On the Tides. By A. McN.
On Disasters at Sea. By J. F. J.
On the Locomotive. By J. F. J.
On Railway Rails. By J. P. T.

Also enquiries and answers from the following.

C. N. F.—S. T.—L. D. D.—A. W.—P. F. M.—C. N. F—F. W. J.—B. S. K. O.—C. F. A.—E. J. F.—W. L. D—C. J. B.—C. S.—C. D. G.—S. G., Jr.—H. S.—J. P. M.—E. F. O.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who sells dynamite, dualin, and lithofracteur? Who sells steam engine indicators? Why do not makers of watch-making machinery advertise in the SCIENTIFIC AMERICAN? Where can pure tallow, for cylinder lubrication, be obtained?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal." which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,328.—LAMP PEDESTALS.—N. Bradley, West Meriden, Ct.
8,329.—COAT HOOKS.—F. T. Fracker, New Britain, Ct.
8,330.—CARPETS.—H. F. Goetze, Boston, Mass.
8,331.—CHARM MEDAL.—C. Hershey, Philadelphia, Pa.
8,332.—STATUARY.—H. Hirschfeld, West Meriden, Ct.
8,333.—CARPET.—A. Martin, Paris, France.
8,334.—FIREMAN'S TRUMPET.—F. Miller, Brooklyn, N. Y.
8,335.—BURIAL CASKET ORNAMENT.—W. M. Reid, Amsterdam, N. Y.
8,336.—HEATING STOVES.—G. Smith *et al.*, Philadelphia, Pa.
8,337.—STOVES.—N. S. Vedder, Troy, N. Y.

SCHEDULE OF PATENT FEES.

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

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, May 18 to 19, 1875.

4,748.—C. O. Gardiner, Springfield, Ohio, U. S. Seeding machine. May 18, 1875.
4,749.—J. Nolan, Malone, N. Y., U. S. Water wheel. May 19, 1875.
4,750.—J. D. Husband, Jr., St. Louis, Mo., U. S. Fire kindler. May 19, 1875.
4,751.—M. Lesser, Montreal, P. Q. Cigars and cigar molds. May 19, 1875.
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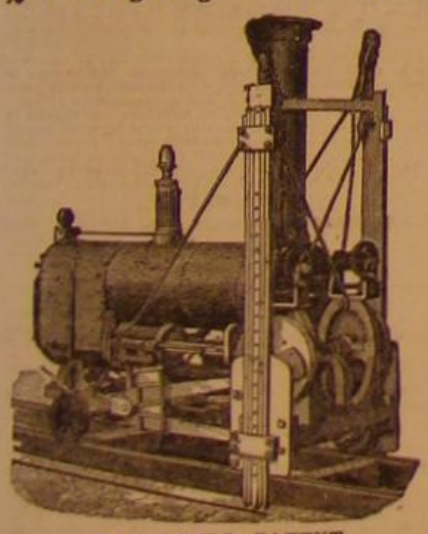
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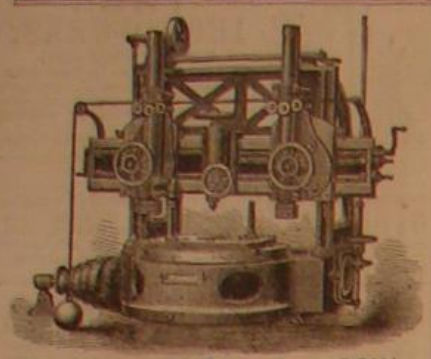
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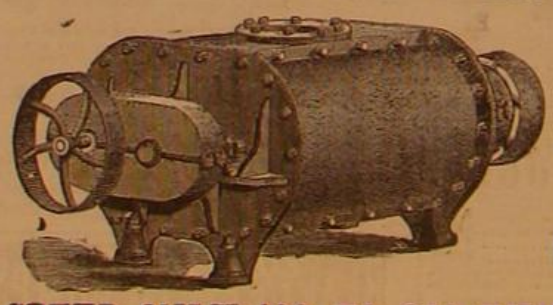
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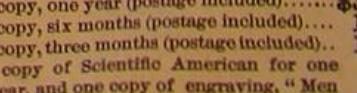
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Vol. XXXII.—No. 26. (NEW SERIES.) NEW YORK, JUNE 26, 1875. $3.20 per Annum Postage prepaid.

THE GRAND CENTRAL RAILWAY DEPOT.

We publish herewith an accurate engraving of the interior of the depot at 42d street, New York city, built for the accommodation of the New York Central and Hudson River, New York and Harlem, and New York and New Haven Railways. As we have already fully described this remarkable structure, there is no need to do more than recapitulate its proportions, which are 652 feet in length and 199 feet 2 inches in width. The roof is supported on 32 semicircular trusses, which are spaced 20 feet 4 inches between centers, extending from a point 2 feet below the rails to an elevation of 94 feet from the springing line to the extrados of the arch. Each truss has at its foot two tie rods 2¼ inches in diameter, with a turn buckle at the mid-length. The pitch of the roof is formed by rafters secured to the top chord of the arch

The trusses weigh about forty tuns each, and were raised in sections by means of a movable staging 80 feet high, 160 feet long, and 30 feet wide, moving on ways, and shifted along step by step as the work of raising the trusses progressed. About 8,000,000 lbs. of iron were used in the structure, 10,000,000 bricks, and 20,000 barrels of cement.

The car house is lighted through three skylights extending over the entire length of the roof—one on the center, double pitched, and a single one on each side of the center, and having altogether 80,000 square feet of glass—nearly two acres. The north end is closed by an iron front, the south end by the building containing the principal offices of the companies.

The roof covers nearly three acres, the station itself about four acres. The station has separate tracks for the trains of each company, besides those for the Fourth avenue horse cars, which run into and to and from this station, which was opened for traffic October 7, 1871. The gas burners of the building are lighted at night by electricity, 25,000 feet of electric wire being used, and 20,000 feet of gas pipe. The 144 steam radiators are heated by 15 miles of steam pipe.

The roof is ventilated by six lines of ventilating slats, 6 feet high and 8 inches wide, with Z-shaped intervals between the slats.



THE GRAND CENTRAL DEPOT, NEW YORK CITY

Great Volcanic Eruption in Iceland.

Mr. Magnusson, of Cambridge, England, says:—"On March 29th, the fall of the ashes was so excessive that it covered the eastern country sides, Jökuldal especially, with a coat six inches at its thickest; and all that day, although it was bright and sunny, the people spent in absolute pitch darkness. Fountains and rivulets were dammed by the ashes, and every mountain stream, always of a crystalline purity in Eastern Iceland, where there are neither glaciers nor *moraine*, ran dark and muddy between banks covered with drifts of ashes. The farmers have fled out of the ash-covered country sides with their cattle, in quest of pastures not yet destroyed by the *scoria;* but with what chance of saving their live stock does not appear. To all appearance, the present eruption seems likely to become a calamitous event for Iceland."

A BEAUTIFUL PALM TREE.

The plant shown in our engraving is one of the most graceful members of the class, and deserves to become popular in



our gardens and conservatories as a striking and decorative foliage plant. It is sufficiently hardy to withstand our climate during the summer months, and grows freely when planted in a richly manured soil and in warm, sheltered positions. In habit, the plant is more robust than of its congeners, if we except *s. augusta*, which frequently attains a height of from 30 to 40 feet. treated as a warm conservatory plant. Both the last named plants are chiefly remarkable for their fine foliage; but some of the smaller growing kinds, as *s. ovata* and the even more beautiful *s. reginæ*, are well known flowering plants, generally grown in a warm conservatory or in a humid plant stove. These species will, however, both grow and flower well in warm, sheltered positions out-of doors, and form striking objects massed along with musas, palms, and the larger arads. Our illustration gives an excellent idea of the noble port assumed by a well grown specimen of *strelitzia Nicolai*, which is common as a half-hardy foliage plant in many continental gardens.

Railway Speed on Horseback.

A fifty mile riding match lately came off at San Francisco, Cal. between two noted riders, Mowrey and Smith. The *Alta* says: It was a contest, as advertised, for $1,000 a side, with the conditions that each man should have ten horses, and be compelled to change horses, or mount and dismount, in each mile.

Both men were of a tallish, slender build, well adapted to long hours on horseback. Of the two, Mowrey exhibited greater strength and activity, and as an expert in the mode of mounting and dismounting is by far Smith's superior. An evidence of this was clearly perceptible in the fact that he gained on an average not less than two seconds at every change. His style was that of throwing himself from the saddle by a spring from his seat, and in mounting to spring from the ground, assisted by the horn of the saddle and catch his seat while the horse was frequently under full headway. Added to this, he was greatly assisted by having a helper on horseback, who invariably accompanied him on the start and outcome by checking and starting his horse, while Mowrey had only to jump on and off. On the other hand, Smith had little or no assistance, except the equipage of his saddle, which was brought into requisition in a manner that showed conclusively his appreciation of its desirable assistance.

Mowrey came in a quarter of a mile ahead in 2 hours, 2 minutes, 36½ seconds, Smith being 16 seconds behind. The quickest mile was made in 2·04 minutes, the slowest in 3 015 minutes.

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Scientific American.

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NEW YORK, SATURDAY, JUNE 26, 1875.

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THE END OF ANOTHER VOLUME.

The present issue of this paper closes the first half of the year. Next week we shall commence a new volume.

Some persons to whom the SCIENTIFIC AMERICAN was not previously known concluded six months ago to try it, and to them we say: Now, after receiving 26 numbers costing $1.60, how do you like it? We hope that none are disappointed. We hope that every one feels that he has had a full equivalent for his money. And we hope that all who are satisfied that they have had their money's worth will evince their satisfaction by remitting $3.20 for the coming year, or $1.60 for the next six months.

Clubs may be formed on the usual terms, and the same reduction will be made on a number of names as offered in last January. To all persons who wish to keep apace with the progress of the age, the SCIENTIFIC AMERICAN is indispensable. No other publication contains the variety of valuable reading, and instead of forty-five thousand—our present actual weekly circulation—we think the publication deserves the subscription of one hundred thousand. What say our friends? Shall we have it? It is for them to answer.

Remit, by registered letter, draft, or postal order, to

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37 Park Row, New York city.

THE KEELY MOTOR DECEPTION.

During the past year and a half, we have had occasion, several times, to allude to this latest contrivance, the chief purpose of which appears to be the wriggling of money out of silly people, numbers of whom are found to invest in it—just as they do in lottery tickets—expecting or hoping to win a prize.

The thing was started over two years ago, when it was given out that one Keely, of Philadelphia, Pa., had made a marvelous discovery, namely, a new motive power, in which an enormous force was generated without expense, without the employment of fuel, fire, electricity, chemicals, or other agency; in short, a veritable perpetual motion. The only apparatus involved was a few strong metallic cylinders, containing air, into which water was admitted, when, presto, a cold vapor was instantly produced, having a force of 20,000 lbs. per square inch, more or less, capable of useful application in the driving of all kinds of mechanism. Thus were the days of steam and its costly fuels numbered, and the value of coal property diminished; while settled principles of Science, demonstrated by Joule, Faraday, and other eminent worthies, were toppled over as by an earthquake.

In one of our comments we designated the Keely Motor as one of the perpetual motion deceptions, by which the owners claim to generate a great force out of nothing. We stated that "once in a while they have a juggling exhibition of the thing for the purpose of selling stock. Keely or one of his confederates is the operating juggler. The power 'generator' is a combination of small tubes or cylinders, communicating by pipes. First they run water through, then air, to prove that there is nothing within, and that the show is 'honest.' Then Keely turns a faucet, and 'now you see it.' The pressure gage goes up. He turns again, and 'now you don't' see it. The gage falls."

Transparent as this deception is, it is a serious fact that it has been indirectly countenanced by numbers of intelligent persons; and the implied sanction they have given to it has led many less informed individuals to stake money for its shares.

In the SCIENTIFIC AMERICAN for May 2, 1874, we devoted two columns to an account of one of the Keely performances like that above described, and mentioned the names of C. H. Haswell, W. W. Wood, U. S. N., S. Parish, Joseph Patten, and other engineers and mechanics who were present, and lent their names to its support. Professor Haswell wrote quite an ingenious report in its favor. A force of 10,400 lbs. to the inch was by him certified to have been developed on that occasion. It was then given out that a new apparatus, of still greater power, was in course of construction, to be finished within a few weeks, which would be still more conclusive and satisfactory in its results; that until this new apparatus was ready, and the patents, then in progress, were secured, the matter was not to be fully explained.

Since that time the new apparatus has been completed, several private exhibitions have been given, and the interested parties are now, it seems, desirous of bringing the "great discovery" fully before the public. We judge that this is the case, because they have lately communicated much information to various members of the press.

We take the following, as a sample, from the New York *Times* of June 11, 1875:

[From our own Correspondent.]

Philadelphia, Thursday, June 10, 1875.

"The mechanical and scientific world has been greatly excited of late by the discovery of a new motive power by a Mr. John W. Keely, of this city. The lately discovered motor is generated, as the gentleman claims, from cold water and air, and evolves into a vapor more powerful than steam, and considerably more economical. It is proposed by this new invention to revolutionize the world, and turn machinery topsy-turvy. Steam will be a thing of the past, and the wonderful power of this new creation will supply all the needs of man, for the uses to which steam is now applied Just what this vapor is, and how it is made, the discoverer refuses to make plain, or divulge his hidden secret, until he has letters patent taken out in all the countries of the world which issue patent rights. This service alone will cost about $30,000, and will not be completed until three or four months hence. Mr. Keely is very reticent on the subject of his discovery, and referred your correspondent to his attorney, Charles B. Collier, Esq. The latter gentleman said that a private view of the working of the motor had been made on the 10th of November, 1874, before a number of capitalists, and that only three weeks since another exhibition had been given before a number of gentlemen from the New England States. These latter were so well pleased with the *modus operandi*, and believed so firmly in the ultimate supersedure of steam by the new power, that they formed a stock company, purchased the patent right for the six New England States, and paid $80,000 cash immediately for their share in the invention, and are ready to forward $200,000 more as soon as called upon. They will organize a company with a capital of $3,000,000, and be ready to manufacture the engines and necessary apparatus as soon as the proper patents are secured.

HISTORY OF THE DISCOVERY.

Mr. Keely alleges that the discovery of this power was purely accidental. Up to within a short time he was a poor man, but, having a wonderful degree of natural mechanical skill, he devoted all his time for the past fourteen years to experiments with water with the view of procuring a motive power from it. He was engaged upon an idea of his own regarding the force of columns of water one day, when he accidentally discovered the vapor he has harnessed. He studied the subject, ascertained how it was generated, learned its power, and thenceforth applied himself solely to the perfection of this idea, working night and day, for a number of years, until his efforts were crowned with success. The apparatus by which this power is made is termed a "generator" or "multiplicator," and the vapor is then passed into a "receiver," and from thence to a cylinder box of the engine, where it drives the pistons and sets the engine in motion. The "generator" is about three feet high, made of Austrian gun metal, in one solid piece, and will hold about ten or twelve gallons of water. It is four or five inches thick, and made to stand the very heavy pressure of 20,000 to 30,000 pounds of vapor to the square inch. The inside is composed of a number of cylindrical chambers, connected by pipes, and furnished with cocks and valves. The "reservoir" is about six inches in diameter and forty inches long, and is connected with the "generator" by a pipe which is about one inch in circumference on the outside, with a bore of about one eighth of an inch. Connected with both "generator" and "receiver" is a "standpipe" of brass, about two and a half inches in diameter and three feet high, having a spherical chamber at the bottom, made in two parts, by flanges, and connected to the pipe uniting the "generator" and "reservoir." The vapor generated in the multiplicator is conveyed to the reservoir, which contains numerous pipes, and from there, by a "feedpipe," to the engine. The engine is of peculiar construction; but the inventor claims that the vapor can be attached to any ordinary engine now in use, with very slight alteration. Steam could not pass through the connecting pipes which are used on this apparatus, since the bore is only about the dimensions of a knitting needle. "In five seconds," said Mr. Keely, "I can supply 2,000 pounds of vapor to the square inch, and enough to run a train of ten cars from Philadelphia to New York and return."

With a Keely "motor" attached to a steamer, the voyage of the world can be made without coal.

Mr. Keely says that the first public exhibition will be upon the Pennsylvania Railroad, when he purposes to take a train from this city to New York and return. The cost of the apparatus will range from $500 to $2,500, according to the size and finish desired.

It is evident, from the character of the gentlemen who are interested in the "Keely Motor Company," and the amount of money they have advanced, that they regard this invention as the wonder of the nineteenth century. About four millions of dollars are already involved in the success of this new invention.

The gentlemen interested in the scheme in New York are Messrs. E. T. Throop, Charles G. Francklyn, Charles Lamson, Sergeant & Cuttingworth, W. D. Hatch, William W Wright, W. B. Meeker, J. J. Smith, A. H. Elliott, John M. Williams, and J. S. Andrews."

The foregoing presents the most recent statements concerning the new motor, as derived from the parties themselves. We will now add a brief "official account" of the actual working of the device, at the great trial mentioned above, made November 10, 1874, as certified by Mr. Collier, the company's counsel and reporter, and published by him in pamphlet form at that time, for the information of the stockholders.

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P. M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P. M., the reaction wheel was removed, and connection applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P.M., the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P. M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplicator was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus."

The dimensions of the "small beam engine" are not given. It is stated by the learned counsel to have been of "peculiar construction, not susceptible of brief description." Judging from the Barker wheel, with 2½ inch arms this "beam engine" was probably about the size of a dollar toy engine. These remarkable pieces of machinery were, according to this report, run for a minute or two at a time, at various intervals, extending over an entire period of 15 minutes. There was no heat and no noise save that of running water when the ear was placed against the multiplicator.

The report, after giving the foregoing facts in regard to actual performances, summarizes the results, which we condense as follows: 1. The invention produced a series of gaseous expulsions of 2,000 lbs. per square inch. 2. The force was almost instantly produced. 3. It moved instantly through a distance of 12 feet. 4. It was attended with no noise. 5, 6. Nothing was nor could have been introduced into the apparatus to produce the force. 7. No heat, electricity, or galvanic action was discernible, except that electric sparks were observed in the spur gearing of the engine, caused by friction. 8. Hydrant water, 26 lbs. to the inch, was admitted. 9. The water was drawn off unchanged after the performance. 10. The vapor had no smell or taste, and did not burn. 11. The interior of the apparatus was found to contain no residuum or substance other than air and water. 12, 13. The operations were conducted by gas light. Every facility for the closest investigation was offered to the persons present.

The counsel then adds that the object of his report is not to make known the precise nature of Mr. Keely's invention, "nor will this be done until the specifications, drawings, models, etc., now in progress, necessary for the procuration abroad and in this country of letters patent, are completed and deposited."

Following the counsel's signature to this report is a certificate by Wm. Boekel, Mechanician, Wm. H. Rutherford, Chief Engineer, U. S. N., and J. Snowdon Bell, to the effect that they were present, that the report of the facts is correct; and the conclusions of Mr. Collier, given in the summary, they say "we fully endorse, as being, in our judgment, the correct conclusions." A certificate from B. Howard Rand, M. D., Professor of Chemistry in Jefferson Medical College, is then given; the Professor says he has read Collier's report, and certifies that the "absence of heat, electricity, or galvanic action as resultants, together with the negative qualities of the produced gas or vapor, lead me to the conclusion that the result, alleged to have been produced, was by some agency or power not known at present to chemists."

