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IMPROVED FEED WATER HEATER AND PURIFIER.

To the use of impure feed water, there is little doubt but that a large proportion of the constantly recurring boiler explosions may be attributed. The history of those catastrophes which have happened on the steamboats plying upon Western rivers shows that the majority have taken place when the streams were high and filled with impurities, which last, often mingled with grease or oil, were allowed to enter the boiler with the feed. It is very questionable whether exhaust steam, charged as it is with lubricating matter from the cylinder, should be permitted to come in contact with the feed water, since the grease, mingling with the impurities held in the water, may easily form an insoluble substance which, settling on the bottom of the boiler, may cause the burning out of the sheets, with the attendant dangers thereupon, or at best, with certain kinds of water, may establish foaming in the generator, likewise perilous.

In the annexed engraving is represented the Berryman feed water heater and purifier, an invention which has been in successful use for some time both in this country and in Europe. It was patented as long ago as 1872, by Mr. R. Berryman, of Hartford, Conn.; and since that date many changes have been made and improvements added, until the manufacturers think they have about exhausted all means for additional improvement.

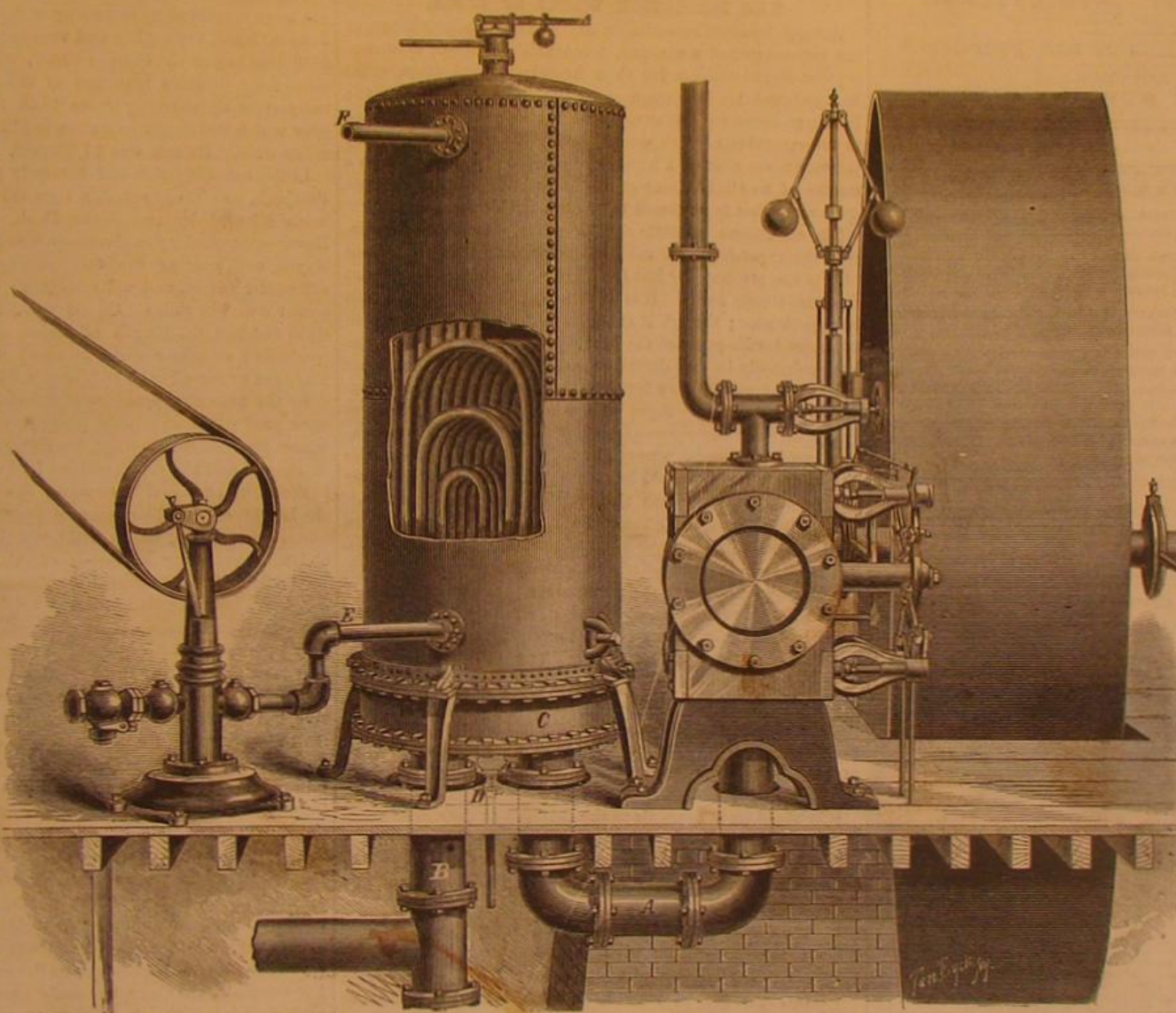
The illustration represents the device attached to an engine, showing all the connections. A portion of the shell of the heater is broken away in order to exhibit the shape and position of the tubes. These last are made in the form of an inverted U, and their lower ends are set in a tube sheet of cast iron varying from two

to three inches in thickness. The shell is composed of boiler plate, strongly put together and capable of sustaining as high a pressure as that to which any steam boiler may be subjected. The tubes are seamless and made of drawn brass or copper. Their shape prevents any alteration by contraction or expansion of the metal, and the mode in which they are set in the sheet renders it impossible for them to work loose.

A is the exhaust pipe of the engine, through which the steam enters the V-shaped tubes in the heater, circulates through them, and finally is conducted off by the pipe, B. The steam can then be utilized for warming a building or shop, or for any other purpose, the same as if it had not been directed out of its course. The area of the tubes is, in every case, at least twenty-five per cent greater than that of the exhaust pipe, so that no back pressure on the engine is produced by them. The chamber, C, is divided by a steamtight partition, and the pipe from the blowcock, D, extends through this partition into the water space around the tubes. The feed water pipe, from the pump, injector, or hydrant, is connected at E near the bottom of the heater, and the education pipe, which conducts water to the boiler, is shown at F. A safety valve is added to guard against excessive pressure within the shell.

It is well known that the large majority of substances which form impurities in feed water will separate and deposit themselves when the temperature of the water is raised to 186° Fah. and thence to boiling; provided, however, that sufficient time is allowed for this to take place, that the water is permitted to remain quiet, and that it is kept under pressure. All of these conditions, it is claimed, are carried

out in the Berryman heater. The capacity of the chamber is so regulated that it contains sufficient water to keep up a constant supply to the boiler for full thirty minutes. This supply being retained at 210° Fah., and under boiler pressure, allows ample time for the impurities to separate and deposit at the bottom of the heater, whence they are removed by occasionally opening the blow-out cock. There is always about 100° Fah. difference between the temperature of the water at the top and that of the water at the bottom of the heater, so that the sediment, falling into comparatively cool water, is not solidified, and therefore, being kept in solution, is easily blown out.



BERRYMAN'S FEED WATER HEATER AND PURIFIER.

The water, being taken in at the bottom and removed at the top of the apparatus, is entirely free from agitation; and as it is pumped through the tubes with simply a check valve between it and the boiler, the same pressure acts upon it as upon the contents of the latter.

We are enabled to glean some idea of the practical working of the invention from a large number of commendatory letters from users of the same, submitted to us by the manufacturer. One writer says: "The feed water, delivered to our boilers in its purity, has not only kept them clean but has entirely removed all of the old scale which incrustated the flues." Another gives a highly favorable report after testing the apparatus very thoroughly on board a Mississippi steamboat. From one letter we learn that the heater maintains the water at a uniform temperature of 206°, and a new boiler connected with it six months ago is yet perfectly free from scale. Still another writer notes a saving of one third of his fuel, another states that hard lime water is rendered as soft as rain water; and thus we might continue giving extracts from dozens of similar testimonials, received from both English and American users, all agreeing in the same excellent results.

The reader interested can, however, obtain full particulars by addressing the manufacturer, Mr. I. B. Davis, Hartford, Conn.

To destroy chinch bugs, put old pieces of rag or carpet in the crotches of the trees attacked. When the worms spin, as they will, in the rags, throw the latter in scalding water. The bugs can thus be killed by wholesale.

Wilhelm Bauer.

There died the other day an inventor who was not entirely unknown in engineering circles in this country. We speak of Wilhelm Bauer, the German submarine engineer, who expired lately at Munich, at the age of fifty-three. In him the now united Germany, for whose cause he fought in his younger days, has lost one of her most gifted inventors, who will now, when he is dead, receive that recognition which he strove hard during his life to deserve, but which the world was slow to accord. Wilhelm Bauer was the son of a Bavarian sergeant-major, and saw the light on December 23, 1822, at Dillengen, near Augsburg. His education was only of a

limited description, and he was at an early age apprenticed to a turner. But this occupation did not suit his ardent temperament and desire for distinction, and he entered the Bavarian artillery at the age of sixteen. Here he had the opportunity of acquiring a knowledge of mathematics, which he was ever eager to extend. On the futile war of independence of Schleswig-Holstein against Denmark breaking out in 1849, Bauer was animated by a disinterested enthusiasm for the cause of the duchies, and was one of the first to enter the collecting Schleswig-Holstein army as volunteer. During the short periods of respite in that struggle, he was able to follow his favorite studies. It is said that in his leisure hours he was fond of watching on the coasts of the Baltic the gambols of the seal, how they rose to the surface and as quickly disappeared, and that their play gave rise to the idea of building a ship which, seal-like, would rise and sink, and which could be navigated under the water. After great pains and exertions,

Bauer constructed a model realizing his idea, and this soon found such favor that he was able, by means of a subscription raised among the officers and soldiers of the armies of the duchies, to build a small ship according to his plan. Accompanied by two sailors he undertook ten submarine trips with the most favorable results; but as the ship had been constructed on the most economical principles, Bauer's funds being limited, it sprung a leak during the tenth trial trip, and sank to the bottom of the Baltic. This happened on the 1st of February, 1851, at nine o'clock in the morning.

The anxiety of the multitude waiting for the reappearance of the vessel may be imagined, but it is impossible even to picture the terrible position in which Bauer and his companions found themselves. During fully six hours they remained in the almost hermetically sealed compartment of the ship, which was filled with compressed air and into which the water could not enter. Fortunately a happy idea struck Bauer in this emergency. He thought that if he were to suddenly open an exit to the great quantity of compressed air, it would rush out with great force. After the necessary preparations he placed one of the sailors close to the small hatch, closed tightly with glass. At the proper moment Bauer opened the hatch and the three were forced upwards, like, as Bauer expressed it, so many corks of champagne bottles, arriving safely at the surface of the water. This was at half-past three in the afternoon. The ship which he had named *Fire Diver* (*Brandtaucher*), and which was destined to serve as submarine fire ship, was of course lost; but general attention was drawn to the young inventor, and King Louis of Bavaria, as well as Prince Albert of England, pa-

troubling him, so that he was able to build a new model, which was inspected by the Emperor of Austria. It was the intention to utilize the invention practically in the Austrian navy; but the project had to be abandoned for the want of money experienced at that time by Austria. When, during the Crimean war, the English and French fleets invested Cronstadt, Bauer was invited by the Grand Duke Constantine to come at once to Russia and construct a ship which could be employed against besiegers. The ship was finished just when peace was concluded; but Bauer undertook 120 submarine trips with it. A large pecuniary compensation had been accorded to him; but as he did not comply with the demands of Russian officials, he was exposed to many intrigues, and had almost to fly from Russia under the protection of the Bavarian ambassador. He repeatedly resided in London, and settled finally at Munich, where he continued his studies undisturbed. His name came again prominently before the public when he effected the raising of the Ludwig, sunk in the Lake of Constance. He earned a lasting name and honors by this feat, but at the same time contracted a severe affliction of the gout, which grew worse with time. Paralyzed and deprived of speech, he spent his days in a chair, but his mind, notwithstanding bodily infirmities, was as fresh as ever. He subsisted on a pension granted him by King Louis, until death released him from his sufferings.—*Engineering.*

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THE ENGLISH PATENT BILL.

The new Patent Bill, which lately passed the House of Lords, was withdrawn in the House of Commons, and has failed therefore to become a law. A great mass of petitions were presented against it, but none in its favor. The general object of the proposed law was, as we have heretofore intimated, to curtail and ultimately to abolish the granting of patents in England. The intended change appears to have roused the strongest opposition among the scientific and working people of England, but was favored by the aristocracy.

The failure of the new bill leaves the present law in force, with all its excellent provisions for the granting and holding of patents by American citizens and other foreigners. Among the provisions are the following:

Any person may apply for, obtain, and hold an English patent for a period of fourteen years; the patent remains good during this period, if the fees are paid, whether the patentee works the invention or not; he is at liberty to do as he pleases in this respect; no one may use the invention without his consent.

Models are not required; but full drawings and specification must be furnished by the applicant.

The government grants a patent to every applicant, whether the invention be new or old; no official preliminary examination as to novelty is made, but the applicant is expected to make his own examinations, all previous patents being printed and accessible.

If the applicant takes out a patent for an old invention, one that is already publicly known, or has been previously patented in England, such patent will be worthless, as it will not be sustained by the English courts. But if the invention is new in England, the patent will be liberally construed and sustained by the courts.

The British patent covers England, Scotland, Wales, Ireland, and the Channel Islands, or a population of about forty millions of the most intelligent people in the world.

The business connected with the obtaining of English patents is easily transacted, while the postal and commercial facilities now existing between the United States and Great Britain are such that an American patentee experiences little more trouble in introducing and profiting from his English patent than from his home patent.

Nearly all inventions that are worth patenting in this country are equally valuable in England.

Circulars containing further information concerning English patents, their cost, etc., can be had, free of charge, at the office of the SCIENTIFIC AMERICAN.

THE IRRIGATION WORKS OF INDIA.

Among the more remarkable engineering undertakings of the last quarter of a century, remarkable for their bold conception and sometimes for their blundering execution, must be numbered the irrigation works of India. And since the Indian government has announced the intention of devoting to the extension of such works, during the next fifteen years, the enormous sum of a hundred million dollars, it becomes a matter of no slight interest to know both what has been done and what is proposed to be done in this direction.

The conditions, climatic and otherwise, which make necessary the expenditure of millions to correct the unkindnesses of Nature, are happily but little known in this land of abundant and timely rains. It is to be hoped that they never will be experienced; though it must be confessed that, in some of the more fertile parts of the land, the drift of climatic change is as pointedly in that direction as it used to be in other parts of the world, once fertile and densely peopled, now deserted and desolate. Ages ago, when Northern Africa was swarming with thrifty people, when Asia Minor harbored unnumbered paradises, when Persia was the garden of the world, their people would have scorned the idea that their lands could ever become the prey of drought and famine. But such has been their fate. So in Northwestern and in North Central India, many seats of ancient power and civilization have become untitled and tenantless through the failure of genial showers; and large areas, as in the lower half of the Punjab and the adjoining territory of Scinde are scarcely habitable, except along the rivers, where irrigation is possible. To a less but still serious extent, the upper valley of the Ganges, a large portion of Central India, and the east coast of the Madras Presidency are made to suffer from a scanty and somewhat precarious rainfall, and are even liable to witness famine following hard upon drought, except where irrigation has made them partially independent of local rains.

It is about forty years since the British conquerors of India began to take a constructive interest in the reclaiming of the formerly fertile parts of the country by means of irrigation works, first by the restoration of ancient works which had fallen into decay.

From an early period the lowlands along the Indus and its five branches—which give name to the Punjab—were saved, from the desiccation which befel the plains away from the river, by means of wells and inundation canals leading off from the natural water courses. These works were shallow trenches, unskillfully planned and rudely executed, from five to seventy miles in length, and fed by the surplus water of the rivers when swollen by the melted snow of the Himalayas. At a relatively early period, many of these canals were restored, deepened, and improved under British management, to the great advantage of the surrounding country. For the further alleviation of the same region, a much more ambitious series of irrigation works has been undertaken, of which more will be said further on.

The earliest work of the sort undertaken by the English was planned and executed by Sir Arthur Cotton, of the Madras Engineers. In the southeastern quarter of Madras, the rainfall, though double that of the Punjab and Scinde, has long been slight and precarious. Various means were adopted by the native rulers to store up water against the time of need, chiefly by means of reservoirs locally known as tanks. Many of these tanks have fallen into ruin, still as many as 43,000 remain, with 30,000 miles of embankment and 300,000 separate masonry works. The same presidency contains also the most ancient specimens of a more ambitious class of irrigation works, consisting of extensive systems of canals, fed from reservoirs formed by the damming of large rivers. The first great work of Sir Arthur Cotton was the restoration of one of these systems, by means of which fertility had once been given to the lower valley of the Cauvery river.

In consequence of the gradual erosion of the bed of one division of the Cauvery, the stream which fed the irrigation canals had been almost deprived of its water, and the total ruin of the country, which depended on the canals, was seriously threatened. By means of an immense dam or annicut, the water was set back into the old channel, the canals were

supplied once more, and the irrigation of Tanjore was restored. Thousands of acres of previous waste were brought under tillage, and the productiveness of the whole territory was much increased. The value of the land was doubled, the annual profits of the cultivators were increased by nearly \$500,000, and the government land revenue was increased \$350,000 a year, all by an improvement which cost only \$400,000.

So successful and beneficial was this work that Colonel Cotton was enabled to undertake a similar but more extensive operation for the improvement of the lower valley of the Godavary. This was the construction of a dam across the river, two and a half miles long, one hundred and thirty feet broad at the base, and twelve feet high. The dam was faced with heavy masonry, filled in with earth, and protected by an apron of masonry stones extending seventy or eighty feet down the stream. A vast system of canals, adapted both to irrigation and commerce, is fed from above the dam. Altogether there are between 800 and 900 miles of artificial channel from which water is supplied to ground otherwise barren, and 50,000 boats and rafts are employed in conveying the produce to market. When the works are finished, 1,000,000 acres will have been brought under cultivation. So far the works have cost somewhat more than \$3,000,000; but this sum has been repaid more than twice over by the increased public revenue. Similar though not so remunerative works have been executed for the irrigation of the delta of the Kistna.

While these works were in progress, the engineers of Bengal were employed in reopening and extending the Western Jumna Canal, giving life and verdure to 350,000 acres. In 1848 was begun the Ganges Canal, with a main channel 348 miles long, primary branches of 306 miles, and minor distributaries aggregating more than 3,000 miles. The area over which it diffuses irrigation is 320 miles long by about 50 miles wide. Its cost was \$7,000,000.

In the naturally rich and formerly populous region of the Punjab, as already noted, a renewal of life and fertility is being effected by the Baree Doab. This canal leaves the Ravee—one of the five rivers—where it issues from the Himalayas, and, passing the famous city of Umrutser, strikes across the desert, and will eventually rejoin the Ravee after a course of 140 miles. On its way, it throws off branches right and left, the length of which gives the whole work (exclusive of minor distributaries) a length of 357 miles. The area expected to be irrigated is 650,000 acres.

In the adjoining province of Scinde are also large tracts of once productive and well peopled country, now a desert, whose productiveness might be restored by the improvement of the old and the construction of new irrigation canals. It is therefore proposed to re-water the country—the valley of the Lower Indus—by means of four systems of canals: an ambitious scheme, which will probably be carried out sooner or later, converting hundreds of miles of waste land into fertile fields.

Many other irrigation schemes are in various stages of development in India, some of great magnitude. Among these may be mentioned the operations recently begun for turning eastward a portion of the waters of the Sutlej, to restore to its ancient condition an immense area, once richly productive, but on which the desert has lately been fast encroaching. Still more important are the works which have been going on for several years in Orissa, to compel the rivers Brahminuy and Mahanuddy to fertilize the deltas which their inundations have heretofore periodically devastated—works on which \$6,000,000 have already been expended.

Though not always wisely planned or economically executed, the irrigation works of India have been, even in a commercial sense, paying investments. Some of them have been extremely remunerative, yielding to the government exchequer, in water rates, increased rent of land, and other revenues, a liberal percentage on the capital invested in them. For example, the Canvey canals are reputed to pay 23½ per cent on their cost, the Godavary works 45 per cent, the Kistna 16 per cent, the Western Jumna 30 per cent. In ordinary years the Ganges Canal, which was unnecessarily costly, pays barely 3 per cent; but in the rainless autumn of 1860, it was the means of saving grain crops enough to keep alive more than a million people, who must otherwise, if left to themselves, have perished from hunger; thus saving to the State not only that number of lives, but the necessity of a proportionate remission of rents and a vast expenditure for the relief of insolvent tenants. The Baree Doab, in the construction of which some stupendous blunders were made, pays 5 per cent. The unfinished Orissa works have not yet begun to be remunerative. Still, as a possible preventive of the horrors of a famine such as scourged the district in 1866, the vast sum thus far expended cannot be said to be an unprofitable investment.

IS EDUCATION FOR CULTURE OR FOR USE?

The interests of education and of educational institutions will occupy a large share of attention during these summer months. And while the universal commendation, by friends and interested parties, of good, bad, and indifferent alike, which conveys the false impression that there is not an inefficient school or instructor in the land, is a topic worthy of serious consideration, we pass it to notice the question as to the real object of education.

Many of our best educators sneer at the idea of making education commercial—at looking to the practical in its pursuit; and in our highest educational circles, these things are considered beneath the dignity of a real student. This idea has been so eloquently and beautifully expressed by President Capen, of Tufts College, in his recent inaugural address, that we quote it as a sort of text for the remarks we wish

to make. On the "Purpose of the American University," he says: "First of all it purposes culture, pure and simple, and this, too, for its own sake. All other objects are sunk from view. It assumes that learning is the highest and noblest of temporal pursuits, that it is even removed from the common range of temporalities, and linked by a mysterious process to the ineffable and eternal. Hence, it aims to present learning in the guise of a fair and beautiful maiden to whom youths are invited to pay their court, as to one who will hold sweet and delightful converse with them and never deceive them or lead them astray." With no purpose or desire of raising a personal issue, we use this simply as a fair exponent of the views now held by those highest in authority and influence in the field of education.

Culture, we admit, is indispensable; but is the real object and end of culture for its own sake? Is it not rather for some greater good it will gain for self and for others? If we strive for the pure and simple culture, with "all other objects sunk from view," wherein is the individual or the world benefited? What is culture, thus limited, but unproductive capital, and why is not this as unwise in intellectual as in political economy? A horse trainer exercises his young horse regularly and judiciously; but does he do it simply to make a trained horse of his beast? Does he not rather do it because he knows a well trained horse will be of more service to him than an ill or untrained horse? Gymnastic exercises tend to the development of physical strength, but do we consider him remarkably wise who has the ultimate end in view simply to gain the organic strength? And does not this limited idea of culture make it mere intellectual gymnastics? If one is more brilliant and instructive in conversation, stronger for any work in which he may be engaged, a more efficient and better friend, neighbor, or citizen, his culture has its use. But genuine culture may still exist if it accomplishes none of these things. The possessor of it may be honored in the training school, but on his entrance into active life, he is staggered by the question: "What can you do?" and may fall to answer it all his future life. He is like the good gymnast who would insist that he is qualified for any manual or physical employment because he possesses strong and well developed muscles.

The shortsighted policy of giving attention to nothing that has not an immediate and remunerative money value—the penny wise and pound foolish policy—and that which can be influenced by no higher consideration than a pecuniary one, we most heartily despise. But if its end and aim and the final result are not beneficial in some way, we are forced to urge the unpopular and vulgar query: What is the use—*cui bono*? Most Science has practical value because it tends to enrich and benefit mankind. Some is called pure science, and is fascinating to its disciples for the very reason that it is "removed from the common range of temporalities," and is entirely uncontaminated with anything of a practical nature. A learned Professor of Zoölogy in a famous institution not a thousand miles from New York, at the close of an exhaustive lecture on some of the cranial nerves, gave a good illustration of this, in reply to a question as to the office of these nerves, by saying he could not tell, as he had no interest in knowing their use, and suggested that a physician had to do with such questions. Such topics as these contribute to general culture in its purity, and it is said by the really wise (!) that none but the worldlywise and shortsighted would interdict them. Many questions of interest to the student arise in the progress of public scientific undertakings, as State geological and natural history surveys, which do not directly benefit the people who authorize these surveys. And in one of our Western States, the legislators had the wonderful providence to direct their State Geologist to exclude theories from his report, and to record only facts. We can hardly conceive of any question connected with the laws of Nature which must not be, either at present or ultimately, of benefit to mankind in one way or another; but if it could be shown that such exists, we ask, in all candor, why not leave it, and give the attention to such investigations as have other recommendation besides the fact that they merely contribute to pure culture?

There may be something defective in the notions of those who desire only the practical in education; and on the other hand, there may be a little error in the ideas of those who ridicule this course. One seeking the purely practical may be unsymmetrical, or a one idea man, from studying only what he wants to use; while by the opposite course he may be a bookworm, or, in his efforts to embrace the whole field of learning for the sake of culture, be necessarily a mere smatterer in all. If the age of Methuselah were ours, it might be reasonable to expect proficiency in an extended range of subjects; but in our short lives, we can reasonably look for the result by pursuing the line of study that is most congenial. In other lines one labors at a disadvantage which is as unwise in intellectual as in physical pursuits. We can see no good reason why that division of intellectual labor, which will give to each the work at which he can accomplish most, is not as wise as a similar division of physical labor. There is no great wisdom in working at a disadvantage, either with the hand or the head, when this can be avoided. The toll we hate is the more fatiguing and less improving in one case as well as in the other. And since the opportunities for research on any one subject are unlimited, and a thorough knowledge of one necessitates a general knowledge, at least, of all allied subjects, who shall say that just as much culture and breadth of mental power cannot be acquired by pursuing only those studies which bear directly on one's chosen object of pursuit? A blacksmith or farmer has no need of resorting to gymnastics to gain strength and skill for his productive work; and cannot a student gain the requisite strength of mind for his life work, in his chosen field as well as out of

it? The mental stimulus which accompanies work in the direction of one's interests tends to greater success in this way than can be gained, under ordinary circumstances, when the attention is called to topics which suggest no definite object besides that of general culture. If culture is the first and highest object, it would seem consistent with this view to make those studies, which are considered most conducive to culture, compulsory in the curriculum, regardless of any practical benefit. But, instead of this, there is a marked and growing disposition to increase the ratio of elective to required studies in the graduating courses of our best colleges. Unless the student is guilty of the unmanly practice of choosing a study simply because it will gain for him the highest "mark" with the least possible effort, he is likely to enter with more zest upon chosen work, in which he has a definite object, than when he has no clearly defined purpose in view. For instance, one will study more closely—and hence gain from it greater culture—something he intends to teach, to use in conversation, for the platform or the press, or to put to some other definite use; and his interest and mental activity will be excited, as a rule, just in proportion to his estimate of the practical benefit resulting from it in the future, to himself or to others. The reason why so many are graduated from our institutions of learning, with comparatively little or no knowledge of the subject over which they have passed, is doubtless that, having no definite object for study, aside from the name of being a graduate, the results of general culture are too visionary and uncertain to afford stimulus to sustained and successful efforts. Hence we claim that, since all are by nature averse to labor, every stimulus that is laudable should be furnished to aid the student to the largest endeavors. A favored few may find sufficient incentive in the mere desire to know; but even in this case, mental activity and success will be increased if, in addition to this praiseworthy desire, there is also a clear perception of some beneficial result which will follow the fact of knowing.

Is it strictly correct to assume that learning is the highest and noblest of all temporal pursuits? If, to make it thus, it must be removed from temporalities, and linked to the ineffable and eternal, it would seem to be no more a temporal pursuit than heart culture, and is not the latter higher and nobler than head culture? There seems to be a natural order of development in the objects which, at different periods, have been held in highest esteem by mankind: from muscular power, through wealth, to intellectual attainments; and we trust the time may dawn ere long, when one with the highest and purest motives, other things being equal, will be looked upon as having attained a higher and nobler object of pursuit than physical strength, wealth, or mental culture.

The idea of presenting learning in the guise of a fair and beautiful maiden to whom youths are invited to pay their court, and with whom they may hold sweet and delightful converse, is a very beautiful and attractive one; and yet, if this is for its own sake, what is it but elevated and innocent pleasure-seeking—a sort of butterfly existence? There is pleasure in gymnastics or physical culture, so there is in mental culture; but if either is sought simply for the pleasure it affords, why is the seeker of mere pleasure in this particular way so much more exalted than the pleasure-seeker in any other way?

It probably will not be denied in theory, however much it may be in practice, that the highest ideal of life is that "no man liveth to himself," and that he is noblest of all who does most for others. The best servant is the greatest. With this truth accepted, it is evident that the primary object of education, and of all effort, is to qualify one's self for the greatest and most effective service to mankind, and to succeed in the performance of this service. This will necessarily bring all desirable secondary objects with it.

SPIRIT RIFLE PRACTICE.

The papers contain an account of a so-called elaborate investigation of a materialized spirit, which recently took place in St. Louis, Mo. The medium was one W. C. Clark, who pretends that he has a band of thirty-two disembodied spirits about him, some of which he can materialize by the odic or mesmeric force in him. During this materialization, the medium was tied up in a closet, and the room darkened; when, after a little while, a curtain was withdrawn, exposing a part of the interior of the closet, in which then the ghost or materialized spirit was seen. As it was suspected that, in this case, the same kind of deception was employed as in the Katie King affair, namely, that a real person of flesh and blood acted the rôle of the spirit, it was suggested that a crucial test would be to fire at the spirit with a loaded musket, as a real spirit could not be hurt by such an experiment. Mr. Clark having asserted that his materialized spirits were no deceptions, but real spirits, and could stand such a test, he received from an able marksman the following formal challenge:

ST. LOUIS, AUG. 4, 1875.

MR. CLARK: Dear Sir:—Having attended a *séance* given by you, and having seen the wonderful materializations, I will give you fifty dollars to produce one face at the aperture, if you will let me, or any person I may name, fire a shot at it with a rifle. If it is a spirit face it cannot hurt it, and it will satisfy me it is not you with a mask on your face. My conditions are that you will disrobe yourself and put on clothes I shall produce, and permit me to fasten you to the bottom of the cabinet. Yours, respectfully, HENRY TIMKENS.

This was accepted by Mr. Clark. On the appointed evening, August 8, he was divested of all clothing, and other clothes brought by Mr. Timkens were put on him; he was tied down to the bottom of the cabinet by ropes passed through holes; a black curtain covered a window at which the ghost was to appear; the window was located on one side of the medium; the string to open this curtain was placed within reach of Mr. Clark. The cabinet was closed

and the lights turned down; and after a period of painful stillness, the medium asked the audience to sing, and they did so with a will. After they had finished several songs, a loud knocking was heard, which slowly became more gentle, and then ceased. After three quarters of an hour, during which nothing happened but an occasional spasmodic knock, a painful cry was heard in the cabinet, the black curtain was withdrawn, and a face appeared at the window. It was that of a girl with blue eyes and brown hair. The face was instantly seen by all present, and is described as having fixed features and other characteristics of a mask. "Fire," said the voice of Mr. Clark in the cabinet; and Mr. Timkens, who had before pointed his rifle at the center of the window, pulled the trigger, and the ball passed through the face and lodged in the back partition of the cabinet: while the face remained at the window unmoved for about a minute longer, when it was concealed by the black curtain, which was drawn over the opening.

The account is very minute in details about the inspection of the cabinet, and the ropes with which the medium was tied; and it especially reports all which the latter said concerning his fatigue and the emanations from his own spirit and the other spirits he controls; but no means appear to have been taken to get hold of the mask, which was doubtless the thing used.

The same parties (the Holmes') who exhibited the Katie King materialization in Philadelphia were recently exposed in Brooklyn, where a company of spiritualists themselves found out the deception practised by masks, which were exhibited before a curtained window, as at St. Louis. Such a mask, of course, would not be hurt much by a ball; but there are other more scientific and refined methods of practising these deceptions, such as optical contrivances, which can be made to give images which are perfectly visible and totally intangible.

Any one who has seen the perfect illusions produced by the stereopticon, which is nothing but an improved magic lantern, or with the megascope, by which the perfect image of solid bodies may be thrown on smoke, vapor, or dust, can understand that the so-called materialization trick can be easily performed by such means. Such an image, falling on a black curtain, is invisible; but on a white translucent smoke, its resemblance to a real body is such that it is next to impossible to distinguish it, except by an investigation during the exhibition of the image, the investigator placing his head in the opening, and looking around to see where the machine is, from which the light forming the image proceeds.

Persons unacquainted with these and similar resources of physical science, which are increased in number and improved almost daily, are of course utterly incompetent to investigate the means by which tricks of this kind are practised; and their conclusions as to the absence of any deception are of no account whatsoever. The above is only one of many illustrations of cases where the nature of the deception remains undiscovered, simply from the deficiency of knowledge and acuteness of those witnessing the performance.

THE KEELY MOTOR DECEPTION.

Most of the newspapers in Philadelphia, the home of the pretended New Motor, have refrained from any condemnation of the Deception. The *Public Record* is, however, a notable exception. The proprietors of that journal, which by the way is one of the most widely circulated dailies in the country, have put themselves to considerable trouble in collecting information, which has been presented to their readers in a series of able and exhaustive editorials. The effect of these articles is to place the grossness of the Deception in such a strong light that its aiders and abettors will, to say the least, be rendered uncomfortable. These people confess to having obtained large amounts of money, paid by credulous persons who were made to believe in the verity of the thing. The principals are doubtless liable to indictment and trial for obtaining money under false pretenses, and it will not be very surprising if some of the victims move in the matter before long.