The opportunities for the acquisition of knowledge by this Jefferson College Professor seem to have been very limited.

We have given above the latest accounts of this latest attempt to impose upon the credulity of the public, as written by the parties themselves and backed by their willing as

sistants. The deceptions of the whole scheme are so transparent that it hardly seems credible that persons of sane minds can be found who are willing to invest. Nevertheless, we hear from a reliable source that quite a number of well known business men have invested money in the scheme, and in one instance we were told so by the party himself. He had paid five thousand dollars down, and fully believed the thing to be a great discovery, and expected to realize a large fortune from his investment. On all other subjects this gentleman was rational and intelligent; but in respect to the Keely motor he was badly hallucinated. He was present at the trial above referred to, saw 2,000 lbs. on the gage, and came away perfectly satisfied.

The question is asked: How could so great a pressure as 2,000 or 10,000 lbs. per square inch be produced, allowing that it really was exhibited as stated? We think that any ingenious mechanic, by means of a hydraulic jack and a small pipe, could readily produce and exhibit such a pressure, and could, by turning a faucet, drive a whirligig for the space of sixty seconds, or from 9:08 P. M. to 9:09 P. M., as the learned counsel gravely reports.

Keely, it will be noticed, talks about his studies regarding the force of columns of water, and describes the use of water pressure in his "generator," "multiplicator," "receiver," etc. Well, now, Keely might, if he wanted to, get up an honest show of air pressure by arranging a series of short water tubes so as to concentrate the combined weight of their water against air confined in a suitable chamber. Allowing, for example, that he had ten communicating water tubes, each holding a cubic foot or 62 lbs. of water, he might, by turning a faucet, fill the tubes from the hydrant, and concentrate 620 lbs. weight on the confined air, which, if conducted to a gage, would indicate 620 lbs. pressure; this air might drive a small wheel from 9:08 P. M. to 9:09 P. M.; it would moreover be a cold vapor, without smell nor taste; it would blow out a candle, but not burn; there would be no noise except that of running water; there would be no residuum save air and water; no heat, electricity, or chemical action would be involved.

A curious arrangement of water and air tubes, in which, by turning faucets, the water weights are concentrated, producing pressure, was illustrated and described in the SCIENTIFIC AMERICAN of April 4, 1868, page 212. It was patented by James R. Cole, of Tennessee, December 10, 1867, as a water elevator. It might be bad for Keely, if he should prove to be an infringer of this patent.

There is also a patented arrangement of mercurial tubes for concentrating the weight of mercury and air columns in an analagous manner. We allude to Quinn's patent steam gage, 1866. It is possible that Professor Rand, Professor Haswell, Chief Engineer Rutherford, U. S. N. Chief Engineer Wood, U. S. N., and other advocates of the Keely motor, are not acquainted with these devices.

One of the strangest developments connected with the Keely motor is the implicit faith which many gentlemen, in this community, of tried experience and business capability, have given to the enterprise. They have yielded not only faith but their money. We can account for this only by supposing that they mistake mere *pressure* for motive power. But mere pressure is not motive power, it is simply a resultant of motive power. A very slight motive power, if sufficiently long continued and properly applied, may produce the greatest pressure. A weight of only a single pound, hung upon the extremity of a suitable lever, is sufficient to produce a pressure, at the opposite end of the lever, of 10,000 lbs., or more, to the square inch. To persons not familiar with the laws of mechanics (and this, we think, is probably the situation of most of the Keely investors), the exhibition of a gage, showing 10,000 lbs. pressure, might readily be regarded as proof positive of an enormous power behind the gage; whereas the actual power, concealed from view, might be only a weight of one pound.

In cases of this kind, when a body is lifted or a pressure produced, the inquirer should take pains to ascertain what the extent of the original moving power or weight is. If this precaution be taken, the falsity of motors like Keely's may be at once detected. In the example of Keely, the certificate of Collier shows that a hydrant force of 26¼ lbs. to the inch is always required to run the machine. This force, if applied to a common wheel or engine, would produce a considerable amount of constant mechanical power. But the moving force is nearly all wasted in Keely's device, for he is only able to drive a toy engine for a minute or two at a time. This does not look much like driving a train of cars from Philadelphia to New York, or crossing the ocean without the consumption of coal.

THE BASTIE PATENT GLASS.

We publish on another page an account of some recent experiments with this novel material, together with the inventor's account of the process as contained in his patent, from which we also give a drawing of one of his furnaces. The apparatus consists of a chamber for heating the glass very hot; and while in this condition, it is quickly plunged into a hot tempering bath of oil, wax, resin, tar, or pitch. This seems to be a simple and easily executed process, which if practically effectual, ought not to increase the expense of the glass but very little. The owners of the patent claim that 5 per cent above the ordinary cost of glass will cover the expenses of the improvement. On this point, we shall hope, ere long, to have further information.

It would appear that Professor Egleston, of Columbia College in this city, who has been employed by the patentee to show up the merits of the new glass in public, and who has been very successful in this part of the matter, has not, during the two months that he has been engaged, made any personal experiments with the simple process itself. All that he has done is to exhibit glass, brought from France, furnished by the patentee, testing them with samples of common glass picked up in the shops here. Whether the patent glass tried by Professor Egleston was in part strengthened, as glass sometimes is, by ingredients and treatment used in its manufacture, or consisted only of common glass, subsequently treated by the new process alone, the experimentor was unable to say. The statements of the patentee in respect to the economy and practicability of improving common glass, on a commercial scale, have yet to be demonstrated.

The patentee's agents in this country deny that the alleged invention of Mr. Pieper, mentioned in an item in our paper of June 12, had the effect to arrest the negotiations for the sale of Bastie's patent in Germany. On the contrary, they inform us that the sale of Bastie's process to the German glass makers was concluded on May 9th.

A NEW FORM OF PATENT LITIGATION.

In a recent article, commenting upon the relative number of patent litigations in England, where they grant a patent to every applicant, without official examination, and in this country, where we reject over five thousand applicants for patents yearly, and employ a standing force of five hundred officials to examine, or assist the examiners, we showed that in England, out of thirty thousand law cases yearly, only eight were patent litigations. We further intimated that a very large amount of patent litigation, of a character wholly unknown in England, was carried on here, and was a necessary adjunct to our present system. We allude to the litigations before the Patent Office, such as re-examinations, appeals to the Board of Examiners, interferences, appeals to the Commissioner in person, appeals from the Commissioner to the District Court, etc.

A new wrinkle in this sort of litigations, and a new direction for appeals, has lately appeared, which seems to indicate that the time has come when Congress should, by the adoption of wise legislation, put an end to this whole business of Patent Office quarreling.

Among other duties of the Secretary of the Interior, he is required to sign all patents after they are prepared, passed, and approved by the Commissioner of Patents.

On a recent occasion, when the Commissioner, after a long and full argument of the matter before him, had decided the case of Prescott *vs.* Edison, in favor of Prescott, ordering a patent to issue in the joint names, the defendant applied to the Secretary of the Interior and petitioned him not to sign or issue the patent. The subject of controversy was a telegraph apparatus. The Secretary granted the request, and decided to hear the argument. This was on the 20th of March, 1875, and no decision has been as yet reached. Meantime the contending parties have marshalled their legal forces before the Secretary, consisting of six of our most able and expensive lawyers, have argued and re-argued, and have filed scores of pages of printed fol-de-rol upon the subject, for the Secretary's consideration. If one dissatisfied applicant may thus occupy the Secretary's time, all applicants ought to have the same privilege. If the Secretary may nullify one legitimate decision of the Commissioner of Patents, he may nullify all.

The money costs of this one litigation before the Commissioner and the Secretary are stated to have reached, at the present time, over fifty thousand dollars. Jay Gould, it is said, is an interested party on the one side, and the Western Union Telegraph Company on the other. Jay is doing all he can to injure the Western Union Company by running down its stock and inflating the stock of a rival company, of which he owns the control.

This case is a little more prominent and has been more expensive than many that are litigated at the Patent Office. But it is notorious that a very large proportion of the time of the Patent Office officials is devoted, in one way or another, to these litigations, which, in the aggregate, involve great expense, but would become obsolete, as they are in England, if we were to adopt the English system of permitting the applicant to make his own examination if he so desires, but confining the duty of the Patent Office to the prompt issue of a patent to every applicant whose papers are presented in proper form.

It is alleged by the advocates of the American system that, if our official examinations and Patent Office wrangles were abolished, then the courts would be overwhelmed with patent litigations. But the experience of other nations shows that no such result would ensue. In England, as before stated, they have only eight patent litigations before the courts per annum; while in France, Belgium, and other countries, where no official examination and no Patent Office litigations take place, the number of patent cases brought before the courts is very small.

COMMERCIAL SPONGES.

It is sad to consider how much we lose in every walk of life through lack of a little observation. There are few stonemasons who, like Hugh Miller, are led to become noted geologists by noting and studying the beautiful fossils in the stones they chisel. A butcher may cut up beeves and porkers by the hundreds, or a fisherman spend a long life on the shore, without noticing the most obvious points of interest and instruction in the physical structure of his victims; and only when a naturalist calls his attention to the beautiful adaptations, which have before passed unnoticed, will he have his interest profoundly excited, which may ever after give him a new motive and zest in his work. The most of us will use sponges in an indefinite variety of ways, all our lives, without even once stopping to think how they were formed; whether they are plants, animals, or neither, or what are their history and habits.

The ordinary sponges of commerce, which we use so extensively, have but little resemblance to animals or plants, and belong to a class of organic bodies concerning the affinities and proper classification of which there has been much doubt. And this doubt has led naturalists to apply the question-begging appellation of zoöphytes, or plant animals, to these and similar organisms. They are now generally considered members of the animal kingdom. The parts we use are the mere skeletons, composed of a kind of horny substance. The animal itself is a soft, jelly-like, amorphous mass, which fills up all the intercellular spaces, lines the tubular canals, and forms a jet black or sometimes a dark purplish skin on the outside, covering the whole skeleton, excepting the larger openings, which project beyond its general surface. In this form the sponge exists in the water, and, out of its native element, is hard and glistening on the outside, and very strongly resembles a piece of liver.

The mode of life in this low order of existence, which is regarded as a compound animal, is very simple, and we would be disposed to call it extremely uneventful. Sponges grow, by a kind of lichen-like root, to some foreign object on the sea floor, and never move from their position; they have no power to contract or expand their body as a whole, or any part of it: and they are quite insensible to every sort of irritation. Their only power seems to be that of absorbing large quantities of water, which they again yield up on pressure without any injury to their texture. The water, which permeates their whole mass, and maintains a constant circulation through it, keeps the skeleton soft and elastic, brings to the animals the air and food on which they subsist, and carries away waste matter from the body.

On examination of a sponge skeleton, it will be seen that the porous surface is finer and of closer texture than the interior, that there are large apertures scattered indiscriminately over the surface, and between these are much finer openings, covering the complete outer surface of the sponge. The latter are called pores, and serve as channels of entrance to the water, which, after circulating through the body by means of the tortuous and branching canals which make up its inner skeleton, passes out at the larger openings. These chimney-like apertures are called *oscula*, but the name is a misnomer, for they are, in reality, vents. They vary in number in the different species, and are sometimes reduced to a single one. By what force the water is made to circulate through the sponge mass is not definitely known. Some have attributed it to vibratile ciliæ, planted within the porous canals which, by their motion, create a circulation in the water. Others ascribe it to the principle of osmosis, by which membranes of all animals, and many other porous substances transmit fluids and gases according to their density and power to act on the transmitting substance.

When obtained for commercial purposes, the animal matter can be removed by soaking it a long time in salt water and then—after it is rotted by this means—rinsing it out. This leaves the horny skeletons just as we use them.

The finest sponges of commerce come from the Mediterranean sea. Our best bath sponges are doubtless from this locality, but the coarser sponges we see most commonly are largely from the coast of Florida or the Bahama Islands. Sponges are found abundantly in tropical waters generally, and perhaps nowhere more abundant than in the seas of the Australian islands. They gradually decrease in numbers towards the colder latitudes till they become entirely extinct. They vary much in shape. Some are beautifully shaped like a vase, others are semi-cylindrical, others nearly flat like an open fan; some are branched like the opened fingers of a hand, and are called glove sponges, and in others these branches seem to be reduced to only one, which is shaped somewhat like a club. These different shapes may belong to one species, and the differences are due, so far as known, to the fact that the first mentioned are found in deep water, and they grade, in the order described, up to the last, which grow in much shallower water.

Sponges are not confined to recent seas, though the commercial ones are not known to have existed earlier, because the keratose matter furnishes hardly favorable conditions for petrifaction. In the oölite and chalk formations, sponges containing flinty spicules were very abundant; and in most of the earlier formations, large sponges containing calcareous spicules abounded. These very closely resemble corals, and have been mistaken for them by some of our best geologists. The spiculæ or needle-shaped particles, which are often microscopic in size, are not thrown in without order, but are arranged to support the skeleton. The horny sponges do not secrete or deposit spicules, but these are sometimes found within the skeleton in broken and disordered form, which shows they were taken in from without.

There is an elastic sponge, as it is called, that is somewhat largely used now as a substitute for curled hair in stuffing beds, cushions, car seats, etc., but this is an entirely different thing from the sponge of commerce. Before it was used for this purpose, it was a worthless sea grass, growing abundantly among corals in rather shallow water.

Terrible Earthquake in South America.

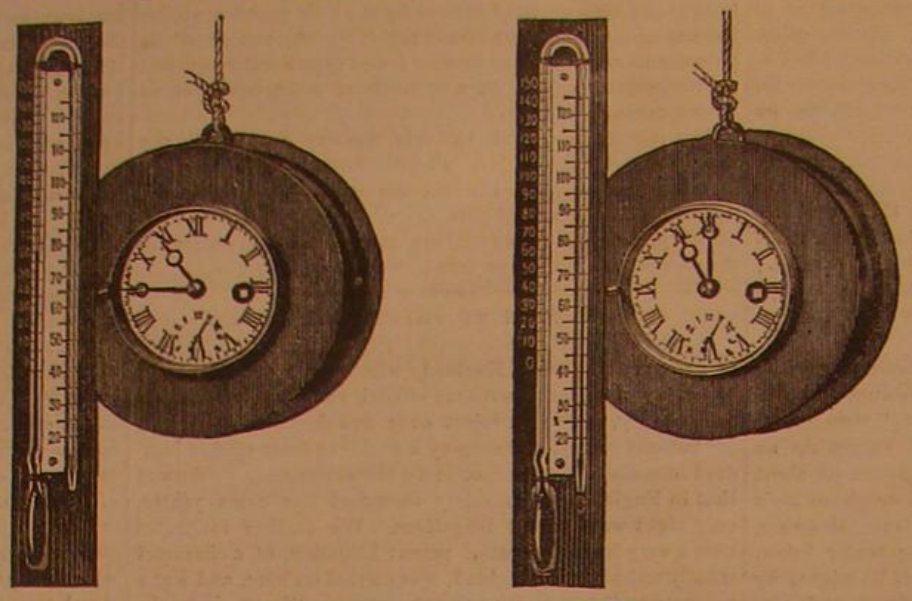
It is reported that an appalling earthquake has lately taken place on the Venezuelan frontier of New Grenada. The destruction was severest in the Valley of Cucuta, in the province of Pamplona, latitude 7° 30′ N., longitude 72° 10′ W. It is said that 16,000 lives are lost by the calamity.

A PUTTY of starch and chloride of zinc hardens quickly, and lasts, as a stopper of holes in metals, for months.

A NEW REGISTERING THERMOMETER.

This new apparatus, represented in our engraving, is designed to measure and register the temperature of ocean depths, of deep borings, or other inaccessible places, or of any locality at any desired time. It is composed of a mercurial thermometer, curved in inverted V shape, and fixed on a scale graduated to Fahrenheit degrees. The cylindrical tube which contains the mercury is slightly bent at the zero point. The instrument is connected with a clock, on the lower portion of the dial of which is a supplementary hand pointing to the numbers 1 to 12. By placing this pointer at any determined number, when that hour is reached the clockwork causes the thermometer to revolve one revolution. The effect of this is to break the mercurial column at the bent portion at 0°, and turn it into the other leg of the tube, where it remains, its hight indicating the temperature at the time for which the dial was previously set.

This will be more clearly understood from the illustration. The figure on the left shows the apparatus set to indicate the temperature at 11 o'clock, the time of setting being 10:45. On the arrival of the hour, the thermometer turns as shown by the arrows in the second figure; and the mercury, passing out into the other leg, remains at the point it then marked on the scale.



REGISTERING THERMOMETER.

THE BASTIE TOUGHENED GLASS.

We recently witnessed a number of interesting experiments upon the Bastie toughened or tempered glass, exhibited by Professor Thomas Egleston, of the School of Mines of Columbia College, in the presence of an audience composed mainly of the glass merchants of this city. Professor Egleston has been investigating the properties of the new material for two months past; but his experiments, though tending to show the remarkable strength of the glass, have given him no information as to the correctness of the process by which the article is prepared. The mechanical apparatus alleged to be used in the process is given in the annexed engraving from the patent drawings.

We summarize Professor Egleston's experiments briefly as follows:

(1). Impact of elongated rounded end steel balls entirely inelastic, with plates secured horizontally: (*a*) Weight of ball, 2 oz. Best English plate glass, $\frac{1}{8}$ inch thick, broke at fall from hight of 15 inches. Bastie glass of equal thickness broke at fall from 4 feet 6 inches. (*b*) Four oz. ball. Ordinary glass broke at fall from hight of 1 foot. Bastie glass broke at fall from hight of 3 feet 6 inches. (*c*) One lb. ball. Ordinary glass broke at fall from hight of 13 inches. Bastie glass broke at fall from hight of 3 feet. The thicknesses of the glass varied in these several experiments, but in each one the Bastie and the common glass were identical. (*d*) Plate glass inclined at about 45°; a low quality glass, such as used in conservatories, was employed. Two oz. ball. Unprepared glass broke at fall of 4 feet. Bastie glass, after withstanding 36 shocks at one point, ruptured with a 9 feet fall. (*e*) Eight oz. ball. Common glass, $\frac{1}{4}$ inch thick, broke with a fall of 3 feet 9 inches. Bastie glass, $\frac{1}{4}$ inch thick, broke with a fall of 7 feet.

(2). Weight applied at end of a strip, 3 inches wide and $\frac{3}{8}$ inch thick, secured in a vise. Common glass broke at 16½ lbs. Bastie glass broke at 46 lbs. Power was applied at a distance of 6 inches from vise.

(3). Weight applied at middle. This experiment failed owing to lack of necessary weights. A strip of Bastie glass, same size as the foregoing, however, withstood 180 lbs. and gave no signs of rupture.

(4) Heat. Lamp chimneys prepared were heated over Bunsen burners to very high temperatures without rupture. Plates and saucers were similarly treated. A plate of prepared glass, about 1 foot square, was subjected to a blowpipe flame of 1,500° Fah. for about 8 minutes. Ordinary glass broke in 7 seconds. The outer edges of the Bastie plate, for a distance of an inch or more, were cool. The spot touched by the flame became barely red hot. On cooling, the plate cracked just at the heated point, and five minutes later it disaggregated throughout its entire area.

Water suddenly thrown on a heated prepared plate caused the latter to break. It appears that, when the glass is cooled quickly at the rate of 300° or 400° Fah. at a time, it breaks; but when the operation is conducted slowly, at intervals of 50°, rupture does not occur.

Referring to experiment 1: The force required to break the glass is best expressed in foot lbs. In better tests than those quoted, Professor Egleston found that ordinary glass broke at 1·6 foot lbs. Bastie glass bore 3 foot lbs., nearly double. Using a 1 lb. knife-edge weight, ¼ inch Bastie glass broke at 17 foot lbs. From experiment *d*, it will be noted that constant hammering on one spot is without effect. With reference to experiment 2, according to Professor Egleston, the glass has supported as high as 60 lbs. Experiment 3 has been conducted with a knife-edge bearing on the glass, when as high as 200 lbs. has been applied. A remarkable feature of the glass is its rupture, which is a general disaggregation of the entire piece. As the weight falls, a metallic resonance is heard; but on breaking, there is a dull crush, utterly unlike the sound caused by fracturing common glass. The rupture takes place everywhere apparently, in perpendicular and horizontal planes, a cleavage, in fact, very much resembling that of trap rock. The fragments, moreover, are destitute of sharp edges. The hand may be plunged in a vessel full of them, or they may be rubbed between the palms, with impunity.

It is claimed that there is no difficulty in polishing the prepared glass, a fact evidenced by a number of watch crystals and other articles exhibited. It may be etched with hydrofluoric acid or engraved with the sand blast, without becoming impaired in point of strength. It cannot be cut with the diamond, as the removal of a part of a piece determines the immediate rupture of the whole; so that window panes and like articles will have to be prepared in the first instance of the proper size. It may be used for photographic negatives; and finally it has, it is said, withstood for several days the action of a cupel furnace at white heat. Window panes of this glass, it is alleged, will be almost as much protection to buildings as iron shutters; since they would shut off the oxygen until the window frames became entirely consumed. The cost of the process is stated to be about 5 per cent additional to that of ordinary glass, so the holders of the patent affirm.

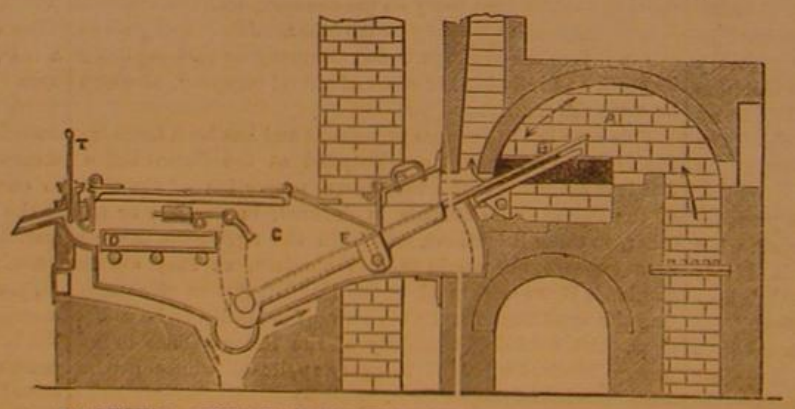
The following is from the specification of the patent as granted in this country December 15, 1874.

"To all whom it may concern:

Be it known that I, François Barthelemy Alfred Boyer de la Bastie, of Paris, France, have invented a new process of tempering flat and shaped glass, and furnaces and machinery to be employed therefor, of which the following is a specification:

This invention relates to a process of tempering glass and glass articles so as to render them less fragile, and to the construction and arrangement of furnaces for effecting the said process.

As the fragility of glass results from the weakness of the cohesion of its molecules, it may be expected that, by forcing the molecules closer together, and rendering the mass more compact, the strength and solidity of the material should be increased.



BASTIE'S APPARATUS FOR TOUGHENING GLASS.

I have found that this cannot be effected by compression, even when applied to the material in a fluid or soft condition. I have, therefore, applied to glass a system of tempering, such as is usually applied to steel, and I will now describe the process and apparatus for this purpose.

Fused glass dropped into water becomes greatly contracted, but, being shapeless, only objects of curiosity can be produced in this way. The sudden cooling in the water puts the glass into a state of unstable equilibrium in its constitution, so that the least shock causes it to break, as in the case of Prince Rupert's drops.

My object is to invert the result, to diminish, or even to remove, the extreme fragility of glass, by tempering it by immersion in a liquid. In attaining this object two essential conditions have to be determined: First, the point at which glass can be tempered without being put out of shape. I have found this to be when it is just at the heat where softness or malleability begins, the molecules being then capable of closing suddenly together, condensing the material, when it is plunged in a liquid at a considerably lower temperature.

Also, glass, when it is thin, may be tempered at red heat, even before becoming soft. Secondly the liquid to be employed for the immersion of the glass is to be such as can be heated much higher than water without boiling. For this purpose I find oils and grease, wax, resin, and tar or pitch suitable. Having settled these conditions, I have devised the process or practical method of operating, and suitable furnaces, which will hereafter be described.

In carrying out the process, it is necessary that the glass to be tempered should be raised to a very high temperature. The hotter it is, the less is the risk of breaking the glass, and the greater is the shrinkage or condensation. Hence the advantage, and often the necessity, of heating the glass to the point of softening, which is attended by the difficulties that glass in the soft condition gets readily out of shape, so that it must be plunged almost without touching it, and that, in plunging the hot glass into a heated combustible liquid, the latter is apt to take fire and cannot easily be extinguished, so that time and material are lost. These difficulties I have overcome by placing the tempering bath in immediate communication with the heating oven, and covering it, so as to prevent access of air. The oven being charged with the articles to be tempered, these are pushed or caused to slide into the adjoining bath without handling them, and the liquid of the bath, having no supply of external air, is not liable to inflame. In order that the shape of the tempered articles may not be affected, particularly for flat glass, the floor of the oven is made to cant, so that, when the glass is heated on it, it is turned to a sloping position, and the glass slides into the bath along a surface therein arranged at the same slope as that of the oven floor. Small articles may be heated on the edge of the bath and immersed by a slight push. The clearness of the glass may be affected by the dust of the furnace flame, which is apt to settle on glass and chill its surface. I avoid this by heating the glass in a muffle, to which the flame has no access, being applied externally. Moreover, the shock of the fall of glass into the bath is prevented by fixing therein a sheet of wire gauze or asbestos fabric, or providing a bed of sand or other like material for the glass to fall on."

The patent drawings contain three figures, one of which we give, and explain briefly as follows:

The sheets of glass are placed in a preparatory oven, and thence, one by one, pushed into the oven, A, by an opening, shown in black. On reaching the requisite temperature, the glass is carried upon table, B, which is normally horizontal though shown in a position for sliding the sheet off. C is the bath of oil, heated by a separate furnace, and so covered as not to be affected by heated gases proceeding from the furnace. A rocking table, E, is supported on a frame moved by a lever and shaft. This is placed in the position shown, and the table, B, is tilted by means of a lever, when the plate of glass slides off on to table, E, and so into the bath. Table, B, is then returned to its horizontal position, and another plate pushed upon it The sheet in the bath is removed as follows: The table, E, and rocking frame are raised; and by suitable mechanism, the table is separated from the rocking frame to such an extent that the buffer of wire gauze on the frame and end of the latter are brought below the level of the table, which is held up by a latch. The plate is then withdrawn by a rake into the chamber, D, whence it is removed with others, when the chamber, being full, is lifted out of the bath.

The claims made by the patentee are as follows:

1. "The process herein described for tempering glass consisting in the immersion of the hot glass in a bath of oils, grease, wax, or resinous or bituminous substances, the boiling temperature of which is above the boiling point of water.

2. In combination with the oven for heating and the bath for plunging, communicating with each other, the rocking table, *e*, substantially as and for the purpose specified.

3. In combination with the heating oven and plunging bath, the tables, *e* and 19, substantially as and for the purpose specified.

4. In combination with the heating oven and plunging-bath, the rocking table, *e*, and the receiver, *g*, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

F. B. A. ROYER DE LA BASTIE."

A Life-Preserving Pillow.

A new life-preserving device, which seems to be both simple and practical, has recently been introduced in the Glasgow and Montreal line of emigration steamers. It consists of two pillows of prepared cork wood, with an upper padding of hair covered with mattress tick. The pillows are attached to each other in such a manner that, when about to be used, they can be placed one on the back and the other on the chest and tied, the head and shoulders thus being kept above water. The device has been tested and has been found capable of supporting the heaviest men breast high. The pillows are utilized as articles of bedding, so that they are always at hand in case of danger.

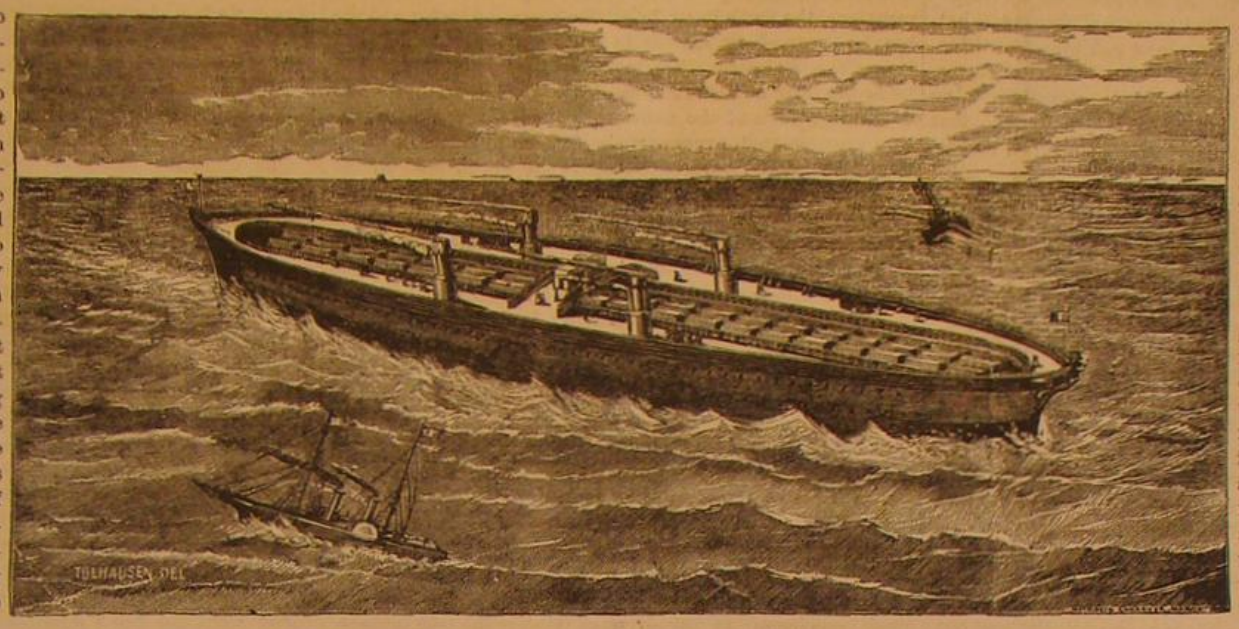
SWEET OIL rubbed on the skin is said to be a sure antidote for ivy poison.

A GIGANTIC FERRY SYSTEM.

Mr. Evan Leigh is another inventor who comes forward to solve the problem of making the passage from England to France rapid and comfortable. He proposes to build vessels large enough to carry three passenger and one freight trains each, as shown in our Fig. 2, so that passengers need not leave their seats at the port of embarkation or of arrival. To enable trains to go on board such vessels, a pontoon of great size would be necessary, and the descent to it would be necessarily very gradual, lest the train acquire sufficient momentum to work damage or destruction to the ship.

The steamer is proposed to be 500 feet long and 90 feet wide amidships, as it is hoped that this great length will prevent pitching, while it is also expected that the corresponding breadth of beam will overcome the tendency to roll, which, in the narrow-sided vessels, presents an almost insuperable difficulty to the performance of a direct passage. As will be seen from Fig. 2, showing a transverse section of the boat, she is almost flat-bottomed, and her dimensions have been so calculated that she will only draw six feet of water when loaded. The chief inconvenience which such a boat might suffer in a gale is that the force of the wind, falling upon the immense surface presented by the broadside (as the tops of her bulwarks stand about 25 feet out of the sea), might, to some extent, interfere with the steering. To render the steering of the vessel all the more efficient under this difficulty, Mr. Leigh follows one of his own patents by fixing a rudder at each end of the keel, so connecting them together that one cannot move without the other moving in the opposite direction. Each rudder is also provided with a valve to diminish its area when required, which valves are so arranged that when one is open the other is shut, in order to balance the rudders to a nicety. Moreover, Mr. Leigh proposes to fit his boat with a pair of engines of 5,000 horse power capacity; each of these engines will drive the paddles independently of the other, so as to use the latter for steering the vessel independently of the rudder, by giving out more steam to one pair than the other, and so on. The boat is to carry a steering house at each end of the upper promenade. These arrangements leave the steersman the option of steering by steam or by helm, or by both together. The steering houses contain each three cabins, one for the captain, another for the steersman, and the third for the mate. The boat will not carry masts, spars, or riggings of any kind, in order to prevent top heaviness, and her capacity is measured at 8,000 tuns. Mr. Leigh, instead of employing the usual paddle wheel, introduces a paddle of his own contrivance, in the hope of saving power; the paddle wheels are 18 feet broad and 24 feet in diameter, with floats 21 inches deep, which are fastened to a cast iron cylindrical shell forming the wheel. The boat is to be propelled by inside paddles, so that the sides may be free from external projections. Four sets of rails are laid on the lower boat deck; three of these sets of rails are intended to carry the goods traffic, while the fourth is set apart for the passenger train, which alone takes its locomotive on board. The platform is raised on each side of the outer rails to a convenient hight for getting into the carriages; and sets of saloons, waiting, and refreshment rooms, affording accommodation for 1,000 persons, are fitted, on one side in the English and on the other in the French styles. Referring to Fig. 1, which represents the ferry boat at sea, the upper decks are seen connected by galleries at each end, thus forming a promenade of 350 yards length round the vessel; and underneath the first and second class saloons, those of the third class are fitted up.

When the boat enters the dock, the sliding doors at each end of the vessel are opened, and, by a self-acting process, the lines of the rails on the vessel become at once closely connected with the corresponding set on the inclined bridge; and while the steamer is awaiting the arrival of the passenger train, goods trains are run on board. As soon as the mail steams on to the boat, the gates are closed, the brakes applied to all the cars, and the vessel sails out of the dock. Arrived at her destination, and as soon as a similar connection with the main lines has been effected, the mail train steams out at the other end of the vessel under the top promenade of the ferry boat on to the existing lines of railway.



LEIGH'S CHANNEL FERRY. THE BOAT AT SEA.—Fig. 1.

THE MOTIVE FORCE OF LIGHT.

In our number of the SCIENTIFIC AMERICAN for June 19, we gave engravings of the remarkable rotary instruments of Dr. Crookes, which are put in operation by the mechanical power of light, given off by a candle, lamp, the sun, or other source of illumination. The following summary and comments upon the marvelous discovery of Dr. Crookes we find in a recent number of the New York *Times*:

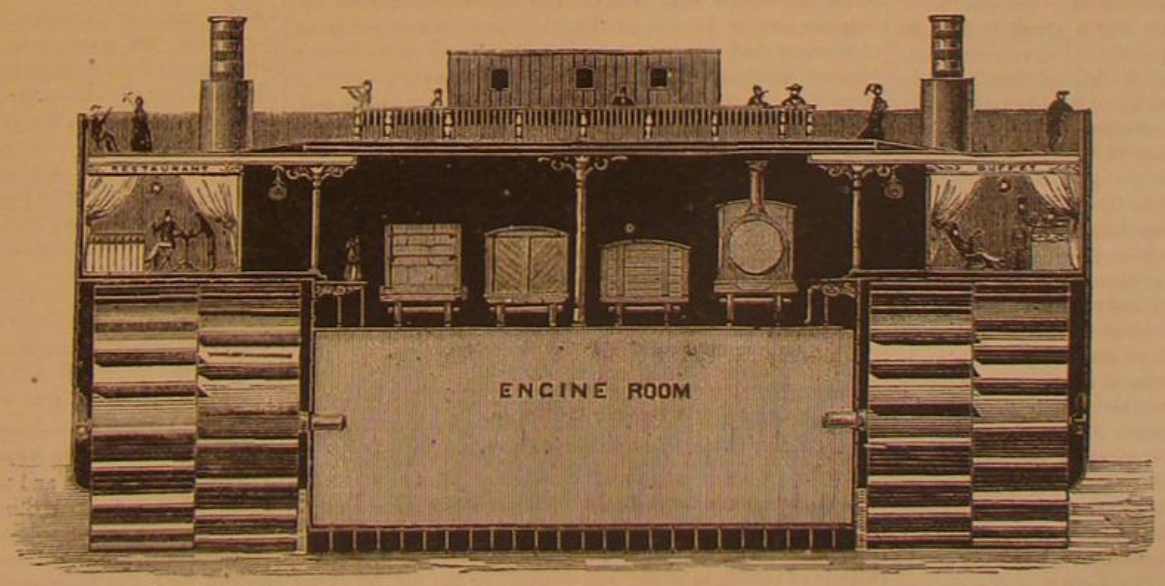
At a meeting of the Royal Society of Great Britain a few weeks ago, Mr. William Crookes, F.R.S., who had previously communicated some interesting facts on this subject, read a paper which may give rise to much more important discoveries, perhaps, than any contribution to celestial mechanics since the law of gravitation was demonstrated by Newton. It has always been assumed, and Dr. Balfour Stewart and other authorities have affirmed, that light, apart from heat, has no mechanical force whatever. This old theory is overthrown by Mr. Crookes, who for some years past has been making experiments, and has at last constructed an ingenious apparatus, by which he shows the power of luminous rays to drive round and round a little vane when the heat rays are excluded, being thoroughly sifted out by means of a screen of alum. We abridge from the London *Telegraph* the following account of one of the experiments, and regret that our space does not allow a more extended notice of the phenomena submitted to examination before the Royal Society:

With an air pump Mr. Crookes first exhausts a tube with a bulb at its end, and in the bulb he mounts, upon a delicate pivot, a little vane of glass or straw. This vane is made in the form of the letter X, and on each of its four arms is mounted a disk of pith, blackened on one side. The use of this blackened surface is ingenious, as will be presently seen. As soon as the machine is ready, it is exposed to the sunshine, when its disks immediately become endued, as it were, with life. They revolve around their common axis just as the planets revolve about the sun in the orrery. What is the motive force in this beautiful experiment? It is not heat. For, as before observed, the heat rays can be sifted out by the alum screen without stopping the rotation of the machine. The atmosphere and its changes have nothing to do with producing the motion. Professor Osborne Reynolds some time ago suggested that the disks revolved because there was a a latent moisture in them which, being evaporated in the experiment, gave a resilient impulse to the little orrery. To refute this theory, and, at the same time, to show that the sole motive force engaged in driving the orrery was the luminous rays of the sun, Mr. Crookes exhibited a machine made wholly of platinum which had been heated to redness while under continuous and absolute exhaustion. The disks being made of platinum, instead of pith as before, revolved as obediently as the disks of pith; inasmuch as they could contain no appreciable amount of latent moisture, the theory of Professor Reynolds was, of course, exploded. The final result was that light is now acknowledged for the first time as one of the mechanical forces, and such eminent men as Professors Stokes and Huxley, Dr. Carpenter, Mr. Norman Lockyer, and others, agree that the demonstration was perfect.