It appears from the researches of the editor of the *Record* that the attempts to procure patents on the Keely motor have failed. In all doubtful cases, the Patent Office has the right to require the applicant to produce a working model or machine; and this was required of Keely, but he could not bring forward the model, and had to abandon his case. But this did not prevent extensive commercial dealings by the Keely people. The *Record* states that the Patent Office books exhibit "no fewer than thirty-four documents relating to the transfer of interests in the following named inventions: "Independent fly wheel," "hydro pneumatic pulsating vacuo engine," "globe motor," "dissipating engine, multiplier, or generator," "automatic water lift." The first assignment is dated July 11, 1871, and the last February 15, 1875. Eighteen different parties have been engaged during this time in buying or selling interests in this invention, and this does not include the subscribers to the stock.

COMMON coal oil is an excellent mosquito bar. Drop a little on a piece of cotton, squeeze as dry as possible, and rub over the exposed portions of the body. The smell of the oil disappears in about five minutes, and no mosquito will alight upon the anointed places. This is said to be better than pennyroyal essence for the same purpose.

DO NOT kill the toads. In Paris, they are sold at fifty cents a dozen, in order to protect vineyards and gardens from insects. A toad will swallow the biggest kind of a tomato worm.

THE BRITISH ARCTIC EXPEDITION.

We have so recently given to our readers full accounts of the nature and purposes of the arctic expedition which has just sailed from England that no recapitulation is necessary in describing the engravings on this and the following page. The first is a portrait of the commander, Captain George Strong Nares, of the *Alert*, the leading vessel of the expedition. He entered the Royal Navy in 1845, having gained the annual naval cadetship given as a prize of merit to the boys of the Royal Naval School at New Cross. He served in the *Canopus*, in the Channel squadron, until 1848, when he joined the *Havannah*, and served three years in her on the Australian station. Having returned with his vessel to England, he was appointed mate of the *Resolute*, employed in the arctic expedition of 1852, under Sir Edward Belcher. With this ship he passed two winters in the ice. Upon the return of that expedition, he became gunnery lieutenant of the *Glatton*, an ironclad vessel of immense armament. He afterwards held a similar post in the *Conqueror*, under Admiral Sir Hastings Yelverton. When the present system of training naval cadets was instituted, Lieutenant Nares was placed in charge of those on board the *Britannia*, under the late Captain R. Harris. He held this appointment till promoted, in 1854, to the rank of commander. With that rank he served in the *Boscawen* training ship at Southampton, and in the *Salamander* and the *Newport*, surveying vessels. In the *Newport*, Commander Nares made a survey of the Gulf of Suez and of the entrance to the Suez Canal. He had made himself known to the public and to the profession as author of an excellent treatise on seamanship, including the fitting and rigging of ships, sailing, management of boats, etc. In December, 1869, Commander Nares was promoted to be captain, but retained command, in the *Shearwater*, of the Mediterranean survey. This he left in 1873, when appointed to command the *Challenger* in her voyage of scientific investigation round the world. Captain Nares took the *Challenger*, whose voyage of discovery has

led to many important results which have been duly chronicled in our columns, to Australia and the Indian and South Pacific oceans; but when his ship reached Hong-Kong, early

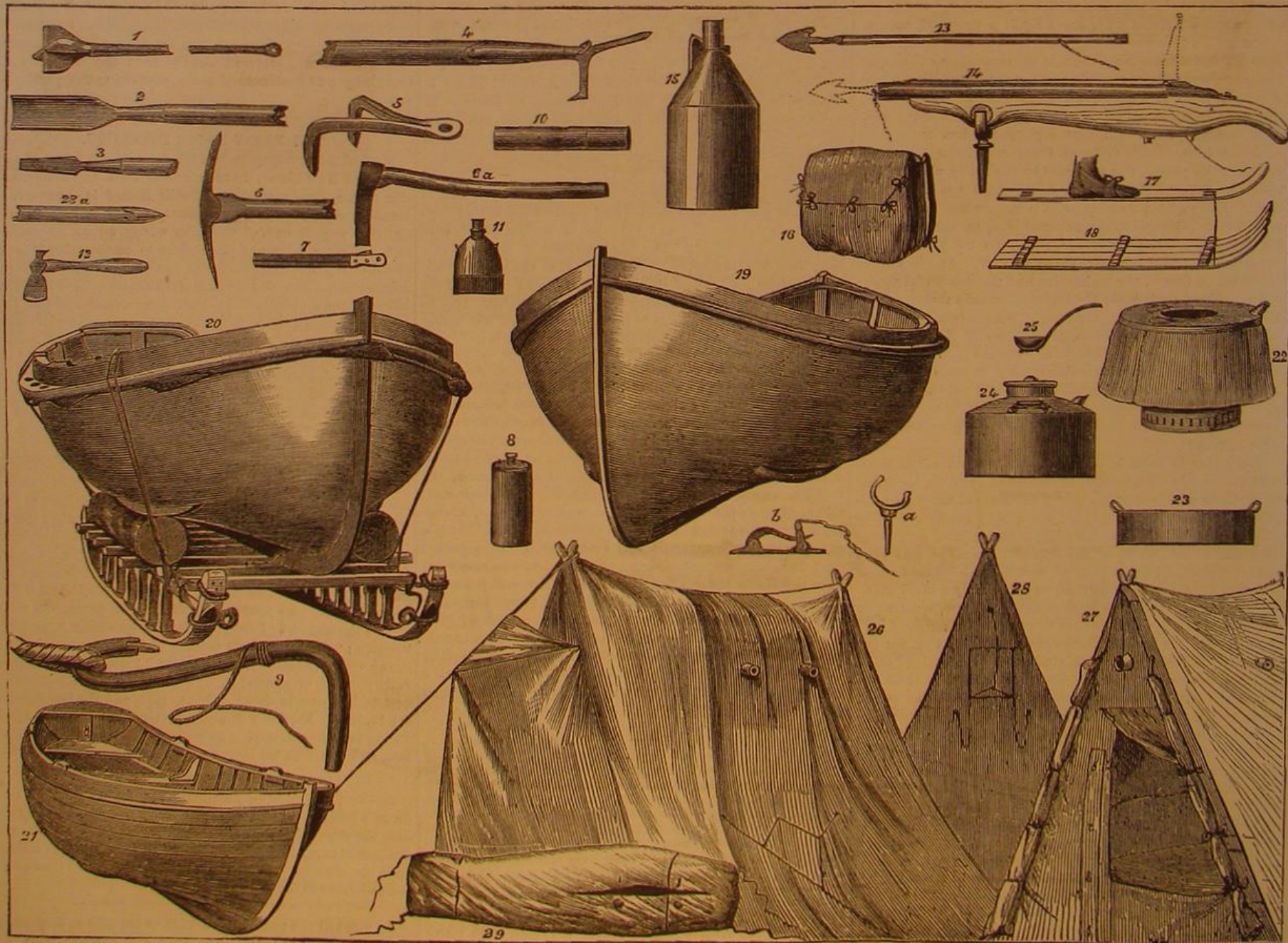
in this year, he was ordered home to take command of the arctic expedition.

Our next engraving contains accurate representations of the principal apparatus and appliances, most of which are new inventions, the result of experience gained in previous expeditions. The list is as follows:

- 1, Ice crusher, with leather handle, 5 feet 6 inches long; 2, ice gouge, 8 feet long; 3, ice chisel; 4, ice point; 5, ice drag; 6, pick-ax, weighing 6 lbs. 14 ozs.; 6a, ice ax, weighing 8 lbs.; 7, snow knife (in case); 8, blasting tin; 9, ice anchor, kept in four sizes; 10, dispatch tin, in different sizes, fitting one within another; 11, water bottle, with leather mouth and cup; 12, pemmican hatchet; 13, harpoon; 14, harpoon gun, the harpoon dotted in position; 15, rum can, with drinking cup fitted on top; 16, canvas knapsack, to be fitted over the shoulder by a strap; 17, snow shoe; 18, small sledge of four snow shoes lashed together; 19, whale boat, 25 feet long; a, row lock, b, catch for main sheet; 20, ice boat, 20 feet long; 21, punt, 12 feet long; 22, cooking apparatus, into which fits (23) the stew pan, and inside this fits (24) the kettle; 25, ladle for the same; 26, tent for eight men; 27, front of the tent; 28, back of the tent; 29, duffle sleeping bag. Most of these articles explain themselves, but special mention may be made of the ice tent (26), which is shown pitched, ready for use. It accommodates eight men, the officer lying furthest in, the men lying heads and heels, with the cook for the next day nearest the door, which it is his duty to make fast; and he lies here because it devolves on him to get up in the morning and prepare breakfast in advance of the rising of his comrades. It is the privilege of the man who has come off duty as cook to lie next the officer. The sleeping equipment for use in this tent consists of various strata. Next the ice is an india rubber sheet, covered with a thick robe of soft felting; on this the men lie in their sleeping bags of the same material, inside which they get, "all standing," for there is no undressing on sledge journeys; and over all there is another duffle robe. The cooking utensils (22, 23, 24, 25) pack into very



CAPTAIN G. S. NARES.



BOATS, TENTS, AND IMPLEMENTS FOR ARCTIC USE

small dimensions, the fuel used being stearine, spirits of wine, or tallow. The harpoon gun (13, 14) will be fastened on a swivel at the bow of a whale boat. Its length is four feet, and it is made of the finest steel. The gun, though single-barreled, has two nipples to the lock, to avoid the chance of a cap missing fire.

While travelling with the sledges, each man will be supplied with a water bottle, resembling an ordinary spirit flask in shape, but with the mouth and cup covered with a leather coating for the purpose of protecting the mouth from cold contact with the metal. The bottles will be replenished from the condensers, and the water will be kept in a fluid state from being carried in the bosom. The sledges will also carry a supply of rum of extra quality; but this will only be used in cases of emergency, as it has been ascertained that the best antidote against the polar temperature is not spirit, but oleaginous food, of which pemmican is a highly nutritious and concentrated form.

Our next illustration (Fig. 3) shows the form of sledge specially designed for this expedition. It is intended to accommodate two officers and eight men, and to carry provisions for a journey of seven weeks. Above the sledge are shown (1, 2, 3) a gage, chisel, and hooks for cutting through the ice.

Fig. 4 shows (1) the substantial sledge intended to convey provisions, etc., to the depots to be established along the route. No. 2 is an ice drill, No. 3 a snow knife, No. 4 a grapnel or drag, No. 5 a snow shoe or skate, and No. 6 an ice anchor. In this engraving is also shown an ice saw and the manner of manipulating it.

Our next engraving (Fig. 5) exhibits sailing sledge, intended for use when the wind is favorable; and the rigging is clearly shown. If these sledges ever attain any such speed as is common on the Hudson river with ice boats, a very careful lookout will be necessary to prevent officers and men being engulfed in the fissures in the ice.

Each sledge will carry its cooking apparatus, shown in our sixth and last engraving. Where more is required, the apparatus will be of two kinds, one being formed entirely of metal, and the other being of wood, with an inner and outer

petroleum is directed on to the surface of the burning coal; the gases are thus mixed in the nascent state, and, to still further ensure their thorough mixture at a high temperature, they are passed through a chamber formed of fire brick, with small spaces between the bricks, heated in the manner of a Whitwell hot blast stove; this ensures a thorough mixture at an exceedingly high temperature.

The charge which has been used in some of the works using this process has been about 280 gallons crude petroleum and 3,600 lbs. anthracite for the production of 70,000 cubic feet of illuminating gas, the total cost amounting to 56 to 60 cents per 1,000 feet.

while the edges of the sun and planet were apparently overlapped, the black disk of the latter not merely stood out in strong contrast on the white disk of the solar photosphere, but the outer portion of the planet was still plainly visible on the reddish background of the chromosphere. Moreover, when the black disk had entered to at least the distance of its radius on the solar surface, the exterior segment became surrounded with a thin luminous halo, supposed to be due to the refraction of solar light in the atmosphere of Venus.

The practical object in which the observation of the phenomenon may result is the rendering possible of observations of transits of Venus when the planet passes behind, as well as when it crosses before, the sun. For if the very weak reddish light of the chromosphere, which forms the corona about the sun, contrasts sensibly with the black of the planet in conjunction, the brilliancy of the planet in opposition and in full phase will afford even a greater contrast. It is true that the apparent diameter of Venus is nearly six times less in opposition than in conjunction; but it is certainly sufficient to render the planet visible as it crosses the chromosphere, and this even when a portion of the solar disk comes into the field of the telescope. The accuracy of the data obtained by these observations would be about six times less than that of observations similar to those of last December, owing to the greatly increased distance of the planet from the earth in the former case. But for the same reason, the passages behind would be more frequent, for they take place for oppositions six times further from the orbital node. This frequency, M. Philippe Breton (to whom the credit of the foregoing suggestions

is due) thinks would compensate for the lack of accuracy; and he further points out that the comparison of observations of transits before and transits behind might add to the precision of the measures which we now possess of the elements of both sun and planet.

The next transit behind the sun will take place in 1878, and will be followed by four others at intervals of eight years, the last occurring in December, 1910. After that year, two centuries will elapse before another series of eight or nine passages will take place, among which series will be included two transits before the sun.

If, therefore, there be anything useful, which seems probable, to be gained by observing these back transits, preparation for the next one should not long be delayed. Four of the present series, those of 1846, 1854, 1862, and 1870, have already passed. They might have been utilized for perfecting the observations for the transit before the sun of 1874, just indeed as the one of 1878 may yet be with reference to the transit of 1882.

Salicylic Acid.

In our paper for August 14, page 96, we gave an account of the chemical formation and nature of this excellent disinfectant. The following information concerning its uses is furnished by Dr. E. R. Squibb, of Brooklyn, N. Y.

"It is used for medical and surgical purposes, either dry or in solution. When used dry, it is sprinkled on to wounds, ulcers, or dressings in the form of very fine powder, in very small quantities, either simply powdered, or mixed in various proportions with some diluent, such as starch. When used in simple solution, either for spraying surfaces, or for washes or gargles, it is used in tepid solution of about 1 part to 300 parts of water. Where stronger solutions are required, for washes, gargles, or to moisten dressings, 1 part of the acid and 3 parts of phosphate of sodium to 50 parts of water have been used. When applied to wounds it appears immediately in the urine.

Its alleged advantages over all other antiseptics are: First, that it is far more powerful and effective in smaller quantities; and secondly, that it is, in all quantities necessary for complete effectiveness, entirely devoid of irritant action upon the living tissues. It is not caustic nor corrosive in any quantity, and never produces in-

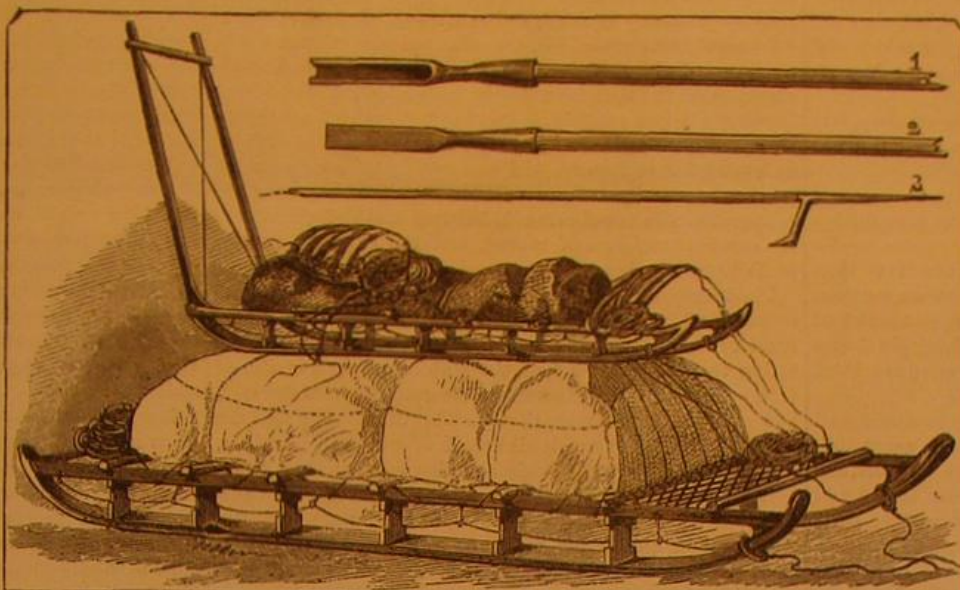


Fig. 3.—ARCTIC SLEDGE.

This promising improvement in gas-making has passed the stage of mere experiment, and appears to have entered that of practical success. Warned by the fate of several naphtha and petroleum processes brought out with many promises and small performance, the inventor of this process and his friends determined to thoroughly test this invention on a practical scale before giving it publicity. They erected their first gas works at Phoenixville, Pa., a place of some 10,000 inhabitants, and have since put it in operation at several small towns. It is, we understand, successfully working at each of these places, at Phoenixville having now, for eighteen months, lighted the town to the general satisfaction. The cold of the past two winters has affected this gas no more than, if as much as, ordinary coal gas, and, consequently, the fixedness of this product appears to be fully established.

To demonstrate the adaptability of the system to the lighting of large cities, works were established by arrangement with the Utica Gas Light Company, and we are informed that, for the past three months, the city of Utica has been lighted exclusively with gas made by this process; and we understand the Gas Light Company is so well satisfied with the results that it proposes to adopt it permanently. Not the least item of saving effected by this process is in labor. But two men—who are common laborers—are employed at the Utica works, and their time is but partially occupied; the addition of one more would suffice for a production of four times the present supply. The cost of the gas in the holder is claimed to be not over one half that by the old method, while the quality of the light is very satisfactory.—*Engineering and Mining Journal*.

Transits of Venus behind the Sun.

The observations of the transit of Venus made in various parts of the world last December have adduced, among other important data, one fact both novel and unexpected. This

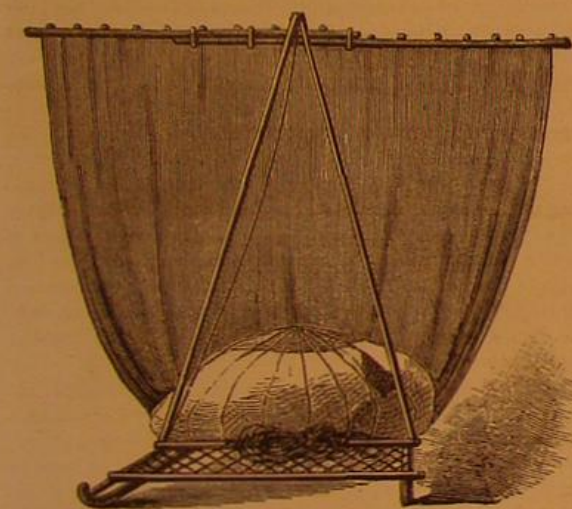


Fig. 5.—SAILING SLEDGE.

sheathing of tin, and having a receptacle on the top for condensing snow, which thus ensures a constant supply of potable water. The cooking stoves are circular, the heat being obtained by burning either spirit or stearine; and by an adjustment of saucepans, one upon the top of another, both pemmican and preserved potato or other condiment can be cooked at the same time. The whole is protected from the weather by an envelope of thick woolen cloth.

A New Lighting and Heating Gas.

It would appear as if a practical success has been attained in the process invented by Mr. T. S. C. Lowe, of Norristown, Pa. His method consists in producing, from anthracite and the decomposition of steam, a gas of very high heating power, and then enriching this by means of crude petroleum when the gas is to be used for illuminating purposes. The anthracite is charged in a small cupola of, say, 3½ feet in diameter, the bed of coal being kept from 3 to 4 feet deep. When fairly ignited, the base is closed, and superheated steam is admitted through tweers a short distance above the grate bars; the steam in contact with the burning coal is decomposed, and the gas produced is a mixture of hydrogen and carbonic oxide. The cost at which this excellent heating gas is produced is very small indeed, and its application in metallurgical processes and for domestic use offers many important advantages. Of course it is in this state entirely unsuited for illuminating purposes. To enrich it, a small jet of crude

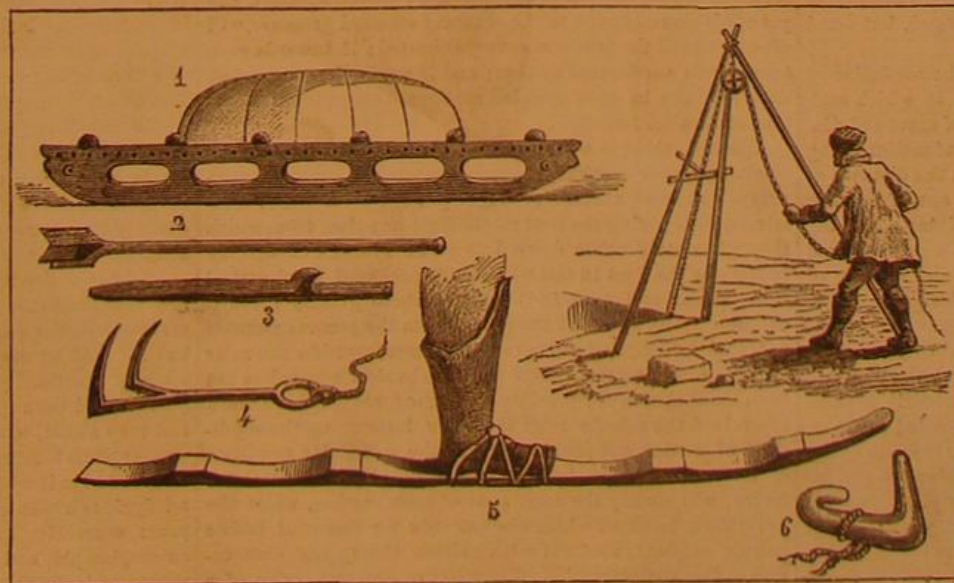


Fig. 4.—ARCTIC TOOLS, ETC.

is that, with the powerful glasses with which the observers were provided, the disk of Venus appeared clearly defined in black upon the chromosphere which surrounds the sun before the first contact and after the last. Between the first and second contact and also between the third and fourth,

inflammation. In large quantities it may be irritant and painful, but yet rarely surpasses a stimulant effect, while it appears to be quite neutral in the very small quantities which are yet thoroughly effective; thirdly, it is said to reach and prevent processes of decomposition which are beyond the reach of all other antiseptics or anti-ferments. These processes are of two kinds, namely, vital, or those in which living organisms have an important part, such as that produced by yeast and many of those which occur in putrefaction; and chemical, or those which occur independent of vitality, as the production of the volatile oils in mustard and bitter almonds, the effect of diastase, etc. Now, while carbolic acid and other anti-ferments are axymotic, or completely arrest or prevent fermentations of the first kind, they are powerless with the chemical processes. Salicylic acid is said to be more effective with the vital ferments, and equally effective with the chemical.

Fourthly, in quantities said to be thoroughly effective, it is entirely odorless, and tasteless, and harmless, whilst it has no poisonous effect in any reasonable quantity.

It prevents or arrests the souring of worts, washes, and beers of the brewers, and prevents or arrests the putrefactive agencies which are so troublesome and destructive to the glue manufacturers; and these and similar trades have thus far seemed to be its principal consumers. Separate portions of fresh milk were set aside to become sour; one to which 0.04 per cent of salicylic acid was added soured thirty-six hours later than the other. Urine thus protected was on the third day still clear, and free from ammoniacal odor.

Professor Thiersch, of Leipsic, used it upon contused and incised wounds, and in operations, with excellent general results, destroying the fetid odor of cancerous surfaces and pyæmic ulcerations. To such uses this writer would add the suggestion that, for washing out the cavities of the abdomen and chest after those operations which tend so strongly to septicæmia, solutions of salicylic acid would seem to offer very great advantages, should it prove to be as bland and un-irritating as it is stated to be, and yet so effective.

Most of these statements are summed up from the periodical literature of continental Europe during the past six months, little having appeared upon the subject in Great Britain, or in this country, and nothing having been done with it so far as known in either country.

If the medical art is to keep pace with the progress of the physical sciences, physicians cannot afford to pass by such articles as salicylic and benzoic acids when offered by chemistry, without investigating their effects upon disease, even though not one out of ten should repay the labor of investigation; for it is certainly in this direction of research that medicine must look with greatest hope of success to control those abnormal vital processes which so far may be modified, but not stopped.

The phenols, especially the so-called carbolic and cresylic acids (phenol and cresol), were, and must always remain to be, most important additions to this class of agents, surpassing in power all that had been previously tried. And if now salicylic acid shall prove more potent than the phenols, the further gain will be very great, and the research will again lead up toward future discoveries of still greater power."

Correspondence.

On a Mechanical Theory of Cosmical Motion.

To the Editor of the Scientific American:

As all attempts hitherto made to frame a satisfactory mechanical theory of the motion of cosmical bodies have resulted in total failure, and as the constancy of motive energy, as well as the aberration of light, show that both the ether and dense bodies are relatively unaffected by the movements of the latter, a reconsideration of the condition of both is demanded. The problem, it is plain, is to find a non-resisting physical cause of balanced motion, the idea of action at a distance being dispensed with. It is fully conceded, from the very fact of our previous inability to explain such motion, that some great and uncommon assumptions are necessary; and this has not only been acknowledged, but acted upon.

As a matter of fact, we observe in Nature the resolution of all cosmical bodies into systems of couples, in which each one of the couple moves in the inverse ratio of mass and distance round the axis of revolution, the force of motion being as the sum of the masses, and inversely as the distance of each from the axis. Such axis may form one of another couple, as in that of planet and satellite revolving round the sun. We are thus furnished by Nature with whatever fixed units we choose to agree upon as giving the relation of masses, distances, and force of motion, such designated units being physical constants. The whole Universe being composed of cosmical couples also argues physical connection.

Now the history of Science has shown that the test of a physical theory should be its power to consistently explain all the phenomena which it can ever be expected to cover, the greatness of the assumption not detracting from its value, providing that its rejection leads to inconsistencies and incompatibility with known facts and principles. In this case, also, it should, upon strict dynamical principles, be impossible to result in any other mode of motion than that observed in Nature. The following, I undertake to show, answers these requirements:

All ponderable matter is the condensation of an elastic ether, the mutual conversion into each other being continuous.

Of course, this transmutation is identified with a physical energy unalterable in amount, the actual and potential energies being equivalent in alternate change. Indeed, the opin-

ion now generally entertained by the highest authorities in Science is that dense matter is, in some way, "a knot or coagulation of the ether." The amount of gross matter is, so far as we know, persistent. This, however, does not preclude dissolution into the ether again, providing condensation is equal. The continuity of transmutation finds an analogy in physiological action, in which matter, assimilated, takes on the constituted quality of the body of which it forms a part, having received it from the matter emitted. We know from the laws of light that the ether permeates all dense matter, and that it is denser in dense bodies than in the fluids. Also that force does not exist apart from matter; and still that all forces (except gravity) are convertible, their activity constantly equable, and exhibiting, throughout their most rapid transformations, a mechanical equivalence. The minimum limit of time occupied by molecular movement may parallel the time occupied in molecular transmutation; for we can set no possible limits to either. The mutual conversion of ponderable and imponderable matter thus violates no known law of Nature, and the totality of transmutation may be practically infinitesimal as regards time, the ether supposed to be in a condition of indifferent equilibrium towards the constitutive forces of matter, and the constant changes in Nature being due to such transmutation.

I look upon the ether as continuous, as shown by its non-retention of heat, but principally because I am unwilling to consider the isolation and repulsion of every atom as constituting the dynamic bond of the Universe. As a matter of fact, no part of the Universe can be isolated from the rest, and we are therefore more than justified in affirming that the all-permeating ether resists all breach of continuity; besides, we have the advantage of only applying mathematical quantities to substance. Now, it is evident that we can have perfectly unconstrained motion and absolute material continuity, if we assume translatory motion to be a progressive mutual conversion of ether and dense matter, analogous to the transmutation of forces, and in no other way. The only resistance thus offered by the ether is towards a break in its continuity, and therefore its condensation into gross matter produces a tension within itself, the stress being directed towards the center of the condensed mass. The same tension is constantly becoming loosened, however, by the condensed matter becoming rarified in the return transmutation into ether. A moving body of constant mass is thus substantially a moving equable strain in the ether.

All motion of translation will necessarily be as enforced by a stress in the ether, bodies being non-resistant in free space. It follows that, in an equally stressed ether, there would be no motion originated. Nor yet could there be stable motionless equilibrium, if but one mass would move; for the motion of all would be towards the balance of stresses. The ethereal strains will thus necessarily be, by theory as by fact, towards each particle taken by itself, and the centers of dense masses taken as wholes, giving any body in which the particles are free to move a tendency to assume the spherical form; but if supposed alone in space, without any tendency to move as a whole. With two bodies the case is different. The mutual tensions produced in the ether by the respective masses cause a compression towards each other, the force of which is greater as the distance is less. But if at any time lateral impulsion, sufficient to overcome the tension, be admitted, the strain being constant and the impulse temporary, they ultimately become equilibrated and form a constant couple, revolving round the center where both bodies balance according to the simple principle of leverage. As tension or pressure, when meeting with insufficient resistance, acts dynamically, and statically when resistance is equal and opposite, the condensing pressure of the ether, which is physically the centripetal force, enforces approach in bodies free to move; but an angular motion, when the strains are equilibrated, offers a constant resistance without expenditure in work, by the loosening tensions being equal in amount to those formed, and they become merely a line of connection, along which each body acts reciprocally as driver and follower. Any number of bodies, then, each of which creates a tension in the medium connecting them, and yet offers no resistance to the constant ethereal pressure, will all move until the tensions are equilibrated; if towards each other, with accelerated motion; and if resolved into couples, will continue in such coupled motions—a conservative system of parallel forces.

Although there is nothing positively known respecting the origin of cosmic systems, it appears most likely that they develop from vast vortices produced in a nebulous mass: electrical action giving the first mechanical impulse, from which they ultimately settle down into static systems of moving bodies; as the dust in the whirlwind, produced by electrical force, settles at length in the place where gravity gives it position. The observed variations from the general plane of balanced motion, and retrograde movements within the solar system, would seem to show that mechanical action has not been alone operative; possibly the same force which primarily evolved the nebulae from the ether, impressing the conditions of motion and position. That the molecular condition of bodies, as altered by a transmutation in the correlated forces, will modify the conditions of mass motion, while the gravitation tensions which are towards the center of bodies remain constant, conflicts with neither theory nor observation. The disintegration, direction, or eccentric orbit of a comet is no more inconsistent with the balanced mass motion of dense bodies, in the system of which it forms a part, than a gunpowder explosion, so long as it moves to or from a center of force. The mechanical conditions of a conservative system, as a final result from theory, is that it forms one vast couple, unchangeable by any local interaction of its component parts—the greater masses, by their greater moments

of inertia, deviating, in general, least from the plane and circular curve of coupled motion.

All bodies, by thus stressing the ether, enforce motion in all others; and as all move unresistingly, it follows that the enforcement to motion of all at a like distance, by the same stress, will be the same whatever the masses enforced: the power, however, being always directly as the masses enforcing. The energy of tension is therefore invariable, whatever diversity there may be in the number of bodies enforced to move, or additional motion produced by the disintegration of a body itself. Nor can intervening bodies cut off the effect, being themselves unresistingly enforced, and adding their own enforcement. Theory and observation thus coincide.

The intensity of stress in the ether necessarily bears a definite relation to the cube of the distance, being greater as the condensed mass is greater, and manifesting itself independently of time. The motive force thereby induced is therefore as the joint mass of a couple. And as the force of motion is as the time of moving squared, so the time squared will diminish as the cube of any assignable distance, rendering the amount of motive force during one revolution for any equal couple invariable, however far apart. Thus every mass of matter in the Universe, equal to one cubic mile of the average density of the earth, enforces a motion in all others; and would enforce a motion of its own particles, if disintegrated, sufficient to produce revolution round a sphere of ether of one mile radius in about 173 minutes: the space being divided among the disintegrated fragments, and multiplied by the additional bodies.

It will be evident that, with this mode of conceiving of the ether and ponderable matter, there is nothing that conflicts with the mode of action of the radiant forces. The ethereal medium by resisting equably all breach of continuity, is substantially an isotropic solid, and all particles of gross matter, centers of spheres of tension. Waves of vibration will thus naturally run transversal to the direction of propagation to all distances. All possible loss of radiant kinetic energy, by friction in interstellar space, may become potential in the transmutation of ether into dense matter. For the structural qualities of the various elements will, in the return transmutation into ether, impress upon it their characteristic motions, which will travel onwards until their energy is absorbed by ethereal friction, or taken up by the similar elements of other ponderable matter. The radiant forces possessing a well defined amount of mechanical energy would seem to necessitate the constitutive qualities of every portion to be constantly modifying the constitutive qualities of each other; although only material atoms in indifferent equilibrium as to motion, as on a photographic plate, or bodies of similar constitution, may palpably manifest it. Optical phenomena show the ether to be in a condition of indifferent equilibrium as to form of motion; and it is not unreasonable to look upon it as being so in regard to constitutive charge. Electro-magnetic induction and polarity appear more intelligible in the light of the stressed connection of every particle of matter, with the equal and opposite flow within the stress of tightening and loosening tensions. As there can be no translatory motion in the ether, save in those portions condensing, a constant of aberration necessarily follows. But as the modes of change into ether are as various as the constitution and conditions of ponderable matter, we may have an infinite diversity in the lengths, directions, and velocities of ethereal vibrations.

Should the above theory meet with general acceptance, not only will the dispute between the advocates of action at a distance and those of action by contact have become ended, but a necessary Creative Power, in constant activity, will be seen to be consistent with laws of evolution through a persistent physical force: views hitherto deemed irreconcilable. Philadelphia, Pa. WILLIAM DENOVAN.

The Grasshopper Plague.

To the Editor of the Scientific American:

In your issue of July 7 there is a paragraph in relation to the late invasion of grasshoppers; it contains a suggestion that said invasion may prove a blessing instead of a curse.