Another point of importance is that the force which light delivers is not like the force of gravitation, but differs from it in several essential respects. One of these is that, while gravitation attracts and gives a centripetal impulse, the force of light is centrifugal, and repels or pushes away the objects on which it is delivered. Thus the black side of the disk is pushed from the sun, and the orrery of Mr. Crookes is kept in constant rotation so long as the light waves dash themselves against the black surface and drive it before them. Shut out the light by covering the machine with a hat, and the rotation instantly stops, to be renewed again the moment the obstruction is taken away and the light readmitted. A green or blue screen diminishes the force of the rotation. Yellow or red glass quickens it into a much more lively activity. If a cloud passes over the face of the sun while this little orrery is working at full speed, its movements are checked and somewhat slower; but the moment the sun is visible again the mechanism responds with alacrity, and its revolutions are as swift as ever.

Mr. Crookes is well known as the man to whom Science owes the discovery of the metal thallium, and the complete establishment of its atomic weight. He has also invented the radiometer. But the little orrery we have described above is a much more remarkable contrivance. It contains the promise of further discoveries. It will perhaps raise its inventor to the front rank among the explorers of physical science. In this simple little machine, one of the most occult forces of Nature is for the first time revealed to the eye of man. "In it," says the authority from which the foregoing facts are chiefly taken, "we see the subtlest of imponderables set like a willing slave to turn a wheel; while tiny as that wheel is in these experiments, we must remember that light pervades it, flashing perpetually from countless centers like our own sun, across the infinite ether; and it may be fairly imagined that the interplanetary ether resembles the vacuum in the bulb, so that the condition of these revolving disks is, perhaps, much the same as that of the planets in space. Strange, indeed, are the thoughts which must be started by this revelation that light, pouring upon bodies freed from atmospheric friction, is in itself an active and mighty force. That so remarkable a discovery solves at once the mystery of the comet's tail—which is always seen to be driven violently away from its natural line upon approaching the sun—is, we believe, affirmed by more than one high astronomical authority. But may it not also have something to do with the axial motion of the planets? May it not have something to do with the maintenance of centrifugal force, balancing, as it were, that of gravitation? Can it be for nothing in the celestial universe that this potency and stress of light sweeps from center to circumference of each system, exercising a power which, in its totality, must be something prodigious? It seems not impossible that our mathematicians, calculating from the small surface of these disks the motive force of sunlight, may soon tell us pretty accurately what is the aggregate power which the luminous rays of the sun command; and nothing of this, by the law of forces, can be really wasted. 'Let there be light, and there was light' seems to derive a new majesty of meaning from the discovery which shows us this subtle something, no mere undulation nor 'mode of motion,' but a living force as well as the illumination of all life. It does appear as if a marvelous expansion of knowledge is about to open in these delicate experiments."

But there are no limits to the ingenious conjectures which may be advanced. To pursue them would be unprofitable in the present state of our knowledge. What is certain is that a great cosmic force has been discovered and submitted to experiment and investigation. But how long this force will be before it finds its Kepler and its Newton, the future will show. "Why in the ranks of our American astronomers should we not look for the expected teacher to rise up?" Sir William Herschel, in his "Lectures on Astronomy," gives



LEIGH'S CHANNEL FERRY. MIDSHIP SECTION.—Fig. 2.

some interesting calculations as to the enormous waste of the rays of light in the solar system. He concludes that "taking all the planets together, great and small, the light and heat they receive is only 1-227,000,000 part of the whole quantity thrown out by the sun. All the rest escapes into free space and is lost among the stars, or does there some other work that we know nothing about. Of the small fraction thus utilized in our system, the earth takes for its share only one tenth part, or less than 1-2,000,000,000 part of the whole." What is that "other work" to which Herschel refers? To this question the discovery of Mr. Crookes suggests an answer. For as Providence has created nothing in vain, so analogy would lead us to expect that the solar rays fulfil many useful purposes which, though long unknown to Science, will hereafter be discovered by the advancing knowledge of man. The present discovery, whatever else it may suggest, affords a new and beautiful illustration of the well known law of the conservation of forces, for it teaches us that the light which is incessantly pouring from the sun is perpetually converted into force, and that this force is utilized in the economy of the Universe, no part of it being wasted, or latent, or lost.

Correspondence.

The Sources of Electricity.

To the Editor of the Scientific American:

It is the general belief that the electricity of the atmosphere is generated by the friction of the air or action of the winds upon the earth's surface, also by the evaporation of moisture. Electricity is easily produced experimentally by either of these means. When we consider the immense surface of the earth and the enormous extent over which these effects are constantly being produced, we have an explanation of the immense reservoir of electricity that exists in the region of rarefied air that encircles the globe. This reservoir is continually being supplied and replenished, mainly by these two causes, evaporation of moisture and friction of the air upon the earth's surface. There is also a continuous outlet to this immense reservoir in the way of silent discharge to the earth, and by atmospheric discharge usually known as lightning. The above figure is given to represent the two great conductors, E being the earth and R A the region of rarefied air that encircles the globe.



Whenever this outward conductor is brought sufficiently near the earth, direct discharges take place; or in other words, lightning occurs. Clouds are conductors, and the above engraving is designed to show how the conductor, which is composed of rarefied air and a cloud, is brought near to the earth. It is simply a conductor of two materials. Thunder clouds extend into the air higher than ordinary clouds. They extend into the region of highly rarefied air. When this occurs, accumulation of electricity into the cloud takes place. The electricity of this immense reservoir flows into the cloud because the cloud is that portion of the conductor which approaches nearest to the earth. S represents a thunder storm floating over the surface of the earth. While this cloud is in favorable condition of form and density, the electricity in this vast reservoir of rarefied air is flowing in the direction of the cloud. The cloud becomes charged, and lightning occurs. While positive electricity is flowing through rarefied air into the cloud, negative electricity is flowing in the surface of the earth in the same direction, and that portion of the earth directly beneath the cloud is charged with electricity of the negative or opposite degree.

It is the belief of the writer that earth currents, which so often show their annoying effects in telegraphy, are the mere counter currents of those that are continually flowing in the almost ethereal regions above, and these upper currents are in continual motion, seeking that portion of the conductor nearest the earth. The force and direction of these currents are as varying as those of the winds.

In the foregoing engraving, the form and relative position, as regards the earth, of this outside conductor is represented. Of course the only visible portion is the thunder cloud. Rarefied air is a conductor, but differing from other conductors, inasmuch as electricity flows through it slowly. In other conductors its speed is comparatively instantaneous. In a former article, this cloud has been compared to a porous standpipe which is filled with or containing water. Suppose we undertake to fill this standpipe. With a certain given supply or head, we can fill it to a certain hight. The hight of the pipe is indefinite, and it is desired to burst it. This can only be done by getting a sufficient hight of water in the pipe. The hight or head, we call accumulation. Now to get sufficient accumulation we must have a certain supply, called quantity. It must have a certain force, called tension, and it must not have too great a leakage. We can, under given conditions, fill this pipe only to a given hight; but to fill it higher, or to the point of bursting, we must increase the quantity—increase the head or decrease the leakage. If the supply is lessened, the quantity accumulated is diminished. If the supply is stopped, the pipe is discharged in time by leakage alone.

The conditions of the thunder cloud are somewhat analagous. It is always charged to some extent. It may not be sufficient to produce disruptive discharge or lightning. It may occur once, and it may occur over a thousand times. We have known such to happen as often as once per second for an hour or more. How very rapid, then, is this flow and accumulation, into the cloud, of electricity from the regions of rarefied air, which the cloud reaches on account of its great elevation!

The earth, with its outer conductor of rarefied air, resembles an immense Leyden jar of almost incomprehensible dimensions, the earth itself being the inner conductor and the heavier strata of air, directly in contact with the earth, serving as the dialectric. The outer conductor is continually being charged, and this source of electrical accumulation is due to the effects of the sun's rays upon the earth. Moisture is evaporated, every particle of which produces its quantity of electricity. When the winds are set in motion, the friction thereof produces its share. Wherever this dialectric is thinnest or interposes least resistance, there accumulation takes place in greater quantity. The dialectric is made thinner by the thunder cloud. Through the agency of the cloud, the two conductors are brought nearer together, and this accumulation finds vent or relief in disruptive charges called lightning. As soon as these thunder clouds assume favorable form or begin to develope themselves, their electricity gathers in greater quantity in this part of the outer conductor, also on the surface of the earth directly beneath.

The hight of thunder clouds is estimated as extending from seven to fifteen miles above the level of the sea.

The origin of thunderstorms is believed to be due to the expansion and rarefaction of the atmosphere. When heated by the sun's rays, it expands and forms a current upwards. The hot air coming in contact with the cooler air above, deposition takes place in form of fog or cloud, and, when sufficiently condensed, falling drops of rain are the consequence. The vapor or cloud of a thunderstorm, as viewed in the neighborhood of the mountains in Pennsylvania, appears to be far above the latter, that is, the lower portions of the cloud are far above the mountain tops. In Central Mexico, the lower portions of these clouds seem to rest or come in contact with the mountains. From observations, I am led to believe that the lower portions of a thunder cloud are from two to three miles above the level of the sea. The tops or higher portions, when observed from these mountains or from a hight of two and a half miles, appear as high as when seen from an ordinary or lower position. That the upper and lighter portions of thunder clouds extend very high is admitted by every intelligent observer. If it be true that the upper portions are about ten miles above the surface of the earth, they extend far into the regions of rarefied air, and thus afford means for the enormous accumulation of electricity with which they are charged.

We have every reason to believe that, in cases of frequent and heavy discharges, the cloud extends to a very great hight. One of the most violent storms ever witnessed by the writer passed over this city on the evening of July 4, 1872. It commenced about nine o'clock in the evening, the rain falling in torrents for about an hour, flooding streets and filling cellars with water. The electric discharges during the greater portion of this time occurred as often as once per second. It was reported that there were over a hundred buildings struck by lightning in this city, and it is more than probable there were as many more, not mentioned. No person was injured by lightning, so far as known, nor was there serious damage to property, except that resulting from the immense rainfall.

It is believed that this thunder cloud, in order that circumstances should favor so many and such violent electrical discharges, must have extended to a very great hight; and the large amount of moisture, in the shape of drops of rain between the cloud and the earth, assisted immensely by reducing the resistance.

DAVID BROOKS.

Philadelphia, Pa.

A Use for Bedbugs.

To the Editor of the Scientific American:

A correspondent in a recent number of your journal asks if there is any use for bedbugs. This reminds me of an accidental experiment I once made and had almost forgotten.

If nice fat bedbugs are placed in a saturated solution of nitrate of potash in water, and exposed to the air for several days in an open vessel, there will be no apparent change in the bugs; but there will be in the odor, for now it is as delicate and delicious as before it was rank and disgusting. No doubt the odorous principle could be easily separated, perhaps by digesting with alcohol or ether; and if neatly bottled and labeled, it would yield a large profit to practical perfumers.

The odor is unlike that of any other perfume I have ever smelt, and no one would suspect its low origin. This is one use for the *cimex;* there may be others.

C. K.

Cincinnati, Ohio.

VELOCIPEDE RACE.—The inter-university bicycle race, between Oxford and Cambridge, England, took place this year on the road from St. Albans to Oxford, a distance of fifty-two miles. It was won by Hon. Keith Falconer, of Cambridge, in four hours, nine minutes, and twenty-four seconds, with a fifty inch wheel machine. The average speed of the winner was 12½ miles per hour.

Action of Sunlight upon Precious Stones.

Dr. Schnauss has directed attention to the fact that certain minerals are quite sensitive to the action of light. To many of our readers this may seem quite surprising, although some cases of this kind have long been known to mineralogists. Strangely enough this property extends to the very hard minerals, and reaches its maximum in the very hardest of all minerals, the diamond. According to Dr. Fight, under certain circumstances the colored diamond is as sensitive to light as chloride of silver. The ancients knew that certain colored precious stones gradually grew paler in the sun light, and that this was very distinctly the case with the beautiful grass green chrysoprase. They said that, when worn for a long time set in a ring or pin, it finally lost a greater part of its beautiful color; and that this could be recovered by wrapping it up in a cloth soaked in wine and keeping it in a cellar. The latter is evidently one of the numerous phantasies of that age, but the former statement is a fact. Even the much harder, transparent, dark green emerald is also influenced by light in time, as the author found to his sorrow in the case of an emerald ring, which he had worn seven years.

The diamond, however, exhibits the most interesting phenomena under this influence. If colored diamonds are highly heated, the color disappears more or less completely, and in most cases permanently. Sometimes, the color is merely changed by ignition, and the original color may be restored by the influence of the sun's light. A diamond merchant named Martin exposed a diamond to a very high temperature, in order to destroy its brownish color, but the stone became of a permanent rose red. Coster treated another diamond in the same way, and that too turned rose red; but the most remarkable part was that this color was only permanent in the dark, and disappeared in 4 or 5 minutes if exposed to the sun's light, the stone acquiring a weak brown color. This change also took place in a room where the light was by no means bright. Another diamond, of a dirty yellow color, was ignited in a current of hydrogen in a porcelain tube and allowed to cool there. The color disappeared, but not the luster. If this specimen were exposed to dif fused light for 6 or 7 minutes, its original yellow color returned. The experiment was repeated in this way, the stone being heated in chlorine gas at as strong a heat as could be obtained by saturating the gas used with benzol vapor; it was farther heated at a lower temperature in a mercury bath, the diamond being wrapped in platinum foil. Each time the color disappeared and remained absent in the dark; but as soon as the stone was exposed for a few minutes to dif fused daylight, it regained its yellow color.

These phenomena are thought by Dr. Schnauss to be related to that of phosphorescence. In addition to the cases mentioned by him, we would recall the fact, usually stated in text books on mineralogy, that a variety of topaz from Brazil, when heated, assumes a pink or red hue resembling that of the Balas ruby.

S. H. Mead, Jr.

We regret exceedingly to note the death of Mr. Samuel H. Mead, Jr., of this city, a young inventor and scientist of much promise. After patenting a number of improvements in fire arms, Mr. Mead, some four years ago, devised a safety explosive bullet, which invention he subsequently combined with one of like character patented by General Meigs. The Mead-Meigs shell, as the combination is termed, is a breech-loading metallic cartridge with a hollow explosive bullet containing fine gunpowder. On penetrating flesh or on striking any hard substance, the bullet explodes, tearing the object to pieces. The missile has been used in hunting in the West, and it was Mr. Mead's design to use it in shooting sharks off Martha's Vineyard.

Mr. Mead was an excellent astronomer and optician, and was indirectly known to the readers of this journal through his articles on astronomical subjects, and through his replies to queries of that nature, which we frequently referred to him for opinion and answer. Just before his death, he was bringing to completion a novel device whereby the recoil of a Gatling gun could be utilized so that the reloading would be effected automatically after every discharge, so long as the cartridge receptacle was kept filled. The de ceased was but twenty-seven years of age.

Completion of the New Atlantic Telegraph Cable.

After many delays and much expenditure of money, the cable of the United States Direct Submarine Telegraph Company was completed on June 9. It will be remembered that the splendid new ship Faraday, built expressly for the service, left the Thames more than 12 months ago to lay the section between Rye Beach, N. H., and Nova Scotia. The company have leased two wires, belonging to the Franklin Telegraph Company, from Rye Beach to New York, and have opened an office at 16 Broad street in this city, where business will shortly be commenced.

The cable from Ireland to Nova Scotia was laid to within 200 miles of the latter country; but owing to unfavorable weather and the Faraday leaking badly, it had to be cut and the end attached to a buoy. Its construction was fully described on page 40 of our current volume. It is the fifth cable now in use in the Atlantic service, and its contract price ($6,055,000) will enable the company, it is claimed, to make a moderate tariff of charges, and reduce the rates throughout the country. A speed of twenty words per minute is anticipated.

TO CUT glass to any shape without a diamond, hold it quite level under water, and, with a pair of strong scissors, clip it away by small bits from the edges.

ELECTRO-METALLURGY.

The deposition of metals in the process of electrometallurgy is of two kinds, electroplating and electrotyping. When our object is to coat a metal with a thin metallic film of some other metal, the object to be coated is immersed in a solution of some salt of the metal to be deposited. A current is passed from the bath to the object, so as to decompose the salt and deposit the metallic portion of it on the object, which is a negative electrode.

ELECTROTYPING.

The art of copying seals, types, medals, etc., by the galvanic current in metal, more especially copper, is called electrotyping. An impression is first taken in gutta percha, wax, fusible metal, or other substance which takes, when heated, a sharp impression. While the impression is still soft, a wire is inserted into the side of it. It is then covered with plumbago to give it conductivity, a camel hair brush being used for this purpose. The wire is then attached to the zinc pole of a weakly charged Daniell's cell, and the copper plate is attached by a wire to the copper pole of the cell. When the impression and the copper plate are dipped into a strong solution of the sulphate of copper, they act as the — and + electrodes. The copper of the solution begins to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire; then it gradually creeps over the whole conducting surface. After a day or two, the impression is taken out; and the copper deposited on it, which has now formed a tolerably strong plate, can be easily removed by inserting the point of a knife between the impression and the edge of the plate. On the side of this plate, next the matrix, there is a perfect copy of the original seal.

ELECTROPLATING.

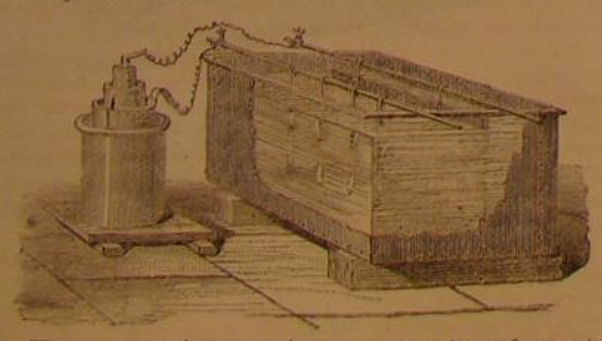
The very useful art of coating the baser metals with silver by the galvanic current is called electroplating. Theoretically it is very simple, but it requires very considerable experience and skill to make a successful application of it. Articles that are electroplated are generally made of brass, bronze, or copper. When tin, steel, iron, zinc, or lead is electroplated, it must be first electro-coppered, as silver does not adhere to the bare surfaces of these metals. Great care is taken in cleaning the articles previous to electroplating, for any surface impurity would spoil the success of the operation. They are first boiled in caustic potash, to remove dry adhering grease; they are then immersed in dilute nitric acid, to dissolve any rust or oxide that may be formed on the surface; and they are finally secured with fine sand. Before being put in the silvering bath, they are washed with nitrate of mercury, which leaves a thin film of mercury on them, and this acts as a cement between the article and the silver.

The bath wherein the electroplating takes place is a large trough of earthenware or other non-conducting substance. It contains a weak solution of cyanide of silver in cyanide of potassium (water 100 parts; cyanide of potassium, 10 parts; cyanide of silver, 1 part). A plate of silver forms the + electrode; and the articles to be plated, hung by pieces of wire to a metal rod lying across the trough, constitute the — electrode. When the plate is connected with the copper or + pole of a one or more celled galvanic battery, according to the strength required, and the rod is joined with the zinc or — pole, chemical decomposition immediately ensues in the bath, the silver of the cyanide begins to deposit itself on the suspended objects, and the cyanogen, liberated at the plate, dissolves it, reforming the cyanide of silver. According, then, as the solution is weakened by the loss of the metal going to form the electro coating, it is strengthened by the cyanide of silver formed at the plate. The thickness of the plating depends on the time of the immersion. The electric current thus acts as the carrier of the metal of the plate to the objects immersed. When the plated articles are taken from the bath, they appear dull and white; the dullness is first removed by a small circular brush of brass wire driven by a lathe, and the final polish is given by burnishing.