The phenomenon of a new variety of grass springing up in the localities lately infested with these insects is not as surprising as one may be led to suppose. A fact not generally known, but nevertheless quite worthy of attention, is that about three quarters of the newly born grasshoppers die while changing their skin, from the effects of cool rains, heavy winds, or otherwise; these, together with the excrements or *detritus* of the grasshoppers, are the very best re-inventor of withered or exhausted grass roots; consequently the extraordinary growth of luxuriant grass can be attributed to the nourishing deposits made by these insects.

I cannot positively assert that the grass spoken of in your article is the same variety as that which came under my observation in Southern Russia, under the same circumstances, but I should be very much surprised if it were not. That which I examined grew in spots where no grass suitable for pasture had been previously known to grow; it was tender and very sweet, so much so that 6 per cent saccharin matter was extracted from it. It was of a bright emerald green, and cattle ate it with avidity; it was called by the inhabitants *solodycia* or sweet grass. It continued to grow for 3 or 4 years, decreasing in richness each season, until it became coarse, insipid, and dry, and totally unfit for grazing. And more wonderful still, it was the facsimile of the grass which formerly grew in these places. I therefore conclude that both grasses, the rich and the poor, come from the same roots, and not from seeds of another country brought by grasshoppers. The grass losing its richness is explained by the exhaustion of the soil, which is replenished by the grasshopper manure.

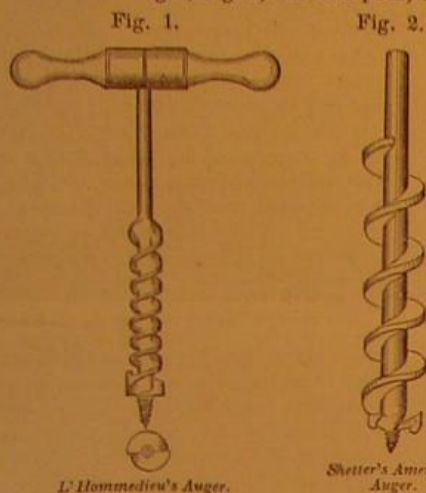
New York city.

G. PROSPER ZALESKI.

AUGERS.

Continuing our series of extracts from Mr. E. U. Knight's "Mechanical Dictionary," we give below a number of illustrations, together with descriptions of various forms of boring tools. Augers are made in numerous forms, including hollow augers, annular augers, taper augers, augers with secondary borers, reamers, or countersinks, or having expansive cutters.

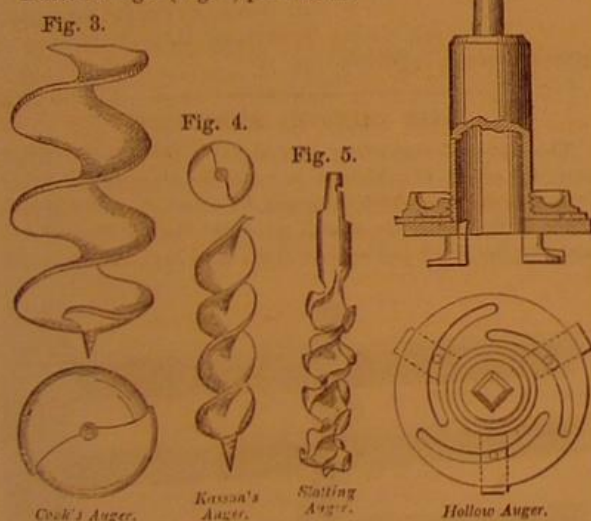
L. Hommedieu's auger, Fig. 1, has two pods, two cutting



lips, a central screw, and a twisted shank. It is, on a smaller scale, like Stephenson's Rocket engine, the type of its class. The form of auger which in England is called the American pattern was patented by Shetter, in 1831. (See Fig. 2.) It has a spiral blade around a cylindrical core, and was long a favorite. It probably offers more impediment to the discharge of the chips than does the shank made from a flat blade twisted into a spiral. Some auger shanks have an increased twist as they recede from the point; this gives a greater freedom of discharge by increasing the caliber of the canal as the chips ascend.

In Cook's auger (Fig. 3) the cutting lips commence at the point, and extend therefrom nearly at right angles, until about half way from the center to the outer point, and then curve upward and forward, giving a nearly semicircular form to the outer portion of the lips, which are curved in the horizontal and vertical planes.

Kasson's auger (Fig. 4) permits the

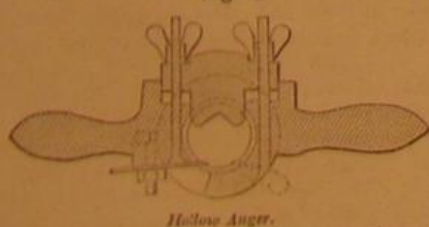


formation of cutting lips at any point on the length of the spiral, by cutting off the twist at any point in a plane vertical, or nearly so, to the axis of the auger, and then sharpening its edges. The front surfaces of the twist are concave, and the rear convex.

The slotting auger (Fig. 5) cuts laterally, the work being fed against its side. It is used in wood mortising and slotting machines. The twist is formed into a number of chisel-shaped lips rising from the edge of the twist, and presenting sharp edges in the direction of the bore of the auger, so that the wood may be cut laterally if pushed against the instrument after the hole has been bored to a sufficient depth for the proposed mortise or slot. If the auger or bit be held in the rapidly revolving arbor of a mortising or boring machine, the mortise may be cut at full depth at one operation, by moving the wood laterally against the auger. The corners of the mortise are afterwards cut out by a chisel.

Hollow augers are used for forming tenons on the ends of spokes, bedstead rails, chair rounds and legs, table legs, and many other articles. The tool shown in Fig. 6 is adjustable for boring holes of different sizes. The rotary disk has eccentric slots acting upon pins inserted into the backs of sliding cutter heads, so that they are driven out or in simultaneously, and fastened by a jam nut, which holds them in the required adjustment.

Fig. 7.

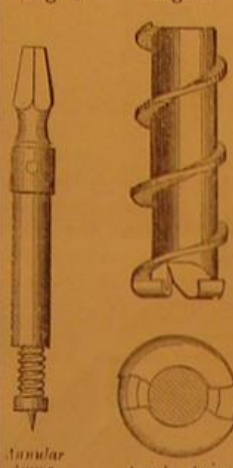


Hollow Auger.

Fig. 7 has cross handles like an auger. The cutting rod is so attached as to project within the opening, and the size of the tenon is regulated by the adjustment of the angular rest. The tool has the usual auger handles, in which respect it differs from most of its class.

Annular augers cut an annular groove, leaving land on the inside and outside of the channel. The example (Fig. 8) is adapted for boring cylindrical blocks out of a board, the lower edge of the tube being serrated. Fitted inside the tube is a cylindrical plug with a central point. On the re-

Fig. 8. Fig. 9.



Annular Auger. Annular Borer.

duced shank of the plug is a spiral spring, which keeps the point extended, except when pressure is applied to the tool in boring. The cutters on the end of the tube (Fig. 9) make an annular groove and leave a core of wood in the center, the chips being

withdrawn continuously by the spiral blade on the tube. The cutting lips start at the periphery of the bit, and extend towards the center in concave lines, till they terminate at the inner portion of the tube, where their direction approaches a line parallel with the axis of the auger. In a subsequent form a number of tubes are arranged concentrically, so as to cut concentric annular grooves simultaneously, and produce a nest of cylinders out of the same stick or board.

Yet another form is found in the tool (Fig. 10) sometimes known as a button tool. It has an upright center standard, with a fine feeding screw on the lower end. The cutter is attached to a radial arm, and is adjustable, so as to describe the diameter required for the hole. The cutter is fed to its work by the thread on the standard, and the chips are ejected by the curved neck. Taper augers (Fig. 11) are used for reaming out bungholes, making butter prints, etc. The center bit bores a hole, and is succeeded by the taper reamer, which has a throat for the chips, cut through from the edge of the bit on one side to the opposite side of the stock. The bunghole reamer (Fig. 12) has a tapering pod, and a cutting lip on one side; the lower end is closed to receive the chips, and is open at the top, except a bail to which the

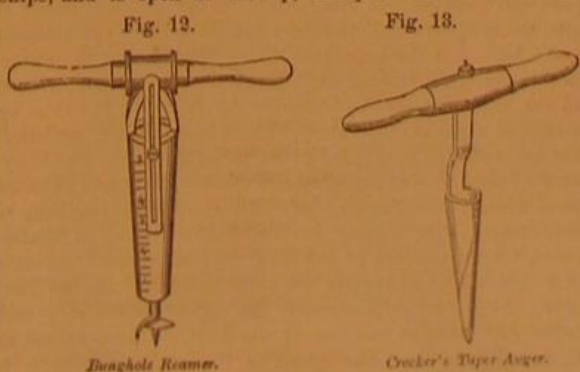


Fig. 14.



Counter-Borer.

handle is fastened. On one side is an adjustable gage and an index to determine the size of the bore.

The ordinary form of bunghole borer is shown in Fig. 13. This has a volute-shaped blade with a sharpened, salient spiral edge and a gimlet point. It, like most of its class, is for reaming out bungholes and taps. Augers are sometimes provided with secondary borers, reamers, countersinks, or expansive cutters.

In Fig. 14 the reamer or secondary borer is formed in two pieces, and is clamped to the auger shank at the required distance from the end of the tool, and at the same time is adjustable to ream out a hole of the required diameter. The clamp is shown separately in the upper portion of the figure.

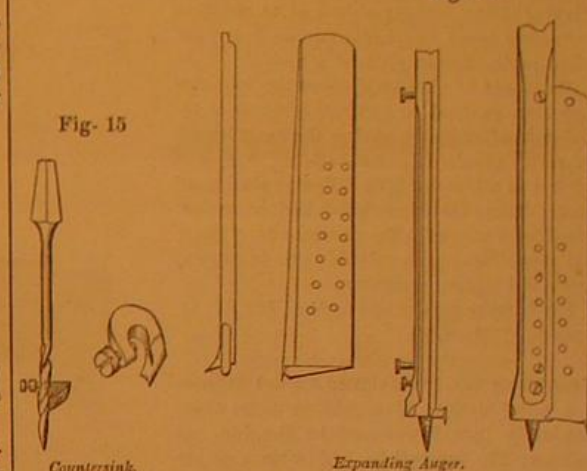
In Fig. 15 the countersink is attached to the auger shank at the required spot, but does not entirely surround the shank,

the opening corresponding with the twist of the shank, so that the discharge of chips is not interrupted.

In Fig. 16 the plate is received into a longitudinal slot in the auger shaft, and one end is secured by a temper screw. A pin, passed through one in the series of holes in the shaft, engages a hole in the oblique series in the plate, and determines the radial adjustment and consequently the diameter of hole bored by it.

The shanks and turned cutting edges of the expanding bits in Fig. 17 pass through a mortise in the head of the tool, and are secured to their adjustment by a key. Their radial adjustment adapts them to bore holes of varying sizes

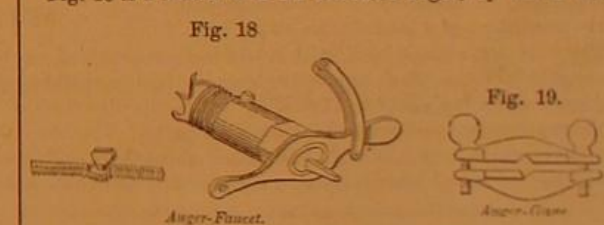
Fig. 16.



Among the other uses of augers may be mentioned that of felling trees in the Mammoth Grove, Calaveras county, California. The "Big Tree," as it was called, contained 500,

000 feet of inch lumber. It was felled by five men working 22½ days, making 112½ days' labor to fell one tree. This tree measured 92 feet in circumference at the base. It was not cut down with axes, but was bored down with long pump augers, and the wood remaining between the holes was cut off with chisels on the end of long sticks.

Fig. 18 is a faucet with an attached auger, by which the

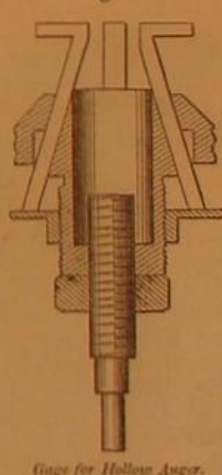


necessary hole is made in the head of the cask. Fig. 19 represents a device to be attached to the shank of an auger to limit the penetration. The example has a pair of bars, secured by temper screws to the spiral shank, so as to form a gage of depth.

Another form has a telescopic tube attached to the shank, larger in diameter than the worm, and adjusted as to length by means of two temper screws whose ends bear against the spiral shaft.

Fig. 20 is for making tenons of a given length on the ends of spokes, etc., and it is adapted for hollow augers. The rear of the stock has a thread traversed by an adjustable screw, which, by contact with the end of the stick, determines the depth of the hole and consequently the length of tenon to be cut. A jam nut secures the adjustment.

Fig. 20.



Gage for Hollow Auger.

New Burn Mixture.

Take the best white glue (extra) 15 ozs. Break it into small pieces, add to it 2 pints cold water, and allow it to become soft. Then melt it on a water bath, add to it 2 fluid ozs. glycerin and 6 drachms carbolic acid, and continue the heat on the water bath until a glossy, tough skin begins to form over the surface in the intervals of stirring. The mixture may be used at once, after the glue is melted and the glycerin and carbolic acid are added; but when time allows, it is advisable to get rid of a little more of the water, until the proper point is reached. On cooling, this mixture hardens to an elastic mass, covered with a shining parchment-like skin, and may be kept for any time. When using it, it is placed for a few minutes on the water bath until sufficiently liquid for application (it should be quite fluid). Should it at any time require too high a heat to become fluid, this may be corrected by adding a little water. It is applied by means of a broad brush, and forms in about two minutes a shining, smooth, flexible, and nearly transparent skin. It may be kept for any time, without spoiling, in delf or earthen dishes or pots turned upside down.—American Journal of Pharmacy.

SPAYTH'S RAFTER SCALE AND BEVEL GAGE.

The annexed engravings represent an attachment to carpenters' bevel squares, whereby the blade of the same can be adjusted and set to any desired angle. The device consists of a quadrant divided on its face into the degrees of a quarter circle, and attached to the square stock by means of a stationary hinge.

The construction of the hinge and of the plate, detached, is shown in Fig. 2, from which it will be seen that the point of intersection of all the divisions on the plate and the tongue varies according to the number of degrees of the angle indicated between them. It will also be observed that a row of fractions is added just inside the outer divided circle. Their object is to enable a carpenter to set the bevel square to any desired inclination or pitch of a roof.

By means of this implement the inventor has been enabled to compute a series of tabulated rafter scales, giving the exact length of rafter required in any building from 4 to 40 feet in width for nine different pitches of roof. These tables are published in convenient form and, with the quadrant bevel gage, will doubtless prove valuable aids to carpenters and builders generally.

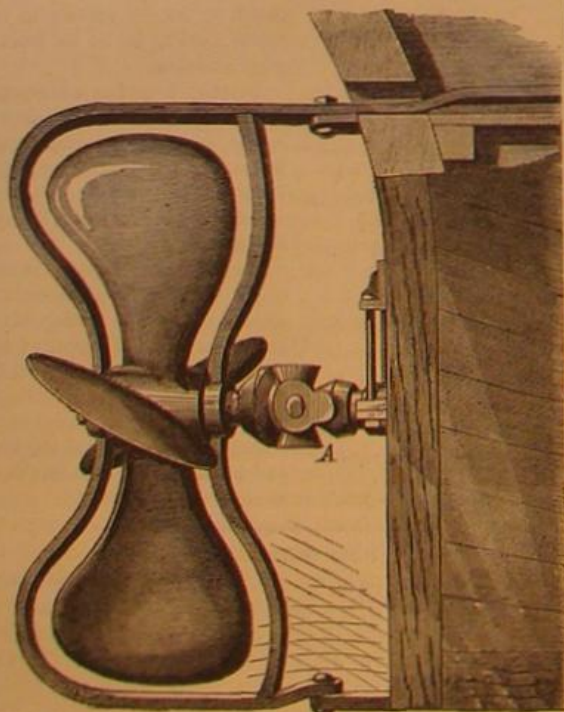
For further particulars address Mr. W. O. Spayth, Tiffin, Ohio.

New Plan for Propelling Canal Boats.

A novel method of propelling canal boats has lately been introduced in Belgium, as follows: The towpath is laid with a single rail, weighing some 16 lbs. to the yard, and fixed on traverses a little more than three feet apart. The locomotive has four wheels, two of which are placed directly along the axis of the vehicle, one in advance of the other, and the others one at either side. The first pair are directing and the second driving wheels. The directing wheels are grooved and fit the rail; the others have rubber tyres, which give purchase on the macadamized road, and which press thereon to the extent of 0.07 lbs. to the square inch. By means of a simple mechanism, the weight of the machine may be thrown upon either the driving or directing wheels at will. In the former case the maximum, and in the latter the minimum, of adherence is obtained, to suit the conditions of a loaded or an empty boat. There is but a single road, with rotary engines provided at suitable distances. Each locomotive tows one boat; and when a meeting takes place of two traveling in opposite directions, the engines change boats and retrace their paths. The locomotives weigh four tons each, and travel about three miles an hour, with full boats carrying a cargo of 150 tons each.

THE HERCULES SCREW PROPELLER.

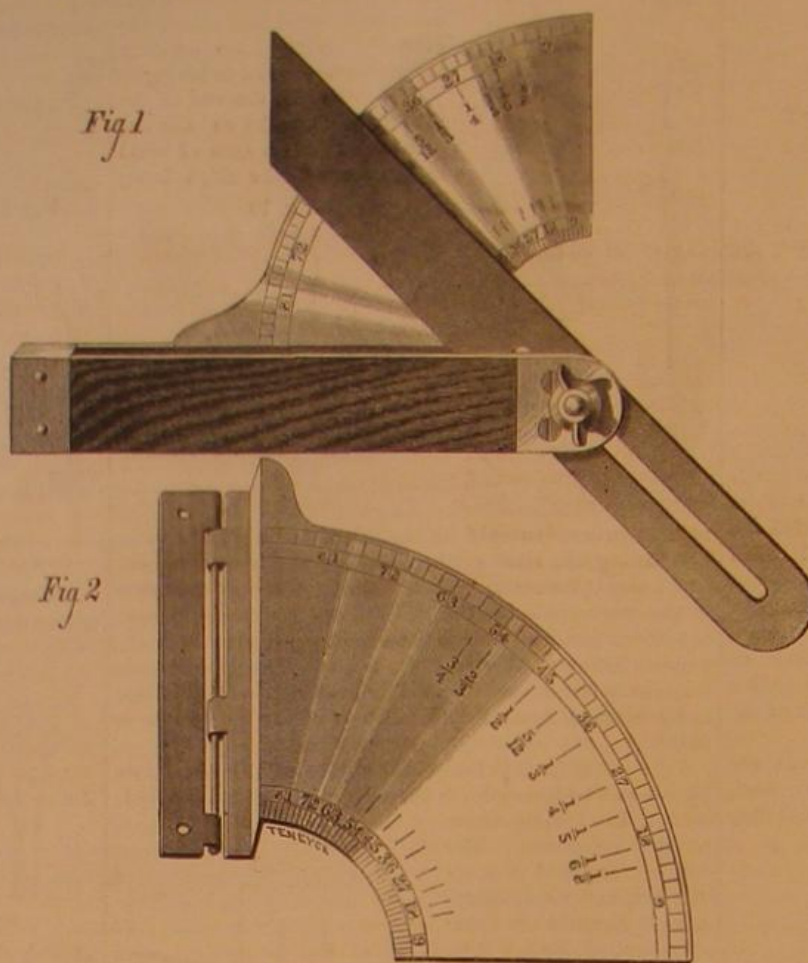
The annexed engraving represents a new form of screw propeller, so attached to the vessel as to serve the double



purpose of a means of propulsion and a rudder. The wheel may be obtained separate from the rudder attachment when desired. It is claimed that the peculiar curve and shape of the blades causes the water to leave them in a spiral column at the hub. The spread of the water is thus prevented, and the force of propulsion, according to the inventor, is concentrated directly back of and within the diameter of the wheel. The combined wheel and rudder attachment is intended to obviate the resistance offered by the usual form of rudder to the free passage of the water from the screw, causing a loss, it is estimated, of from eight to ten per cent of the motive power.

The axis of the propeller is hung in bearings in a stout metal frame, which is pivoted to the sternpost of the vessel

or to outriggers on the same, and is so connected with the tiller as to be readily swung to the right or the left thereby. The propeller shaft projects out through the stern post, and is attached to the propeller axis by a flexible coupling joint, A, which consists of two jaws upon the shaft, circular on their face. Similar jaws are affixed to the propeller, and all are united by joint pins to hold them in place. The joint is made of cast steel and is very strong in construction. For canal and harbor navigation, this invention furnishes a quick and powerful steering apparatus by which boats are enabled



SPAYTH'S RAFTER SCALE AND BEVEL GAGE.

to round the sharpest curves with ease, and to avoid the frequent danger of collision incident to crowded localities.

The wheel is guaranteed, under a correct test, to show more power with the same pressure of steam than any other screw of the same size and lead. It is made of the best cast iron, or of cast steel, as desired.

Patented by H. K. Stevens and S. Miller, September 16, 1873. For further particulars address the manufacturers, R. L. Howard & Son, Howard Iron Works, Chicago street, Buffalo, N. Y.

NEW LIFE RAFT.

A trial was lately made in the Thames river, London, of G. F. Parratt's deck seat and life raft, as represented in our engraving.

The apparatus consists of a long metal cylinder with two stretchers, and an oval air tube. Attached to the tube are cork and india rubber floats. Should an accident occur at sea, the cylinders and stretchers can be fixed in two minutes and a half, and the apparatus, being thrown into the water, is then ready for instant use. When the crew of the raft are in her, they increase the buoyancy by inflating the tube by means of eight or ten valves, which are worked by hand, the full inflation occupying a quarter of an hour. The buoyancy of the raft was satisfactorily shown, for thirty-five men were upon it as it floated down the river from Lambeth to the Temple Pier, casting anchor off the Houses of Parliament, for the purpose of showing the handiness of the craft to a number of honorable members assembled on the Terrace. As a test of buoyancy, the whole of the crew and passengers stood at one side of the craft, yet it remained as trim and even upon the water as if no person were in it.



The raft, which cost \$500, and is capable of holding one hundred persons, can be easily made up into a deck seat, so that very little can be said against it on the score of clumsiness, and, the weight being only 400 lbs., the launching

would be easy; while, the sides being constructed of india rubber, a heavy sea would not crack it to splinters against the ship's side, as in the case of an ordinary ship's boat. The main cylinder is hollow, for the purpose of holding oars, sails, and provisions, and the bulwarks are of netting and canvas fixed to iron stanchions.

An Enamelled Iron Ceiling.

A ceiling made of thin plates of iron, and enamelled, has just been put up in its place in the central refreshment room of the South Kensington Museum, London, and is probably the first experiment of the kind. The decorations of this room were designed to resist all dirt and impurities incident to a public room where food is eaten by an average of 10,000 persons a week. The walls and columns are of majolica, the floor is paved, and the ceilings are of iron enamelled. The whole gives an impression of perfect cleanliness, and every part might be washed down by a fire engine weekly, if necessary.

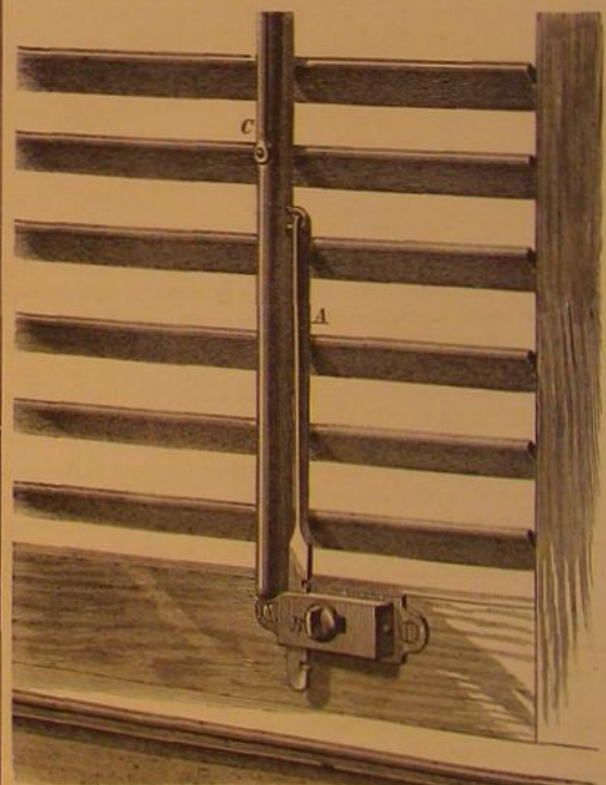
The manufacturing part of this ceiling was done at Birmingham by the Enamelled Iron Company, the whole enamelled plates being sent from Birmingham, and painted with charming and vigorous arabesques by the artist, Mr. James Gamble. The work is highly effective and the experiment successful. In cases where it is necessary to keep a ceiling clean and to wash it frequently, this material promises to answer perfectly, and the artistic work will last for centuries, as the design is burnt into the enamel.

The New Paris Opera House.

To raise the temperature with sufficient rapidity before the commencement of a performance, and to provide for a renewal of air at the rate of nearly 3,000,000 cubic feet per hour, fourteen hot water and hot air furnaces are employed. They consume ten tons of coal per diem. To carry off the vitiated air, the upward draft created by the central luster is utilized through several large conduits communicating with different parts of the house, while fresh air is admitted through openings measuring from 26 to 32 square yards. The footlights are arranged to burn upside down, the flame being drawn downwards through sheltering glass chimneys by currents of air.

JONES' IMPROVED BLIND STOP.

The annexed engraving represents a new form of blind stop, the object of which is to retain the slats of the blind in any position in which they may be adjusted. The advantages of the device are that it prevents the rattling of the slats by the wind, and enables them to be kept with the pitch



upward, and thus clean; and being on the inside, it prevents the slats being opened from the exterior, serving in this respect as a protection to the window.

The slat rod is connected to the rod, A, which has several notches near its lower end. Rod, A, passes through slots in a box in which there is a spring catch operated by the thumb piece, B. Said catch engages in the notches of the rod, and so locks it at various points of elevation. The wire, C, serves to connect the panel with the one above, so that the slats of both may be controlled by the single device.

Patented through the Scientific American Patent Agency, February 2, 1875. For further particulars regarding price, also relative to sale of rights, etc., address the inventor, Mr. John D. Jones, P. O. Box 523, Omaha, Neb.

THE ANT-EATER FAMILY.

The ant-eater is a remarkable animal of the old genus *myrmecophaga*, and of the edentate or toothless order. The hind feet are plantigrade, and armed with large claws bent inward, so that the animal walks on the extreme edge of the foot. This arrangement is a wise provision of Nature for preserving the claws from damage, they being used for tearing down the ant hills and unearthing the insects on which the animal chiefly feeds. The South American variety is a hairy creature, sometimes called the ant bear (*myrmecophaga jubata*); it is about four feet long, and has a bushy tail of two and a half feet more, and its height at the shoulder is about three feet three inches. The tongue of the ant-eater is remarkable; it can be darted from the mouth to a length of eighteen inches, and is thus very effective in picking up its food, resembling in this respect the tongue of the chameleon.

We publish herewith an engraving of the scaly ant-eater, commonly found in Africa and Asia. This specimen is known as the pangolin, and its scaly covering is formidable, being hard enough to turn a musket ball. When it is alarmed, and cannot reach its hole in the ground, it rolls itself up like a ball, throwing up the sharp edges of its scales, and then the animals which usually attack it are glad to let it alone.

Sir Emerson Tennent, while in Ceylon, kept two of these creatures alive at one time, and says: "One was a gentle and affectionate creature, which, after wandering over the house in search of ants, would attract attention to its wants by climbing up my knee, and laying hold of my leg by its tail. It seized ants by extending its long, glutinous tongue along their track."

Still another kind is found in Africa, it is called the phatagin. In the hot countries where all these species have their habitat, the ants are very troublesome, and destroy much property, and animals that are capable of getting rid of them in such numbers are viewed by some eastern races with superstitious awe.

A Human Analysis.

Dr. Lancaster, of London, recently analyzed a man, and presented the results of his investigation in palpable form to his audience during a late chemical lecture. The body operated upon weighed 158.4 lbs. The lecturer exhibited upon the platform 23.1 lbs. carbon, 2.2 lbs. lime, 22.3 ozs. phosphorus, and about 1 oz. each sodium, iron, potassium, magnesium, and silicon. He apologized for not exhibiting 5,595 cubic feet of oxygen, weighing 121 lbs., 105,900 cubic feet of hydrogen, weighing 15.4 lbs., and 52 cubic feet of nitrogen, likewise obtained from the body, on account of their great bulk. All of these elements combine into the following: 121 lbs. water, 16.5 lbs. gelatin, 132 lbs. fat, 8.8 lbs. fibrin and albumen, 7.7 lbs. phosphate of lime and other mineral substances.

Action of Sulphuric Acid on Lead and its Alloys.

Few metals are able to resist the action of hot oil of vitriol, lead being, of all the common metals, the least acted upon by this acid. The addition of some metals assists lead to withstand the attacks of sulphuric acid, while others render it a more easy victim. The careful experiments of A. Bauer, which were published recently in the *Berichte der Deutschen Chemischen Gesellschaft*, cannot fail to be of practical value to manufacturers and others.

Several alloys were prepared by fusing pure lead with other metals, the exact composition being determined by analysis. These alloys were rolled out into plates of equal thickness, and heated in a suitable apparatus with sulphuric acid of 66° B., the temperature at which a reaction took place being carefully observed. The apparatus consisted of a flask secured in position a little above the bottom of an air bath, the sides of which were formed by a glass cylinder. A thermometer, reaching down to the acid in the flask, showed its temperature. In every experiment an equal weight of alloy and an equal volume of acid were employed. The results were as follows:

1. Pure lead: A strip of pure lead weighing 3 grains was heated in $3\frac{1}{2}$ cubic inches sulphuric acid of 66° B. At about 347° Fah., a considerable evolution of gas took place, which was stronger at 374° Fah. At 446° or 464° Fah., all the lead was at once converted into sulphate of lead, which dissolved in the sulphuric acid. At this sudden decomposition, sulphurous acid and hydrogen appeared, and sulphur separated.

2. Alloys of lead and bismuth: (a) With 10 per cent of bismuth. The action began at 302° Fah., and continued, slowly and quietly, up to 374° Fah., at which temperature all the metal was destroyed. (b) With 4 per cent of bismuth. The decomposition followed more rapidly than with the 10 per cent alloy, and was finished at 266° to 284° Fah. (c) With 0.73 per cent of bismuth. The decomposition followed, suddenly and completely, at 320° Fah.

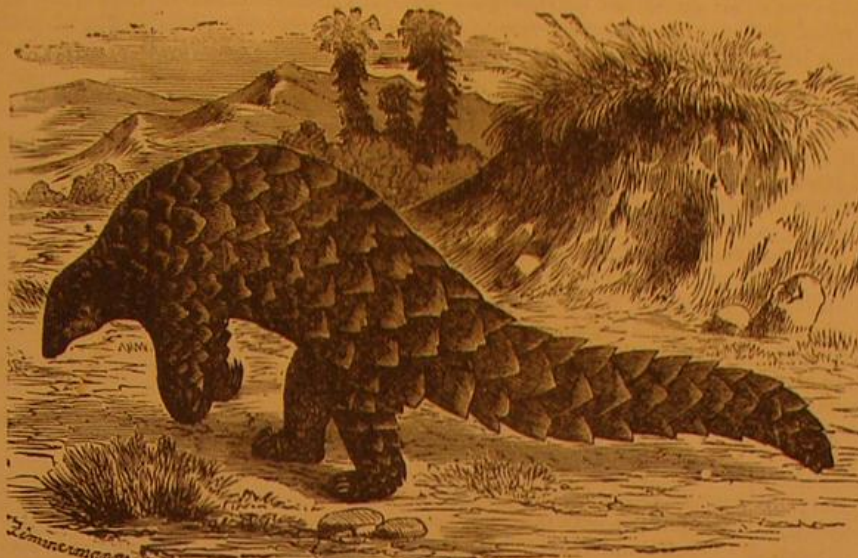
3. Alloys of lead and antimony: (a) With 10 per cent of antimony. This alloy decomposed slowly and steadily; a strong action began at 374° Fah., and ended at 446° to 464° Fah. (b) With 5 per cent antimony. This alloy also dissolved slowly. A more violent action began at 356° to 374° Fah., and the end was at 428° to 437° Fah. (c) With 1 per cent antimony. Here too the decomposition is slow, but a

considerable evolution of gas takes place at 482° Fah., and the action is ended at 536° Fah.

4. Alloy of lead and arsenic: Containing 10 per cent arsenic. This alloy acts very like the 10 per cent antimony alloy. The action is slower, and ends at 464° Fah.

5. Alloy of lead with 1 per cent copper: This acts very similarly to the 1 per cent antimony alloy; a strong reaction begins at 482° Fah., and all the metal is dissolved at 536° Fah.

6. Alloys of lead and platinum: (a) With 10 per cent platinum. The decomposition is slow and incomplete, and



[THE SCALY ANT-EATER.]

ends at 536° Fah. (b) With 2 per cent of platinum. The decomposition is sudden and complete, between 500° and 536° Fah.

7. Alloy of lead and tin with 10 per cent tin: This alloy acts like pure lead; solution takes place suddenly at about 392° Fah.

These experiments show that the addition of a little antimony or copper renders the alloy more able to resist sulphuric acid, while bismuth has a decidedly injurious effect.

THE COBWEB APPLE MOTH.