ELECTROGILDING.

The operation of electrogilding very closely resembles that of electroplating. The solutions are always alkaline, and usually consist of the cyanide or chloride of the metal, dissolved in an alkaline cyanide. To prepare the gold bath, *two ounces* of fine gold are dissolved in *aqua regia*; and the solution is evaporated till it has the consistence of syrup. Water is then added, together with two ounces of cyanide of potassium, and the mixture is boiled. The quantities named give about twelve gallons of solution.

The negative electrode consists of the article to be gilded. The positive electrode is a plate of fine gold, which constitutes a soluble electrode, and serves to keep the solution at a constant strength. In order that the gilding may be well done, the bath must be maintained, during the operation, at temperature of from 140° to 160° Fahrenheit.



The accompanying engraving represents a form of apparatus which is very frequently employed. The poles of the battery are connected with two metallic rods resting on the top of the cistern which contains the bath. The articles to be gilded are hung from the negative pole or rod. From the positive rod is hung a plate of gold, whose size should be proportional to the total surface of the articles which form the native electrode.

The same arrangement of the battery and the cistern for holding the bath is applicable for electrotyping and electroplating as well as electrogilding.

GENERAL DIRECTIONS.

The success or failure of the electrotype process depends very much on the preparation of the copper solution, and on the strength of the battery. A perfectly saturated solution is not so well adapted for the purpose as such a solution diluted with one fourth part of water. To prevent it from becoming too weak by the deposition of metallic copper, some crystals of the sulphate are added during the process. The strength of the battery, in relation to the strength of the solution, causes the metals to be deposited either as a black powder, in a crystalline form, or as a flexible plate. The metals are deposited as a black powder when the current of electricity is so strong that hydrogen is evolved from the negative plate in the decomposition cell. The crystalline state occurs when there is no evolution of gas, and no tendency thereto. The regular deposit takes place when the electric current is stronger in relation to the solution than in the last case, but is not sufficiently strong to cause the evolution of gas.

There are various methods of preparing the solution for electroplating and of dissolving the silver, but the cheapest and best is to dissolve the silver in a solution of cyanide of potassium, by the action of a voltaic battery. Dissolve 1½ ounces of cyanide of potassium in 1 gallon of water; place one of two flat porous vessels in this solution to within half an inch of the mouth, and fill them to the same hight with the solution; in these porous vessels, place small plates or sheets of copper, and connect them with a zinc terminal of a battery; in the large solution place a sheet or sheets of silver connected with the positive pole of the battery. This arrangement being made at night, and the power employed being five Daniell's cells, the zincs seven inches long by seven in circumference, it will be found in the morning that the solution is ready for use. The strength of the solution recommended is that of one ounce of silver to the gallon. An ounce and a half of silver to one square foot of surface gives an excellent plating. A few drops of bisulphate of carbon confer peculiar qualities upon the silver.

NICKEL-PLATING.

Nickel-plating is now very extensively carried on for the covering of articles hitherto plated with silver. Nickel is very easily deposited, and may be prepared for this purpose by dissolving it in nitric acid, then adding cyanide of potassium to precipitate the metal; after which the precipitate is washed and dissolved by the addition of more cyanide of potassium. Or the nitrate solution may be precipitated by carbonate of potash; this should be well washed, and then dissolved in cyanide of potassium; a proportion of carbonate of potash will be in the solution, which is not found to be detrimental. The sulphate of nickel is also a soluble salt, and the metal is reduced more readily from it than from the nitrate. It is preferable to use the solution as strong as possible. Nickel forms a compound with the cyanide of potassium on boiling the oxide in a solution of that salt, which takes up a considerable quantity. The acetate of nickel is easily formed, by adding pyroligneous acid to the oxide of nickel, but it is a bad solution for obtaining reguline or pure metal. The chloride of nickel is formed by dissolving the metal in muriatic acid. It forms a fine green colored salt, and a very excellent one for nickel plating. It may be used with a nickel positive pole, with one or two Daniell cells.

Absence of Mind.

We heartily concur with the Philadelphia *Ledger* in its assertion that among the bad habits, which are usually classed with the minor faults of mankind, is that of absence of mind. Says the writer: "We have all laughed at the awkward blunders of the absent-minded, their irrelevant remarks, their ludicrous mistakes, their forgetfulness of the ordinary proprieties of life. Often, however, serious results ensue through these seemingly trivial oversights; property is wasted, friends estranged, losses incurred, health and even life sacrificed. In times of strong excitement or peril of any kind, nothing is so valuable as presence of mind. It is not exactly courage, or fortitude, or sagacity, or judgment, but rather the calm and well poised ability to marshal all these forces into action just where and when they are most needed. How many lives have been saved and disasters averted by this simple endowment! How much of the heroism which we delight to honor may be traced to this potent source!

It is precisely this attribute of which the absent minded man is destitute. Whatever be his knowledge, or wisdom, or skill, however excellent his motives and intentions, however great his powers and capacities, he has not that control over them that ensures the rightful action of each in its own time and place. He is continually off guard, surprised, confused, unprepared. His mind may be of the finest order, but it is not at its post of command, and his powers are scattered and lost like soldiers without a leader.

It is not only in times of emergency that this presence of mind is essential. Every hour of our lives must depend upon it for value and efficiency. If a man would be a prosperous farmer, a skillful mechanic, or a successful merchant: if he would be a kind neighbor, a faithful friend or a loyal citizen: if he would be a good and true husband, or father, or brother: his mind must be present in each of these relations, not absent. It must assume its rightful dignity of command over each phase of his life in turn, and not become absorbed in one to the exclusion of the rest, nor flutter in every chance wind. This is the chief cause of absent-mindedness. The thoughts are suffered to linger about some favorite topic or to wander aimlessly, and of course the matter in hand cannot be thoroughly performed. If we cannot or do not direct our whole attention to the object on which we are engaged and banish all others, we cannot do justice to it or to our own powers. It is the mixing up of different things and the confusion of mind thus created that are largely responsible for much of the inferior work in the world, and many of its failures and disappointments.

Much of this absence of mind might be avoided if concentration of thought upon one subject at a time were made a prominent part of education. Children should be accustomed to think earnestly for short periods, and then to dismiss the subject wholly from their minds. Weariness, listlessness, and half-hearted attention should always be prevented. It is far better for a child to play with his whole soul than to study with but a fragment of it. If he be thus trained in his youth, if work and play and study, each in their turn, absorb him utterly for the time, there will be but little danger of his growing up to be an absent-minded man. Those in mature life who have unfortunately acquired this pernicious habit may, by a similar process of self-culture, gradually overcome it. No one who indulges in it can make the most of his powers in any direction or give out to the world his full value; and certainly no one in our present varied and complex civilization can fulfil his manifold relations in life unless he resolutely bring all the powers of his mind to bear upon each one of them in its own appointed season."

Discoveries.

Discoveries in Science are the result either of experiment, of thought, or of chance. An experimental discovery is usually the result of a well planned attack upon some fortress of Dame Nature—every step, every sap, and every battery being well considered and faithfully followed; or it results from the attacking force perceiving indications of some sunken mine, or unknown treasure, and following it up with care and determination. Davy's discovery of the safety lamp is an example of the first kind. Something was wanted—its requirements were well defined; Nature was asked to supply those wants and requirements, and she was forced, by experiment and enquiry, to reply. Faraday's discovery of magneto electricity was of the second kind. He was engaged in solving a difficult and intricate problem; something attracted his attention, he followed it up, traced it out, and was rewarded with the discovery of what ought to be universally called *Faradaism*.

A discovery the result of pure thought must be bared on experience. An experiment sets

—"that inward eye
That is the bliss of solitude"

a-working. The imagination is brought into play. Thought pictures something that should be, and observation finds out that it is. Graham's discovery of dialysis, and of the occulsion of hydrogen by iron, was of this character. So have been the innumerable additions made to organic chemistry by Liebig and his followers. So have been the strides made in the theory of energy by Mayer, Joule, Thomson, Clausius, and others. Experiment has set the ball rolling, thought has kept it going, and imagination has said: "If I only direct it in such a path I am sure to alight on some treasure, or it is sure to bring me to the goal I seek."

Discoveries cannot be said to be the simple result of pure chance. Newton and the apple are said to have led to the discovery of gravitation; but the apple was only the means to direct the thoughts of the philosopher in a certain channel, which certainly led to success; but he had been previously pondering and weighing innumerable other channels and courses. Galvani and the frog are said to have led to the chance discovery of voltaic electricity; but the frog may have jerked its legs on the professor's balcony, or skipped into the physicist's laboratory with the energy of a ballet dancer, before it would have led to the discovery of current electricity unless there had been a trained mind to watch its antics, to follow up its peculiarities, and to ferret out its indications.

Daguerre's discovery of the influence of the vapor of mercury upon sensitive plates of silver is another which is included among chance discoveries. He had been experimenting on silver plates rendered sensitive by iodine, and had, after exposure, put them in a cupboard full of chemicals. To his surprise he found, after a time, pictures develope themselves on the plates, attributing the effect to some chemical. He removed the chemicals one by one, until all had been removed. The effect, however, continued. He then found an unknown and forgotten flask of mercury, which gave out its vapor, and thus produced the effect observed—and this was the origin of the daguerreotype process. But this was not purely the result of chance. It was the previous training and previous experience which arranged the conditions that led to the discovery, and which enabled the mind to seize upon those very facts which resulted in success. Training and experience are therefore essential in seizing upon abnormal indications of Nature, as they are in comprehending and appreciating her laws and applying them effectively to practice. —*Telegraphic Journal.*

THE STEAM MAGNET.—M. Donato Tommasi states that, if a current of steam at a pressure of 5 to 6 atmospheres is passed through a copper tube of 0·08 to 0·12 inch diameter, and coiled spirally around an iron cylinder, the latter is magnetized so effectually that an iron needle, placed at the distance of some inch or two from the steam magnet, is strongly attracted, and remains magnetic as long as the steam is allowed to pass through the copper tube.

IMPROVED HAND CART.

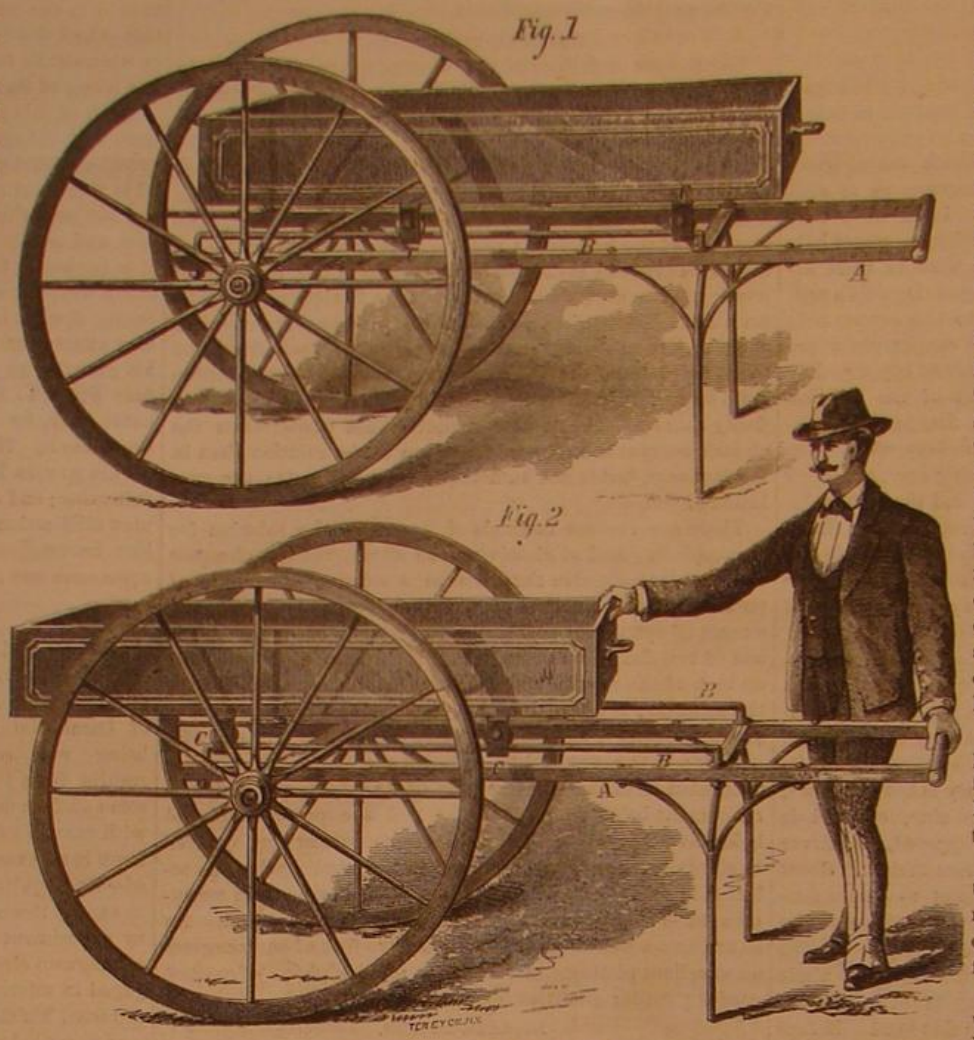
The ordinary hand cart is open to two objections: first, the impossibility of loading from the rear on account of the disposition of the vehicle to tilt; and second, the inconvenience of loading at the side, owing to the wheel being in the way. Both of these difficulties, it is claimed, are overcome in the invention illustrated in the annexed engravings, which consists in an arrangement of the bed so that it slides back and forth at the will of the operator.

A is a frame attached to the axle of the cart and further supported by the braced standards shown, which rest on the ground when the cart is stationary. On the top side of the frame are secured the metal runners, B, upon which clips, C, having eyes, and attached to the bottom of the vehicle body, fit. These clip eyes are loose upon the runners, so that the body can be moved forward from the axle, as shown in Fig. 1, to allow of loading without the interference of the wheel. When the loading is finished, the body is pushed back and balanced over the axle, as shown in Fig. 2.

It will be seen that the standards give the body a firm support when the same is pulled forward. The inventor suggests that, as there is no establishment in this country which makes a specialty of hand cart making, a profitable trade might be monopolized under his patent.

The inventor, Mr. Joseph M. Jones, desires to dispose of his right for two thirds of the United States; for further particulars regarding which offer, etc., he may be addressed at Paris, Bourbon county, Ky.

Patented through the Scientific American Patent Agency, May 11, 1875.



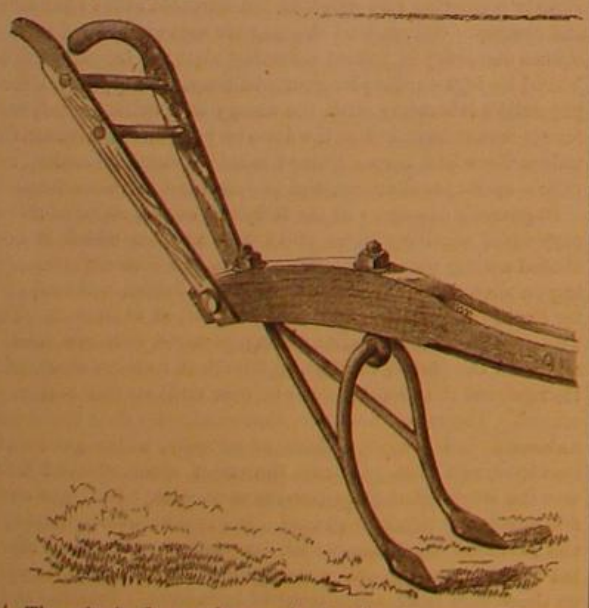
JONES' HAND CART

Feeding Marine Boilers.

The use of a second boiler for the purpose of providing a supply of fresh water to keep up the feed to the main boilers of ships fitted with compounded engines, is becoming very general. Various contrivances have been adopted also with the view to utilize the working power of the steam of this second boiler by passing it through the engines before allowing it to go to the condensers. The *Societa Nazionale* of Naples have adopted the following plan in the engines fitted by them to the ships of the Italian navy: The small boiler is vertical, with a number of transverse tubes of very simple arrangement. These boilers are easily cleaned by loosing a joint and removing the outer shell, which leaves all the parts in contact with water and steam exposed. These boilers are also used for other purposes, such as working pumps and winches, and are not always in use for their primary purpose.

DUNN'S IMPROVED VINE RAKE.

The invention illustrated herewith is an implement for pulling sweet potato or other vines off from the ridges preparatory to the digging and plowing of the ground. It consists of a supporting plow beam provided with lever handles of the usual construction, and having, in place of the plow stock and share, a fork or rake made with two forward curved teeth. This is rigidly secured to the beam by a central eye bolt and rear braces.



The rake is drawn by a pair of animals, one walking on each side of the ridge to be cleared. The beam is placed directly over the top of said ridge, with the teeth on the sides of the drill, at base of the vines. As the team advances, the teeth pass under the vines and tear them loose from the ground, carrying them along until the rake becomes full. The implement is then pulled back and raised clear of the gathered vines, and again started to clear another section of the field.

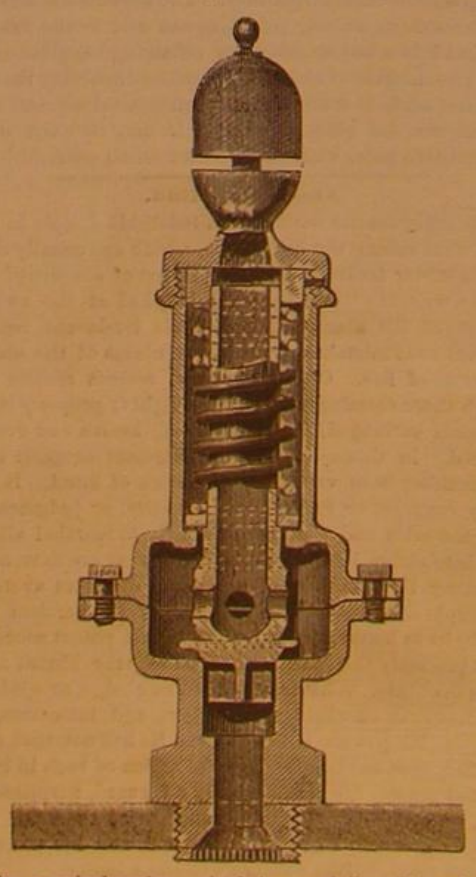
Patented through the Scientific American Patent Agency, April 20, 1875. For further particulars address the inventor, Mr. Joseph W. Dunn, P. O. Box 8, Corpus Christi, Texas.

The Odorless Broiler.

This consists of a gridiron of the usual kind, fitted within a case of tin, so arranged that, when placed over the fire of an ordinary stove or range, the smoke and odors of the cooking operation, instead of escaping into the kitchen apartment, are drawn into the fire and go up chimney. We are using this improvement in our household, and therefore speak from experience when we say that it operates with success, prevents all escape of smoke and odors, and, by concentrating the heat upon and around the meat, insures, we think, better cooking. Housekeepers will highly appreciate this invention. Maker and patentee, Joseph Mansfield, Jefferson, Wis.