The little moth represented in the accompanying engraving is very injurious to our apple trees. As is often the case, its size bears no proportion to its destructive powers. The *liparis chrysorrhea*, for example, which is a moderately large



bombyx, is generally thought a very bad inmate in an orchard, and on the continent its hurtful propensities are so well known, and the means of counteracting them so simple, that municipalities and powers have given it renown, by enacting decrees for its extermination and putting a price upon the heads of its members; and yet, destructive as it is, it is nothing to this tiny *ypomometa*. The *liparis* strips the branch on which the brood has been established—nay, many branches may be wholly defoliated, but the whole tree is rarely entirely stripped, whereas the *ypomometa* spares nothing; it invades the whole tree, and leaves it as bare as if fire or the locust had passed over it. One thing only it leaves behind it, as it were in charity or contempt, namely, a white veil wrapped round the tree, as if to conceal its nakedness. It looks like a forgotten skeleton enveloped in spiders' webs.

This is the work of the caterpillars. Hatched in the previous winter, they revive in the months of May and June,

and the eggs from which they spring having been laid in the previous autumn in numbers, near each other, large families or societies speedily spin a commodious tent, represented in the engraving, in which they are sheltered from sun and rain. At first a number of leaves are inclosed in the web, and on these the young larvae feed. These are soon consumed. The tent is then enlarged, and more leaves covered in. When all these are consumed, they flit to a new region, where they spin a new web. This, repeated by multitudes of families all over the tree, leaves it utterly consumed, and annihilates all chance of the smallest crop. In the month

of July the larva passes into the chrysalis state in its web, the head being downwards. The perfect insect comes out in August. After coupling, the female lays her eggs in numbers in the bifurcation of the branches. The young larvae are hatched in the month of September. They then shelter under a slight envelope of silk, when they pass the winter in a state of torpidity, out of which they awake in the month of May, to follow the course of life above indicated. This species feeds on the apple, the thorn, and sometimes on the service tree; rarely, if ever, on anything else. The larva, when young, at the beginning of May, is yellowish white, covered with small blackish points; the head and plate of the first segment are blackish brown. When it is adult, at the end of June, it is velvety gray, with two dorsal rows of deep black quadrangular spots. The head, the plate of the first segment, and the true legs are dull black. The perfect insect has the upper wings entirely pure white, without any tinge of leaden hue, and with about twenty-four small black spots. The lower

wings are blackish. The figures are slightly enlarged. No satisfactory remedy has been found for this scourge. Scorching the nests with blazing torches and sweeping them away with stiff brooms have been suggested; but the suggestions are neither very practical nor efficient.—*The Garden*.

The Magnetization of Gas Spectra.

Some very curious experiments have recently been laid before the French Academy of Sciences by M. Chautard, relative to the influence of a powerful magnet upon the spectra of gases contained in Geissler tubes and illuminated by means of the electric current. In all simple bodies of the chlorine family, and in the gaseous or volatile compounds derived therefrom which thus far have been examined, the action of the magnet is immediate, and manifests itself, not merely by a change of color in the tube, but by an increased brilliancy of the spectral lines, which become doubled. The bodies thus far submitted to investigation, besides chlorine, which behave similarly include bromine, iodine, the chloride, bromide and fluoride of silicon, the fluoride of boron, hydrochloric acid, chloride of antimony and of bismuth, bichloride of mercury, and the protochloride and bichloride of tin.

The lights of sulphur and of selenium become extinguished the instant the magnet is excited, and the same is the case with that of the tubes containing chlorine, bromine, and iodine when the tension of the coil is suitable. The feeble brilliancy of the oxygen illumination is not sensibly modified, nor is that of carbon compounds, such as carbonic acid, carbonic oxide, etc. The fine bands of the nitrogen spectrum are not changed, except in the red and yellow portion. These colors become almost completely extinguished, or at least are replaced by a flat uniform tint, in which all traces of lines disappear. The lines in the more refrangible region remain intact.

The hydrogen lines keep sensibly their normal appearance, but by employing a sufficiently powerful magnet, at the moment of excitation a very brilliant yellow line appears, which is due to sodium, doubtless obtained from the surrounding glass. This line vanishes as if by magic when the current is interrupted, to reappear again, however, for some time, as often as the electric flow is established. Eventually it loses intensity, and it becomes necessary to allow the tube several minutes of repose before the line can again be caused to appear. It shows itself also in nitrogen tubes, and in those containing carbonic and hydrochloric acid.

The protochloride of tin, crystallized and dry, but bihydrated, offers remarkable phenomena of dissociation under the magnetic influence. Normally the spectrum is pale, and shows a few of the green chlorine lines; but as soon as the magnet is excited, two characteristic bands of hydrogen, the red and the blue, appear, which remain as long as the magnetization exists, and return with the same indefinitely. M. Chautard attributes this to the momentary separation of the elements of the water of the salt, due to the considerable resistance opposed to the passage of the induced current during the magnetization.

M. Chautard's investigations are still in progress, and doubtless further novel and interesting results remain to be adduced. The phenomena noted are remarkable, and will attract the close attention of chemists and physicists generally.

At Columbia, Tenn., recently, the boiler of a steam thrasher suddenly exploded, killing three and wounding seven persons who were working the machine. It is stated that one piece of the boiler fell at a distance of three miles from the scene of the disaster; but this requires confirmation. The cause of the explosion was the usual one—carelessness.

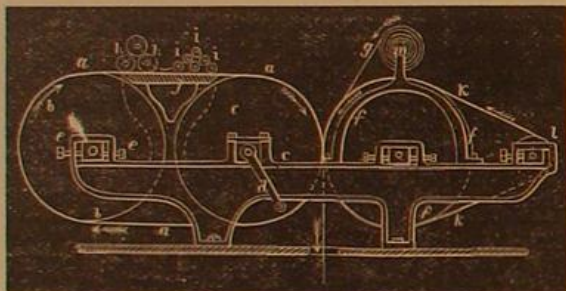
Printing Photographs by Machinery.

The name of M. Despaquis has for several months past been associated with earnest efforts made, not unsuccessfully, to hasten the advent of the time when the production of photographs at the printing press may be effected with a degree of celerity rivaling the production of typographic works at the platen printing machine.

Like, we believe, all typographic machines in which rapidity is a desideratum, the printing surface in this process is curved; but unlike the typographic processes, the "surface" in this case is that of a flexible endless band, which passes over two rollers.

Before describing the press and its mode of action, we shall explain the construction of the flexible printing band. A web of flax or hemp (not of cotton or wool) is faced with bichromated gelatin, on the surface of which the light has been allowed to act through the negative, and this it is which becomes the printing band. But a certain method of procedure is requisite in the preparation of this gelatinized linen. A single pellicle of gelatin is treated by itself under the negative, and when exposed to light it is sponged on the surface with cold water containing a little glycerin, which retains the surface in a state of moisture, and thus prevents it from becoming insoluble during the operation which follows. This latter consists in laying down the cloth referred to upon the back of the pellicle thus treated, and saturating it thoroughly with bichromated albumen, in consequence of which, after it has been exposed to light, no water can penetrate the film or, at any rate, act upon the linen in such a way as to cause it to swell or become altered. The albumen is applied by means of pouring it over the surface of the linen, by which the albumen, linen, and original pellicle of gelatin, which bears the impression on its opposite side, are incorporated and form a strong flexible web. By exposing the back to the light, the entire body of the band is rendered insoluble, except on the extreme surface already exposed under the negative, and upon which the light has now no more action, owing to its being still moist with the glycerin.

This forms the flexible printing surface, and it is impossible not to admire the ingenuity displayed in its production. We now arrive at the press in which this endless printing band is to be utilized. The following is a view of the press in elevation:



In the above, *b* and *c* represent two rollers or drums, to one of which is attached a handle, *d*, for the purpose of rotating it. Over these rollers passes a cloth either of ordinary material or of metallic gauze, to which is attached the flexible printing pellicle just described. Three rollers, at *h h*, serve to moisten the printing surface in the same way as a lithographic printer moistens the surface of his stone by a wet sponge, while a series of other rollers, shown at *i i*, serve to ink the surface wherever the moisture absorbed admits of the ink adhering. At *e* is an adjusting screw, by which the large rollers are separated to such an extent as to insure the printing band being retained in a tight state.

A third roller, *f*, is placed so as to act against *c*, and produce the pressure of the paper, *g*, against the printing cloth. On this roller turns an endless cloth, *k*, in flax or zinc, which passes over a second movable roller, *l*, which serves to stretch it more or less. Connected with the roller, *m*, is the paper, in a band, which unrolls by the action of the two large rollers, *f* and *c*.

It is, of course, necessary that the ends of the printing cloth should be united by sewing—not forming a thick seam, but so as to pass smoothly between the two cylinders.—*British Journal of Photography*.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The regular annual meeting of the above named association convened at Detroit, Mich., on the 11th of August. Hon. C. J. Walker, of Detroit, delivered an address of welcome, to which Professor Hilgard, as President of the Association, made a suitable response. Up to the time of writing the members have been engaged in organizing details, so that, with the exception of the speech made by the retiring President, Dr. Le Conte, a brief *résumé* of which is given below, we defer publication of our usual abstracts of papers of interest read, until our next issue.

Dr. Le Conte's address dealt with the evidences of evolution, and he endeavored to show that, while change of species may be admitted in creation, there still is reconcilable evidence of intelligence and design. He discussed the strict relation of natural history or biology to that great mass of learning and influence which is commonly called theology, and to that smaller mass of belief and action which is called religion; and in reference thereto stated that it will be necessary to separate the essential truths of religion from the accessories of tradition, usage, and, most of all, organizations and interpretations, which have in the lapse of time gathered around the primitive or revealed truth. In conclusion, the speaker considered that the influence of Science upon religion has been beneficial. Scholastic interpretations founded

upon imperfect knowledge, or no knowledge but mere guess, have been replaced by sound criticism of the texts and their exegesis, in accordance with the times and circumstances for which they were written.

The Most Powerful War Vessel in the World.

The British ironclad *Inflexible* is now about one fourth completed, work having been begun upon her in February, 1874. Unless the progress of invention results in the projecting of a still more formidable engine of marine warfare before the *Inflexible* is launched, she will possess the thickest armor, the heaviest guns, the largest displacement in tons, the most machinery in the world, and probably prove more expensive than any other war vessel hitherto constructed. She will have engines for steering, for loading guns, for hoisting shot and shell, for ventilation, for moving turrets, for lowering boats, and for turning the capstan as well as for propulsion. The vessel is little more than a floating castle, rectangular above water, 100 feet long, by 75 feet in width, and protected by 24 inches total thickness of iron. The two turrets which are placed within the citadel are formed of iron of a single thickness of 18 inches, and within each of them are two 80-ton guns, which can be trained to any point of the compass.

The main engines work up to 8,000 indicated horse power, and the bunkers carry 1,200 tons of coal. The total cost of the vessel is placed at 2,605,000 dollars.

Centennial Notes.

Egypt is to make an exceptionally fine display at the centennial. The Viceroy's Commissioner has arrived in this country, and is pushing preparations vigorously. Egypt acts in conjunction with Germany.

The General Transatlantic Steamship Company offer reduced rates to freight and passengers coming from France to the Centennial.

Application has been made by the Royal Academy to the English Government for the latter to defray the cost of transporting works of art for exhibition in the Centennial. The request was favorably received, and is now under consideration.

Mr. John Jay recently gave his views regarding the Centennial in an extended letter to the *Tribune*. He advocates the division of space into national and State plots. Such a plan, he thinks, would do much to develop that international rivalry to which the Vienna Exposition chiefly owed its success, while it would be less expensive to the Centennial Commission. He also advocates international scientific discussion upon a list of subjects to be selected by the Smithsonian Institute, congresses of scientific men being summoned from all parts of the world for the purpose, and national vessels being sent to transport them. Mr. Jay also suggests a congress which shall decide upon an international patent system which will give to an inventor in one country protection throughout the world.

A Brilliant Light.

Fill a small vessel of earthenware or metal with perfectly dry saltpeter or niter, press down a cavity into its surface, and in this cavity place a piece of phosphorus; ignite this, and the heat given off melts a sufficient quantity of the niter to evolve oxygen enough to combine with the phosphorus, and the effect is to produce the most magnificent white light which chemistry can afford.—*Photographic News*.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT SHADE FIXTURE.—STEWART HARTSHORN vs. JAMES F. ALMY & CO. [In equity—Before Shepley, J.—Decided April, 1875.]

SHEPLEY, J.: The bill in this case is brought for alleged infringement of reissued letters patent No. 2,756, dated August 27, 1867, granted to Stewart Hartshorn, for improvement in spring fixtures for shades.

The claim is for—The application to a shade roller, provided with a spiral spring for automatically raising or rolling up the shade, of a pawl and ratchet or notched hub, so arranged that the former will engage with the latter at any point or height of the shade by simply checking the rotation of the roller and the upward movement of the shade under the influence of the spring, substantially as set forth.

Upon the construction of this claim depends the question of infringement in this case. Defendants contend for a construction which will limit the claim to the peculiarly shaped pawl and the peculiarly shaped ratchet described in the specification of the patent. Complainant contends for a construction which will embrace, in combination with the other elements, any pawl and ratchet or notched hub so arranged that the former will engage with the latter at any point or height of the shade by simply checking the rotation of the roller and the upward movement of the shade under the influence of the spring, substantially as set forth.

The statement of the invention of Hartshorn was this: A roller was used, having within it a coiled spring, one end fixed to the roller and the other end to a loose journal of the roller. A pawl and ratchet were so applied to the roller that the pawl would hold the roller against turning under the action of the spring, but allow the roller to be turned against the action of the spring. The ratchet lifted and disengaged the pawl from the ratchet in a downward pull of the curtain. These rollers were adapted, like the Hartshorn, to be hung in brackets. In the form of spring fixtures for shades which was known as the "Coach Fixture," and in use prior to Hartshorn's invention, a cord was used to lift the pawl and disengage it from the ratchet when it was desired to allow the curtain to roll up under the action of the spring. Hartshorn's invention differed from those which had preceded it, in that it dispensed with the cord used to disengage the pawl from the ratchet when the curtain is to be rolled up, and operated the fixture wholly by means of the shade or curtain.

The operation of Hartshorn's fixture, so far as concerns winding up the curtain and stopping it at any desired height, is as follows: A pawl is attached by a pivot to one of the brackets in which the shade roller is hung. The end of the pawl opposite the pivoted end has a tendency to fall by gravity on a hub attached to one end of the roller. Two notches are made in the periphery of this hub. The width of these notches is but slightly in excess of the width of the toe of the pawl. The ratchet supports the pawl for the full extent of its periphery, except as to the slight difference in excess between the width of the ratchet notch and the width of the toe pawl. Should the roller be revolved rapidly with the pawl engaged with the ratchet notch, the width of the toe of the pawl before the toe of the pawl has had sufficient time to gravitate into the ratchet notch. This space of time is very short, for it is only while the excess of width between the width of the notch and the width of the toe of the pawl is passing under the toe of the pawl. This only allows the pawl toe to gravitate into and engage with the ratchet notch the pawl toe will not be unsupported by the ratchet for a sufficient distance of time to sufficiently long to allow it to gravitate a sufficient distance into the ratchet notch to become engaged with it while the ratchet notch is passing under it.

The patentee also states that, if desired, the pawl may be placed underneath, or at one side of, the hub, instead of over it, as represented, and a spring may be made to bear against it, in order that its projection may engage with the notches.

It will thus be seen that the invention of Hartshorn consisted, so far as concerned the spring roller shade fixture, in dispensing with the weights, counterpoises, and pulleys which had been previously employed, and also in the ratchet notch, and in arranging the pawl and ratchet that the shade may be stopped and retained at any desired point within the scope of its movement by a simple manipulation of the shade itself, the arrangement of the pawl and ratchet being such that the former will engage with the lat-

ter at any point by simply checking the rotation of the roller and the upward movement of the shade under the influence of the spring. In the fixture of the defendants the pawl or pin engages with the notch by the force of gravity acting on the pin. This mode of engagement is like that in the Hartshorn fixture. In the Hartshorn fixture the pawl is kept away from its engagement in the ratchet notch by being raised by the periphery of the hub, and kept up by portions of the periphery of the hub until the notch is under it; and it is raised so high by the non-holding wall of the notch that, when the roller is rotating freely under the action of the spring, it will not have time to fall far enough to engage with the holding wall of the notch during the time the notch is passing under it. In the defendants' fixture the pin or pawl is kept from engagement in the ratchet by centrifugal force. It is not supported by the periphery of the hub, or raised by the non-holding wall of the ratchet, or knocked up slightly by the blow of the holding wall of the ratchet, as in Hartshorn's fixture.

In the Almy roller there is a thimble with a side aperture, surrounding the hub, forming a closed chamber when covered by the end cap of the roller. In this chamber is placed a little roller or pin, lying horizontally, and allowed to revolve loosely, and in the rapid revolution of the roller to be thrown above the periphery of the notched hub by centrifugal force; but when the roller is revolved slowly, or its motion arrested, the loose pin, roller, or pawl falls on to the hub and into the notch; and, in rolling up the curtain, it is caught between that part of the notch which is at right angles with the axis of the hub and the shoulder formed in the thimble at the pin chamber. In this respect the pawl and ratchet in the defendants' may properly be said to have a different operation from the pawl and ratchet in the Hartshorn fixture. In a similar sense the pawl and ratchet in the Hartshorn patent operate in a different manner when actuated by a spring in one of the modes described in the patent, and when left to engage by the pawl falling into the ratchet notch by gravitation, as in the mode stated as the preferable mode in that patent.

In both the Hartshorn and the Almy roller the pawl and ratchet are so arranged that the one will engage with the other at any point or height of the shade by simply checking the rotation of the roller, and the upward movement of the shade under the influence of the spring, by simply manipulating the shade, dispensing with counterpoises, or the usual cord for operating the roller, or the cord for holding the pawl disengaged.

In this respect, wherein Hartshorn differed from all that had preceded him, the mode of operation is the same; and even if Almy's fixture has some advantages over Hartshorn's, it clearly embraces what was his invention, and is secured by the claim of his patent, and is an infringement. As stated by Judge Blatchford in the case of Hartshorn vs. Trippe & Co., in the circuit court for the southern district of New York: "There is the difference between these two modes of operation in the withholding from engagement, so far as regards the real invention of the plaintiff and the scope of the claim of his patent."

Decree for complainant for injunction and account, as prayed for in the bill.

[S. D. Law, for complainant.

J. E. Maynard, for defendants.]

Supreme Court of the United States.

PATENT RUBBER PENCIL HEADS.

The Supreme Court of the United States, Chief Justice Waite reading the decision, has decided, in the case of the Rubber Pencil Company, appellants, vs. Samuel E. Howard, et al., defendants, that what is known as Blair's patent for rubber pencil heads was not a fit subject for a patent. The description names a combination of parts with some other substance to increase the elastic powers which the opinion decides was not a novel device, and at length limits the claim of originality to the affixing of the head to the end of the pencil in extended and longitudinal shape. The opinion avers that any piece of rubber could be so treated, and says, in closing: "An idea of itself is not patentable, but a new device by which it may be made practically useful is. The idea of this patentee was a good one, but his device to give it effect, though useful, was not new; consequently he took nothing by his patent."

United States Circuit Court—Southern District of New York.

PATENT GAS MACHINE.—GILBERT AND BARBER MANUFACTURING COMPANY vs. ABRAHAM BUSHING.

[In equity—Before Woodruff, C. J.—January, 1875.]

This was a suit under letters patent granted to C. N. Gilbert and J. F. Barber, August 3, 1869, for an "improved apparatus for carburizing air." The patent had been sustained at final hearing in a suit against Oakes Tirrell, decided by Judge Woodruff in July, 1874, and the complainants had obtained an interlocutory decree for an accounting as to gains, profits, and damages. Tirrell was a manufacturer of the infringing machines, and the defendant in the present suit had purchased one of the machines so manufactured by Tirrell, and was using it to light his own residence.

A mere interlocutory decree for gains, profits, and damages against the manufacturer of infringing machines cannot operate as any defense in behalf of the purchaser of one of such machines.

A patentee cannot take compensation for an infringement, including manufacture, sale, and use, and thereafter enjoin that use for which he has taken compensation.

When a patentee claims and recovers, not only the actual gains and profits of the manufacture and sale of the infringing machine, but all the damages which he has sustained therefrom, it is at least to be presumed that such recovery embraces all the profit which the patentee would have received had he made and sold the machine with the incidental and consequential right to use it.

Where the complainants had obtained an interlocutory decree for an accounting of gains, profits, and damages against the manufacturer of the infringing machine, an unqualified injunction *pendente lite* against the purchaser and user of one of the machines was refused. The defendant, however, was put under bonds.

On final hearing the complainants might become entitled to a perpetual injunction against such defendant, as they cannot be compelled, against their will, to permit the defendant to use their invention.

[E. W. Stoughton and W. Stanley for complainants.

Edmund Wetmore for defendants.]

United States Circuit Court—Southern District of New York.

FREDERIC A. KURSHIEDT vs. ROBERT WERNER.

[In equity—Before Blatchford, J.; June, 1875.]

[The case came up on motion for preliminary injunction.]

BLATCHFORD, J.: The letters patented on herein are reissue No. 3,006, granted to George E. King, June 23, 1868, the original letters patent having been granted to him, as inventor, February 26, 1867.

The patent is for "an improvement in futing machines." The specification of the reissue says: This invention is designed for making puffing applicable to shirt bosoms, trimming, or other purposes of dress, in which the article, as it issues from the machine, is (without having recourse to laundering) delivered in a complete form, either single or in two or more series or rows, composed of flattened borders, with flutes running along their inner edges, and puffed or crinkled surfaces between the flutes. The invention consists in a guide, constructed with one or more curved, or arched portions, in combination with one or more suitable fluting rollers, whereby the material, in passing through the machine, is fluted and contracted laterally, as it were, or drawn up between the flutes to produce the required crinkled surface or surfaces in the puffing.

The main feature of the machine is the arched guide, in combination with two rollers, one above the other, and opposite and near to the guide. The rollers are so formed that the strip of material, after being acted on by the guide, passes between the two rollers. The rollers have such configuration externally on their surfaces as to produce a finished fabric which has a longitudinal strip that is puffed or crinkled in such manner as to possess an irregular wavy surface, and on each side of such crinkled strip a longitudinal strip that is fluted, and on each side of, and outside of, each of such fluted strips a longitudinal flattened strip, through which stitching may be made longitudinally, to render permanent the conformation of the finished fabric. The rollers are of the same width as that portion of the finished fabric which it is designed to shape. The parts of the rollers from between which the crinkled part of the finished fabric issues are of such diameter that, when the rollers are in proper position, the face of that part of one roller is situated at such distance from the face of that part of the other roller that no considerable pressure is exerted upon the fabric in passing between them. It is the action of the guide, in connection with the grooved and fluted parts of the rollers and the plain parts of each roller that lies between the two grooved and fluted parts of each roller, that produces the crinkled part of the finished fabric.

The claim designates as the invention the curved or arched portion of the guide, in combination with suitable fluting rollers, substantially as set forth in the specification, for the purpose therein specified. The patentee calls the whole instrument in front of the rollers a guide; but the only material part of it is the curved or arched portion. The expression in the claim, "the guide, constructed with a curved or arched portion," is the same thing as saying "the curved or arched portion of the guide."

This has been the construction heretofore given to this patent, King vs. Maedelbaum (6 Blatchf., C. C. R., 468).

The same patent was again before this court in the case of King vs. Werner (decided August 13, 1874).

The defendant in the suit last referred to is the defendant in this suit. He has altered his machine by taking off the dent or finger and putting in place of it an arched projection, raised up in front of the plain parts of the rollers, and like the arched projection in the said Muller guide No. 5; but he dispenses with the Muller embossing rings, and uses instead rollers like King's, which have plain parts between the fluting parts and opposite the arched projection. He has removed from the King machine those parts before spoken of as immaterial to King's invention, namely, the upper piece of metal in King's guide, and the metal each side of the arched projection. He retains all that there is essential in King's guide, that is, its curved or arched portion opposite the plain parts of the rollers, which are between the fluted parts of the rollers; and he uses such curved or arched portion in connection with rollers which have plain parts suitable for fluting each side of plain parts, in a machine which operates by means of such fluting parts and such plain parts of the rollers, and such curved or arched piece in front of such plain parts, to produce the crinkled or puffed conformation in the fabric in connection with the fluted parts of it. The mode of operation of the parts is the same as described and claimed, and the result is the finished fabric stated in the claim. The defendant takes up an extra width of material by causing the material to ride over and to be raised by the arched or curved projection, and this extra width is crinkled as and because the adjacent parts are fluted.

The plaintiff is entitled to an injunction, as prayed for.

[F. R. Betts, for complainant.

A. V. Breese, for defendant.]

Recent American and Foreign Patents.

Improved Fire Escape Ladder.

David Sanford, Ashton, Ill.—This invention is an improvement upon the fire escape ladder for which same inventor obtained letters patent dated January 19, 1875. The lower section of the square hollow ladder is connected to the frame by means of a gimbal coupling. By means of chains and windlasses, the ladder may be raised and lowered, and there are devices for holding it in any desired position. Swiveled brace bars are added to give a firm support, and may be easily turned out of the way.

Improved Boot or Shoe.

Wm. Meyer and Henry Freiburg, Quincy, Ill.—The invention consists in a boot or shoe having a wooden heel and shank with attached continuous insole, the latter being provided with flaps bent over and secured to the under sides of the wooden shank.

Improved Bale Tie.

A. A. Szabo, Houston, Tex.—The invention consists in an improved bale tie block having a laterally open side slot from whose end proceeds a hole that extends obliquely through the block together with cramping grooves, whereby the band can be tightened on the bale with great facility and without liability to slip.

Improved Harvester Knife Sharpener.

G. V. Phelps, Newark, Ohio.—The invention consists in combining, with a rotary grinder, a traveling pin in front, a guide on table, a folding frame, and a laterally moving frame.

Improved Boring and Mortising Machine.

Henry Neumann, Central City, Col. Ter.—The invention consists of a sliding support for a tool slide, contrived to be shifted around on its sliding base, in combination with feed racks on both sides, whereby the mortising tool may be fed up to both ends of the mortise. The invention also consists in a portable boring and mortising machine, having rollers for shifting it along the timber easily, and provided with clamps and screws for attaching it to the latter.

Improved Chair Base.

William T. Doremus, New York city.—This chair base is so constructed that it may be slipped in a knock-down shape, and conveniently put together by the buyer. By means of suitable devices the legs will be held firmly in place, even when made of narrower timber than the breadth of the leg sockets. When a person leans back in the chair, he brings into play the elasticity of two rubber blocks, an arm, and a long bolt. Several holes are formed in the arm to receive the bolt, so that the springs may be adjusted nearer to or farther from the bolt, which is the axis of motion to adjust the tension or strength of the springs to the weight of the person who will ordinarily use the chair.

Improved Chair Base.

William T. Doremus, New York city.—This invention consists in plates made with a central socket to receive a pivot, and with angular half sockets to receive the legs, and provided with pins and screw holes for securing said legs in place. The legs are made in two parts, jointed to each other by tapering tongues and grooves. Hollow pins are cast in the angles of the half sockets of the plates, to adapt them to receive bolts for securing the legs in said sockets, and clamping the plates to each other and to the legs.

Improved Lamp.

Joshua B. Godwin, Washington, N. C.—This is a taper tube, placed in a lamp burner parallel to, and in connection with, the ordinary wick tube, so that a constant flame of diminished size may be maintained.

Improved Reversible Plow Point.

Marcus M. Bowers, Richmond, Va., assignor to himself and John P. Schenckhorn, of same place.—This is a detachable and reversible plow point, made with lips upon the upper and lower edges of the sides of its shank, whether said shank be made tapering or with parallel sides.

Improved Sash Holder.

Patrick Mullane, Davenport, Iowa.—In the edge of the sash is an angular notch, the lower inclined side of which forms a smaller angle with the horizontal line than the upper side, the inclination of the said lower side being not enough to bind a fastening roller against the casing when the window is being raised. The inclination of the upper side of the notch is such as to wedge the roller between it and the casing, so as to hold the sash fastened in any position. The weight of the roller is such that the said roller will rest upon the lower side of the notch while the sash is being raised and lowered. When the sash has been raised to the desired point, a slight pull upon a cord will raise the roller into the upper part of the notch.

Improved Hose Spanner.

John Burke, Newburyport, Mass.—The jaws of a hose spanner are provided with slots at some distance back from the ends thereof in order to be enabled to obtain a closer bite and to be adapted to hose of any size.

Improved Stove Pipe Joint.

George D. Umland, Osceola Mills, Wis.—The object of this invention is to render the pipes of stoves and other heating furnaces less dangerous than they now are, and to make them so that they cannot work or be pulled apart when once put together; and it consists in spiral beads or grooves made to fit each other, so that the two parts may be put together by revolving either one.

Improved Butter Preserving Firkin.

John Wilhelm, Orrville, Ohio.—This is a butter firkin so constructed as to adapt it for receiving brine or pickle, which, by surrounding the butter on all sides, will prevent its becoming rancid.

Improved Cooling Apparatus for Rooms.

William Braeunlich, New York city.—Within a tank is placed a coiled pipe, the upper end of which passes out through the upper part of the tank, and is led into the room to be cooled. The lower end of the pipe passes out through the bottom, and is connected with a force blast rotary blower. In the center of the tank and coil is placed a cylindrical tank. The space around the coil is then filled with any freezing mixture which will cool the current of air passing through the coil, so that when introduced into a room it may reduce the temperature of the same. The inner tank is provided with a cover, so that it may be used as a refrigerator.

Improved Trileaf Scales.

Lucius H. Crane and Albert A. Miner, Brattleboro', Vt.—This is an improvement in measuring scales of trihedral form, used in drawing and in dividing spaces into equal proportions; and it consists in making the leaves detachable, and so that they, or any one of them, may be drawn out from a common central core to elongate the scale.

Improved Car Coupling.

William H. Bodenbamer, Xenia, Kan.—This invention consists of the coupling pin, fixed in a guide above the drawhead, to work up and down, and also fixed in the end of a spring for lifting. The spring is extended rearward along the drawhead, to which it is connected. Under the spring, between the coupling pin and the point where the spring is fastened, is a setting and tripping dog on a crank shaft, by which the pin can be held up to allow the coupling link to enter, and then let fall, for self-coupling, when the link strikes the dog.

Improved Photographic Vignetting Machine.

Chester C. Merrill, Port Jervis, N. Y.—This consists in the interposition of a serrated vignette between the sitter and the camera or instrument, and, by means of a frame or other support, suspending the name of the sitter or other written or printed name or words either above or below the impression or print at the same distance from the camera as that occupied by the sitter.

Improved Gas Fitters' Lamp.

Joseph D. Galloway, Philadelphia, Pa.—This invention consists of a gas fitter's lamp that is provided with a hollow handle, forming the blowpipe, in connection with a flexible tube, swiveled thereto. The white lead box is screwed on the wick tube of the lamp, forming thereby the cap of the same.

Improved Apparatus for Measuring Distances.

Francis Weldon, Mominabad, Deccan, India.—This invention proceeds on the principle of first dividing into equal parts a straight line, and then selecting a point at right angles to that line and at such a distance as to enable the observer to see distinctly each of the divisions on the range line from beginning to end. All the divisions being thus distinctly visible, a scale is made by setting up, at the point of observation, and at right angles to the range line, a bar having a pointer hinged to it. This limb, when aligned on each of the divisions of the range line in succession, will exhibit a distinct movement, the registering of which is effected by an indicator and guide rod. The instrument is used as follows: Place the bar on a tripod and a support or other convenient rest, and from it measure the length of base for which the instrument may have been graduated. At that distance set up a staff to mark the exact spot at which an angle of ninety degrees is subtended by the instrument and the object whose distance is to be ascertained. This can be done with an optical square, reflecting telescope, or other suitable instrument. On this staff direct the fore and back sights of the bar, align the fore and back sights of the limb on the distant object, and the distance indicated by the index rod on the graduated scale of the bar will be the distance of the object from the staff.

Improved Pianoforte Case.

Harrison J. Baker, Chicago, Ill.—This is a cover for the key box for square pianos, which is contrived to be opened independently of the top cover of the case. Instead of coming forward to the front of the case, it terminates back of the key board and at the music rest, so as to expose the key board cover and other front portions of the top of the piano to view.

Improved Feed Cutter.

Thomas Webb, Elyria, Ohio.—This invention has for its object to improve the construction of the feed cutter for which letters patent were granted to same inventor August 5, 1873, so as to make it run steadier and with less friction, to enable it to be readily adjusted to cut the feed finer or coarser, and to enable it to hold the material more firmly while being cut, and thus prevent any of the said material from being drawn out uncut. When the machine is at work, a hand nut is screwed up with only sufficient force to hold the feed gearing in gear, so that, should any hard substance get into the feed box and be fed forward, a lever can be instantly thrown down to throw the feed gearing out of gear, and thus prevent the machine from being broken.

Improved Lock for Doors.

William Unverzagt, Memphis, Tenn., assignor to himself and I. A. Chase, of same place.—The drawing out of a slide piece changes the position of all the tumblers, so that their recessed extensions form a bar to the tongue pieces of the bolt, and render the opening of the same impossible, except by setting all the tumblers to the exact position by means of a graduated key, which brings the tumbler extensions so far back that they enter on the openings of the bolt immediately between the tongues of the same.

Improved Machinery for Raising and Transferring Hides from Vats.

William Coupe, South Attleborough, Mass.—The machine may be run from one tier of vats to another, or to any desired place. Two cross heads are placed upon the inner sides of uprights, and are connected. They may be raised and lowered by turning screws. To each of the cross heads are attached chains and hooks of galvanized iron. The hooks receive hard wood cross bars, upon which rest the ends of other bars, to which the hides are attached by hooks in the ordinary way. In using the machine, the green hides are hooked upon the upper bars. The machine is then run to the vat in which the pack is to be placed, and the gearing is operated to turn the screws and lower the cross heads. As the lower bars enter the tanning liquor, the hooks are detached, leaving all the bars and the hides in the liquor. To transfer hides from one vat to another, the cross heads are lowered, the hooks are hooked upon the ends of the bars, and the cross heads are again raised, bringing with them the bars and the hides. The machine is then moved upon the stationary or temporary track to the other vat, and the bars and hides are lowered into it in the manner before described.

Improved Liquid Mixer.

John B. Meyers, New Orleans, La.—This invention consists of a main mixing vessel or vat, with a revolving paddle or stirrer wheel arranged therein, in connection with the strainer vessels through which the liquids pass before entering the vat. Large quantities of liquids may thus be handled easily and mixed in a short space of time, while being also strained from any coarser impurities on the passage.

Improved Double-Acting Pump.

Charles Gordon, Savannah, Ga.—Each stroke of the double piston forces the water in the cylinder section at one side of the same through a pipe with a check valve into a longitudinal connecting pipe, and to the delivery pipe, while the vacuum formed in the other cylinder section draws the water through the suction pipe with check valve into the same, to be forced on the return stroke of the piston to the delivery pipe, while the other section is filled with water through the opposite suction pipe.

Improved Damper Mechanism for Pianofortes.

Edward Porter, New York city.—The object of this invention is to enable the dampers of the bass strings of a piano to be raised and held suspended without raising the dampers from the other strings—that is, the strings of the upper part of the scale—by means of the ordinary damper or loud pedal mechanism. The invention consists in the strip attached to the forward upper part of the lifter rail, and extending beneath the forward part of the damper levers of two octaves, more or less, of the bass strings; and in the combination of the spring with the damper pedal spring, and with the strip attached to the lifter rail.

Improved Padlock.

Henry S. Lockwood, South Norwalk, Conn.—The wards of the key correspond to the recesses of tumblers, so that, on the introduction of the same, all the tumblers are engaged and thrown back. The spear-shaped heads of the same are thereby released from the projecting end of a projection of a sliding ring, admitting the sliding of the ring for opening the lock. When a false key is introduced, some of the tumblers are not released, while others are forced back with the opposite hooks of their spear heads against the hook-shaped end of a guard arm, so that the obstructing action of at least one tumbler prevents the opening of the lock. For attaching the lock, no key is necessary, as the mere turning of the ring produces the throwing of the bolt and the connection of the lock with the staple.

Improved Peg-Cutting Machine.

Jeremiah F. Smith, Keokuk, Iowa.—The cutters are applied at the outer ends of two forward extending arms, which spread in the shape of a V from their common rear part, one being straight, the other being curved in upward direction. The straight arm is used for cutting out the heel of the shoe, while the lower curved arm reciprocates forward and backward, and is passed easily along the sole edge for cutting the pegs, being guided along the upper by a protecting casing. The pegs are rapidly and neatly cut off by the reciprocating knives.

Improved Hot-Water Heating Apparatus.

Ernest F. Wackwitz, New York city.—The heating pipes in the heater are made flat and thin, so that they afford larger surface in proportion to capacity than round pipes do. By practical tests, it is found that the flat form gives equal size of heating and radiating surface, with less than half the quantity of water that is contained in round pipes giving the same surface. A cross pipe is arranged on the top of a vertical overflow pipe with both ends open, and inclined a little to the horizon. The highest end discharges into the air, while the lower one returns into a funnel, from which a pipe leads down in the heater nearly to the bottom, for returning the water which may be forced up out of the overflow pipe by expansion, while the steam will have freedom to escape.

Improved Burglar Alarm.

Samuel Searight, Pettisville, Ohio.—This invention consists of the combination of bells, revolver, and other alarm devices with suitable mechanisms that set them in motion when their cord connection with the doors and windows is stretched or interrupted.

Improved Dental Plugger.

Candidus Biharz, Pittsylvania C. H., Va.—Upon one side of the inner surface of the cavity of the head is formed a cam, which, as a rod and head are revolved, strikes against the end of a lever and turns it upon its pivot so as to draw the holder and point inward. As the end of the lever drops from the shoulder of the cam, the holder and the point are thrown out to give the blow by the elasticity of a spring.

Improved Steam Engine.

William Read, St. Cloud, Minn.—This invention consists of movable cylinder heads, with apparatus to cause them to follow the piston until the crank has passed the centers sufficiently to be acted on with good effect. The two heads of the cylinder are connected together by rods outside of the cylinder, so that, as the one follows the piston, the other will be returned to the end of the cylinder, out of the way of the piston. They are worked by a cam on the crank shaft, and stops are provided to fall in behind and hold them against the back action of the steam, to relieve the cam by which they are operated from such pressure.

Improved Plow.

Oliver P. Sanford, Dadeville, Ala., assignor to himself and Jacob Henry, same place.—The rear end of the plow beam is curved downward. The plow standard is made of a bar of iron bent into U shape, the parallel arms of the bar being at such a distance apart as to receive the rear end of the beam between them. The pitch of plow and the position of the handles may be readily adjusted as required. The plow plate rests upon the forward side of the standard, and is secured in place by a bolt that passes through the said plow plate and through the space between the arms of the standard, below the rear end of the beam, so that the said plow plate may be raised and lowered by loosening the nut. The bolt also passes through a washer, the lower edge of which is bent inward to enter notches in the standard, to prevent the plow from slipping downward.

Improved Grain Tally.

Aden K. Munson, Marysville, Kan.—In the ends of a box are formed openings to receive the measures, which are made of a single piece of sheet metal. To the upper part of the ends of the box is secured the striker, the lower edge of which is notched to receive bars, and which is secured to the box by bolts that pass through transverse slots in the said striker, so that it may be conveniently lowered or raised to strike off the measure more or less closely, as may be desired.

Improved Neck-Tie Fastener.

James H. Harrington, Providence, R. I.—This invention consists of a pair of gripping fingers pivoted together, and contrived to clutch round the shank of a collar stud or the thread fastening a button, and hold thereon by a spring. The fingers are so attached to the tie that it may hang down below the fingers to afford access to them for readily connecting them to the button, and, after the fingers are attached, be shifted up in front, and be adjusted under the collar.

Improved Corn Planter and Cultivator.

Philip S. Starnes, Pink Hill, Mo., assignor to Darnall & Womacks, same place.—The dropping slides are pivoted to an arched bar, so that both the dropping slides may be operated at the same time. The arched bar is made in three parts, so that it can be expanded or contracted to correspond with the adjustment of the plow beams. In the middle part is pivoted another bar, also made in three parts, so that the bar can be expanded or contracted to correspond with the adjustment of the first bar. By this construction, the plow beams will be held in their proper relative positions, and at the same time may be moved laterally or vertically in guiding them.

Improved Door for Grain Cars.

Frederick J. Kimball, Philadelphia, Pa.—This invention consists in the arrangement of a swinging bar, a pivoted latch for locking its free end, and permanent or fixed vertical bars, whereby the door is secured and also adapted to be opened outward.

Improved Press.

Jacob P. Kefauver, Madisonville, Tenn.—This consists in the combination, with follower levers, of arms having pulleys, ropes, and a windlass having two drums. One set of ropes, for pulling up the levers to press the bale, work on one drum, and other ropes work on the other drum for pulling the follower back, the latter ropes being arranged on the pulleys.

Improved Windmill and Watering Apparatus.

Ezra Richardson and Porter Harkness, New Rutland, Ill.—The wheel has rigid vanes, and is mounted on a vertical shaft, which carries a tail vane at its upper end, which is free to turn on the shaft. This vane has arms; and on the outer end of the upper one another vane is pivoted, so as to be held up to the wind by a weight. When the vane is forced down, the wheel and the tail vane will be turned into the same plane, and the wheel will be held by the tail vane with its edge to the wind. The weight is raised by heavy winds to relieve and regulate the wheel. When a trough is empty, the weight will open the valve; and when it is filled, the weight of the water will close it, and thus supply the trough with water as it is required, and without waste.

Improved Window Frame.

Elias Roth, New Oxford, Pa.—This invention is an improvement upon the construction described in patent No. 157,224. In that case the side of the casing is recessed opposite the lower sash to receive a strip, which is removable. When the strip has been detached, the lower sash may be readily taken out, and after that the upper sash. The improvement relates to forming an opening in the casing at the upper end of the recess for the removable strip, whereby the removal of the latter is facilitated.

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Notes & Queries

L. K. Y. will find directions for lacquering brass on p. 253, vol. 31. The Minotti battery is described on p. 25, vol. 32.—H. M. will find a full description of artesian well boring tools on p. 54, vol. 33.—A. P. H. will find a recipe for aquarium cement on p. 202, vol. 28.—W. R. will find a recipe for paste for labels on tin boxes on p. 253, vol. 30.—J. W. C. P. will find directions for casehardening iron on p. 202, vol. 31.—J. B. will find a description of paper boats on p. 153, vol. 27.—C. B. H. can calculate the power of his engine by the rules given on p. 33, vol. 33.—L. M. S. will find directions for making an aolian harp on p. 330, vol. 26.—D. O. will find a recipe for filling for walnut wood on p. 315, vol. 30.—P. V. J. will find a recipe for cement for gas bags on p. 305, vol. 32.—W. B. will find directions for making Pharaoh's serpents on p. 315, vol. 32.—R. R. W. will find a full description of the Carrière machine on p. 82, vol. 33. Salicylic acid is described on p. 96, vol. 33.—E. R. & W. will find a recipe for copying ink on p. 123, vol. 32.—L. K. L. will find a description of blue lacquer on p. 75, vol. 22.—W. B. H. can destroy ants by sprinkling salt plentifully over their holes.—P. C. H. will find a recipe for indelible ink on p. 112, vol. 27.—A. C. H. will find that the construction of a windmill is fully described on p. 241, vol. 32. There is no government foolish enough to offer a premium for a perpetual motion.—A. O. will find formulas for engine fly wheels on p. 251, vol. 32.—H. E. H. will find directions for expelling rats on p. 66, vol. 32.

(1) C. M. asks: Why does the sun shine in at the north door in latitude of a house 40° N. in the summer? It seems to indicate that the sun is further north than 40°, though the sun never comes further north of the equator than about 23° 28'. A. Were the earth so poised in space that the sun were vertical at the equator throughout the year, it would, of course, rise exactly in the east, and set exactly in the west throughout the year, for this is what the sun does do on March 21 and September 23, when it shines vertically at the equator. As the earth's inclination from a perpendicular to the plane of its orbit is the same throughout the year, thus causing unequal day and night, alternately north and south of the equator, when the sun shines vertically at the equator it shines obliquely, more or less, according to the latitude toward either pole; and the moment that it deviates from a perpendicular at the equator, it must shine beyond the north pole, as in our summer, or beyond the south pole, as in our winter. When the sun's declination is 23° 28' north of the equator, as at the summer solstice, it, of course, rises 23° 28' north of an east direction, and then will shine in at a north door for a portion of the morning and evening, until, in its oblique course through the heavens, it reaches those points where it will be south of an east course in the morning, and south of a west course in the evening. At the north pole, at the summer solstice, and for 23° 28' this side of the pole, the sun will shine directly into a north door at midnight; and at the exact pole it will, at that hour, occupy a position in the sky 23° 28' above the horizon.

(2) A. E. P. asks: Will a three horse engine give power enough to run a small planing machine to plane boards about one foot wide? A. It may not run the machine at full speed, but it will probably answer quite well.

(3) G. B. says: The pump on our boiler suddenly stopped working, without any apparent cause. It cannot be made to force water into the boiler in any amount, though it will pump when there is no pressure. The water is merely forced both ways between the cistern and pump valves. The packing around the plunger is perfectly tight. The valves have been refitted and well ground into their seats. Every part is in as good repair as a machinist experienced in making engines and pumps can make it. Where can be the defect? A. As you state the case, it is indeed a mystery. But if the pump continues running when turned on to the boiler with the cylinder full of water, and still does not deliver any water, it is reasonable to suppose that there is a leak. You can try the experiment, and settle the matter conclusively.

(4) J. P. asks: Can I draw water through a 1/4 inch lead pipe, out of a well, over a hill, to my house, the distance being about one hundred rods, and the rise from bottom of well to top of the hill 25 feet, and the fall from the top of hill to the house about 35 feet? A. Yes, if you make provision for drawing off the air that will collect at the highest part of the pipe. You must also be very particular to lay the pipe without kinks and bends, and with easy curves, whenever it is necessary to curve it at all.

(5) T. C. H. asks: I have had an argument as to the value of a glass gage on a boiler. My friend claims that a gage glass is more liable to get stopped up than gage cocks, and therefore is useless and not reliable. He also claims that the glass is not of any value in detecting the foaming of a boiler, and that the only way to tell if a boiler foams is by carrying water over into the cylinder. I claim that the glass is the best. A man in charge of a boiler is not supposed to rely on the look of the water in the glass to determine the water line in boiler, unless he is sure that the openings of the tube are free from stoppage. It is as easy to try your glass as your gage cocks. I say also that, if the piston has a large clearance, it might carry a great amount of water in the cylinder without its being detected. Which is right? A. A glass gage is a very useful appendage to a boiler, and it is as easy to tell whether it is in working order as to determine the same for a gage cock. For several reasons, if it is necessary to make a choice between a glass gage and gage cocks in determining the fittings of a boiler, it is

generally better to take the latter. When a boiler foams, it is frequently indicated in the glass gage, though the gage cocks give a more certain test. Glass gages are frequently fitted up in such a manner that foaming can readily be detected. A boiler containing clean fresh water may foam, if badly proportioned, or if the fire is violently forced.

(6) G. W. H. asks: Will it increase or decrease the power of an engine to raise numerous pyramids on the face of the piston head, so as to increase its surface? A. There would be no change as far as the effective area of the piston is concerned.

(7) J. A. B. asks: Do you know of a seed called bird pepper? If so, can you tell me any other name by which it is known? A. We are acquainted with it under that name. It may be *capsicum annuum* or *piper nigrum*.

(8) B. T. asks: What are the names of the explosive agents that explode at a very low temperature, and what are the degrees of heat, respectively, at which they explode? A. There are many compounds known to chemists which explode with violence at temperatures below that of boiling water; but owing to their properties of undergoing spontaneous decomposition, as well as instantaneous explosion from the slightest cause, such as friction or contact with metals, etc., they are exceedingly dangerous to handle. Gun cotton might answer your purpose, but as regards the temperature at which it ignites, statements differ; it has been in some instances dried at a temperature of 90° to 100° without any dangerous consequences, while it has been found to ignite at 43°. In one instance a small magazine of gun cotton situated in the Bois de Vincennes, Paris, was exploded by the sun's rays.

(9) A. L. K. says: The water in my cistern smells as though it were putrid. How can I render it pure and odorless? A. Place several bushels of animal charcoal in the bottom of the well.

(10) J. N. says: For the past six months my hair has been continually falling off. How can I remedy it? A. Try the following: Iodine (crushed small) 1/2 drachm, olive oil (lukewarm) 1/4 pint; agitate them together in a small phial until solution is complete. It may be scented with a little essential oil of almonds or lemons; but it is better without it. Most of the other oils cause the gradual decomposition of the hair. It has been very highly recommended as a hair oil for daily use, in partial loss of hair and baldness, also to rub indurated glands, etc., with.

(11) O. W. B. asks: What can I put in with common glue to make it dry quickly and become hard? A. Try a little sulphate of lime (plaster of Paris).

(12) W. H. W. asks: Is it possible to decolorize a solution of copper and ammonia and still retain the copper in solution? A. Salts of copper, except in very dilute solutions, always reveal their presence by their characteristic blue or bluish green color; and in the presence of an excess of ammonia, the color, even in extremely dilute solutions, is of a strong, deep blue. In the presence of ammonia, therefore, the solution of the salts of copper cannot be rendered colorless.

(13) C. W. asks: By what process is crude coal tar refined and made into a paint? It is used extensively for roofing purposes. A. The tar is placed in large low iron stills, and heated to about 176° to 212° Fah. for the purpose of distilling off the lighter hydrocarbons along with the ammoniacal water the tar may contain. After about 36 hours, the residue, consisting of the refined coal tar, or coal tar asphalt as it is sometimes called, is drawn off by means of a tap in the lower part of the still.

(14) W. V. W. asks: What is the philosophy of death by sunstroke? A. *Coup de soleil* or sunstroke is thus mentioned by Tanner: "Causes: In its perfect form, it is met with only in the tropics. It has been noticed that those attacked have often been affected for a few days previously with suppression of perspiration. The nights have been sleepless, while attacks of vertigo and a sense of weariness have been complained of. Such men, too, may have been irregular in their habits; while perhaps they have also been indulging freely in alcoholic drinks, and prowling about under exposure to an almost vertical sun for two or three days previous to the seizure. Symptoms: These are generally faintness, thirst, great heat, and dryness of the skin, with prostration. As the disease advances, the heart's action becomes violent, the man can scarcely be roused, the face gets pallid and perhaps an attack of vomiting ushers in the stage of coma. The affection sometimes comes on very insidiously. A man will be seen to be listless and stupid; but he makes no complaint beyond saying that his head feels a little queer. Yet in twelve hours he may be dead. Dr. Morehead agrees with those observers who refer the phenomena of sunstroke to depressed function of the cerebro-spinal and sympathetic nervous systems. The three most urgent things to be performed in treatment are: Cooling the body, removing listlessness and oppression, and increasing the respiratory action.

(15) T. G. says: The inside of a store was painted with guaranteed pure white lead and pure raw linseed oil. All the white and light colored paint has turned yellow, even as dark as yellow ochre. Why is this? A. The trouble is probably due to the presence of some salt of iron in the materials.

(16) J. R. asks: I. In making plaster figures I use gelatin molds, made of glue. In summer the gelatin melts and I cannot work. How can I prevent this? Will tannic acid be of any use? A. No. Melt the gelatin in a small quantity of water by heating it over a water bath until a thick paste is formed; add glycerin in the same quantity by weight as the (dry) gelatin. Then stir the mix-

ture and allow the excess of water to evaporate. It may then be poured on a marble slab or in a mold, and allowed to harden. The above, we think, will answer your purpose. 2. How can I melt pure rubber and make it into molds? A. Pure rubber may be softened by steam or hot water; but if melted by application of heat, it suffers partial decomposition, and does not gain in solidity. Caoutchouc dissolves in naphtha by heat and agitation. This is accomplished over a water and sand bath, or by means of a steam jacket, in closed vessels.

(17) J. M. H. says: Recently a frightful flash of lightning fell from the gathering clouds, striking a lightning rod, breaking it in two, and melting the metal, which ran down in drops. The house was somewhat damaged, pieces of the second floor being torn out and scattered over the room. The rod was only about three feet in the ground, and I think it had not a sufficient connection with the earth. Am I right? A. If the rod had been in proper connection with the ground, the currents would doubtless have passed into the earth without damage to the building. See p. 336, vol. 32.

(18) J. R. asks: 1. Under what conditions will common coal gas become a liquid? A. The requisites are a sufficiently low temperature and an adequate pressure. 2. What is the process of distilling coal oil or crude petroleum, and how are the lighter constituents collected? A. The crude oil is pumped into stills holding from 200 to 1,000 gallons each, and submitted to a gradually increasing heat, the vapors being passed through a worm immersed in cold water. At first, there comes over a very light, mobile, and volatile liquid, exceedingly inflammable. As the operation proceeds, the product is tested from time to time; and when the specific gravity corresponds to about 90° Baumé's hydrometer, the receiver is changed, and the operation of testing, but by a different standard, is again repeated. The receivers are changed several times, or until, at a high temperature, paraffin and illuminating gas constitute the bulk of the products of the distillation. At the end of the operation there remains in the retort, as the heat has been greater or less, a thick tarry matter, or a porous coke. The products of the distillation are commonly classified as follows: Those products whose densities are below 90° Baumé are termed gasoline; those between 70° and 80°, naphtha; from 60° to 70°, benzine; those between 40° and 60°, kerosene; and finally the heavier products, fit only for lubricating purposes, and paraffin.

(19) C. T. V. says: Please publish directions for welding iron rings without scaling. A. We know of no reliable compound for this purpose; but you might try the Belgian recipe. It is: Iron filings 1,000 parts, borax 500 parts, resinous oil of any kind 50 parts, sal ammoniac 75 parts. Pulverize completely and mix; heat the rings to a cherry red, powder the parts with the mixture, and join them together.

(20) T. H. asks: 1. Of what lenses are the most improved opera or field glasses composed, and what is their arrangement? What power is attainable in those of moderate size? The common telescope or spy glass is obtainable, of convenient size, to powers of 15 to 20 diameters, but it is inconvenient to use, being difficult to hold steadily without a rest, and it taxes the eyes more than a field glass. Is there any portable instrument having a power of 15 or 20 diameters? A. All opera and field glasses are constructed on the principle of the Galilean telescope, that is, with a convex object glass and a concave eyepiece. In the better class of instruments, all the glasses are achromatic. The object glasses are generally made with two lenses (crown and flint); and if the eyepieces are not achromatic, those are known as six-glass (three in each tube). Sometimes the object glasses and eyepieces are each triple achromatic, having three lenses in each, in which case the instruments are known as twelve-glass, and are so marked. In the best opera and field glasses, the power rarely exceeds 6, and is seldom more than 5. For a power of 15 to 20 diameters, you can get nothing that will be as good or as cheap as a telescope.

(21) M. H. V. says: I have just made a refrigerator, filled in on all sides with charcoal. There is a partition up and down through the center, with 4 holes 3 inches square through the partition. We put in 20 to 30 lbs. ice, and yet my butter, milk, etc., sours almost as though there were no ice in the refrigerator. There is a discharge pipe for waste water, 1 inch in diameter, running down from the ice box, which is of zinc. What is the trouble? A. We would suggest the removal, in part, of the partition. Also place in one corner a quantity of caustic lime, in such a position that water from the melting ice will not reach it, and see that the box is closed as tightly as possible.

(22) Bicycle.—You can probably buy good bicycles through carriage dealers at your place.

(23) M. E. J. asks: 1. Who was the first man who invented the self-rake on a reaper? A. The earliest instance of a self-acting rake on a reaper appears in an English patent granted to Mr. Gladstone in 1806. 2. Who invented the first reaper? A. The first account of a machine to reap grain appears to be given by Pliny the Elder, who was born, it is thought, in A. D. 23. And the first patent for a reaping machine was granted in England to Joseph Boyce, July 4, 1790, and in the United States to Richard French and J. T. Hawkins, May 17, 1863.

(24) J. C. C. asks: 1. Are metal roofs superior to lightning rods as a means of protection to dwellings? A. If the metal roof be connected with the ground properly, by means of several stout rods of copper or iron, which should also have connection with all the interior metal work of the building, this method will afford excellent protection to the property. 2. In what manner should metal roofs be constructed, of what metal

and how should the connection be made with the earth? A. It will be necessary for you to erect metallic rods, extending five or six feet above the highest points of the roof, tipped with some metal not readily oxidized, and also having a sufficiently large surface connection with the metallic roof to avoid the melting of the sheet metal in case of a heavy discharge. In the construction of some of our large public buildings, this simple yet efficient method of protection from lightning has been employed, differing from the above only in the respect that the ground connections are made directly with the main water and gas service pipes of the city. 3. In an article on protection from lightning, to which reference was made by you a few weeks since, you say the extremities of lightning rods "should be put in connection with water or moist earth if possible." In the same article, a little further on, you say that "water and moist earth, which are so frequently recommended as terminals for lightning rods, are among the poorest of conductors." Is not this a contradiction? A. It is true that both water and moist earth are, in comparison with the metals, very poor conductors of electricity, but it is equally true that the resistance of any conductor is inversely as its sectional area; hence the necessity of a large terminal contact surface with the earth. From the above facts it is obvious that, if the earth connection be sufficiently extended, the resistance of the earth may be reduced almost to zero.

(25) C. Z. M. says: I am building a small engine with link motion. Where is the proper place to get the radius of the link from? A. The center of the engine shaft.

(26) G. S. W. says: I have a Wardian case of my own make, and ferns or anything else will not prosper in it; they mold, rot, and die away. New shoots come up, but they in turn are killed off long before maturity. When I open my case, there is a very musty smell. What is wrong? A. The moisture which falls on the inside of your glass probably falls upon your plants, and kills them by what is termed damping them off. The case must be left open an hour or two every day, to prevent this. Also bore some holes in the bottom of your case, to afford drainage.

(27) O. W. I. says: I made a mixture of 1 oz. nitric acid and 4 oz. muriatic acid and then put in a \$2.50 piece of gold; and when it was all cut and dissolved, I put in 2 ozs. sulphate of potash in 1 pint rain water. It will not precipitate the gold. I then dissolved $\frac{1}{2}$ ozs. sulphate of potash, and it makes no impression on it. What shall I do to recover the gold? A. Evaporate your solution nearly to dryness in order to expel as much of the free acid as possible, and redissolve in pure water. Then add to the liquid a strong solution of sulphate of iron (common green vitriol) until no further precipitate forms. Allow the precipitate to subside, and then filter, and thoroughly wash the precipitate on the filter with water. Allow the filter paper with its contents to dry, and then place it together with a small quantity of borax in a Hessian crucible, and fuse. By the above method you will obtain the gold in a very pure state.

What is used for charging a battery composed of two zinc plates and one copper plate? A. Use 1 part oil of vitriol to 12 parts water.

(28) E. K. asks: How can I obtain the silver out of old broken black lead crucibles? A. Pulverize the crucible and digest it in nitric acid for several hours. Decant off the clear liquid and add to it muriatic acid until no further precipitate forms. Allow to settle and again decant the clear liquid, wash the precipitate several times with clean water, dry, and fuse in a small crucible with a quantity of carbonate of soda.

(29) W. T. P. asks: What kind of gas are toy rubber balloons inflated with? How is it generated? A. The gas is hydrogen; it is obtained by acting upon small pieces of zinc with dilute oil of vitriol.

(30) J. S. & Co. ask: What amount of power is required to run a grindstone 5 feet in diameter by 8 inches face at 300 revolutions per minute, for grinding plowshares? A. Use a steam engine with cylinder of 6 inches diameter and 8 inches stroke, cutting off at $\frac{3}{4}$, with a steam pressure of 60 lbs. per inch.

(31) D. P. H. asks: 1. If two locomotives are on a level track one mile long, and No. 1 is fired up, No. 2 being filled with water up to the second gauge cock, with valves open to go ahead while it is getting towed backward, and at the end of the mile the engines are uncoupled: will No. 2 have any pressure in boiler? A. If the slide valve were held firmly to its face, there would undoubtedly be a pressure pumped into the boiler equal to about 40 per cent of that of the steam; but as the slide valves of locomotives are not held to the cylinder faces save by a light spring, and sometimes are without even that, the valve would lift, and the air from the cylinder would flow in and out of the steam chest. There would undoubtedly, however, be a slight air pressure in the boiler under the conditions named. 2. Will there be enough to carry it back to starting point? A. No.

(32) L. C. S. asks: Are not portable fire extinguishers filled with water and effervescent matter, and have they to be re-charged when the charge is exhausted? A. Yes.

(33) E. says: I differ with you as to the advisability of conducting lightning rods into wells. The patent lightning rod man who put up my rods held your opinions, and down the well went his rod. Our water, which had always been noted for its purity, became after this at times unpleasant in taste. It seemed as if we had opened into a mineral spring of nauseous fluid. One suggested foul air; another, dead rats. The well was pumped dry and examined, but the trouble remained undiscovered. For a while again, good water; then a repetition of a sulphur spring, to our great annoyance, and so it went on for years. One day, after a violent thunderstorm, our eyes were opened

to the difficulty by the sudden change in the taste of the water. Then out came our rod from the well, and since then the old well has regained its reputation for pure tasteless water "fit for the gods." Do not put your rod into a well.

(34) W. C. B. asks: 1. How much power is required to drive a pair of millstones, to grind 8 bushels of fine meal per hour, the runners to be 20 inches thick and 42 inches in diameter? A. About $\frac{1}{2}$ horse power. 2. How much power is required to drive a 30 inch pony or panel planer? A. About 2 horse power.

(35) H. R. asks: 1. I have a boat, 15 feet long by 4 feet beam by 2 feet depth. She is built to cut the water easily. The engine is 2 inches bore by 4 inches stroke. The horizontal boiler has a smoke bonnet all around, is 25 inches long by 16 inches diameter, and has twelve 12 inch flues; and the heat runs from the front end to the back end into a smoke box, whence it runs through the flues into a smoke box fixed on the front end, and escapes into the chimney. The firebox is 25 inches long and 14 inches high. I cannot make the boiler larger. Is the engine large enough to run the boat? A. The power of your engine depends on the pressure of steam used, but your cylinder is too small in any case. 2. Is the boiler large enough to run the engine? A. The boiler is too small for the engine or the boat. 3. How thick ought the heads and shell of the boiler to be to stand safely a pressure of 100 lbs., and how thick to stand 150 lbs.? A. To stand the pressures you name, make the shell of the boiler $\frac{3}{8}$ inch, and the heads $\frac{1}{2}$ inch, if of steel, or the shell $\frac{1}{2}$ inch, and the heads $\frac{3}{4}$ inch, if of wrought iron. 4. Of what size, pattern, and pitch should the propeller be to give the highest speed that can be got with so small an engine? A. Propeller for the size of your engine should be about 16 inches in diameter and of 20 inches pitch; but for the boat, it should be 18 inches in diameter and from 2 to 2 $\frac{1}{4}$ feet pitch. 5. Will coke give enough heat? A. Yes, if you maintain a good draft. 6. How fast will she run? A. This is best ascertained by experiment. 7. Will a steam gauge, as used on large boilers, show 100 lbs. pressure in my little boiler just as well as on a large one? A. Yes. 8. If the boiler (25x16) should not have enough steaming capacity, please give the proper dimensions and thickness of heads and shell. A. The boiler should have 25 feet of heating surface, the shell being $\frac{3}{8}$ inch, and the heads $\frac{1}{2}$ inch thick. 9. Can you tell me of a good book on the proportions of a steam engine? A. Bourne's "Handbook of the Steam Engine." 10. Will good boiler iron answer to make the boiler? A. Yes.

(36) E. B. W. says: I am exceedingly annoyed by the flies eating the ink lines of my drawings. Can anything be put into the ink to prevent their depredations? A. Not that we know of. They are ravenous for it.

(37) F. W. H. asks: What amount of animal heat is required to develop hen's eggs, and what ought to be the temperature of an incubator? A. The temperature of the incubator should be about 106° Fah., which will impart to the egg 104° Fah., the proper heat.

(38) G. S. B.—The size, shape, and length of the steam ports, the amount of condensation, and many other considerations affect the initial velocity of steam. We are not aware of any means, save actual test, of ascertaining this initial velocity; and an actual test, under any particular conditions, would not be sufficiently accurate for general application.

(39) Constant Reader.—We have not heard of any reward offered of \$50,000 or other sum for a plan for the removal of oil from marble.

(40) T. S. asks: Is there any way of making tissue paper airtight without adding materially to its weight? A. We do not know of any.

(41) A. B. asks: 1. What is the dispersive power, respectively, of Chance's flint and crown glass? A. The dispersive power of flint glass being 0.043, that of crown glass is 0.0246. 2. What form is generally used for convex lenses for achromatic telescope objectives, plano-convex or double convex? A. The best telescope objectives are made by combining a double convex lens of crown glass with a concavo-convex lens of flint glass.

(42) E. A. B. asks: I took a semi-concentrated solution of bichromate of potash, in a stone bottle, and added $\frac{1}{10}$ part of No. 1 gelatin to 1 part of solution, and boiled these ingredients until I was certain that the gelatin was dissolved. In a dark room I poured this on a glass plate, dried it, and exposed to light with a photograph under it. I wetted it in cold water. Result after repeated trials was that the plate was rough, due, I think, to the formation of crystals of bichromate of potash. There was no sign of an impression. What was the matter? A. You should allow the gelatin bichromate to cool, and filter it before attempting to use it. In exposing the prepared paper in the printing frame, the photographic negative (on glass) should be on the top, that is, between the paper and the light, and with that side of the plate which contains the picture pressed tightly against the paper. On removing the paper from the frame, it should immediately be placed in a large quantity of clean, cold water, in a dark place, and allowed to remain immersed for some time.

(43) A. W. W. says: 1. I hear a great many complaints of water from galvanized iron and zinc lined water coolers. Is it injurious, and what effect has it on the system? A. The use of zinc or galvanized iron for this purpose is not wholly without objection. The presence, in the water, of any appreciable quantity of soluble sulphates, chlorides, or free acids, is apt to corrode and partially dissolve the metal. Salts of zinc act upon the animal system in much the same manner as verdigris or corrosive sublimate, although not so violently. 2. How would a cooler lined with ordinary earthenware and metallic plate, with springs attached to the lower part, placed in the cooler to keep the ice from breaking the bottom, answer?

A. Earthenware will answer the purpose admirably, but by far the best arrangement for this purpose is composed of a deep, porcelain-lined iron pot, having an iron or nickel plated faucet near its base. The vessel is placed in a box of any desired shape, leaving a space of two or three inches between the pot and the inside of the box. This space is packed closely with good dry charcoal, in powder, and sealed around the top by molding or otherwise. The lid of this water tank is a tightly fitting iron cap, and over this is one of wood, having between it and the iron cap a piece of clean felt.

(44) L. K. Y. asks: How can I make gutta serena soft like wax? A. Warm it.
In what country is aluminum mined and worked? A. See p. 91, vol. 32.

(45) S. V. P. asks: Does hydrogen gas behave exactly like air in the matter of giving out heat by compression and taking it back by expansion? A. Yes.

(46) F. D. says: I am making two tin cylinders for use in learning to swim, connected by a strap passing under the chin; they are slightly conical in front, in order to overcome the resistance of the water. The object is to keep the chin and mouth out of the water and give the arms and legs free play. How long ought they to be? A. Make them about 4 inches in diameter and 12 inches long.