SMITH'S STEAM SENTINEL.

An English inventor has recently produced a combined safety valve and whistle, which cannot be tampered with, and is, as will be seen from our engraving, an efficient and simple device. The safety valve is conical, and is kept in place by a spiral spring, which is carefully adjusted to the required pressure. The lifting of the valve is at once made known by the sounding of the whistle.



Consumption.

At a recent meeting of the New York Academy of Medicine, the pathology and etiology of pulmonary phthisis, in relation to its prevention and early treatment, was described. The discussion was opened by Dr. Leaming, who gave an abstract of Dr. Hudson's paper

Dr. W. H. Draper said that phthisis in its early stage was one of the most unsatisfactory diseases that we had to deal with. The recent pathological views were only of indirect benefit in guiding us. Laennec held that phthisis was always tuberculosis; but Dr. Addison, in 1846, declared that inflammation was the object of destruction in every form of phthisis, and at that time his views were coincided with by some of the French pathologists. If phthisis, said Dr. Draper, is inflammatory in its nature, rest is and must be one of the most important ends to attain in its treatment, and any action, exercise, or anything which tends to increase the pulmonary circulation, of necessity is contraindicated. Dr. Roberts, of London, and Dr. McCree, of Belfast, have followed this out with good results in strapping the chest, and thus keeping it to a great extent in a quiescent state.

Those who ignore the element of inflammation in the disease consider rest prejudicial. In respect to climatic influence, there can be but little advantage gained beyond allowing the patient to live out of doors a great part of the time. Patients, however, frequently derive more benefit from a residence in the Northwest than they do from more southerly latitudes. Phthisis as a disease is most common in the tropics, and decreases in frequency toward the extreme north or the extreme south. Elevated regions have also a beneficial effect, and in mountainous sections phthisis is relatively unknown.

Dr. John C. Peters did not think that phthisis should be considered as an inflammation, though it might provoke it He was strongly convinced of its dyscratic nature.

Dr. Sullivan was of the opinion that the subject of defective ventilation had a most important bearing on the production of phthisis, and brought forward different facts to substantiate his views.

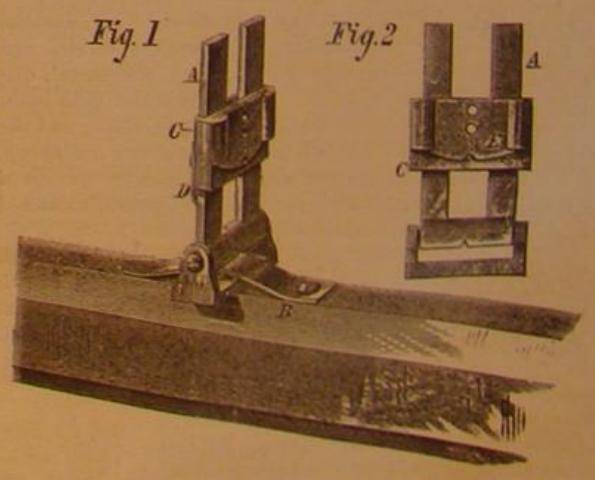
Dr. Willard Parker coincided in the views of Dr. Sullivan in respect to ventilation, and thought deficient sunlight also a most important factor to consider in reference to the etiology of the disease. He was strongly opposed to the plan of rest for consumptives in the beginning of the disease. The cases that do best are those that spend most of their time in outdoor exercise. He cited different cases in which the disease had made decided progress, and which were thoroughly cured by a life of activity outdoors.

Dr. Hubbard said that the same climate did not suit all patients; some patients do exceedingly well in Santa Barbara, where the thermometer does not vary more than ten degrees the year round; while others, who are not benefited there, improve by moving sixty or seventy miles inland.

HARRINGTON'S IMPROVED GUN SIGHT.

The invention herewith illustrated is a globe or peep sight which may be adjusted so as to present either a coarse or fine sight as desired. It can be attached to any gun, and is claimed to insure accuracy in shooting.

A is a slotted standard suitably hinged to the barrel and held upright by the spring, B. C is an adjustable slide held in any desired position by the spring, D, engaging in notches on the standard. This slide is provided with a sight hole. E is another slide adapted to move in guides on the slide, C, and pierced with a number of holes of different sizes, as shown. By raising the slide, E, the slide, C, can be used as a coarse sight, and by lowering the former a finer sight is obtained. The finest sight hole that can be seen through may be used, and generally the size of the orifice may be easily changed to suit differing conditions of weather, whether bright, overcast, or dark.



Patented February 25, 1873. For further particulars address the inventor, Mr. Munson W. Harrington, York Center, Iowa county, Iowa.

GLYCERIN paste for office use may be prepared by dissolving 1 oz. gum arabic and 2 drachms glycerin, in 3 ozs. boiling water.

SWIMMING.

Mr. Paul Boyton's feat of crossing the English Channel by the aid of a life-preserving dress tends to prove the value of a knowledge of how to swim almost as much as it does the efficacy of the invention tested. While the dress afforded buoyancy to his person, the wearer, through his expertness as a swimmer, knew just how to use his members so as to aid in his propulsion, with the least expenditure of power. The season is now at hand when the water becomes sufficiently warm to allow of bathing at almost any hour of the day, and hence the present is an excellent time, for those who contemplate acquiring this very necessary part of the knowledge of self-protection, to begin.



BOYS LEARNING TO SWIM.

The manner of swimming properly is as follows: Supposing the bather to be in the water, he throws himself forward on his stomach, his whole body being only just covered by the water and no more; his hands are brought up under the chin, knuckles upward and with the first fingers touching each other: the whole palm is slightly contracted so as to form a concave surface, and the fingers are pressed closely together. The legs are drawn up as short and as near the body as possible; the breath is fully inhaled; then the stroke is made; the hands and feet are both darted forth to their fullest stretch at the same moment; the former are still kept close to each other, and the balls of the toes are made to touch, in which position they remain unmoved till the whole stroke is finished. The hands, fully extended, are then separated and moved round, each describing part of a circle till they are opposite the shoulders, and then the stroke is finished. But observe that which is of most consequence; the exhalation of the breath begins with the stroke, and is slowly continued as long as the striking lasts; indeed, the quantity of breath determines how long the stroke will be, for it is taken only once at every stroke. It is very measuredly given out by a good swimmer, and all the time he is breathing forth he brings his hands round, making the lungs and the hands work and cease working together. The legs all the while, after the first rapid kick, remain stretched out rigidly, with the heels quite close to the water surface; thus a flat position is secured, which greatly conduces to speed.

The hands are only slightly propulsive; their chief use is to act as a cutwater, cleaving the way for the body, but, much more, to prolong the impetus given by the legs, and to eke it out to the utmost. The breath acts as a float to the whole, and cannot be too carefully husbanded and proportioned to the long sweep of the arms. A swimming stroke resembles that of an oar in its perfection; for it is quick forward, evenly pulled out, and the recovery for a new stroke is rapid; and on these two things, namely, lying truly horizontal just under the surface of the water, and proper treatment of the breath, the art of swimming depends.

In entering the water head foremost, or "taking a header," as it is called, the water should be struck by the forehead bone, just below the hair—the hands having first cloven the water, as shown in the illustration. The angle which the body should form with the water should be less than *half* a right angle, or from thirty-five to forty degrees, as shown in the diving figure in the annexed engraving, selected from the *Art Journal*. Then recovery upwards is rapid, and the appearance of the whole graceful. Adepts have brought this branch of the art to such perfection that they can jump into less than two feet of water without touching the bottom.

In fresh water a strong swimmer will move fully five feet and a half at every stroke without great exertion. How many strokes he will make in a minute must depend on his breathing capacity; twenty-five to twenty-six would probably be the average. This will give fifty-eight yards per minute, or just two miles an hour; and we should think, to accomplish that pace without distress would be a fair criterion of a good swimmer. At racing pace the strokes are much more rapid, exceeding fifty per minute; and the highest speed that seems attainable is thus eighty-eight yards, or exactly three miles an hour.

Mastodon for Yale College.

Professor Marsh has secured, for the Peabody Museum of Yale College, the skeleton of a large mastodon, exhumed by Mr. A. Mitchell on his grounds at Otisville, seventy-five miles from New York and within a mile and a half of the Erie railroad. The bones were found on and in clay, beneath a deep bed of muck, and are in an excellent state of preservation. This Otisville mastodon is the sixth that has been found in the swamps of Orange county, N. Y.

THE GROUSE FAMILY.

Of the many feathered races that afford beauty to our moors and woodlands, sport to our gunners, and food to our tables, the grouse is one of the most distinguished. There is a great variety of birds known under this generic name, including species widely different, as for instance the ptarmigan and the black cock, or the capercailzie and the cock of the plains. The sand grouse (*pterocles*) is found in the arid deserts of Asia and Africa, also in Southern Russia. The wings are long and pointed, and the powers of flight are exceptionally great; and the toes are connected by a membrane, enabling the birds to run rapidly on loose sand. Their plumage is variegated, brown, gray, and ochreous yellow being predominant. Though the birds associate in pairs, they are often met with in flocks, and they are striking objects on the wing, being beautifully marked. Their flesh is, strange to say, coarse and flavorless.



THE SAND GROUSE.

The hen lays her eggs in a hole in the sand, and hatches out her young, which are soon able to obtain their own living, being strong and hardy.

The British Telegraphs.

From the annual report of the Post Office Department of Great Britain, just rendered to Parliament, we gather that the total receipts for telegraph service for the year ending March 31, 1875, was $5,600,000, and the expenditures for the same, $5,965,300, showing a net loss of $365,300. The Chancellor of the Exchequer, referring to the telegraphs, in his speech on the budget, took a rather gloomy view of what he termed a remarkable experiment, and held the results up before the House as a warning not to enter into any other kind of business which could better be carried on by private enterprise. He said: "Undoubtedly the telegraph service has not yet been brought into a remunerative condition. We are not as yet paying our way, and are contributing very little toward the interest on the debt incurred for the purchase."

The telegraphs of Great Britain have already cost that government about $60,000,000, and there are claims still pending which will amount to several millions more. Every year the deficiency has been enormous, to say nothing of the loss of interest upon so vast a sum. This latter item alone, at the low rate of 3½ per cent, amounts to $2,100,000 yearly. At the prevailing rate of interest in this country, 7 per cent, this loss would, of course, be twice as great. All of this has to be met, and there is but one way to meet it—by increased taxation. In this manner the burden of affording telegraphic facilities at less than cost, to the one per cent of the population whose business necessitates their use, falls upon the ninety-nine per cent who do not use the telegraph at all.—*Journal of the Telegraph.*

How Inventions are Made.

The life of George Stephenson proves that, notwithstanding the novelty and great importance of his improvements in steam transit, he did not discover these improvements. He did not discover that a floating embankment would carry a railway across Chat Moss, neither did he discover that the friction between the wheels of a locomotive and the rails would enable a train to be drawn by tractive power alone. Everything connected with his history shows that all his improvements were founded on a method of reasoning from principles, and generally inductively; to say that he "discovered" our railway system, according to the ordinary construction of the term, would be to detract from his hard and well earned reputation, and place him among a class of fortunate schemers who can claim no place in the history of legitimate engineering.

Count Rumford did not by chance develope the philosophy of forces upon which we may say the whole science of dynamics now rests; he set out, upon a methodical plan, to demonstrate conceptions that were already matured in his mind, and to verify principles which he had assumed by inductive reasoning.

The greater part of really great and substantial improvements which have performed any considerable part in developing modern mechanical engineering have come through this course of first dealing with primary principles, instead of groping about blindly after mechanical expedients; and present circumstances point to a time not far distant when chance discovery will quite disappear. —*Engineering.*

Mastic for Iron and other Materials.

The following is the composition invented by M. I. Machabee, which is said to preserve iron from rust, and also to be applicable to other materials, such as stone or wood, used in conjunction with iron or other metal, in the formation of reservoirs or other works: Virgin wax, 100 parts; Gallipoli, 125; Norwegian pitch, 200; grease, 100; bitumen of Judea, 100; gutta percha, 235; red lead, 120; and white lead, 20, all

of which, says the inventor, have their special value. The materials are mixed in a boiler in the order in which they are given, the gutta percha being cut up in small pieces, or rasped. The mixture must be well stirred at each addition, and, when homogeneous, is poured into molds, and looks like chocolate. When used for preserving iron from rust, it is melted and laid on with a brush; but for stopping holes, etc., it must be in a pasty state. It may also be used as a glue to fix a piece of metal over a hole. For certain purposes, such as stopping holes in large vertical metal surfaces, the composition is slightly varied, the Gallipoli being reduced to 115, the bitumen to 90, and the red lead to 100, while 40 parts of gum copal are added next to the gutta percha.

Tasmanian Devils.

The United States steamer Swatara lately arrived at this port from Australia, with the instruments and apparatus used by the American astronomers during the late transit of Venus observations.

Among the curious animals brought home by the officers are a *sarcophilus ursinus*, or Tasmanian devil. This hideous creature is said to be the only living specimen in this country, and it will probably be sent to Central Park for exhibition. In appearance it has some resemblance to the American raccoon. It is carnivorous, and in its wild state principally lives upon birds, rats, and other smaller animals. Although partially tamed, it is deemed necessary to keep the creature confined on deck.

There is also on board a wombat or Tasmanian hog, which lives upon vegetable matter. Several kangaroos, with a wallaby and two beautiful Gordon setters, were also noticed playing upon the deck of the Swatara; while a number of love birds and parrots, and a Sultana bird, were caged in different portions of the vessel. A fine collection of Australian ferns has been made by several officers connected with the expedition.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of Ohio.

PATENT FEED WATER FILTER.—THE STILWELL AND BIERCE MANUFACTURING COMPANY *vs.* THE CINCINNATI GAS LIGHT AND COKE COMPANY, THE ARMSTRONG HEATER AND MANUFACTURING COMPANY, JAMES A. ARMSTRONG, AND STEPHEN H. STARR.

[In equity.—Before SWING, J.—Decided January, 1875.]

The first claim in reissued patent for feed water heater and filter, granted to E. R. Stilwell, August 24, 1869, which is for "filtering material F, between a series of shelves and outlet, substantially as described," held valid notwithstanding the fact that filters had been used for freeing the feed water for boilers from the matter held in mechanical suspension therein, and the further fact that heaters composed of a series of shelves had been used for a similar purpose to remove from the water the matter held in solution and a portion of that held in suspension.

Although the operation of neither the shelves nor the filter is affected by the union of the two in the same machine, a new result is produced, inasmuch as the water is passed into the boiler in a condition different from that which would have been produced by either of the devices separately.

The Stilwell patent is not invalidated by the earlier English patent of Wagner, since it is doubtful whether the Wagner device could be practically used with success.

There is no force in the objection that the Stilwell patent does not specify what filtering material is to be used. The patent permits the use of any suitable filtering material, and persons skilled in the art could at once use the invention without experiment or additional invention.

The mere making of a model of an invention held not to constitute invention, as against a patent subsequently granted to another for the same thing.

The alleged anticipation of the Stilwell invention by James A. Armstrong discussed.

It was decided by the court that the respondents infringe the first and second claims of the second patent, namely, the filtering material between the shelves and the outlet, and the arrangement of steam inlet and shelves; and that they do not infringe the first and third patents, as alleged in complainants' bill.

[*Wood & Boyd*, for complainant.
Fisher & Duncan and *John E. Hatch*, for defendants.]

Supreme Court of the United States.

PATENT LOOM.—WILLIAM MASON, APPELLANT, *vs.* E. H. GRAHAM AND W. HOUSE.

[In equity.—Appeal from the Circuit Court of the United States for the District of Massachusetts.—October term, 1874.]

[This was a suit in equity under letters patent relating to an improved picker staff motion in looms, granted to E. H. Graham, October 16, 1860, and reissued May 28, 1867, to the inventor and Wanton House, a half owner in the patent.

The case as decided in the circuit court will be found fully reported in 5 Fisher, 1.

It was appealed by the defendant.]

STRONG, J.

The patent of E. H. Graham, of October 15, 1860, reissued May 28, 1867, for "picker staff motion in looms," has no relation to the mere form of a journal-bearing arm, nor does it consist in arranging a journal-bearing arm in a slot in the rocker. It embraces every combination of a rocker with a bed and loose journal-bearing arms, arranged so as to produce the result described in the specification as effected by the combination.

Inasmuch as defendant employs a combination of a rocker with a bed by loose journals projecting on each side the picker staff, and the combination is effected by means of a journal-bearing arm, it is immaterial that the form of his journal-bearing arm is unlike that of complainant's, or that its mode of attachment is different, so long as it performs the same function in substantially the same way.

Where defendant had been in the habit of selling the infringing picker staff motion both separately and attached to looms, in ascertaining his profits upon those sold with the looms, regard should be had to his profits upon those sold separately, rather than to the aggregate profits made by him upon the loom and attachment combined.

If defendant has cheapened the cost of producing the infringing device by an improvement of his own, he is entitled to a corresponding credit in the ascertainment of the profits which complainants are entitled to recover.

[*Benjamin Dean*, for appellant.
J. E. Maynadier, for appellees.]

NEW BOOKS AND PUBLICATIONS.

THE MOSAIC ACCOUNT OF CREATION, THE MIRACLE OF TO-DAY: or New Witnesses to the Oneness of Genesis and Science. By Charles B. Warring. New York city: J. B. Schermerhorn & Co., 14 Broad street.

Scientific students who attempt the task which Mr. Warring has imposed upon himself must be careful not to underrate its magnitude, and must prepare for vigorous attacks from both classes of polemics. The author, in the work now before us, has assembled a large number of coincidental similarities between the Genesitical account and the revelations of research; and although his zeal has induced him to claim as proofs some points which are rather fanciful and far-fetched, the book will repay any one who will read it attentively; for it contains much laborious thought and many evidences of careful study, and shows that the author has not too hastily thrown himself into the arena of combat. But the battle is not likely to be ended for some time; and we are not yet able to pronounce whether either side, the theologians or the sceptics, or the "harmonists" (to coin a word to describe the most recent writers), are likely to secure even a temporary victory.

HISTORY OF THE UNITED STATES OF AMERICA. Illustrated. Supplied to subscribers only, in parts at 25 cents each. New York city: Cassell, Petter, and Galpin, 596 Broadway.

This is another of the many series of finely illustrated standard works which have gained for the above named publishers an enviable reputation, both in this country and in England. The history begins with Sir Walter Raleigh's attempted colonization of North Carolina in 1584-5; and it will embrace all subsequent events up to the present time. The illustrations are excellent specimens of the wood engraver's art, and are lavishly interspersed throughout the text. Many of them are of especial interest as *facsimiles* of old pictures, documents, etc. The work is written in a clear and graphic style, and seems to fulfil all the requisites of a popular descriptive history.

THE ARTIZAN'S GUIDE AND EVERYBODY'S ASSISTANT, embracing nearly Four Thousand New and Valuable Receipts, Tables, etc. By R. Moore. Price, in cloth binding, $2.00; morocco, $3.00. Rouse's Point, N. Y.: John Lovell & Sons. Montreal, P. Q.: The Lovell Printing and Publishing Company. New York city: John Wiley & Son, 15 Astor Place.

A copious selection of instructions for using various industrial and domestic processes, well arranged and edited. The articles are classified by the trades for use in which they are designed, and so form, in many cases, complete treatises on the subjects.