(47) J. F. asks: 1. Can an hydraulic press be worked with a column of water in a stand pipe? A. Yes. 2. Can air be compressed by hydraulic pressure until it will attain an expansive force of 10,000 lbs. per square inch? A. Yes. 3. Can all the results of the Keely motor trick be attained by such an apparatus with compressed air? A. Yes, all of which we have seen an account.

(48) M. V. O. asks: Does a fan blower require more power to drive it when the discharge or blast pipe is open, than when it is closed wholly or in part? If so, how do you account for it? A. The action is just the same as that which occurs on partially closing the discharge valve of a pump. If the same speed of pump or blower be maintained, the resistance is increased.

(49) G. S. R. says: Your account of the appearance of the bull's eye at 1,000 yards distance has provoked a great deal of discussion. Some contend that it would appear to be about a six inch square dot, and others that it would be like a dot about half an inch square. You say the bull's eye would appear of about the same size as a dot half an inch square held at a distance of some three yards from the eye. Please explain. A. The remark did not refer to relative, but to actual size, that is, the bull's eye looked exactly the same size as the dot.

(50) R. asks: What are rotary steam boilers? In what respect do they differ from ordinary boilers? A. We do not know anything about this class of boiler, unless you refer to the kind in which only a small quantity of water is evaporated at a time.

(51) B. K. D. asks: If a person should succeed in perfecting a simple water elevator which would work automatically, with no apparatus to get out of order, and with no expense excepting the price of the necessary length of pipe and of a simple attachment (costing probably \$2.50), is it probable that such an elevator would have a great demand? I have been successful on a small scale, drawing water freely 6 feet from source of supply, by a simple device. Would the probabilities warrant some expense in experimenting upon a larger scale? All of the elevators of which I am aware depend upon some mechanical force or power; but I need no power other than that contained in air and water. A. As we understand it, you propose to do work without incurring any expense for the necessary power. You can judge of the demand such an invention would create by reading about Mr. Keely's experience.

(52) W. H. B. asks: If a man in the car of a balloon were to work an apparatus like a common pump, the pipe running through the bottom of the car, would the balloon be drawn downwards? A. No, as we understand your meaning.

(53) C. B. A. asks: Can isinglass be dissolved in water? I got a piece such as is used in stove doors, and put it in a cup and kept it on the stove 36 hours, but it did not dissolve. A. You used mica. You will have no trouble in dissolving isinglass.

What keeps the ball against the jet of water in the fountains shown in some stores? A. As soon as the ball gets much over to one side, it fills, and descends on to the jet of water in the conical base of the apparatus.

(54) A. H. M. asks: What lubricant is best for high pressure horizontal engine cylinders? A. There are a number of oils in the market which are well spoken of and recommended for use in cylinders; but we imagine that none of them are superior to sperm oil in any particular except that of first cost.

(55) B. F. R. says: I have a theory in regard to the manner in which Nature affected the crystallization of the diamond. It is generally conceded that it could not have been done by fusion; might it not have been from solution? Do you not think there may possibly be a solvent for carbon in some of the uncombined forms? A. The diamond has probably proceeded, like mineral coal and oil, from the slow decomposition of vegetable material, or even from animal matters, either source affording the requisite carbon; but it has been formed under those conditions as to heat that has produced the metamorphism of argillaceous and arenaceous schists and auriferous quartz veins, since it is found exclusively in gold regions, or in the sands derived from gold-bearing rocks. The schists that were altered at the time

may have previously been shales impregnated with petroleum or other carbonaceous substances (hydrocarburates) of organic origin. Chancourtis observes that the formation from a hydrocarburated vapor or gas is analogous to that of sulphur from hydrosulphuretted emanations. In the oxidation of the latter by the humid process, the hydrogen becomes oxidized, and only a part of the sulphur changes to sulphurous acid, the rest remaining as sulphur. So in the humid oxidation of a carburated hydrogen, the hydrogen is oxidized, part of the carbon becomes carbonic acid, and the rest remains as carbon and may form crystallized diamond.

(56) J. A. B. asks: By what process is the distillation of glycerin effected? A. The mother liquor is first concentrated by evaporation, the saline matter which is thereby gradually separated being removed from time to time. When the fluid is sufficiently concentrated, ascertained by the boiling point having risen to 240° Fah., it is transferred to the still, and the glycerin distilled off by means of superheated steam carried into the still. The temperature of the steam should not exceed 500° Fah., as otherwise a partial decomposition of the glycerin will take place. The distillate is next concentrated, and brought to the consistency of a sirup in a vacuum pan.

(57) N. S. W. says: 1. I have an electric battery which fails to work. I have increased the strength of the liquid of sulphuric acid so as to destroy the platinum plate, and still the magnet would not vibrate, and no current is perceived in the coil. What is the difficulty? A. The connections between the battery and coil were probably at fault. In arranging the apparatus for use, you should follow the directions to be found, generally, glued on the inner side of the lid of the case containing the coil. See that the ends of the connecting wires are free from all rust, also that the contact points of the small vibrating armature spring are perfectly clean. 2. I wish to make a steel magnet of thin plates. Ought the plates be bolted together, without insulation between them? A. They are joined without insulation. 3. Should it be charged after being clamped together, or should each plate be charged separately and the poles reversed? A. Separately. Join like poles together. 4. I hold that the strongest point of attraction in a magnet is the center of armature between the two poles. Am I right? A. The greatest magnetic force is developed at the poles. 5. Suppose a body of iron were surrounded with a coil of copper wire, slightly excited, would a magnet attract it more readily or not? A. It would. 6. In the electric light, where two carbon points are used, are two charcoal points in effect the same? A. Yes; but they are more rapidly consumed than gas carbons.

(58) J. D. asks: What can I use to thoroughly cleanse freshly made cider of all sediment, for the purpose of preserving it? A. Filter it through a clean linen bag containing some animal charcoal.

(59) S. asks: Can an ice boat travel faster than the wind? A. Ice boats very frequently travel at a faster velocity than the wind that drives them.

(60) L. C. C. asks: 1. What is the size and location of the heaviest gun in the world? A. We believe the largest has a bore of 20 inches. 2. What is the size and weight of ball carried by the large gun at Fort Hamilton, New York Harbor? A. Weight of shell, 1,080 lbs.

(61) M. A. G. says, in reply to A. K., who asked as to building a rain water cistern: One thing is essential, and is very generally neglected. It is to have the water as it comes into the cistern conducted to the bottom. In this way, the water is entirely changed when it rains. When the fresh water simply pours in at the top, it immediately runs off and all the mass of stagnant water remains undisturbed, and soon becomes impure.

(62) J. J. says, in reply to J. G. G., who asks: Why does the second crop of clover produce more seed than the first? Clover blossoms require to be fertilized by some agency outside of themselves. Bumble bees are the chief means employed, and butterflies and other insects to some extent. Honey bees do not trouble the red clover. As very few bumble bees live through the winter, they are not numerous in the early part of the season; consequently but few blossoms are fertilized. If the fore part of the season is wet, there will be but few bees or other insects in the latter part, and but very little seed in the second crop of clover. It has been a wet season here in Illinois, and I do not recollect seeing a single bumble bee. We may leave our clover seed alone this fall, and save ourselves work. J. G. G. may set it down as a rule that, when bumble bees are plentiful, there will be plenty of clover seed, and vice versa.

(63) J. C. says, in reply to T. M. C., who asks what is the best remedy to prevent unpleasant odor from the feet caused by perspiration: Sprinkle pulverized alum in your boots once or twice a week for two or three weeks, and then not so often. It will cure the worst case.

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

J. R.—The filaments in motion were specimens of the *anguilla aceti*, a vinegar eel. They can be found in almost all vinegars.—R. F. W.—It is iron pyrites. In 100 parts of the mineral, 53.3 are sulphur, and 46.7 are iron.—J. M.—It is a deposit of carbonate of lime and magnesia. The water charged with carbonic acid unites with the lime, forming CaCO_3 , which is deposited as in the specimen sent. We cannot form any opinion of the soil over which the water runs, save that it contains a large percentage of lime.—I. R. M.—Diox received; but there was no bug in it.—O. P.—It is trap rock. The fine brilliant particles are pieces of hornblende.—W. K.—Your specimens arrived in very poor

condition. We should call them *phytoecoris lineolaris*. The history of the insect is yet imperfect. It is found most abundantly in the months of June and July. It has been found in Maine, New York, North Carolina, Pennsylvania, and Missouri. The great increase of these and other noxious insects may fairly be attributed to the exterminating war which has wantonly been waged upon our insect-eating birds, and we may expect the evil to increase unless these little friends of the farmer are protected, or left undisturbed to multiply and follow their natural habits.—J. H. P.—It is hematite. It contains no nickel. The tooth sent, being very imperfect and broken, cannot be named or classified. The bone has been sent to a distinguished naturalist for examination.—G. W. H.—No. 4 only was received. It is hematite.—J. L.—Send us a sample of the water you complain of.—R. J. & S.—They consist of quartz rock and iron pyrites.—J. McC.—Send small samples by mail, marked legibly with name.—S. H.—It is marcasite, or white iron pyrites.—M. J. D.—We will shortly answer your questions in full.—A. A. J.—It is quartz, containing iron pyrites and a small amount of chalcopyrite.—E. P. C.—It is coal of a very poor quality, containing so much silicious matter as to be worthless.—H. F. L.—It is iron pyrites mixed with carbonaceous matter.—S. K. B.—We cannot make a complete analysis. The specimen is hematite, an ore of iron containing, when pure, nearly 70 per cent of iron.—F. C.—It is iron pyrites.—O. D. B.—It is a limestone containing mica, talc, and iron.—F. & B. It consists chiefly of the double sulphate of nickel and ammonia, mixed with a small quantity of organic matter.—N. V. C.—It appears to be a poor variety of elaterite. It contains a large percentage of sand and clay. We do not consider the sample to be of much value.

J. L. asks: How can I best convey sawdust from a sawmill to a fire 300 feet distant?—E. M. says: In Europe a paste or cream is used to remove the beard from the face, without the use of soap or razor. How is this cream made?—A. A. asks: What sort of varnish is used on the sounding boards of guitars? Are the sounding boards made of heart or sap pine, or both? What is used for dyeing wood black for finger boards, bridges, etc.?

COMMUNICATIONS RECEIVED.

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

- On Terrestrial Magnetism. By W. E. S.
- On the Altitude of Storm Clouds. By J. M. S.
- On the Heavy Rains. N. B. G.
- On the Keely Motor. By A. A., and by J. T.
- On Motive Power without Fuel. By S.
- On Geometry. By E. C.
- On Mental Science. By F. H.
- On Using Steam Expansively. By F. C.

Also inquiries and answers from the following:

- R. K.—N. J. T.—F. Q.—N. W.—R. B. S.—J. F. S.—C. M.—M. V.—C. K.—E. T.—T. Y. J. H.—L. W. T.

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.

Inquiries 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 inquiries analogous to the following are sent: "Who sells dynamite? Who sells machinery for drying corn meal, etc.? Who sells snow spectacles? Who sells cheap telescopes? Who buys kaolin?" 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

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8,475.—STEAM PUMP, ETC.—D. A. Burr, Philadelphia, Pa.	
8,496.—GLASS VESSEL.—E. Finney, Philadelphia, Pa.	
8,497.—CIGAR BOX.—F. Hachuel et al., New Orleans, La.	
8,498.—TOY BANK.—J. Hall, Watertown, Mass.	
8,499 to 8,523.—CARPETS.—O. Heintzke, N. Utrecht, N. Y.	
8,524 to 8,527.—CARPETS.—H. Horan, East Orange, N. J.	
8,528.—CARPETS.—L. G. Malkin, New York city.	
8,529 to 8,531.—OIL CLOTH.—C. T. Meyer, Bergen, N. J.	
8,532 to 8,545.—CARPETS.—E. S. Ney, Draent, Mass.	
8,546 to 8,549.—CARPETS.—J. H. Smith, Enfield, Conn.	
8,550 to 8,555.—FABRICS.—E. C. Clark, Rockville, Conn.	

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
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On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (14 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA July 24 to 31, 1875.

5,017.—J. Prentice, New York city, U. S. Cigar mold	July 24, 1875.
5,018.—A. G. Haskell, North Andover, Mass., U. S. Life-preserving bed.	July 24, 1875.
5,019.—W. L. Pawleson, San Francisco, Cal., U. S. Smoke consumer.	July 24, 1875.
5,020.—E. Heley, Dublin, Ireland. Printing machine.	July 24, 1875.
5,021.—T. Herron, Ottawa, Ont., et al. Churn.	July 24, 1875.
5,022.—S. Spicer, Goderich, Mich., U. S. Hame lock.	July 24, 1875.
5,023.—D. R. Proctor, Gloucester, Mass., U. S. Spark arrester.	July 24, 1875.
5,024.—S. M. Barré, Montreal, P. Q. Ironing board and stretcher.	July 24, 1875.
5,025.—J. Fenselm, Toronto, Ont. Hydraulic elevator.	July 24, 1875.
5,026.—S. T. Waggoner, Mattison, Mich., U. S. Folding table.	July 27, 1875.
5,027.—C. G. C. Simpson, Montreal, P. Q. Railway car wheel.	July 27, 1875.
5,028.—F. Dodge et al., Oswego, N. Y., U. S. Feat machine.	July 30, 1875.
5,029.—H. Rogers, Eureka, Cal., U. S. Lock.	July 30, 1875.
5,030.—A. S. Acker, Lockport, N. Y., U. S. Hoe.	July 30, 1875.
5,031.—D. M. McPherson, Lancaster, Ont. Cheese hoop.	July 30, 1875.
5,032.—J. Stubbs, Mount Pleasant, Iowa, U. S. Road scraper.	July 30, 1875.
5,033.—A. S. Hopson et al., Plainview, Minn., U. S. Vehicle spring equalizer.	July 30, 1875.
5,034.—C. L. Riker, Rochelle Park, N. J., U. S. Lining for excluding cold.	July 30, 1875.
5,035.—T. F. Gordon et al., Rouseville, Pa., U. S. Process for decolorizing and refining petroleum.	July 30, 1875.
5,036.—L. A. Dodge, Keeseville, N. Y., U. S. Nail feeding device.	July 30, 1875.
5,037.—A. T. Jones, Clinton, Wis., U. S. Food preserving process.	July 30, 1875.
5,038.—J. Higby, Montreal, P. Q. Gas from petroleum.	July 31, 1875.

Advertisements.

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GEO. PLACE & CO., 121 Chambers street, N. Y.
PIERCE & WHALING Milwaukee, Wis.

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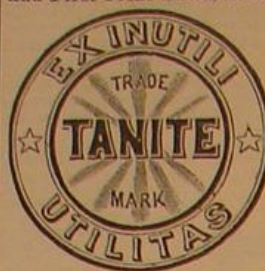
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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 10.
(NEW SERIES.)

NEW YORK, SEPTEMBER 4, 1875.

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IMPROVED POWER PUNCH AND SHEARING MACHINE.

We illustrate herewith a new power punch and shearing machine, manufactured by Messrs. Long, Allstatter & Co., of Hamilton, Ohio. The machine is adapted and arranged for the speedy attachment of tools for the accomplishment of all kinds of punching, shearing, and bending. The jaws are constructed to accommodate blocks which are interchangeable for carrying from one to fifty punches, to make from one to five washers or nuts; or for carrying any peculiar shaped punches singly or in gangs. The height of the punches may be adjusted to compensate for wear or grinding, and the punches and dies may be removed without disarranging the other parts. The machines are made on cores, and consequently are exceedingly rigid. All the bearings are adjustable to take up wear. The counter-shafts have separate caps easy of access for oiling.

The cam works in steel pintles with steel bearings at top and bottom. It extends through the face plate, which is securely locked and bolted to the jaws of the press, and has a bearing in it for the outer end of the cam shaft, thus securing a bearing on either side of the cam, which prevents the latter bending. A hand wheel is attached to raise and lower the slide for the purpose of arranging the punches when the machine is not running.

The illustration represents a medium machine. Its ordinary working capacity is to punch 1 inch diameter through 1 inch thickness, or to cut off $\frac{3}{4}$ by 5 inches flat or 1 $\frac{1}{4}$ inches round iron. The speed, when the machine is fed by hand, is from 20 to 40 strokes; if fed automatically, 60 strokes, per minute. Safety feed tables are attached to all sizes of the machine, when desired, also an adjustable automatic stop, which is advantageous in boiler, plow, or other kindred work. This device is simple, easily adjusted, sure in its operation, and may be used or not as the nature of the work may determine.

There is, besides, an improved pull-off, which consists of an iron lever which passes through a slot in the center of the press body. It is pivoted to the front, and arranged to be raised or lowered and fastened in place at the back by a loose pin. It can be changed instantly to accommodate any thickness of material. This is also constructed to work automatically, and to adjust itself to unequal surfaces, pressing hard on the material and holding it firmly until the punch passes through and is withdrawn entirely, when the jaws of the pull off are quickly raised out of the way. This method, it is claimed, prevents the machine from curving, and enables many kinds of work to be done with safety to the punches that could not be done with the ordinary pull-off. The pull-off is removed from the press by simply disengaging a loose pin.

The above manufacturers make a specialty of meeting the requirements of the trade in sizes, shapes, and the arrangement of tools for every variety of punching, shearing, and bending. They have, we are informed, accomplished the difficult task of punching all the holes in a hot horseshoe at one stroke of the puncher. The work is as accurate as if

done by hand, the shoe is left perfectly true; and the holes all the same shape. As the eight punches penetrate at different angles, and are tapering, the novelty of the operation can be imagined.

The sizes of the machines range from a punch and shear weighing 500 lbs., capable of punching $\frac{1}{4}$ x $\frac{1}{4}$ of an inch, and to cut off $\frac{1}{4}$ of an inch round iron, to the steam machine weighing 25,000 lbs., which will punch 2 $\frac{1}{2}$ inches diameter

face to warn him of the approach of enemies or prey, and the rest of his carcass securely hidden beneath the waters.

Take another instance. Observe the habits of a mole. With what rapidity it burrows under ground, shoveling away the earth with its fore feet. Then look at its skeleton. We find just what we should have expected. The bones of its fore legs of astounding strength and breadth, furnished with deep grooves, which, together with its sternum or breast

bone, which is furnished with a keel almost like that of the sternum of a bird, afford attachment to the powerful muscles. Its hind legs, being simply needed for locomotion, are of the normal size. So also with the birds. The size of the keel of the sternum varies in proportion to the powers of flight which each species requires, for it is to the broad surfaces of the sternum that the great wing muscles are attached. Take the skeleton of a humming bird, which spends its life almost upon the wing. We find there a keel of so vast a size that the remainder of the skeleton is reduced to insignificance in comparison.

In these researches, one is soon struck by the fact that, in the modifications in various bones, or sets of bones, in ac-

POWER PUNCH AND SHEARING MACHINE.

through 1 $\frac{1}{4}$ inches thick, or cut off 4 inches square iron cold. The jaws vary in depth from 3 to 26 inches.

Letters patent for parts of these machines have been granted, and steps taken for securing recent improvements.

Glass Cement.

A cement to stop cracks in glass vessels, to resist moisture and heat, is made by dissolving caseine in a cold saturated solution of borax. With this solution, paste strips of hog's or bullock's bladder, softened in water, on the cracks of glass, and dry at a gentle heat. If the vessel is to be heated, coat the bladder on the outside, just before it has become quite dry, with a paste of a rather concentrated solution of soda and quicklime or plaster of Paris.

Bones.

When a new bone finds its way into the student's hands, he observes, says Professor Elwin, some peculiarity in shape or structure in which it differs from the bones he is already acquainted with; the question naturally occurs to him: Why does this bone assume one shape in one animal and in another is modified into a different form? He may look in vain in his books for an answer to his query. And yet it is points like these which, in my opinion, make up the true science of osteology. It is through careful, constant, and intelligent observation that these enigmas are to be solved. Observation, indoors and out; close attention to the habits of the animal in question, on the one hand, and careful consideration of its anatomical peculiarities, on the other.

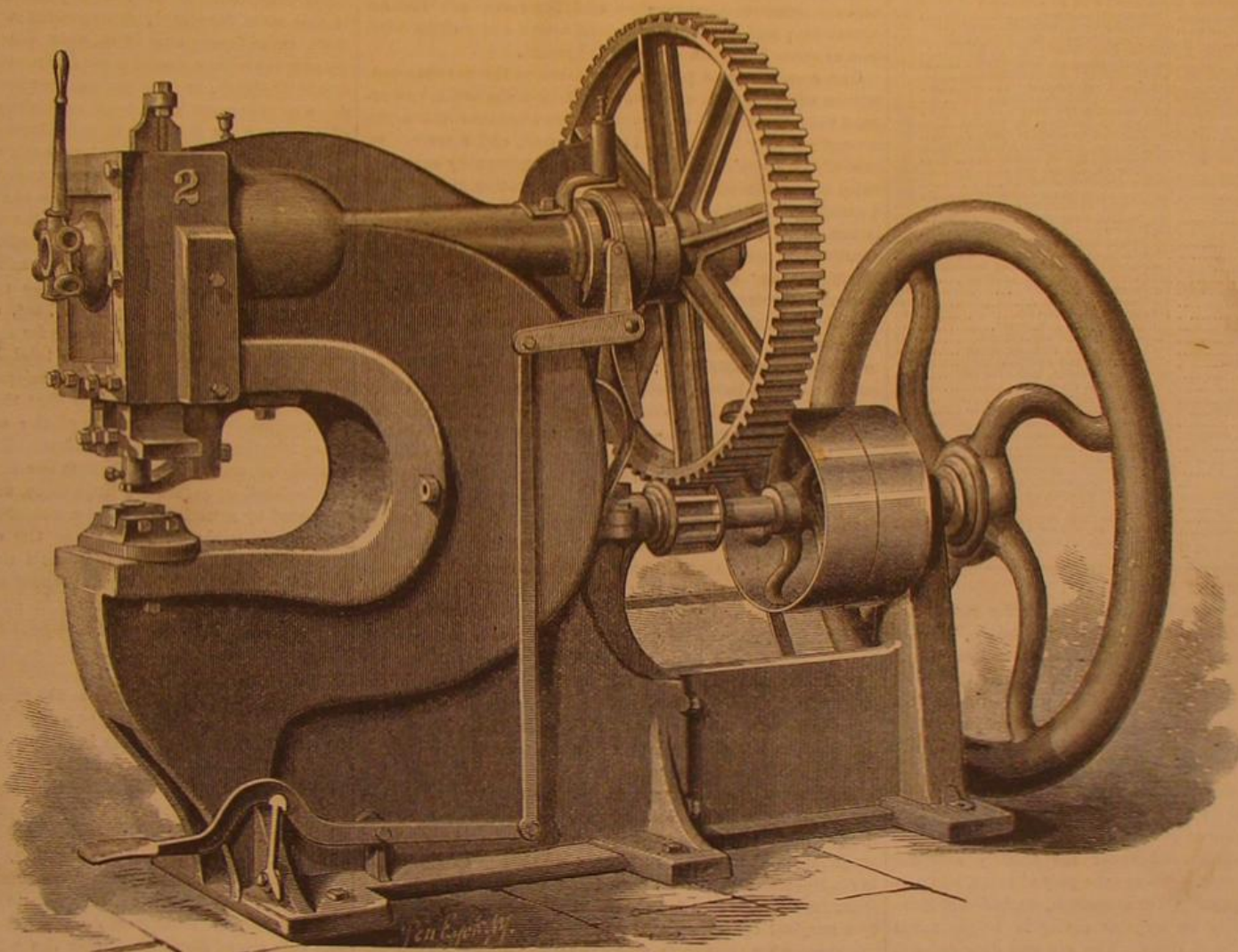
Take the skull of a crocodile. What do we find? The orbits of the eyes, the nasal orifice, the passages leading to the auditory apparatus, all situated on a plane, along the upper flattened surface of the head. What, then, is the cause of this? Palpably, to allow the crocodile to remain submerged in the water, with its nose, eyes, and ears just above the sur-

face to warn him of the approach of enemies or prey, and the rest of his carcass securely hidden beneath the waters. Take another instance. Observe the habits of a mole. With what rapidity it burrows under ground, shoveling away the earth with its fore feet. Then look at its skeleton. We find just what we should have expected. The bones of its fore legs of astounding strength and breadth, furnished with deep grooves, which, together with its sternum or breast

bone, which is furnished with a keel almost like that of the sternum of a bird, afford attachment to the powerful muscles. Its hind legs, being simply needed for locomotion, are of the normal size. So also with the birds. The size of the keel of the sternum varies in proportion to the powers of flight which each species requires, for it is to the broad surfaces of the sternum that the great wing muscles are attached. Take the skeleton of a humming bird, which spends its life almost upon the wing. We find there a keel of so vast a size that the remainder of the skeleton is reduced to insignificance in comparison.

In these researches, one is soon struck by the fact that, in the modifications in various bones, or sets of bones, in accordance with the habits of each animal, the original type is never departed from, only modified. See, for example, the paddle of a whale, more like the fin of a fish in general appearance; and yet the same set of bones which are found in the arm of a man are again found in an adapted form in the paddle of the whale. So, also, the foreleg of a horse preserves the same general plan. What is generally called his knee is in reality his wrist. It is there that we find the little group of bones which form the carpus. All below it answers to our hand—a hand consisting of one finger. Take even a wider instance. Compare the arm of a man and the wing of a bird. Still greater adaptations have taken place, and yet the plan remains the same. We still find the clavicle or collar bone, the scapula or shoulder blade, the humerus, ulna, and radius, answering to the same bones of our arm, a small carpus or wrist, and finally the phalanges or fingers, simplified and lengthened and ankylosed to form but one series of bone, with the exception of a rudimentary thumb. It is not uncommon to find a rudimentary bone like this which, in some allied species, is fully developed. The leg of the horse again gives us a very striking example of this. There is, so to speak, only a single finger, but we find, one on each side of this little finger, two small bones, commonly known only as splint bones. These are the rudimentary traces of the same finger bones, which in the rhinoceros are fully developed.

Now osteology abounds in wonderful forms of structure like these. It is a study pregnant with pleasurable results, and is a really profitable study, and one in which each fresh student may do real solid work. It is all the little facts observed by naturalists, from time to time, all over the world, which, on being collected together, forms the nucleus of knowledge, for indeed all the scientific knowledge which we possess is little more than a nucleus, with which we are supplied.—*Science Gossip*



Scientific American.

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VOLUME XXXIII., No. 10. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, SEPTEMBER 4, 1875.

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WHAT DO WE SEE?

Not a little comment has been provoked by the recent article entitled "The Trustworthiness of the Senses," in the course of which we expressed the belief that in health our senses are truth-telling and trustworthy, and that the cases commonly cited as illustrating sense deception, or deception by the senses, are really instances of mistaken judgment. The sense does not tell us a lie, but we infer what is not true through haste, carelessness, or lack of knowledge. Accustomed to associate certain conditions with certain appearances, for instance the presence of a gem when a particular play of light and color is perceived, we infer the existence of the familiar condition whenever the usually ascribed phenomenon is observed. We see the play of color, and pronounce its source a gem. On examination, we find that there is no gem, but merely an angular cavity in bright metal bathed in clear or colored light. The eye was deceived and reported a lie, men say: not so, say we; the eye reported the appearance correctly; it was not within its province to tell what caused the appearance. Our erroneous inference arose from lack of knowledge of the fact that that particular play of light could be produced in various ways other than the refractive action of a particular gem.

Such misleading inferences are frequently made by microscopists; bubbles are mistaken for solids, solids for cavities, transparent globules for opaque masses, and so on, the liability to error lessening with increase of experience and knowledge. A notable instance occurred but a little while ago. A mineralogist thought he had discovered what mineralogists have been so long looking for, the native place of the diamond. In a rock with which diamonds were associated, he observed under the microscope what he took to be diamonds. The observation was apparently confirmed by other microscopists; but another, more acute or more fortunate, was able to see that the supposed gems were merely minute cavities, once occupied by crystals but now empty, the original tenants and formers of the faceted spaces having been dissolved and washed away.

Shall we say that the eyes of the mistaken microscopists deceived them? Not at all. They saw truly all that was to be seen, a certain play of light. They inferred that it was caused by tiny diamonds, and erred, not knowing or forgetting that there were other ways in which such appearances could be produced.

Take a still more plausible instance of reputed sense deception. Cross the second finger over the forefinger and roll a small object in the angle between their tips. The object will seem to be double. Touch gives a false report, it is said. We say: No; it simply reports the contact of some objects with the inside of one finger and the outside of the other, a sensation commonly produced by two objects separated by the breadth of the fingers. After a little practice with the crossed fingers, we cease to make the wrong interpretation of their report, just as we have all learned to do in the case of thumb and finger. So familiar are we with the

touch of objects indifferently between either side of the thumb and either side of the several fingers that we never mistake their combined report. The same is true with regard to our two hands; from long experience we instinctively combine the double sensation they give into a single perception. Not so, however, with hands and feet—at least among a boot-wearing people. We are not used to feeling objects with our fingers and toes together; consequently when an object is touched, say by the great toe and the forefinger, the double sensation gives a double perception, though the object be single. Very probably the education of savages is more complete than ours in that respect. Shall we say their senses are therefore more trustworthy?

Against the view we have illustrated so fully, several correspondents have taken exception. One says:

"Allow me to ask, is not our judgment the offspring of our senses? Yes; and the more acute the senses, and the more harmony there is in their working together, the more accurate the judgment. Blot out of existence the five senses, and you blot out the judgment which you make lie back of them, and seem to make independent of them."

To this we need only reply that the fullest dependence, not only of judgment, but of all the faculties of the mind, upon the senses, may be admitted, as far as their development is concerned, without affecting our position. Whatever their organic connection, perception and inference are distinct operations; and no theory of mental action can make a delusion of sense out of an error in judgment.

Our correspondent proceeds to describe the nervous connection of the several organs of sense with the brain, and organs that the senses cannot be trusted because the nerve connection may be deranged or destroyed, and a correct report of the sense's action prevented: a contingency carefully ruled out of the discussion by our specification of health as a condition of right action on the part of the senses. This is not so bad, however, as the course of another who pronounces our position absurd and foolish, and, in proof of his assertion that "everything goes to prove the trustworthiness of the senses," gives a series of examples, all but one of which belong to the domain not of sense but of sensibility; for example: that one man delights in the odor of roses while to another it is indifferent; that one man enjoys the tumult and clamor of a battle, another abhors it, another cannot bear it; that one man likes tobacco, which to another is disgusting. The single exception was this: that a distant church spire looked to him not more than a foot long; therefore his sense of sight was not to be trusted!

It is surprising how common is this twofold error, to suppose it a function of the eye to see size, and to accuse the eye of inefficiency or dishonesty because the apparent size of objects is variable. Our first-mentioned correspondent has in this connection a theory that is quite new to us. "I have said," he remarks, "that the organs of sense have brain nerves; I not only believe this, but I believe that they each have more than one brain nerve. The eye, for instance, has a brain nerve which enables the mind to recognize form, another which enables it to recognize color, another which enables it to recognize size, etc. And upon the acuteness of these nerves depends the power of mind to recognize the different qualities reflected through the eye."

The theory is simply enough, but unfortunately it is not supported by anatomy and is flatly contradicted by experience; particularly the experience of those persons who have taught us most with regard to what we see and how we learn to see it—men and women born blind with cataract or some other curable organic defect, and enabled to see in later life by a surgical operation. To speak mildly, it is hardly just to impose upon the eye so many functions which do not belong to it, and then hold it guilty of breach of trust because it does not perform them satisfactorily.

This brings us by a roundabout way to our original enquiry: What do we really see?

We use our eyes in determining the size, solidity, distance, and motion of objects. Can we say absolutely that we see them? We frequently pronounce an object hard or soft, hot or cold, at sight. Do we see hardness or heat? From varied experience we have learned to associate different degrees of density and temperature in many objects with certain visual aspects of those objects; these perceived, we infer the softness or hardness, the warmth or cold; and so closely united are the perception and inference that we are apt to say we see what we really infer.

In like manner we infer or estimate size, distance, solidity, speed of motion, and the rest. In all such cases, then, an act of judgment involves many elements, sight being supplemented by extravisceral processes, the mastery of which was slowly gained in infancy, but so thoroughly gained that they now seem automatic. In reality we see only light in its various hues and shades; but whether the source of the light is near or far, solid or superficial, it is no business of the eye, primarily, to determine. Consequently, when we mistake a painted object on a flat surface for a solid object in open space, when we think a sheet of water is ten miles across one day and only three miles the next, when a hawk speeding through space seems motionless, when a pool of water is mistaken for a damp flagstone by gas light, in the infinite instances when things are not what they seem and the eye is charged with treachery, that useful organ is simply wrongly accused. Its duty is correctly done; but through inattention, haste, or ignorance, we misinterpret its report.

We are not asserting the perfection of the human eye as an optical instrument. It is far from perfect; but the untrustworthiness with which it is charged does not arise from its optical imperfection; so, in almost every instance, in the case of the other senses. If we are deceived by them, it is our fault, not theirs.

But it may be asked, what difference does it make whether we regard the senses or what lies back of them as a source of error, so long as liability to mistake is admitted?

This very great difference: The one view logically leads to the brooding apathy of the Indian mystic, the other to the questioning, testing creative activity of modern thought. To surrender ourselves to the belief that error is our normal condition is to lose our grip of reality and drift into dreamy speculation. Believing the senses honest and truth-telling, we must regard error as an evil to be corrected by caution, culture, and widening knowledge; where they fail through dullness or narrowness of range, we can strengthen and verify them by mechanical devices. Distrust them utterly, and hope is lost; trust them, and we may pursue our course with something of the confidence of the passengers of the *Prairie Belle*, with Jim Bludsoe at the wheel, when

"They all had faith in his cussedness
And knowed he woul' keep his word!"

THE CAUSE OF PROFUSE RAINS.