DIGEST OF THE UNITED STATES PATENTS FOR PAVING AND ROOFING Compositions to January 1, 1875, and English Paving Compositions to January 1, 1874. By L. W. Sinsabaugh, United States Patent Office, Washington, D. C. Price $10.

Mr. Sinsabaugh adds another to a very valuable series, which we hope will be continued till every class of patents has been summarized. To any one engaged in operations involving the use of patented articles, whether as inventors, manufacturers, or merchants, such books are indispensable; and the high price necessitated by the labor of compiling them and their limited circulation is more than repaid by the handiness and facility of reference which they afford.

THE JOURNAL OF EDUCATION, devoted to Educational Interests, Science, Literature, and Art. Yearly Subscription, $2.50; single copies, 25 cents each. Brooklyn, N. Y.: 185 Montague street.

There has been a great opportunity for establishing a high class periodical devoted to educational subjects. The lavishness with which provision for education has been made by all our States has long been matter for congratulation and pride; while the illiterateness of many of the senior pupils causes us to wonder how so much money can be spent to produce so poor a result. The failure is undoubtedly due to imperfect and unmethodical teaching; and the science of imparting instruction needs to be carefully and studiously learnt. To this end, a literature of the whole subject is needed; and the magazine now before us is a long step towards supplying it. It is well written and edited, and is altogether a creditable publication.

NEW YORK CITY DIRECTORY. Volume LXXXIX, for the Year ending May 1, 1876. Price $6. New York city: The Trow City Directory Company, 11 University place.

The organization for compiling this indispensable book should, after 89 years' labor, be tolerably complete; and we are already (June 11) in receipt of a handsomely printed volume, containing a correct list of all persons doing business or occupying houses in New York city, including the many changes which took place as usual early in the month of May. The names in the Directory are 4,468 more in number than those of last year, and the increase of the population within the 12 months may be estimated at 22,000. The whole value of such a work consists in its accuracy; and we feel bound to testify to the care bestowed on its compilation and its consequent value as a thoroughly trustworthy book of reference.

WILSON'S BUSINESS DIRECTORY OF NEW YORK CITY. Volume XXVIII. Price $2.50. New York city: The Trow City Directory Company, 11 University place.

We have here a very compendious classification of the firms and business men of our city, arranged under the heads of their respective professions and trades. Commercial travelers, advertisers, and others wishing to obtain complete lists of persons occupied in any particular calling, will find this directory complete.

A NEW TABLE OF EXTENDED MULTIPLICATION. Devised by George A. McLane, of Chicago, Ill.

This is something of a mathematical curiosity. It is intended to take the place of Crelle's "Tables of Calculation," now generally used in life insurance offices for adjusting premiums, etc. The new table enables an accountant to divine a result involving figures up to 10,000 almost at a glance. For insurance companies, railway clerks, and others, it will save much time and greatly lighten labor. The author may be addressed, care of American Express Company, Chicago, Ill.

TARIFF REVISION, a Reply to the Proceedings of the Philadelphia Drug Exchange on the Proposed Revision of Tariff. By Daniel C. Robbins. New York city: Thitchener and Gastaeter, 14 and 16 Vesey street.

An able and convincing argument against a grinding and unjust monopoly.

ON THE DUPLICITY OF THE PRINCIPAL STAR OF *Nu* SCORPIONIS. By S. W. Burnham. Reprinted from the Royal Astronomical Society's Monthly Notices.

Mr. Burnham is continuing his valuable labors on the double stars, and the paper now before us is a report of an interesting investigation of one of the most remarkable of the binary heavenly bodies.

SKEW ARCHES: Advantages and Disadvantages of Different Methods of Construction. By G. W. Hyde, C. E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

A valuable treatise on an interesting and somewhat difficult branch of engineering science. It is issued in Mr. Van Nostrand's excellent Science Series.

Recent American and Foreign Patents.

Improved Earth Auger.

Andrew M. Hanna, Kosciusko, Miss.—A cylinder, made of heavy sheet metal, carries a cross bar, to which are bolted blades which are curved into spiral form, and each of which makes about half a turn. To the rear edge of each blade is hinged a valve, which shuts down against the other cutter, so that the earth contained in the cylinder may be raised by and with it. To the upper end of the cylinder is rigidly attached a ball. The shaft is attached to the ball and to the cross bar, and is made in sections, the lower end of each upper section having a square socket formed in it to receive and fit upon the squared upper end of each lower section. The interlocked ends of the shaft sections are secured together by a bolt, pin, or key, so that the cylinder can be raised and lowered by the shaft.

Improved Ironing Board.

Henry Clay Green, Oshkosh, Wis., assignor of one half his right to John H. Gettman, of same place.—This ironing board has, at its upper end, a self-adjusting neck wire, and at the lower end a spring cross bar, and a groove for the bead on the bar. When the bar is turned back, it gives the side of the shirt or other garment a strain, and draws it tight over the board in a proper position for ironing. The shirt or garment being confined at the top of the board by the spring, which adjusts itself to the neck, any required degree of tension may be given.

Improved Hot Air Furnace.

William O. Crocker, Turner's Falls, Mass.—The cover of the base is provided with two rows of holes, communicating, respectively, with the space between the outer casing and a jacket, and the space between said jacket and the combustion chamber. The jacket is perforated by means of a conical punch, so that conical caps project over the opening, which receives the air and cuts it up into numerous jets, and throws it in contact with the radiating combustion chamber. The air which enters inside the jacket passes directly upward in contact with the combustion chamber. The top rim of the fire pot is provided with a series of perforations, so as to enable an indirect draft to take place by causing the products of combustion to pass through the top rim, down the rear side of the fire pot, under the partition plates, up the front side of the fire pot, and through the lower exit. The object of this arrangement is to cause the heated gases to pass over the entire surface of the combustion chamber.

Improved Harvester.

Frederic F. White, Stacyville, Iowa.—To the shaft are attached two chain wheels, around which pass two endless chains, which pass down along the upper sides of inclined bars, around chain wheels pivoted at the lower ends of said inclined bars and around pulleys pivoted to hangers connected with the framework of the machine. To the endless chains are attached cross bars, to the inner ends of which are pivoted the ends of the rakes. By suitable construction, as the rack bars are moved rearward, the rakes will be raised into a position at right angles with the cross bars; and as the rack bars are moved forward the rakes will be lowered into line with the cross bars. The rakes are lowered at the proper time to sweep the grain from the platform up an inclined apron and into a receiver, and raised and held up while moving back to the outer end of the platform by guides attached to the inclined bars.

Improved Single Rail Railway Car.

Chandler McWayne, Colfax, Cal.—Upon the upper ends of posts are crossheads running longitudinally with the track, and having deep longitudinal grooves in their upper sides to receive the base of the rails. The rails are supported midway between the posts by arched braces. To the sides of the posts are attached flat bars for the horizontal wheels to bear against. The car body is made with a deep longitudinal recess extending up from the middle part of the bottom of the car, so that the main weight of the car and load may be below the rail. The trucks, to which the wheels are pivoted, are pivoted in the upper part of the recess in the car body. The passengers and load of the car occupy the compartments in the sides, below the level of the rails. In the upper part of the car body, directly above the rail, is formed another compartment, the floor of which slides transversely in ways in the frame work of the car, so that, by moving the said floor toward one side or the other, the weight of the passengers or load in said compartment may serve as a counterpoise for balancing the car.

Improved Automatic Gate.

Hiram Krom, Dartford, Wis.—This improved gate is constructed in duplicate and aligned parts, rigidly connected to and turning upon a central pivot post, to which weighted cords are attached. The latches are so connected together as to operate simultaneously.

Improved Stirrup.

Joseph B. Waggoner, Athens, Ill.—The bottom turns horizontally on its ends in a yoke, which is pivoted to a suspending yoke which is swiveled to a suspending strap, so that it can turn in a vertical axis. The combined movements thus afforded cause the stirrup to adjust itself to the foot, so as to allow the latter to slip out without the possibility of being caught.

Automatic Car Brake.

F. L. Kirtley, Cleburne, Texas.—This invention consists in improving automatic car brakes by connecting the brake lever with a sliding drawbar, so that, as soon as the engine slows up, the drawbar is forced back by contact with that of the next adjacent car, and the brake shoes applied to the wheels. The drawbar or buffer is jointed so that the shoes may remain aloof from the wheels whenever the cars are backed.

Improved Extensible Safety Bridge.

William Campbell, Floyd C. H., Va.—This invention consists of a series of bars arranged crosswise of the car loosely on rods, which project from and slide forward and backward in another bar connected to the car for supporting them. The loose bars are linked together at the ends to limit the extent to which they may be separated; and the outermost bar of each platform is contrived to couple with the corresponding bar of another car. A practical platform is thus formed whereon persons may walk with safety from one car to the other when the cars are in motion, or the platform may be permanently connected at the middle in one part only for two cars, and be connected and disconnected with a car at one or both ends.

Improved Compound for Scouring White Goods.

Moritz Mayer, 271 East 10th Street, New York city.—This invention is an improved compound for cleaning and dressing white kid gloves and shoes of morocco, sheep, satin, cloth, and similar white fabrics, so as to restore their original glaze and whiteness. The compound consists of a mixture of French chalk and salts of sorrel in water, under an addition of a small quantity of oxalic acid and bicarbonate of soda. The compound is applied by a small sponge to the articles to be cleaned, giving them one or more coats, as required, each coat being exposed to the open air for drying. The inventor claims that any soiled or discolored parts, ink spots, etc., will be completely cleaned without hardening or injuring the fabric, which retains its original pliability, and is restored by the dressing to its former whiteness and luster.

Improved Excavator.

John S. Whitesearver and William C. Whitesearver, Pontiac, Ill.—By suitable construction, by operating a lever, the point of the plow may be raised and lowered, to cause it to run shallower or deeper in the ground. By other devices, a frame may be moved out and in to tighten or slacken an endless apron. The machine may be adjusted to carry the earth up a high grade, or even discharge it into a wagon, and the inner end of the carrier may be readily adjusted to, and held securely at, any desired hight from the ground to receive the earth from the plow.

Improved Railway Track Closer.

Isaac N. Haines, Pomeroy, Pa.—This invention consists of blocks of suitable size, which extend with their top parts over the rails, and slide in base shoes by the action of lever and double crank connections, so as to put the blocks simultaneously on or off the track.

Improved Extensible Ladder.

Edward Clark, New York city.—To the lower part of the side bars of the upper section are pivoted bars, which, when the said upper section is extended, overlap the upper parts of the side bars of the lower section, and are secured by bolts and nuts. This construction makes the joints between the sections the strongest part of the ladder. The novel features in this invention, which is composed of sliding sections, are as follows: To the side bars of the lower section are pivoted two buttons, the lower ends of which are notched to fit upon the rear upper corners of the steps to support the sections. This construction allows a pawl to be thrown back, and cords to be detached from pulleys, allowing the pulley shaft to be used for hoisting purposes.

Improved Refrigerator Car.

Richard Armiger, Baltimore, Md.—This invention consists in making the ice and provision chambers entirely distinct and air-tight, so that the moisture from the provisions and in the provision chamber will be condensed at the top and held there in troughs, the provisions being perfectly dry as well as cold. In this state they keep their freshness and flavor during a travel over great distances.

Improved Ore Concentrator.

James V. Pomeroy, Boulder, Col. Ter.—This invention consists of a series of ore pans or troughs, which are placed in detachable manner in a supporting frame, to which reciprocating motion is imparted by concussions with suitable actuating mechanism. The pans are connected by one of the sides being of suitable inclination, and overlapping the edge of the adjoining pan, for facilitating the wave motion of the water, and the separation of light particles on the motion of the frame.

Business and Personal.

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

Hoadley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

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

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

Small Gray Iron castings made to order. Hotchkiss & Ball, Foundrymen, West Meriden, Conn.

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

Wood Planers—Five 2d H'd Wood Planers for Sale Cheap; 1 2d H'd 30 H.P. Boiler. Wm. M. Hawes, Fall River, Mass.

Rare Chance—Complete set Sci. Am. for Sale.—E. B. Gilman, Dansville, Liv. Co., N. Y.

Machinist's Tables, Price 25 cts. E. B. Knight, Manayunk, Philadelphia, Pa.

For Sale—Model Engine. Address W. E. Lewis, Cleveland, Ohio.

Soap Stone Packing, in large or small quantities. Greene, Tweed & Co., 18 Park Place, New York.

Moss Agates, Petrified Bones, Wood, Shells, and other curiosities, will be sent C. O. D. by S. H. Wright, Church Buttes Station, Winta Co., Wyoming Ter.

We can commend Messrs. Geo. P. Rowell & Co., of New York, to those of our patrons who may have occasion to advertise in papers beyond their immediate vicinity, as the firm have business relations with the press throughout the whole country.—[Quincy (Ill.) Whig.]

A competent Civil Engineer, experienced in the construction of Water Works, Reservoirs, Dams, &c., desires an engagement. Address Lock Box 637, Poughkeepsie, N. Y.

Scale in Boilers Removed—No pay till the work is done. Send for 34 page pamphlet. George W. Lord, Philadelphia, Pa.

Small Engines and Boilers, $25 to $50 each. Address N. Sohn, Manchester, N. H.

For Sale—One second hand Horizontal Engine, 20 in. x 48 in. stroke, Puppet Valves, Stevens' Cut-off, Fly Wheel, 14 ft. by 26 in., face turned. Also, one second hand do., 12 in. x 16 in., Slide Valves, Variable Cut-off, Fly Wheel, 8 ft. diam., 12 in. face. Clute Brothers & Co., Schenectady, N. Y.

Hotchkiss & Ball, West Meriden, Conn., Foundrymen and Workers of Sheet Metal. Will manufacture a royalty any Patented articles of merit.

Wanted—To sell a half interest in a large, well established business, secured by original patents. C. H. Kirkpatrick, Lafayette, Ind.

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 13.

Diamonds and Carbon turned and shaped for Scientific purposes; also, Glaziers' Diamonds manufactured and reset by J. Dickinson, 64 Nassau Street, N. Y.

2nd Hand Engines and Boilers for Sale at Low Prices. Address Junius Harris, Titusville, Pa.

The "Lehigh" Emery Wheel. A new patent. Address Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the Boiler, used by all boiler makers who have seen it, $15. Hilliard & Holland, 57 Gold St., New York.

A Valuable Patent of Cast Iron for Sale or on royalty. Box 51, Westchester, Westchester Co., N. Y.

For Blind Fastenings, Securely locking Blinds, top and bottom, preventing sagging, warping, and rattling, address Philipp Weigand, Westchester, Westchester Co., N. Y.

Rubber and Oak Tanned Leather Belting.—Greene, Tweed & Co., 18 Park Place, New York.

Pipe and Bolt Threading Machines. Prices from $80 up. Address Empire Manufacturing Company, 48 Gold Street, New York.

Johnson's Universal Lathe Chuck. Medal awarded by the Franklin Institute for "durability, firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Agents.—100 men wanted; $10 daily, or salary selling our new goods. Novelty Co., 300 Broadway, N. Y.

For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Genuine Concord Axles—Brown, Fisherville, N.H.

Tempies and Oilcans. Draper, Hopedale, Mass.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Machinery Wanted—Edging, Milling, and other Gun Machines wanted, new or second hand. Address E., Box 1755, New York.

Single, Double and Triple Tenoning Machines of superior construction. Martin Buck, Lebanon, N. H.

Notes & Queries

S. W. & Co. will find a recipe for black finish on German silver instruments on p. 283, vol 31.—W. H. S. will find a recipe for fine blacking on p. 283, vol. 31.—J. G. will find a recipe for hair stimulant on p. 363, vol. 31.—R. can clean his rusty guns by using the method described on p. 299, vol. 31.—A. C. C. can stereotype by the paper process as described on p. 333, vol. 30.—J. B. J. can cement marble to granite by using the preparation described on p. 251, vol. 31.—J. B., Jr., will find a full description of colored glass on p. 43, vol. 32.—W. H. H. can preserve eggs by the process described on p. 219, vol. 31.—F. W. A. can mend cracks in cast iron stoves with the cement described on p. 409, vol. 31.—J. C. J. will find directions for making picture canvases on p. 75, vol. 32.—H. L. W. and others will find a description of the production of gelatin relief plates on p. 272, vol. 32.—W. S. H. will find directions for gilding with leaf on p. 347, vol. 31.—W. B. can bronze iron articles by the method described on p. 283, vol. 31.—J. K. A. will find a recipe for a depilatory on p. 362, vol. 32, and for indelible ink on p. 111, vol. 27.—J. McS. should consult Bourne "On the Screw Propeller."

(1) L. J. asks: What composition can I apply to an irregularly shaped brick wall, so as to protect the mortar effectually from the effects of the vinegar generated in apple pomace? A. Coat with tar.

(2) J. H. S. asks: What will remove so-called indelible ink from linen without injury to the fabric? A. Marking inks containing nitrate of silver may be removed by rubbing the spot with a little cyanide of potassium; but it is well to caution those who use this latter salt for this purpose, as it is a dangerous corrosive poison and should be handled with the greatest care, always avoiding any possibility of its getting into an open cut.

(3) A. T. asks: Which is the best external coating with which to paint a cask in which soda water is to be charged and kept for six or seven months? The coating should prevent the escape of carbonic acid gas. A. The carbonic acid would make its escape through any such coating on a cask.

(4) A. B. S. says: Along the Mississippi river, where the water is used for drinking purposes, it is the custom to draw twenty or thirty gallons, which is put into a large earthen vessel, and then a teaspoonful of powdered alum is added and stirred up with the water to clarify it and throw down the sediment, which it does effectually. How does it act? A. The sulphuric acid of the alum unites with the lime held in solution in the water, and forms an insolubie salt which precipitates, and in settling carries down the other impurities with it.

(5) H. E. N. asks: Where can I find a description of Pettenkofer's method for estimating the carbonic acid and ammonia in the air? A. Consult Angus Smith's work entitled "Air and Rain."

(6) W. W. F. asks: 1. What is the gravity of a body which weighs 900 lbs. at the earth's surface, at the distance of 3 miles in the air? A book states that, at 1,656 miles, any object would lose ½ of its weight. Please give a simple rule to work this. A. The question is solved by the equation: $g = g' \frac{(R+h)^2}{R^2}$, where g is the intensity of gravity at the hight required, g' its intensity at sea level, R = radius of the earth, h = the hight desired. If $g = 32$ feet, R = 4000 miles. h = 1656 miles, then $32 = g' \frac{(4000+1656)^2}{(4000)^2}$, and $g' = 16$ feet, which is one half its value at sea level.

(7) R. asks: Will an ordinary gas meter register more without the gas being lighted than if it is lighted, the burners in each case being open alike? A party connected with one of the gas companies of New York has been appealed to, and he states as the result of experiments that about 4 per cent more gas passes through the burners when unlighted than when lighted. Is this correct? A. The difference in rate is due to the difference in density and temperature of the unlighted gas and the products of combustion.

(8) M. W. M. asks: What is the simplest and most effective hygrometer now in use, and how can I make one? A. Place side by side two accurate thermometers, the bulb of one of which should be covered with muslin and kept constantly moist by means of a string or small wick which dips into a reservoir of water below. Evaporation takes place from the moistened bulb which depends upon the dryness of the air; and by the coldness thus produced, the mercury in the thermometer is correspondingly depressed. By comparing the difference between the two thermometers, and referring to a published table, you can easily determine the dew point, etc.