Every one knows that the heat of the sun raises water from the earth in the form of vapor, which becomes clouds, that float around, and at last discharge the water of which they consist; this simply is the cause of rain. But we ask the reader if he has ever considered that the amount of water evaporated by the sun depends on the latter's heat? If this were increased, more water would evaporate and more come down; and if it were diminished, less would evaporate and less would come down, and the amount of rain would diminish, as it is certain that the water which comes down as rain must have been previously raised by the heat of the sun; as the sun is sometimes obscured by spots, it must be supposed to give less heat, and therefore cannot raise so much water as vapor; and under these circumstances the sun cannot properly be the cause of extraordinarily heavy rains and inundations. This is the theory advocated in some quarters, but it cannot stand the scrutiny of reason.

Measurements show that the heat emitted by the sun is not regulated by the spots; while at the same time that spots appear, the faculae, giving more heat, also make their appearance, and go far to compensate for the diminution of heat caused by the spots, so that the total heat emitted by the orb is, for all practical purposes, a tolerably constant quantity; and it must be remembered that the evaporation chiefly takes place from the surface of the ocean, which covers three fourths of the earth's surface. Three fourths of this evaporated water falls back into the ocean, and one fourth on the land, or perhaps a little more, as clouds appear to be attracted by mountains, and by preference discharge their contents on land; but in any case the ocean receives back, in the form of rain, more than half the water evaporated from the surface. The circumstances attending the condensation of the cloud vapors into rain are very complex; and this operation is subject to so many various conflicting influences that a regular distribution of rain would be a matter of surprise, if not a total impossibility, and therefore we see the greatest irregularity in the rainfall prevail. In some limited regions of the earth, however, there exists a regularity in this regard; but this is simply caused by the more uniform circumstances in which such exceptional localities are placed; and the causes of this regularity may be, and have been, clearly traced by those who make the investigation of this subject a special pursuit.

If the total amount of evaporation, over the whole surface of the earth, be a nearly constant quantity, the total amount of rain falling over its whole surface must also be regular, because what goes up must come down; and if we had rain gages distributed over the whole earth and ocean surface, this proposition would, no doubt, be verified. But, by the irregular distribution of rainfall, some localities may be liberally supplied at the expense of others; or at some periods of time, the rainfall may become concentrated into shorter periods. If, then, such larger rainfalls take place within the limits of the valleys which supply our rivers, an inundation is the consequence. It may be that the amount of rainfall in some inundated districts is not greater for the whole season than is usually the case, or, if it is, the rainfall of other localities, or on the ocean, may have been so much less; so that, in order to account for an inundation or a great rainfall, it is not necessary to suppose the total amount of water falling has been greater than usual.

These considerations show how unnecessary it is to look for cosmic causes in explanation of such comparatively trifling meteorological phenomena as an extra rainfall in some districts. Some philosophers have even gone so far as to attribute it to the jets of incandescent hydrogen, ejected in the form of protuberances (during solar storms) from the sun's surface to a height of a hundred thousand miles toward the earth, which, cooling while approaching our atmosphere, form water. If we consider that, at a distance of three million miles from the sun, the gravity towards that body is nearly as great as is the gravity on the surface of the earth towards the earth, it is clear that this solar hydrogen has little chance to reach us. If it did, and if it combined with our atmosphere's oxygen to form water, a terrible fate would be in store for the earth; because, if all the oxygen in our atmosphere were exhausted to combine with hydrogen to form water, it would only form water enough to raise the surface of the ocean six feet, as is easily proved by calculation.

STEEL BRONZE AN AMERICAN INVENTION.

We recently described the so-called steel bronze, which, as material for ordnance, is at the present time being widely discussed by European military people. It is an ordinary bronze of 90 parts copper and 10 of tin, of which the gun is cast on a copper core of less diameter than the bore. The

latter is then reamed out until about one quarter inch less in diameter than it is intended to be ultimately. The gun being firmly secured, a series of conical plugs of hard steel are forced through it by hydraulic pressure, compressing the metal about the bore and rendering it, as proved by extended experiment, stronger, harder, and much more elastic. General Uchatius of the Austrian Army, the reputed inventor of this process, has been experimenting upon it since September, 1873, but his claims as to origination are opposed by those of Colonel Rosset of the Italian, and Colonel Narroff of the Russian, army, both of whom state that they also separately conceived the idea of thus treating bronze guns as early as the year above mentioned.

The results which have been reached in testing guns of steel bronze, some of which have withstood the firing of 3,000 rounds without any diminution of accuracy of fire or deterioration in any other respect, prove the invention to be of more than ordinary importance. This fact is certainly well recognized by the Austrian government, which, as already stated in a previous article, has ordered a large number of batteries to be made of the improved metal. Consequently it is all the more gratifying to Americans to learn that the so-called steel bronze is neither an Austrian, an Italian, nor a Russian invention, but one created by Samuel B. Dean, of Boston, Mass., and patented by him in this country and in England in 1869. Mr. Dean's claim is, "as a new manufacture, a bronze gun in which the metal immediately surrounding the bore is put in the condition by the process of condensation set forth," which process we need not here recapitulate, since it is identically the same as that described in the first paragraph of this article, and now asserted to be theirs by Uchatius, Rosset, and Narroff.

It appears further, and the fact may not be so gratifying to Americans as that just mentioned, that Mr. Dean patented his invention in Austria in 1869. Three years later a general in the Austrian army comes out with precisely the same idea, and is backed up in its ownership by Austrian authorities, who reward his alleged discovery by permitting him to sell out rights for certain countries, other than the great powers of Europe.

Colonel Laidley of the U. S. Ordnance, to whose suggestion we are indebted for reference to Mr. Dean's patent, states that the records of the U. S. Ordnance Office show that an order was given in July, 1870, for a number of these guns, but that, through lack of funds, the same was countermanded. We agree with the above named officer in the hope that the next Congress will make a suitable appropriation for the introduction of Mr. Dean's invention into our service.

DEATH IN THE NURSING BOTTLE.

In a city like ours where the death rate at the present season averages seven to eight hundred per week, mostly children, every humane person feels the necessity of increased vigilance to combat every evil which tends to increase "the slaughter of the innocents." High temperature is one of the causes which we are powerless to combat. Dirty streets and filthy houses we must leave to the Board of Health. Poverty of the parents, which prevents their providing suitable food and medicine for their little ones, is another cause of our great infantile mortality, against which we can and ought to do something. But ignorance is another cause, too often overlooked, against which we are not powerless if we organize for action. The daily papers warn old and young against the dangers of unripe fruit and stale watermelons; but people will indulge, and we must allow the American citizen, however young, to exercise his inalienable right to take his own life in this way.

But there is another prolific source of infant mortality to which we wish now to direct special attention, namely, the patent nursing bottle. It consists of a rubber tube, one end of which is held in the child's mouth; the other end, passing through a cork, is attached to a glass rod which descends to the bottom of a bottle of so-called milk. We might write a column on the dangers that reside in the milk, unless special care has been taken to obtain it fresh or by suitably diluting pure condensed milk. But this danger is well known, and our business at present is with the bottle, or rather its dirty tube, which should never be used more than once, then thrown away and a new one bought.

Even when new, these white tubes, impregnated as they are with oxide of zinc, are not objectionable; far worse are they when saturated with sour milk, germs of putrefaction, decay, and disease. Some of these child-murdering Yankee inventions have reached Berlin, and have called forth the following from a practicing physician of that city:

"The supposed advantage of these bottles consists in this, that they can be placed beside the infant in bed, while other bottles must be held in the hand all the time. What sensible mother or nurse would leave a child with a bottle with out watching it? The danger of the bottle consists in this, that it is absolutely impossible to cleanse it. When sucked on, little particles of milk become attached to the tube and cork; these curdle and soon turn sour. If some of this deposit be placed under a microscope, we see innumerable bacteria, organic beings which indicate decomposition and decay. At every meal the child draws in thousands of these germs. The decomposing process acts upon what it finds in the mouth, esophagus, and stomach; and the result is diarrhea, cholera infantum, etc. I will here expressly remark that the usual method of placing the apparatus in water, or merely rinsing it out with a stream of water, is in no way sufficient. Some dealers sell a suitable little wire brush with the bottle, but even this does not answer the purpose, for the apparatus is not clean by a long way after drawing

the brush through it several times; and who will take the trouble to clean it so thoroughly 8 or 10 times a day? How much time it would require! Another disadvantage is that the bottle is airtight, and a partial vacuum is formed, which renders sucking so difficult as to exhaust the child, and it stops before its hunger is satisfied. Hence, parents, ye who are compelled to feed your children with a bottle, throw away this apparatus, which can only bring destruction upon your children, and either select a bottle with glass mouthpiece, which is filled from below, or take a large rubber mouth-piece, which is perforated by a small hole and can be drawn directly over the neck of the glass bottle. This large mouth-piece or nipple can readily be turned inside out and thoroughly cleaned and rubbed with dry salt."

CLOUDS AS STORM SIGNALS.

It is commonly believed that the barometer is an infallible indicator of weather changes. Practical meteorologists know that its merits fall far short of its popular reputation, though as an indicator of variations of atmospheric pressure it is the main dependence of isolated observers—especially mariners and travelers—in estimating the probabilities of wind and weather.

In his newly published work on storms, Blasius questions even this limited usefulness of the barometer, and insists that observers, particularly navigators, will find a far better guide and counsellor for safety in the forms of the clouds, which not only foretell approaching storms much earlier than the barometer, but show at the same time the observer's position in regard to them, and how their dangers can be best escaped.

Mr. Blasius enters the field of meteorological discussion with a theory of his own, and boldly pronounces the accepted theories of storm-formation incorrect, because based on a part only of the facts involved. Both the leading theories of storm development and movement—the rotary or cyclone, and the inblowing or centripetal—are misleading, he claims, for two reasons: first, in that they make an exceptional form, the tornado, the type of all storms; second, because they are based on partial observation even of that. Observations of the same storm are thus made to support two directly contrary theories, the error of both consisting in the taking of part of the storm, and each a different part, as representative of the whole, and holding that the action of storms is of the same nature at its beginning and throughout its entire course.

From the unequal distribution of the temperature of the air, and the varying effect of the sun's heat upon it, there arise, first, currents caused by a tendency to re-establish, in a perpendicular direction from the earth's surface, both upward and downward, an equilibrium which has been disturbed; second, currents caused by a tendency to re-establish, in a horizontal direction from the equator to the poles and from the poles to the equator, an equilibrium which has been disturbed. From the movements and conflicts of these currents, modified by the configuration of the ground in certain cases, storms arise; and according to Mr. Blasius, every sort of storm has its representative cloud formation, which gives timely notice of approaching danger.

In accordance with these views storms are divided into the following classes: (1) Local or vertical storms produced by the rushing in or inblowing of the atmosphere to re-establish in a vertical direction an equilibrium which has been disturbed. In our latitude, the summer shower is an example of this sort of storm. Its characteristic cloud is the *cumulus*.

(2) Progressive or lateral storms in which the equilibrium is re-established in a lateral direction. These storms are of two kinds: (a) Equatorial or northerly winter storms, produced by a warm current displacing a cool one to supply a deficiency toward the pole; temperature, changing from cool to warm; characteristic cloud, *stratus*. (b) Polar or southerly summer storms, produced by a cool current displacing a warm one to supply a deficiency toward the equator; temperature, changing from warm to cool; characteristic cloud, *cumulo-stratus*.

(3) Diagonal storms—tornadoes, hailstorms, sand storms, waterspouts, etc.—produced by an atmospheric effort to re-establish the equilibrium of a polar storm which has been disturbed in the plane of meeting by a peculiar configuration of the ground; direction, the diagonal of the forces of the two opposing currents transversely through the polar storm; characteristic cloud, *conus*, heretofore known simply as the tornado cloud.

It is in the first described storms that the barometer is chiefly of use as a predictor, especially in the torrid zone, where they attain very great dimensions. In the temperate zones they are of less importance, and cannot be long foreseen by the clouds.

In the next class, the barometer is of less advantage, the clouds indicating the approach of such storms from half a day to a whole day before the meteorological instruments begin to show any change. These storms generally come from the northeast, and report themselves in advance by means of hazy stripes of stratus cloud above the southern horizon.

Of still less use is the barometer in foretelling the polar, southeast, and southwest storms of summer; for in those which are most violent and destructive, the worst is over before the barometer begins to fall. It is from these that tornadoes originate. They do not send their warning clouds so far in advance as the northeast storms, but, on the other hand, they do not extend over so large a territory, and travel much more slowly, especially when about to become destructive. Their cloud sign is a long bank of round black clouds along the northern or northwestern horizon. If rightly in-

terpreted, these not only indicate the approach of the storm early enough for safety, but also tell which way to sail to avoid them. They can generally be seen from one to eight hours before the middle of the storm arrives; and the more violent the storm, the slower its approach.

The loco-progressive or diagonal storm is an offspring of the foregoing, but differs totally from the other kinds of storms in origin, motion, and appearance. Its area is the smallest and its effects the greatest of all. It arises at the culmination of the southeast storm, that is, where the polar current balances the equatorial, and the region of conflict has become nearly or quite stationary. If any local advantage is given to either current by the configuration of the ground at this stage, a whirl or eddy may be produced and a rotary storm generated, traveling in the diagonal of the forces of the two currents through the region of calm between them, its course delineated by a long black bank of cloud. Its first sign is a rotating disk of cloud, darker than ordinary, formed by the sudden and profuse condensation of the moisture contained in the air of the equatorial current, which is suddenly thrown into higher and colder regions.

The art of cloud-reading, Mr. Blasius is good enough to say, is easily learned. The best time to begin the study is in midwinter, when the irregularities of the earth's surface are partially obliterated by the snow, and when the horizontal air currents which produce the progressive storms and their registering clouds are less disturbed by upward currents. "The experience gained in the repeated forward and backward oscillations of these currents will prepare the student for the more complicated influences and effects which the vertically rising currents, the originators of local storms, bring into consideration as the season advances. A year's observation will acquaint him with the cycle of phenomena and make him a reliable weather prophet, at least for everyday purposes"—presuming, of course, that he has taken pains beforehand to learn the significance of elementary cloud changes, as indicators of the direction and character of aerial currents and conflicts.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW EMERALD GREEN.

Any pigment which approaches in beauty the fearfully poisonous Paris green certainly deserves attention. One of these is said to be an hydrated oxide of chromium, prepared in a peculiar manner and known as Guignet's green. We doubt the statement that it is not poisonous; but it is, at all events, far more harmless than Paris green, or any other arsenical color. It is prepared on a large scale by fusing together, on the hearth of a suitably constructed flame furnace, at a dark red heat, 3 parts boracic acid to 1 part bichromate of potash. The mass swells up, much oxygen gas is evolved, and the substance is finally converted into a beautiful green double salt, a borate of chromium and potash. By repeated washing with boiling water, it is decomposed with hydrated oxide of chromium and a soluble borate of potash. After suitable washing and very fine grinding, this oxide of chromium has a most beautiful shade of color, covers well, stands the air and light, and is only attacked by boiling concentrated acids. On a small scale, this green pigment may be prepared in a porcelain crucible.

VANILLA AS A WASTE PRODUCT IN THE MANUFACTURE OF PAPER.

We take the following interesting suggestion from a recent number of *Diagler's Journal*: In the preparation of wood pulp for paper, fine wood is treated to a solution of caustic soda under high pressure in iron boilers. After the operation the solution contains the soda salts of resinic acid, humic acid, and carbonic acid, and some other resinous bodies. In this solution the soda salt of vanilla must also be present, if it has not been destroyed by the high pressure and temperature. The presence of this body is indicated by the intense vanilla odor which always appears on treating the above liquor with acids and allowing it to stand a few days. The writer above referred to has not yet succeeded in obtaining crystals of vanillin, and hence does not describe his process in full. If any of our readers possess sufficient quantities of this lye to experiment upon, we have strong hopes that their labors will be rewarded with better success than those of our German friend, and that America will one day boast of a vanillin factory.

ALUMINUM.

According to Winkler there are at present four aluminum manufacturing, which produce about 35 cwt. per annum. Of this quantity 20 cwt. goes to France and 15 to England. Aluminum is also made in Berlin. The price for a number of years has been \$12 to \$15 per lb. It is not probable that it will be produced cheaper than that. This fact, with its unchangeability and lightness, being 3 times lighter than copper, 4 times lighter than silver, and 7 or 8 times lighter than gold, render it excellently adapted to coin, especially as it is easily coined.

Kansas City Industrial and Agricultural Fair.

It is intended to hold a fair at Kansas City, Mo., to be open from September 13 to September 18, both inclusive. An unusual interest is being taken in this meeting, as the Kansas State Fair will not be held this year, and the exposition at Kansas City will be the only one held in Missouri, west of St. Louis. Liberal awards of diplomas and gold, and silver, and bronze medals for merit in all classes of articles will be made; and proper arrangements for the care of machinery, etc., have been perfected. Further particulars will be found in our advertising columns.

A NEW GUNBOAT.

Messrs. J. and G. Rennie, of Greenwich, England, have recently launched a gunboat, the Bermejo, built for the Argentine Republic. She is intended to carry a 26½ ton, 11 inch Armstrong 600-pounder gun, and is after the arrow and Bonetta type, now being constructed for the British navy by the same firm. She is of the following dimensions: Length, 105 feet; beam, 30 feet; and depth, 10 feet 6 inches, having a draft of water of about 7 feet 6 inches when loaded, with an intended speed of about nine knots per hour. There are two pairs of inverted compound twin screw engines, each driving a separate screw under the quarter. They are expected to give out, when at full working, an indicated power of about 400 horses. She is also fitted with a steam steering apparatus, enabling the gunner to point the gun by means of the rudder, without the necessity for separate means of training. The rudder is unusually large. A small temporary fore-castle is to be fitted forward to enable the vessel to proceed with more comfort and safety to her destination, the River Plata.

The gun platform is movable, as in the British gunboats, and lifts and lowers by means of screws worked by a small engine for that purpose; the same engine is used to work a pair of hydraulic pumps, which will supply power to load and ram the gun.

Compass Variations on Iron Ships.

It is now believed that some of the sudden and hitherto unaccountable changes in the deviation of the compasses of iron ships—which are often unsuspected until alleged as the only conceivable cause of the vessels running ashore—are the effects of an unequal and varying distribution of heat over the iron hull. Sudden slight changes of compass deviation, not exceeding five degrees, have been noticed on board iron ships on our American coast, and these are now attributed to changes in the hull, occasioned by the vessel's passing from warm to cold water, and the reverse. The warm temperature of the Gulf Stream, taken in connection with the cold counter current, may account for many of the suspected compass errors on iron ships, and the devising of a remedy for this would be an excellent subject for study on the part of an enterprising inventor.

DRIVING PORTABLE TOOLS.

We illustrate herewith a mode of working portable tools for drilling, boring, sawing, polishing, etc., designed and patented by Mr. John Paterson Smith, of Glasgow, Scotland. As the arrangement will, says *Engineering*, probably at once remind our readers of hair-brushing by machinery, as the plans really consist in adaptations of the mode of driving a rotary brush, used by the hair-cutting fraternity, to the varied requirements of the workshop.

Fig. 1 of our engraving is a perspective view, showing one method of operating with a portable tool. In this figure, *c* is an overhead shaft, driven from the prime mover by the belt, *f*, and pulley, *g*. The shaft, *e*, is carried on bearings,

h h, and has planed on it a groove or key way, *i*, running its whole length. The pulley, *j*, is bored out for the shaft, and fitted with a key or feather to suit the key bed just mentioned, and it is, moreover, so mounted as to be easily moved or shifted along the shaft to any portion between the bearings, *h h*; this pulley, *j*, has formed in its periphery a V groove to receive the elastic or other endless band, *k*, which conveys the motion to the grooved pulley, *e*, of the portable tool. *Z* represents the work to be operated upon, held in the vise, *m*, attached to the workman's bench, *n*. The hands, *o*



NEW GUNBOAT THE BERMEJO.

o, of the operator grasp the handles on the movable tool, and guide and direct it when in operation, as shown.

Fig. 2 is a longitudinal vertical section of a tool suitable for drilling, boring, widening, or other purposes, similar to the modification delineated in Fig. 1. In Fig. 2, *a* is the center spindle, having one end formed as a socket to receive the drill or other tool, *b*, and on this spindle, *a*, is fixed the V grooved pulley, *c*, for receiving the driving band or power transmitter. Two tubular or loose handles, *d d*, are also mounted on the spindle, so that the latter rotates within them.

Fig. 3 is a side elevation, and Fig. 4 a sectional elevation of means for fixing drilling, boring, or other cutters in holders, when tools are arranged to be operated as portable hand tools. In these figures, *a* is the cutter holder, having one end formed to enter the socket of the portable tool spindle, while the other end is taper or cone-shaped, with a slit, *b*, to receive the small steel cutter, *d*, and the bridge of the taper thimble, *c*. The taper thimble, *c*, is bored out to fit the cone, and has a bridge at the wide end to pass up the slit. The steel cutter bears on this bridge; and the harder the cutter is pressed on the work, the more firmly the taper thimble compresses the slit cone and causes the slit cone to grip the cutter.

Fig. 5 is a sectional elevation of a bevel gear tool suitable for operating in a horizontal, vertical, or angular direction. In this view, *a* is the central spindle, having one end formed as a socket to receive the tool, *b*. The V-grooved pulley, *c*, runs loose on a stud handle, *d*, fixed in the frame, *e*, which latter is also bored out to receive the central spindle, *a*, and back center screw, *h*. The grooved pulley, *e*, has fixed on it a bevel tooth pinion, *f*, which gears into and actuates the wheel, *g*, on the center spindle, *a*. The adjusting screw, *k*, is fixed into framing, *e*, by cotter, *i*, and the box screw back center nut, *j*, is arranged in the usual way.

Fig. 6 is a plan of a single spur-gear boring, drilling, widening, or other tool, specially useful where the work to be done is of a heavier class than is suitable for the modification represented in Fig. 2. In this case, *a* is a central spindle having one end formed as a socket to receive the cutter, *b*. The V-grooved pulley, *c*, is fixed on a counter spindle, *d*, running in bearings in the frame, *e*, which is also bored out to receive the center spindle, *a*, and back center screw, *h*. The counter spindle, *d*, has keyed on it a tooth pinion, *f*, which gears into a wheel, *g*, fixed on the center spindle, *a*. The adjusting screw, *k*, is fixed into the frame, *e*, by the cotter, *i*, and the box screw back center nut, *j*, is of an ordinary kind; *k* is a handle fixed in the revolving frame, *e*, by means of which the driving pulley, *c*, and spur pinion, *f*, are carried round the periphery of the spur wheel, *g*, thus giving means for tightening up the driving band.

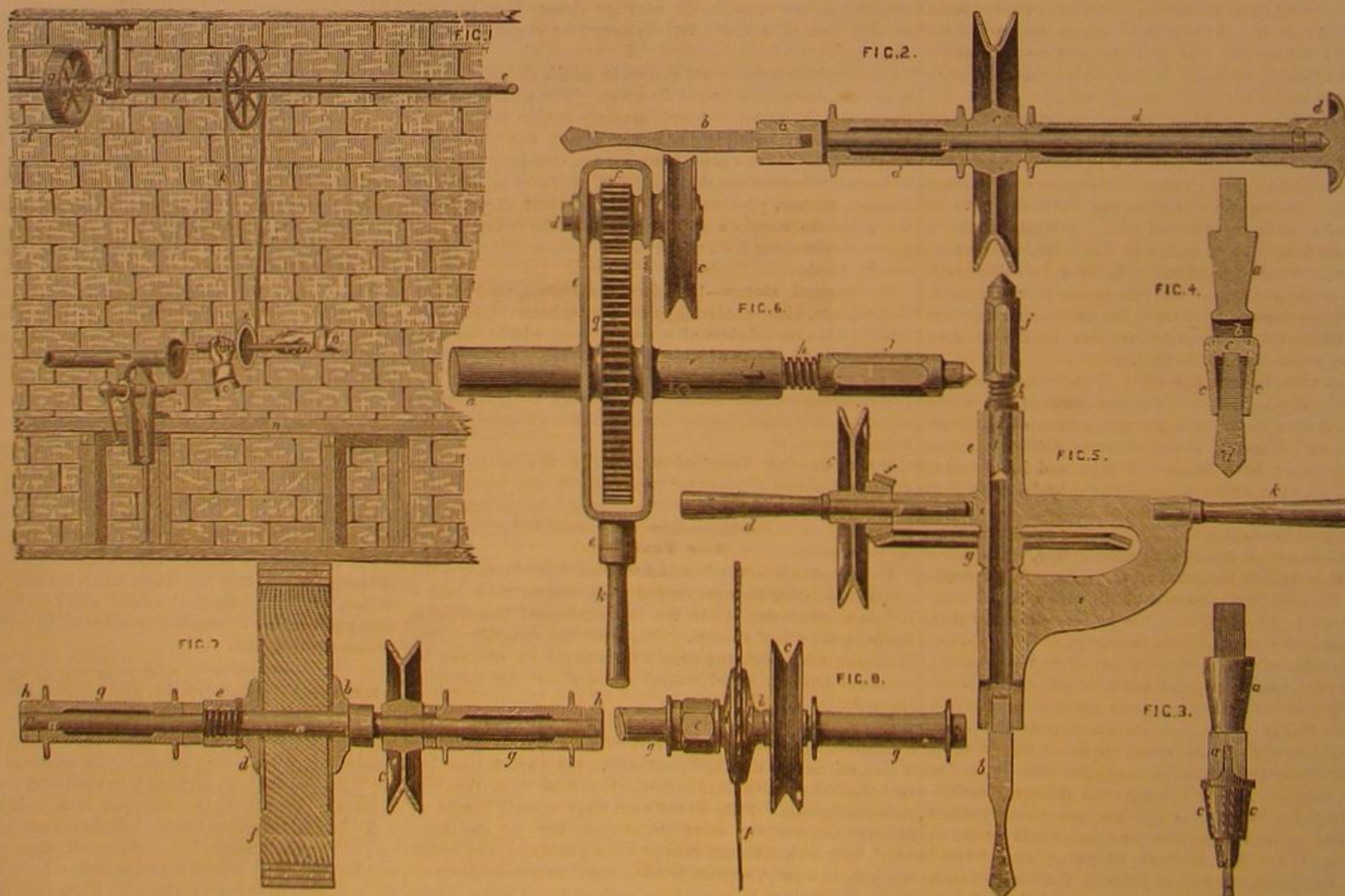
Fig. 7 is a section of a grinding or polishing tool, arranged to be worked in the same way as the drills already described. In this figure, *a* is the center spindle, on which are fixed the disk or collar, *b*, and V-grooved

pulley, *c*. The disk, *d*, is free to slide longitudinally on the spindle, *a*, and to adjust closer to disk, *b*, by screwing up the nut, *e*. The cylindrical grinder or polisher, *f*, is held between the two collars, *b* and *d*. On the spindle, *a*, two loose guiding handles, *g g*, are mounted, so that the spindle rotates within them; the collars, *h h*, keep the handles in position on the spindle.

Fig. 8 is a front elevation of a sawing or cutting tool, also driven in the same way. Here *a* is the center spindle, on which the tubular bush, *b*, with enlarged collar, *b'*, for fixing saw, freely revolves. The V-grooved pulley, *c*, is keyed on the tubular bush, *b*. The collar or disk, *d*, is free to slide on the tubular bush, *b*, and the saw or cutter, *f*, is held between the collars, *b'* and *d*, by screwing up the nut, *e*. The guiding handles, *g g*, may either be fixed to or free to rotate on the spindle, *a*.

We need merely add that there is a variety of light work for which tools so driven might be advantageously employed.

A POUND of copperas dissolved in a pailful of soft soap, and, when thinned with water, applied to onions, is good to keep off the maggot and to promote the growth of the onions.



SMITH'S MODE OF DRIVING PORTABLE DRILLING TOOLS, ETC.

American Grape Vines in France.

Mr. C. V. Riley, State Entomologist of Missouri, has lately returned from France, where he has been on a tour of inspection among the grape-growing regions. He was everywhere received and treated like a prince, dinners were given in his honor, and every possible attention shown to him in public and in private.

The particular reason for these civilities is the fact that Mr. Riley was the first to call the attention of the French to the fact that a simple remedy for all their troubles in connection with the grape vine disease was the substitution of certain species of American vines, by him named. These, he affirmed, would yield good wine in France and be free from the pest.

Some of the wine growers tried the experiment, which was continued the next year and that following; and the success has become so well established that extensive orders have now been sent to this country for vines. In fact it is believed the demand from France will be so great that our nurserymen will be unable to fill the orders for exportation this season. Mr. Riley saw plantations of American vines flourishing in France, where the native vines had been utterly destroyed.

A NEW CIRCULAR COMPASS.

M. Emile Duchemin substitutes for the ordinary compass needle two concentric circles, A B, in the annexed engraving, connected by a crosspiece, C, of aluminum or other metal. The maximum of magnetization starts from the N. and S. poles, and decreases to the neutral points, *n n*, as is indicated by the dark shading on the circles in the illustration.



This compass is said to be much more sensitive than the needle, to be less affected by rolling of the ship, and to be much less sluggish than the liquid compass. These facts were adduced by recent French naval tests of the instrument in comparison with compasses of the usual construction.

Centennial Notes.

About \$3,500,000 have been subscribed toward the building fund, leaving a deficit yet to be made up, according to the reduced estimates, of \$2,000,000. This is exclusive of the cost of Memorial Hall (\$1,500,000), which is guaranteed by Philadelphia and the State of Pennsylvania, over and above their subscription. The latter amounts to \$2,575,000 out of the \$3,500,000, leaving \$925,000 as representing the total received from the balance of the Union thus far.

France wants special laws enacted by Congress in order to protect her exhibitors from piracy of their inventions by the "grasping Yankees." The French say that they passed such enactments for the benefit of contributors to the 1867 show and that now we should go and do likewise. If we remember rightly, the French laws did not prevent sundry grasps of American inventions at the 1867 Exposition, and exhibition of the same in French shop windows, for sale, while the owners waited and sought for redress which they never got. We have no illiberal policy which prevents foreigners taking advantage of our patent laws, and thus securing full protection for their ideas with as much facility as our own citizens; and such laws we think will be found to answer every purpose of preventing piracy, without any additional legislative tinkering.

The Director General of the Centennial has issued the following rules for the information and guidance of exhibitors.

The space granted to an exhibitor within the building is available floor space, exclusive of the intermediate passages between the exhibits.

There will be no charge for space, but all platforms, counters, ornamental partitions, show cases, and appurtenances must be erected at the expense of the exhibitor; but they must not exceed the following heights without special permission from the Chief of Bureau:

Show cases and partitions: Fifteen feet above the floor.
Counters: Two feet ten inches above the floor, on the side next the passage way.

Platforms: One foot above the floor.

Exhibitors have the privilege of placing railings of approved design around the space allotted to them, of the uniform height of two feet six inches above the floor level. The floor space granted includes the area embraced by the railing.

Each column within the building will be lettered and numbered, the letters designating the lines of columns, lengthwise, from east to west, and the numbers the lines, crosswise from north to south. Each exhibitor will have his location defined with reference to the nearest column,

and the official directory of the building will give the position according to this system.

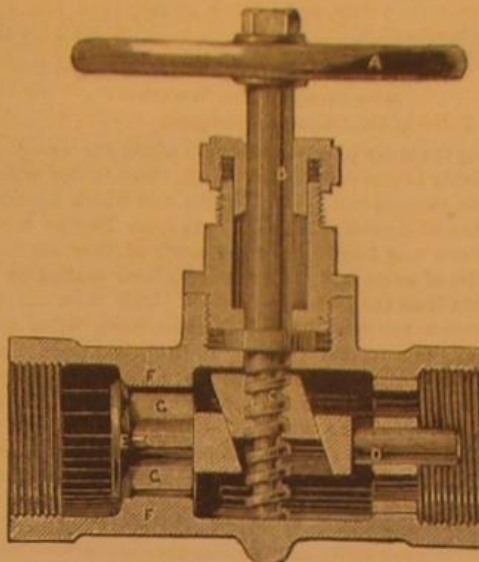
Exhibitors having space granted in close proximity to the columns or outer wall of the building will be furnished from the Bureau of installation with drawings showing the form of the columns, the water spouts, and the available wall space. Cards stating the exhibitor's name, class of objects, catalogue number, place of manufacture, and price will be affixed to goods under such regulations as the commission may prescribe.

All products arriving at the doors of the building by rail, wagon, or otherwise, will be received by the Bureau of Transportation and delivered on the space granted.

All exhibits must be arranged, completely and finally in position, not later than May 1, 1875.

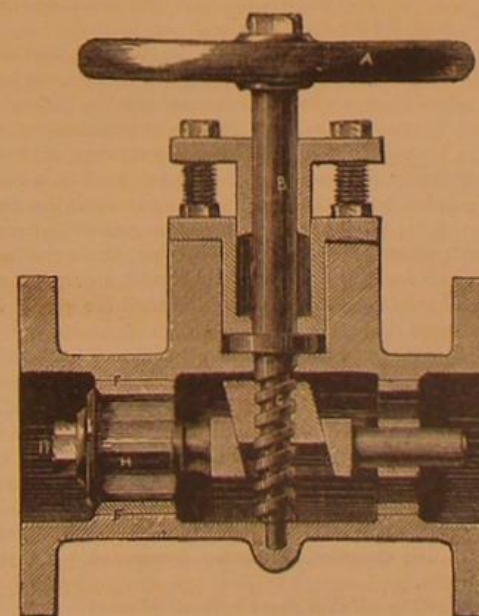
WHITTON'S STOP VALVE.

We publish herewith sectional views of two forms of a



stop valve recently invented by Mr. Whitton, and introduced by Messrs. Low and Duff, of Dundee, Scotland. Its chief characteristic is its powerful closing and opening movement, obtained by a combination of the screw and the wedge. This gives it a ready control over the supply of steam or water under great pressure, and especially adapts it for use as a throttle for a locomotive or as a water hydrant valve.