(9) J. W. D. E. asks: Is there any kind of cement or other substance that would render a wooden vessel impervious to air and water under a pressure of from 2 to 4 atmospheres? A. You failed to state for what purpose the cask is intended to be used, or the nature of its contents, whether liquid or gaseous, or the conditions of temperature. It is obviously necessary that all this should be known before any one cement can be recommended.

(10) W. P. K. asks: 1. Can borax be used for toning photo prints in lieu of gold? A. Borax has been used with chloride of gold, in place of carbonate of soda. 2. What can cheaply replace gold chloride? A. The old process of sulphur toning is sometimes employed for cheap prints; but although the tone produced by this method bears a close resemblance to that produced by the gold bath, it renders the picture less permanent. The process of sulphur toning consists in adding to the fixing bath of hyposulphite of soda, on immersing the print therein, a few drops of acetic acid, which renders the bath opalescent. This is due to the liberation of sulphur in a very finely divided condition.

What can be used in a small blast lamp furnace? A. Alcohol.

How can I mount a thin glass electrical wheel so that it shall run truly, the center hole being small? A. Place at each side of the plate a small thick disk of hard rubber, fastened securely to the axle, and having between it and the plate a thin washer of soft rubber, the same size as the disk.

(11) J. H. asks: 1. How can I distinguish an imitation from a real diamond? A. In the case of certain silicates, hydrofluoric acid would answer by attacking them; but in the case of various other imitations, it would be necessary to resort to other measures, such as specific gravity, difference of refrangibility of light, etc. 2. Would fluoric acid act on a real stone? A. Hydrofluoric acid is without action on the diamond.

(12) C. F. G. asks: What is the best kind of iron for electro-magnet cores? A. Swedish charcoal iron.

(13) W. O. asks: Will a lightning rod be safe if it runs down inside of a barn, boxed up? I built an addition to my barn on the side where the rod formerly went down on the outside, leaving the rod where it was, and boxing it. A. If the rod was safe before, it is so now. The main thing is to make a good ground connection. It should terminate in earth constantly wet, and have two or three long lateral branches.

(14) L. & D. say: 1. We have a telegraph line ⅝ of a mile in length, of No. 11 galvanized iron wire, and want to use four sounders, magnet wire No. 23, copper covered. How many cups of 4½×7 inches Callaud must we use? A. Twelve cells. 2. What is the most suitable battery to use on 70 feet of copper circuit for an electric bell, and how many cells? A. Six cells of Léclanché. 3. What kind of battery shall we use for nickel plating? A. Two cells of Callaud.

(15) J. M. says: I tried the recipe given by W. H. S. on p. 132, vol. 32, for making a cheap galvanic battery for plating. I used a quart fruit jar and sheet iron for plates. What kind of wire should I use? Will it succeed? A. Use copper and zinc plates instead of iron. This will answer best for plating. You will find instructions for gold, silver, and nickel plating in recent back numbers.

(16) E. W. P. asks: 1. In making electro-magnets, is the wire wound on the cores in a continuous coil, like cotton on a spool, or is each layer wound separate and the ends afterwards joined together? A. In a continuous coil. 2. In the Tom Thumb battery, is it absolutely necessary to have a septum of paper around the zinc plate? A. Yes. 3. How large a battery would it take to drive an electric engine for a small boat 3 feet long? A. About 150 of Bunsen's large sized cells.

1. Does the term squaring the circle mean finding a square of the same area as the given circle? A. Yes. 2. Why will not the square root of the area of any circle give the length of one side of a square of equal area? A. It will; but how do you measure your circle?

(17) B. S. F. asks: 1. How can I make iron soft for making electro-magnets? A. Anneal it. 2. Can steel be made softer than iron? A. No.

(18) B. B. asks: Please give me directions for making a small galvanic battery. A. Take a glass tumbler, and place in the bottom a sheet of copper, having an insulated wire attached and extending out of the tumbler. Cover the copper with blue vitriol, and suspend a sheet of zinc near the top. Fill the tumbler with water. Connect the zinc and copper together for 48 hours and the battery will be ready for use.

(19) H. S. J. says: In your issue of April 7, in answer to the question: "How can I prepare mucilage for office use?" you tell F. M. A. to "add a little Billitter sulphate of quinine to it, to prevent molding." What is Billitter sulphate of quinine, and in what does it differ from the officinal sulphate? A. The term Billitter sulphate of quinine probably refers to the bisulphate, which crystallizes in thin plates, and not to the normal sulphate, which forms silky needles.

(20) G. C. M. asks: How can I purify fat oils? I have filtered them and obtained them in a very clear state, depriving them of their color, but I am at a loss how to rid them of their taste and smell. A. Try the addition of a very small quantity of iodate of calcium, and allow to stand 24 hours or more before filtering.

(21) G. W. H. says: 1. I want to light gas by electricity. What size and length of platinum wire shall I use for one burner? A. Of the size of a pin and half an inch long. 2. I want to make an electro-magnet to lift a small weight. What sized wire, and how much, shall I wind on it? A. Seventy-five feet of No. 14 copper wire.

(22) W. J. T. says: I have just finished the construction of a Rhumkorff coil; it gives a severe shock but no spark unless the ends of the secondary wire are almost touching, when a minute spark is perceptible; and the increase of battery power does not increase the length of spark. The coil is constructed as follows: Primary wire, No. 16, copper, about 150 feet, cotton covered. Secondary wire, 7,000 feet No. 24 American gage, copper, not covered, but wound so that a paraffined cotton thread of the same size as the wire is interposed between each coil. Each layer of secondary wire is insulated from the succeeding one, by two thicknesses of paraffined paper, care being taken that, at the ends of the coil, the wires did not slip over the insulating paper and so come in contact. The core consisted of No. 20 annealed iron wire, ¾ inch in diameter and 10 inches long, cemented together with paraffin and introduced in the primary wire. The condenser has 60 sheets tin foil, 5x11 inches, laid between paraffined paper 7x11, and properly connected with the two parts of the circuit breaker. What is the trouble? Probably the first thought that would occur to you would be that the condenser was either improperly made or improperly connected with the primary wire; but that is not the case, as the same condenser works well with another coil in which the secondary wire is somewhat finer, but no longer. A. Use No. 40 wire for the secondary coil.

(23) A. W. asks: Is a quantity of frictional electricity as intense as a similar quantity of voltaic electricity? A. Yes, very much more.

(24) A. R. says: 1. A Russian claims to have invented an electric light: A small tube of glass is filled with a pencil of charcoal, the air is exhausted, and the tube hermetically sealed. A moderate current of electricity is then passed through the charcoal from an ordinary electro-magnetic machine, causing it to glow with a very brilliant, but at the same time soft, light. It is stated that the charcoal lasts for an indefinite period, and that the current required is so small that two hundred of these lights can be easily maintained by a single machine. Does such an apparatus require two carbon points slightly separated, or is the carbon in one piece, filling the tube as described? A. Two carbon pencils are used. One is attached to one pole of the machine, and the other to the other. 2. What is meant by the single machine? A. A single machine means simply one machine. No such results as claimed can be attained.

(25) G. J. W. asks: How can I dye kid gloves black or brown? A. The dyes may be applied either by immersion or by brushing over the surface. The latter method is more ordinarily practised.

(26) W. B. asks: What is suitable for staining a brick wall cherry red, so that it will hold its color? A. It is the practice to paint such walls. Clay can be so stained by oxide of iron, but not the finished brick.

(27) E. E. M. says: I have a work on electricity which tells me that a hollow coil of wire, through which a current of electricity is passing, will draw in an iron bar. I have been trying to make such a coil, but have failed. Will you give me the proper directions? A. Take a small rod of wood 4 inches long, and fasten at each end a disk of wood 2 inches in diameter. Wind copper wire, covered with cotton in close spirals, over the rod and between the two disks, filling the entire space. Then remove the coil and you have the helix. Now connect the two ends of the wire of the helix with the poles of a battery of two large Bunsen's cells, and the coil will attract a small iron bar to its center.

(28) J. G. T. says: 1. I wish to bring a stream of water from a reservoir, in a 1 inch pipe, down a hill and across a level to the bottom of the hill. The fall is 100 feet. How high will it throw the water at the foot of the hill? A. If your pipe is smooth inside, has no sudden bends, and is not too long, and you place at its lower end a conical jet of small aperture, you may throw it half the hight of the fall, or a little more. 2. How high would it throw water if the length of the pipe were 600 feet? A. For such a distance you will need a pipe of larger diameter, otherwise you may not throw the water up more than 20 feet or thereabouts. 3. How much pressure will there be on the square inch under 60 feet head and 100 feet head respectively? A. At 60 feet 26 lbs., at 100 feet 43 lbs., provided the water is at rest; when running, the pressure becomes much less, and then depends on the velocity of the flow and the distance from reservoir.

(29) W. P. D. asks: How can I calculate the amount of air in a given quantity of water, at ordinary temperatures and pressures? A. Water at the moderate temperature of 68° Fah. and 30 inches barometric pressure (15 lbs. to the square inch) contains 0·042 volumes of air, or a little over 4 per cent; a cubic foot (1,728 cubic inches) will contain 72½ cubic inches of air. But the air differs from the ordinary air in that, while the latter consists of 4 parts of nitrogen to 1 of oxygen, the air contained in the water consists of 1 part nitrogen to 2 of oxygen. When the temperature descends, the water dissolves more air; at 50° Fah. the proportion is 0·05 parts or 5 per cent, at 32°, 0·06 or 6 per cent. When the temperature ascends, the air is driven out; while, when the pressure increases, the volume of air contained is exactly proportionate to the pressure, so that, at 2 atmospheres or 30 lbs. pressure, water will dissolve 8 per cent of air, at 6 atmospheres or 90 lbs., 24 per cent, etc.

(30) B. B. asks: What is the proper quantity of soda and tartaric acid to be used to a pound of flour? A. Use 2 scruples bicarbonate of soda and 4½ drachms cream of tartar.

(31) J. H. C. asks: How can I amalgamate nickel and mercury? The nickel melts at a very high heat and the other is fluid at common temperature and is very volatile at a high heat. A. Nickel does not form an amalgam with mercury.

(32) A. S. L. asks: 1. How can I make nitrate of silver (for photography) out of good coin silver? A. Dissolve the coin in pure nitric acid and evaporate the solution to dryness. Ignite the residue until all of the nitrate of copper is decomposed. The residue is next to be exhausted with pure water, and the solution filtered and left to crystallize. These crystals should be redissolved in distilled water and re-crystallized. 2. How can I make gold solution (for the toning bath) out of coin gold? A. Place the coin in any convenient vessel, and pour over it a little nitric acid mixed two and one half times its weight of hydrochloric acid and three times its weight of water; digest at a gentle heat, but do not boil the acid, or much of the chlorine will be driven off in the form of gas. At the expiration of a few hours add a fresh portion of nitro-hydrochloric acid, the same as at first. Continue this until the coin is completely dissolved. Then decant into another vessel carefully, so as not to disturb any sediment of chloride of silver at the bottom of the vessel. Next, dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (6 parts to 1 of gold). Collect the precipitated gold, which is now free from copper, and dissolve in *aqua regia* as at first, and evaporate to dryness on a water bath.

(33) H. L. N. asks; How can I best remove ink spots from writing paper, so as not to injure it? A. Wash with a camel's hair brush dipped alternately in oxalic acid and cyanide of potassium.

(34) L. F. B. says, as to the hight at which a tree has to be cut so that its top will strike a given point on the ground: Square the hight of tree and the given distance from tree to point. Divide the difference of these squares by twice the hight of tree, and the quotient will be the hight from the ground where the tree has to be cut. Example: Hight of tree=60 feet, distance of point to the tree 20 feet; then $60^2=3{,}600$, $20^2=400$, difference=3,200. $3{,}200\div(2\times60)=26{\cdot}6$ feet.

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

We have received a handsome stereoscopic picture made by Mr. E. H. Train, photographer, Helena, Mon. Ter., of octohedral crystals of gold. It was sent by Charles Rumley, Esq.—A specimen of galena has been received, inclosed by a mineral supposed to be kaolin. It was, in fact, sulphate of barytes or heavy spar.—N. J.—It is clay, with some carbonaceous matter and a trace of oxide of iron. —P. F. T.—It is spiegeleisen, a kind of cast iron containing a large percentage of manganese and used in making Bessemer steel.—J. A. T.—No. 1 is hematite coated with crystals of ferruginous quartz. No. 2 is wulferite. No. 3 is analcite.—G. G. B.—It is mispickel, and consists of arsenic 46 per cent, sulphur 20 per cent, and iron 34 per cent. It possibly contains some cobalt, but the samples sent were too small to determine this. It has previously been found at Franconia, Jackson, and Haverhill, N. H.—O. A. B.—It is pyroxene, a silicate of lime, magnesia, iron, and manganese. The percentage of iron is not large enough to make it valuable as an ore.—R. T. P.—It is a mixture of clay with grains of quartz and felspar.—S. L.—It is a portion of a large octohedral crystal of iron pyrites.—C. H. W. Jr.—It is white crystaline limestone.—G. W. B.—There was not sufficient for complete analysis, but there was found to be some chloride of sodium or salt, some sulphate of iron, and oxide of iron.—F. H. McK.—It is a mixture of silex and mica, and appears similar to powder from rocks underlying the coal.

COMMUNICATIONS RECEIVED.

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

On Decay of Teeth. By E. D. P.
On the Mouths of the Mississippi. By O. P. S.
On the Inventive Power. By A. A. M.
On Lightning. By D. B.
On Powder Mill Explosions. By C. H. R.
On Fire Escapes. By L. K. Y.
On the SCIENTIFIC AMERICAN. By D. B.
On the Iron Horse. By F. H. R.
On the Potato Bug. By T. A. C.
On the Fireless Locomotive. By F. G. W.

Also enquiries and answers from the following.

E. H. S.—T. J. F.—A. L. P.—J. B. J.—M. R.—C. C. J. —H. C. T.—J. S. B.—W. C. B.—A. E. Z.—A. L. F.— W. H. G.—H. K.—W. H. L.—C. H. C.—G. M. M.— C. & N.—J. P. H.—E. M. B.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who furnishes information as to water wheels? Who makes the most accurate water meter? Who buys sumac? Who makes mercury air pumps? Who sells the best blower for using with a cupola?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained

[OFFICIAL.]

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8,338.—BURIAL CASKET.—F. A. Field, Everett, Mass.
8,339.—BASE PANEL.—M. D. Jones, Boston, Mass.
8,340.—VASE BORDER.—M. D. Jones, Boston, Mass.
8,341.—VASE PANEL.—M. D. Jones, Boston, Mass.
8,342.—TELEGRAPH KEY.—C. W. Lewis, Chicago, Ill.
8,343.—ORNAMENTAL STAR.—W. Martin, Philadelphia, Pa
8,344 to 8,351.—CARPETS.—J. M. Christie, Kidderminster, England.
8,352 to 8,354.—BACKS OF LOUNGES.—G. Hartzell, Philadelphia, Pa.
8,355.—NECK TIE.—R. R. Parker, Indianapolis, Ind.
8,356.—LAMP POSTS.—W. Tweeddale, Brooklyn, N. Y.
8,357—CIGAR BOX.—H. Zimmermann, Chicago, Ill.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, May 19 to June 4, 1875.

4,754.—P. W. Hart, Camden, N. Y., U. S. Lathe machine. May 19, 1875.
4,755.—A. Tracy, Pickering, Ont. Horse power. May 19, 1875.
4,756.—A. B. Sheraton, St. John, N. B. Steam carpet cleaner. May 19, 1875.
4,757.—P. N. Rugg, Compton, P. Q. Wash bench. May 19, 1875.
4,758.—J. D. Lawlor, Montreal, P. Q. Washing machine. May 19, 1875.
4,759.—J. Aikman, North Norwich, Ont. Secret lever hinge. May 19, 1875.
4,760.—M. Lesser, Montreal, P. Q. Cigar. May 19, 1875.
4,761.—D. W. Davis *et al.*, Detroit, Mich., U. S. Preparing fish for market. May 19, 1875.
4,762.—G. W. Howell, Covington, Ky., U. S. Elbow machine. May 19, 1875.
4,763.—T. Warren, Flint, Mich., U. S. Safety stop governor. May 19, 1875.
4,764.—J. Wilson, Toronto, Ont., *et al.* Horse clipping and sheep shearing machine. May 19, 1875.
4,765.—S. W. Benham, Sweetsburgh, P. Q. Fire kindler. June 4, 1875.
4,766.—H. L. Smith, Westminster, England. Single rail railway. June 4, 1875.
4,767.—I. Fréchette *et al.*, St. Hyacinthe, P. Q. Boot shank pieces. June 4, 1875.
4,768.—L. J. Atwood, Waterbury, Conn., U. S. Fireside burner. June 4, 1875.
4,769.—G. M. Mowbray, North Adams, Mass, U. S. Mica blasting powder. June 4, 1875.
4,770.—J. Struthers, Alma, Ont. Snow plow. June 4, 1875.
4,771.—J. E. Waterous, Brantford, Ont. Steam condenser and feed water heater. June 4, 1875.
4,772.—T. E. Webber, Pittston, Me., U. S. Harness lug lining. June 4, 1875.
4,773.—C. D. Wilson, Elmwood, Ill., U. S. Picture frames. June 4, 1875.
4,774.—J. Nicholson, Jr., Pittsburgh, Pa., U. S. Glass furnace. June 4, 1875.
4,775.—Wm. Ascough, Buffalo, N. Y., U. S. Pontoon boat. June 4, 1875.
4,776.—T. J. Blake, Pittsburgh, Pa., U. S. Making shovels. June 4, 1875.
4,777.—O. B. Kendall, Buffalo, N. Y., U. S. Water regulator and indicator. June 4, 1875.
4,778.—P. B. Hennessy, Hamilton, Ont. Time lock. June 4, 1875.
4,779.—G. Henry, Lennoxville, P. Q. Boiler feed regulator. June 4, 1875.
4,780.—R. G. McLellan, Woodstock, Ont. Measure indicator. June 4, 1875.
4,781.—H. E. Susand, Berlin, Ont., *et al.* Saw mill dog. June 4, 1875.
4,782.—H. Hagen *et al.*, Toronto, Ont. Marble-veneered concrete. June 4, 1875.
4,783.—Wm. Schnabel, Orillia, Ont. Elastic wooden seat June 4, 1875.
4,784.—A. G. Bayles, New York city, U. S. Gas burner. June 4, 1875.
4,785.—E. Draper, London, Ont. Musical instructor and game. June 4, 1875.
4,786.—Wm. M. Leyde, Newport, Minn., U. S., *et al.* Thrashing machine. June 4, 1875.
4,787.—Wm. P. Yeoman, Waukegan, Ill., U. S. Ear rings. June 4, 1875.
4,788.—L. M. Bissell, Addison, Ont. Sower shaker. June 4, 1875.
4,789.—L. J. Atwood, Waterbury, Conn., U. S. Lamp burner. June 4, 1875.
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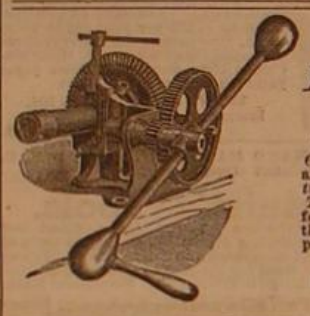
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