In Fig. 1, the spindle, B, has a square thread, C, cut upon it, upon which slides a wedge block, moving in an inclined slot in the valve spindle, O, by which arrangement it will be readily understood that the disk, E, is powerfully controlled by the wedge, which is again acted upon equally and uniformly by the action of the screw. It will be seen that the stuffing box and gland, through which the spindle, B, passes, are both screwed into the socket of the valve. In Fig. 2, however, the stuffing box arrangement is improved, the box being driven in tight and screwed down, and the gland being



adjusted by studs. The seat of the valve, being put in separately, can be easily repaired. The bottom of the screwed spindle is also recessed into the bottom of the valve, giving lateral support to the spindle.

A New Textile Industry.

The government of India has been encouraging of late the culture of China grass (tachu-ma) or inner bark of the *Bombyx mori*, which yields a very beautiful fiber, some three times as strong as hemp, and as soft as flax, while possessing a luster equal to that of silk. Although the properties of this fiber have long been known there has been an absence of proper machinery for its preparation, and until quite lately it has been supposed that only the green stem could be operated upon. Since it has been discovered that the dry stems may be treated by ordinary flax and hemp machinery, producing a fiber but little inferior to that obtained from the green plant, their utilization bids fair to constitute an important addition to existing textile industries.

Although the vegetable is indigenous to China, India, Japan, and has been successfully cultivated in Martinique, Ja-

maica, Trinidad, Algeria, Queensland, and Mauritius, and to a limited extent on some portions of our continent, we are not aware of any extended efforts being made towards its acclimatization in the United States. It is said that the plant adapts itself to climatic conditions with considerable facility, and hence it may be inferred that systematic culture in southern states would be attended with favorable results.

THE CATALEPTIC ROOSTER.

There is a curious experiment which any one who is the possessor of a rooster can try for himself with success, and which has never been positively explained. It is an ancient one, in fact it is two hundred years and over old, since it was commented upon by Kircher in 1646. Still it is none the less curious, and almost as much a subject of speculation now as it was when first observed. It is performed thus: Select a dark colored table with a smooth top; place it so that a narrow streak of sunlight will fall across the surface. The sunlight is not absolutely material to success, but we have found the desired result to be more quickly obtained when it is present. Then set the rooster on the table, and hold his head down so that his beak comes in contact with the wood. Now, with a piece of chalk and in the sunlight, draw a line straight from the bird's beak, as represented in our engraving. Move the chalk very slowly, and by the time the line is a couple of feet in length the rooster will fall into a cataleptic or trance-like condition; and although the hands are removed from his body, he will remain perfectly rigid for a minute or two. It is said that a black line on a white surface will produce the same effect. Hens may be similarly treated, but it takes much longer to get them into the trance state, it being necessary to hold the head down several minutes before they come under the influence.



This phenomenon is termed hypnotism, or the result of a curious sleep-producing property incident to the fixation of the attention upon some bright object. It is by some considered a partial paralysis of the brain. The same can be done upon human beings. The person should fix his eyes steadfastly on any glittering object, say a disk of silver paper, fastened on a black surface and brought within ten inches of his face, for about twenty or thirty minutes. A state of torpor supervenes, during which, if the limbs be gently raised, they will rigidly remain as placed. Surgical operations have been performed under these conditions without causing suffering to the patient.

A Method of Increasing the Solubility of Salicylic Acid.

The solubility of salicylic acid is enormously increased by the addition of borax to the water, so that as much as ten parts of the acid can be dissolved in 100 parts of water, if eight parts of borax be present. This discovery we owe to Dr. H. Bose, assistant in the Surgical Clinic at Berlin, who has contributed a paper of much interest to the *Berliner Klinische Wochenschrift* (No. 28, July 13), to which we are indebted for the following details. The solution should be made by first dissolving the borax with the aid of heat, and then gradually adding the salicylic acid to the boiling fluid. Since commercial samples of both these drugs are not chemically pure, a small amount separates, and requires to be filtered off on cooling. The filtrate is a clear yellowish or light brown fluid, according to its concentration. The proof that the addition of borax does not convert more than a part of the salicylic acid into salicylate of soda—a salt devoid of antiseptic properties—is easily shown; for if we dissolve 6.9 parts of the acid in 100 parts of boiling water, and then add 2.89 parts of bicarbonate of soda, the carbonic acid in the latter is set free, while the soda combines with the salicylic acid, and on cooling there is such an abundant deposition of the excessive acid that the whole liquid becomes nearly solid, owing to the formation of crystals. Now, if the whole be reheated until the acid is completely dissolved, and then 3.58 parts of boracic acid added, no deposit of any kind occurs on cooling. The most suitable strength in which the above solution can be used for direct application to wounds is, according to Dr. Bose's experience, one which contains from 2 1/2 to 5 per cent of salicylic acid, and 2 to 4 per cent of borax. Solutions containing more than 5 per cent of acid are too irritating, and give rise to a very abundant capillary hemorrhage if applied to the surface of a fresh wound. Dr. Bose speaks highly of the result obtained with the boro-salicylic dressing in a number of cases of removal of small tumors. The operations were all performed without the spray, and only the sponges and forceps used were cleansed antiseptically with the above solution. The wound was thoroughly washed with the same liquid, and then a thick layer of salicylic wadding, also soaked with it, was laid on its apposed edges, so as to reach several finger's breadths beyond them

and fixed by means of a bandage; catgut was used to tie any vessels requiring ligature. In those cases where the edges of the wound could not be accurately brought together, Dr. Rose put in catgut sutures, and then filled the spaces between the edges with the salicylic solution by means of a small syringe, and applied the wadding over all. The greater number of the cases thus treated healed by first intention, without the formation of a drop of pus.

Dr. Rose concludes his paper by stating that he has as yet no experience of the value of the boro-salicylic acid solution in dressing large wounds, and that he has not found it invariably successful in the case of small ones.—*Medical Times and Gazette*.

Correspondence.

Death by Strychnin.

To the Editor of the Scientific American:

On Saturday, July 24, Dr. J. O. Hill, of Ithaca, New York, in a hurry to go out, took thoughtlessly a drink of water from a graduated glass, in which he had previously dissolved some strychnin. He walked a quarter of a mile, and then felt dizzy, and this and an exhausted feeling seem to have been the first effects of the poison. These increased, and they seem to have enfeebled his mind somewhat, but not seriously. At the end of about a half mile walk, his lower extremities had become so affected that he could not move. It is not known what the exact form of this action of the poison was; but as seen by me a few moments later, it is probable that it was possibly numbness, and certainly spasm of the extremities, with quivering of the muscles on every attempt to use them; with congestion, or its opposite, anemia, of the brain, such as a ghastly pale face would show. In 5 or 8 minutes later, I saw him. His condition was that of constant spasms of the lower limbs, with occasional spasms of the arms; and in every half minute or minute, a spasmodic convulsion of the greater part of the involuntary muscles would take place. His mind was clear when no convulsions were on; but it was affected, but not suspended, during the convulsions. A death-like paleness preceded each general convulsion, with a stoppage of the pulse at the wrist, which soon took definite shape. In the brief intervals between the spasms or convulsions, he was able to speak, and to describe his case accurately. His vision was clear. He was cool and accurate in verbal expressions, but had that excitement that underlies danger. Being of a hopeful and mirthful turn of mind, he at this moment had no fear of death; for he wished still to take the railroad train, and said: "I shall be over this soon." If I am correct, and I think I am, his case shows that, beginning with a serious impression on the brain, the poison begins its fatal action on the extremities, the hands and feet, and by degrees proceeds up the extremities of the body to the trunk. When he spoke to me, this had reached the hips, pelvis, and shoulders, as was evidenced by his pointing to these parts and saying: "I am sick; it is cramps here," that is, on the circumference of bowels and ribs, and in the hips and shoulders. A few minutes later, he evidently felt that the poison was invading the involuntary muscles of the heart and lungs, as a sorrowful and alarmed expression evidently showed. A convulsion came on, and was followed by his clear statement: "What I fear is that a clonic spasm of the heart and lungs will take place, and I shall go, go soon in it." And after the next general convulsion, he said: "Doctor, you know what I fear," meaning the clonic spasm of heart and lungs.

Next the tetanic or clonic spasm was evidenced by his saying: "My jaws are becoming locked." The word "clonic," used by the dying doctor, means an irregular spasm. It is also used, probably without authority, as he used it, for violent closing or locking spasm, suddenly coming on. Very soon after, he was unable to swallow camphor and water I offered to him, and the teeth were locked as in tetanus, though not so rigidly. Then follow the fifth and sixth general spasm or violent convulsion within twelve to fifteen minutes, during the brief intervals of which he spoke: "I am gone," "it is over," "raise me up," "lift me up," and he turned purple or livid in the face; the clonic or closing tetanic spasm of the heart and lungs took place, and he who, forty-five moments before, had taken, into an empty stomach, a drink of water with the poison in it, was dead.

The action of the poison was, as I have said, first on the brain and voluntary muscles, then on the ganglia of the voluntary muscles; and it ended in death as soon as the involuntary muscles of breathing became involved, the breast being the last involuntary muscular organ that stopped. The spasms evidently were very painful, but not remarkably so. His mind was clear, so much so that he saw and spoke of what was best to do, and what was being done for and about him. Had not the celerity and the certainty of the progress of the poison been known (being absorbed by one in violent exercise, in water or solution, on an empty stomach), we might have well thought that such a self-possessed, strong, well reasoning, and conscious man was not at the gate of death.

Thinking that these facts are of interest to the medical profession, I have sent them to you.

S. J. PARKER, M.D.

Weighted Silks.

To the Editor of the Scientific American:

I noticed in your issue of July 10, an article headed "Weighted Silks." It states that the increase is by means of salts of iron and astringents, and salts of tin and cyanide; and that it cannot be too widely known that, by this adulteration, silk is rendered very inflammable, and, under certain

circumstances, spontaneously so. I admit that silk in the process of dyeing, and where heavily weighted, receives all of the material named. Iron is the base; cyanide of potassium forms with the iron Prussian blue, giving the blue ground; it is then given a bath of tannin, which is precipitated with tin salts, fixing the tan insolubly on the silk. The result of all this is: Silk being, like hide, an animal gelatin, having an affinity for tan, becomes leather, and is about as inflammable.

I enclose a skein of black silk; one half of the weight is silk, the other half iron, cyanide, tin salts, and astringents, used as I have named. It is true the weighting of silks is carried to the extent of ruining the fabric. Although the goods thus weighted appear firm and solid, they will not wear. This weighting process adds bulk, so that the weighted silk will make two yards, where the unweighted would only make one. The silks will not last like those our mothers wore; to redye them is out of the question; but they have a decent appearance for a time, and I think no lady need fear spontaneous combustion.

A SILK DYER.

Pittsfield, Mass.

The Recent Wet Weather.

To the Editor of the Scientific American:

Among the many probable causes to which the exceptional weather of this year is attributed, there is one which I have not yet seen mentioned in print, and which appears to be worthy of consideration. Advices from Europe tell us that, over a very large area of the north of that continent, quantities of ashes have fallen, having been wafted on the winds from the Iceland volcanoes. This does not take into account the quantity which must have fallen unobserved on the intervening seas. To lift this immense mass of material to so great a height requires an immense force, and an amount of the gaseous products of combustion terrible to think of. The question it would present to the meteorologist is: What effect would be produced on the atmosphere by this body of gas? Or if, as seems reasonable, there is an atmosphere of hydrogen above our atmosphere of combined oxygen and nitrogen, what would be the effect on it, and the resulting effect on the lower atmosphere?

Many years ago, Professor Epsy claimed that the atmospheric disturbances caused by large fires produced rains; but so far as I know, he did not assign a reason. If fire is wanted to bring rain, here is an amount of fire and heat to which the heat of the fires of Chicago and Boston combined would be nothing, and an amount of matter raised high into the air that would make many such cities.

Louisville, Ky.

N. B. G.

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

The best remedy for currant and gooseberry worms is powdered white hellebore, obtainable at any druggist's. Put the powder in a common tin cup, tying a piece of very fine muslin over the mouth. Fasten the apparatus to the end of a short stick, and dust the powder through the muslin lightly upon the bushes. Do not work on a windy day, and stand to windward during the operation, as, if taken into the nostrils, the hellebore excites violent sneezing. The same material is a good remedy for cucumber beetles.

Sawdust can be converted into a liquid wood, and afterwards into a solid, flexible, and almost indestructible mass, which, when incorporated with animal matter, rolled, and dried, can be used for the most delicate impressions, as well as for the formation of solid and durable articles, in the following manner: Immerse the dust of any kind of wood in diluted sulphuric acid, sufficiently strong to affect the fibers, for some days; the finer parts are then passed through a sieve, well stirred, and allowed to settle. Drain the liquid from the sediment, and mix the latter with a proportionate quantity of animal offal, similar to that used for glue. Roll the mass, pack it in molds, and allow it to dry.

The following table for boiling fruit in cans will doubtless prove useful, as the present is the time for putting up such preserves for winter. The first figure after the name of the fruit refers to time of boiling in minutes, the second to ounces of sugar to the quart: Cherries, 5, 6; raspberries, 6, 4; blackberries, 6, 6; gooseberries, 8, 8; currants, 6, 8; grapes, 10, 8; plums, 10, 8; peaches (whole), 15, 4; peaches (halves), 8, 4; pears (whole), 30, 8; crab apples, 25, 8; quinces (sliced), 15, 10; tomatoes, 30, none; beans and peas, three to four hours.

The following soluble glass is best adapted for coating brick and stone: Dry carbonate of potassium, 10 parts; powdered quartz, 15 parts; charcoal, 1 part. Sand, free from alumina and iron, may replace the quartz. Fuse together and dissolve in boiling water of 5 or 6 times the weight. Filter.

Handsome ornaments can be made by mounting fern leaves on glass. The leaves must first be dyed or colored. They are then arranged on the mirror according to fancy. A butterfly or two may be added. Then a sheet of clear glass of the same size is placed on top, and the two sheets secured together at the edges and placed in a frame.

Photography of Children.

W. A. Nicholas, Australia, says: As nearly all children are photographed in white dresses, and the faces are a great deal tanned through exposure to the sun, I have found a useful help in a simple wax match. If I have been unable to get full exposure through the restlessness of the little sitter in dull weather, by lighting a match and holding it just under the face only, so as to make that part of the plate hot during development, it is astonishing the increase of detail I get. There is no danger of the plate cracking through uneven expansion.

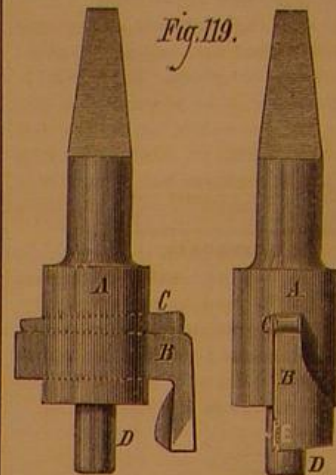
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXX.

CUTTERS.

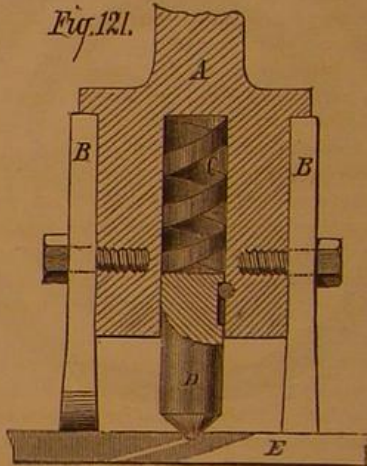
Cutters are steel bits, usually held in either a stock or bar, being fitted and keyed to the same; by this means, cutters of various shapes and sizes may be made to fit one stock or bar, thus obviating the necessity of having a multiplicity of these tools. Of cutter stocks, which are usually employed to cut out holes of comparatively large diameter, as in the case of tube plates for boilers, there are two kinds, the simplest and easiest to be made being that shown in Fig. 119.



A is the stock, through which runs a slot or key-way into which the cutter, B, fits, being locked by the key, C. D is a pin to steady the tool while it is in operation. Holes of the size of the pin, D, are first drilled in the work, into which the pin fits. To obviate the necessity of drilling these holes, some modern drill stocks have, in place of the pin, D, a conical-ended pin which acts as a center, and which fits into a center punch mark made in the center of the hole to be cut in the work. Most

of these devices are patented, and the principle upon which

Fig. 121.

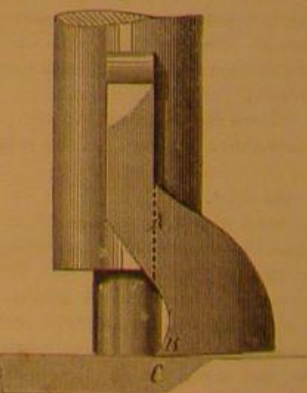


they act will be understood from Fig. 121, A being the stock to which the cutters, B B, are bolted with one or more screws. C is a spiral spring working in a hole in the stock to receive it. Into the outer end of this hole fits, at a working fit, the center, D, which is prevented from being forced out (from the pressure of the spring, C) by the pin working in the recess, as shown. E is the plate to be cut out, from which it will be observed that the center, D, is forced into the center punch mark in the plate by the spring, C, and thus serves as a guide to steady the cutters and cause them to revolve in a true circle, so that the necessity of first drilling a hole, as required in the employment of the form of stock shown in Fig. 119, is obviated. The cutters are broadest at the cutting end, which is necessary to give the point clearance in the groove. They are also, at the taper part (that is to say, the part projecting below the stock), made thinner behind than at the cutting edge, which is done to give the sides clearance. It is obvious that, with suitable cutters, various sized holes may be cut with one stock.

In cutting out holes of a large diameter in sheet iron, a stock and cutter such as shown in Fig. 120 is generally employed; but the great distance of the cutting from the cutting edge, that is to say, the extreme length of the cutter, renders it very liable to spring, in which case these, and other tools having a slight body and broad cutting edge, are almost sure to break, unless some provision is made so that the tool, in springing, will recede from and not advance into the cut. To accomplish this end, we must shape the cutter as shown in Fig. 120, which will, at the very least, double the efficiency of the tool.

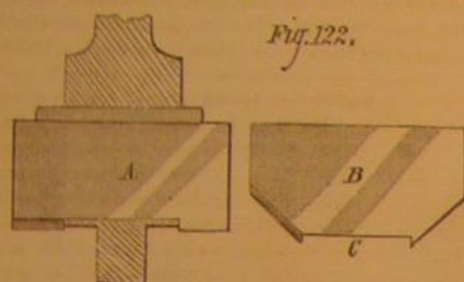
In Fig. 120 the cutting edge, B, stands in the rear of the line, A, or fulcrum from which the springing takes place; hence, when the tool springs, it will recede from the work, C. To avoid springing and for very large holes, the cutter may be a short tool, held by a stout crossbar carried by the stock; but in any event the cutter should be made as shown above.

Fig. 120.



shown in the stock, and B a countersink cutter out of the

stock, the recess being shown at C. In making these cutters they should be first fitted to the stock, and then turned up in the lathe, using the stock as a mandrel, the ends being then backed off to form the cutting edges. Those slight in substance should be tempered to a light straw at the cutting edge, and left softer at the back part. Those above five



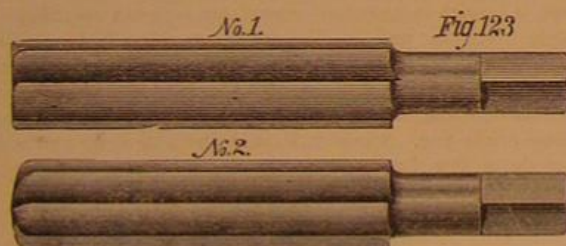
sixteenths of an inch in thickness may be hardened right out, and not tempered at all.

Here it may be as well to describe a process for tempering cutters, which, as several very expert workmen have assured me, gives superior results. It is to heat the cutter to a cherry red heat, and quench it in the water until it is cold, and to then reheat it until water dropped upon it will dry off in slight bubbles. If, however, the reheating is rapidly performed, there will be no need to drop any water on it, since that which adheres to it after quenching will be sufficient. I have no doubt but that for stout cutters, or even for slight ones which perform a light duty, this method is preferable to all others; but for light cutters performing a heavy duty, I should judge that it would leave them too hard for their strength, and therefore liable to break.

Cutters for boring bars should be, if intended to be of standard size, recessed to fit the bar, as shown in Fig. 122, the bar having a flat place filed around and beyond the edges of the hole, to form a broader bearing for the cutter to fit upon. But if the cutter is intended to vary the size of hole, it must be left plain, so that it may be moved inwards or outwards to accommodate the size of bore required. All cutters and bits should be used at a cutting speed of about 15 feet per minute, and with oil or soapy water for work in wrought iron or steel; and for use on those metals, the cutters, etc., may be given a little front rake by grinding away the metal of the front face, as shown by the dotted line in Fig. 119, at E.

REAMERS.

Reamers are cutting tools usually employed to finish holes requiring to be very true and smooth, and may be employed in a machine or lathe, or by hand. As reamers are generally of a standard size, but little metal should be left to be cut out by the reamer, so that they will not, from excessive duty, become rapidly worn and hence reduced in size. Fig. 123 represents reamers for hand use, No. 1 being a taper reamer to be introduced first, and No. 2 a finishing one to make the hole parallel. It is obvious that the taper one, by

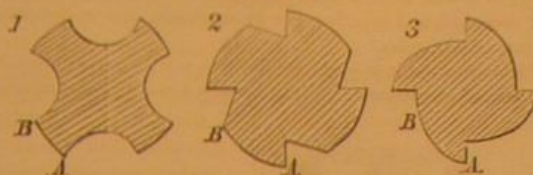


entering the hole a part of its length before its diameter becomes large enough to perform any cutting duty, is steadied during the operation. To steady the finishing reamer, it is usually made slightly taper at its cutting end for a length about equal to its diameter. To illustrate the indispensability of this tool, we will take the case of fitting an eccentric rod double eye to a link or quadrant. The faces of the latter are planed, and the hole is bored as true and parallel as possible. The double eye may be planed, milled, or slotted, and the holes in the eyes are bored as true as it is practicable to get them; nevertheless, when the double eye is fitted to the quadrant, it will be found that the holes in the eye and that through the quadrant are not true one with the other. Theory would say that they must come true, but practice proves that they never do; hence they are fitted together, and the reamer is applied to true them out and make them parallel. The reason for this want of truth is this: If the holes in the double eye are bored before the inside faces are cut out, the latter operation varies the form of the whole double eye, in consequence of freeing the tension which always exists on the outer surface of either forgings or castings, as has already been explained in former remarks. If, on the other hand, the faces of the double eye are turned out first, then boring the hole will have the same effect; hence the use of the reamer cannot be dispensed with for holes requiring to be practically true.

Reamers should be made as follows: Forge them of the very best steel, and to within one sixteenth inch of the finished size; then turn them up, taking care to properly center-drill and square the ends, and to rough them out all over before finishing any one part, bearing in mind that the diameter is sure to be a trifle increased by the process of hardening. Then cut out the flutes in a milling machine; the number of flutes should increase with the diameter of the reamer, but a good proportion is five flutes to a reamer of an inch diameter. Let the flutes be deep and roomy, so as to allow the cuttings free egress and the oil free ingress. An odd number of flutes is better than an even one, since they ren-

der the reamer less likely to follow any variation from roundness in the hole. Nor need the flutes be the same distance apart, a slight variation tending to steady the reamer when in operation. The form of flute is not arbitrary; Fig. 124a shows, however, the forms usually employed, either of

Fig. 124a.



which will answer excellently for hand reamers, the only difference being that No. 2 is rather more difficult to sharpen (without softening it) on an emery wheel, while No. 1 is the most difficult to sharpen when it is softened, in consequence of the file being liable to slip out of the groove and take off the cutting edge.

After the flutes are cut, the rake is given to the cutting edges by easing off or filing away the metal behind the cutting edges, A, towards the point, B; but this should be done by drawfiling to a very slight degree near the cutting edges, otherwise the reamer will be liable to wobble when cutting. In forms 1 and 2, the amount of the rake at the point, B, need not be more than the thickness of a piece of thin writing paper; but in No. 3, while near the cutting edge it may be very slight indeed, it must at the point, B, be considerable; hence (save for rough work requiring an excess of cutting duty) form No. 3 is not so desirable as the others.

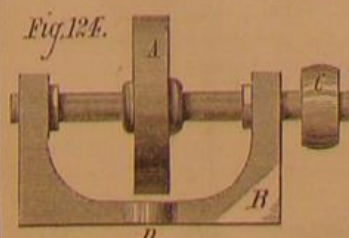
The best method of hardening such reamers, and in fact all others, is to heat them in molten lead, and to quench them endwise in water; because, when heated in lead, the outside will become sufficiently heated before the inside metal is red hot; and so, when the tool is quenched, the inside or central metal will remain sufficiently soft to permit of the tool being straightened should it warp in the hardening. The straightening should be performed by slightly warming the reamer and laying it upon a block of lead with the rounded side upwards; then place a rod of copper or brass in the uppermost flute, and strike the copper with a hammer. The use of the copper is to prevent damage to the tool by the hammer. The object of dipping the tool endwise is to prevent the reamer from warping in hardening. If great care is not taken in the hardening process, reamers and all tools having grooves or flutes in them are very apt to crack along the bottom of the flutes, which cracking is due to the unequal contraction of the metal in being rapidly cooled by quenching. Those having deep flutes, or sharp corners at the bottoms of the flutes, are the most liable to flaw in hardening, so that, in this respect, the flute shown in No. 1 is far preferable. To obviate the liability to flaw, the water in which the quenching is performed may be made sufficiently warm to be just bearable to the hand; and if it is also made a little saline, its hardening value will not have been impaired by the warming.

For light work, the hand reamer should be, if above 1/2 inch in diameter, tempered to a light straw color. For sizes less than that, and for heavy duty, a deep brown will prove the most serviceable, being less likely to cause the tool to break. The whole value of a reamer depends upon its being true or straight, and it is therefore necessary to exercise great care in the re-sharpening, as well as in its manufacture.

Many attempts have at various times been made to produce adjustable hand reamers, that is to say, those formed of cutters held in a stock and adjustable as to diameter, the object being to make one reamer serve for several sizes of holes, and to render the manufacture less expensive by having to simply remove the cutters to grind them when dull, and to renew them when worn out. The difficulties in the way of producing such a tool are that, in the smaller sizes, there is not sufficient strength to permit of their being made in pieces, and that, in requiring to set the diameter of the tool, a slight deviation as to size is very apt to occur. They are also liable to wear out of truth.

The best and truest method of making long fluted reamers is the one instituted in the Grant Locomotive Works, of Paterson, N. J. It consists in turning the reamer from one sixty-fourth to one thirty-second inch too large in diameter; then, after cutting out the flutes and hardening, the straightening and backing off is performed as follows: Upon the top of the slide rest, in the position usually occupied by the tool post or clamp, there is fastened a small head carrying an emery wheel of say eight inches diameter, upon a spindle having a small pulley attached, speeded to run about 2,000 revolutions per minute. An overhead countershaft is provided to drive the same, the appearance of the device being as in Fig. 124. The belt is arranged to drive the emery wheel in a direction opposite to that in which the lathe runs.

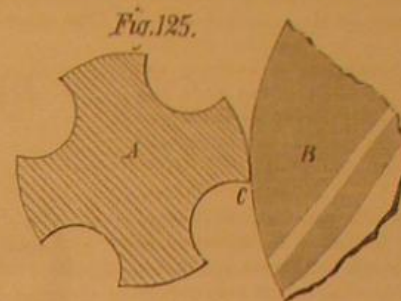
Fig. 124.



A is the emery wheel, B the head carrying the spindle, and C the pulley, D being a lug to bolt the appliance to the top of the slide rest of the lathe. The reamer is, after being hardened, driven in the lathe at a fast speed; the revolving emery wheel is then brought into contact with it and traversed along the length, thus serving as a cutting tool to true the reamer to a dead true and, by proper adjustment, to the requisite diameter. The backing off is performed thus: The lathe is stopped in such a position that the emery

wheel will make contact with the reamer just behind the cutting edge, as shown in Fig. 125, A being a section of the reamer, and B a section of the emery wheel, C being a cutting edge of the reamer. The position being adjusted, the lathe is locked, so that it cannot move, by locking the back gear or in any other convenient manner. The revolving emery wheel is then brought into contact with the reamer, and traversed from end to end of its length of flute, thus performing the backing off, the reamer being turned a little fur-

Fig. 125.



ther round and the grinding operation repeated until the backing off is completed upon that flute; the other flutes are then similarly treated, the whole process producing a true and sharp reamer, unequaled by any other method of manufacture. It is obvious that, by adjustment of the back head of the lathe, any desired degree of taper may be given to the reamer. The journals of the hardened spindles for lathes may be, and in fact are, in many cases, made true and round by the application of the same device.

Professor Winlock.

Joseph Winlock was born February 6, 1826, in Shelby county, Kentucky. Graduating in 1845, at Shelby College, he afterwards held the professorship of mathematics and astronomy in that institution until 1852. The remainder of his life was passed chiefly at Cambridge, Mass.; but he spent some months at the United States Naval Observatory at Washington, and for more than a year was at the head of the mathematical department of the United States Naval Academy at Annapolis. He was twice made superintendent of the *American Ephemeris*, finally quitting this office in 1866 to take the post of Phillips Professor of Astronomy at Harvard University, and in that capacity to serve as Director of the Observatory. He held this office at the time of his death, June 11, 1875. His last illness was short, and did not appear dangerous until a few hours before its termination.

Professor Winlock was an excellent mathematician and astronomer, and had a remarkably retentive memory, not only for facts relating to his branch of science, but for the sources of information concerning those facts. The originality of his mind, however, was chiefly shown in his suggestions for the improvement of astronomical instruments. These inventions were singularly simple and effective. Four among them deserve special notice in this place.

(1) The mounting of large meridian circles in such a manner as to allow the piers to be shortened, so that the graduated circles are wholly above the piers, and the steadiness of the whole instrument is increased. The theoretical advantage of this arrangement cannot here be discussed; it has been tested by five years' experience at Harvard College Observatory with very gratifying results; it has been adopted in other observatories, and will probably come into general use.

(2) The application of a diagonal eyepiece, moved by a rack and pinion, to any large telescope, in such a manner as to dispense with the customary finder, and to enable the principal object glass to be used in finding faint objects which are to be examined with the spectroscope or otherwise. This invention has also been for some years in use in Harvard College Observatory.

(3) A method of registering spectroscopic observations by marking lines upon a silver plate without requiring the removal of the eye from the spectroscope, or the use of artificial light. Professor Winlock registered in this manner his observations of the solar eclipse of December, 1870, which he observed in Spain.

(4) The use of a lens of long focus and of a plane mirror in making photographs of the sun. Apparatus of this kind was brought into daily use in July, 1870, at Harvard College Observatory. Priority in this invention is claimed by some other astronomers; but it does not appear that any one actually used the combination of the mirror with the lens of long focus until some years after Professor Winlock. It should also be noticed that in 1869 Professor Winlock first photographed the solar corona without enlarging the image by an eyepiece.

During his connection with the Observatory, Professor Winlock greatly increased its instrumental equipment, and also its pecuniary resources, by the aid of contributions from neighboring friends of Science. In particular, the system adopted for furnishing electric signals from one of the clocks at the Observatory, to various points in Boston and elsewhere, has been profitable alike to the Observatory and to the public. It illustrates Professor Winlock's practical good sense, that, instead of introducing new clocks, controlled by that at the Observatory, at the places where the signals are received, he provided simple telegraphic apparatus for the reception of the signals every two seconds: a method much cheaper than the other, and in practice equally satisfactory.

In private life, Professor Winlock's amiable though reserved character greatly endeared him to his friends.—A. S., in the *American Journal of Science and Arts*.

COMBINED BELT TIGHTENER AND COUNTERSHAFT HANGER.

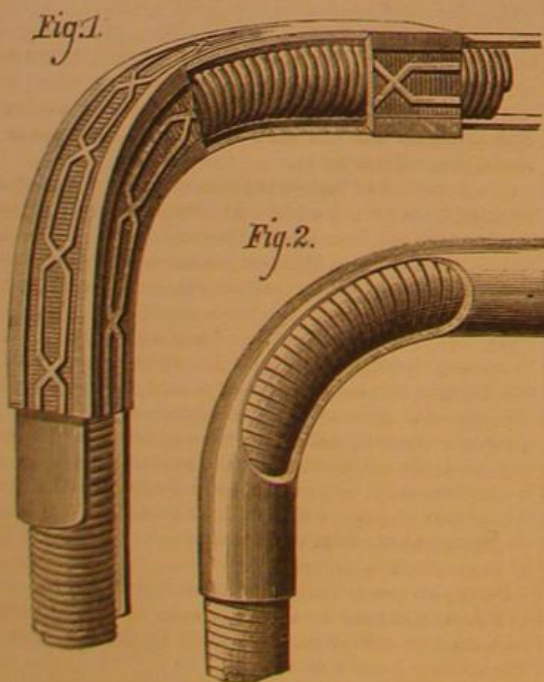
The annexed engravings represent a device for the transmission of motion in a prompt and uniform manner, and with safety. The invention also obviates the use of loose pulleys and the consequent changing of belts.

The construction will be understood from the sectional view, Fig. 1, which shows a countershaft supported in a bearing upon a standard, A, which slides in guides. Engaging with rack teeth upon said standard is a pinion, B, with which is connected the weighted lever, C. The effect of this arrangement is to raise the countershaft, the standards, A, entering the ways as far as possible; but when the lever is elevated, the countershaft will be moved down, and the belt pulley will take the position indicated by the dotted lines in Fig. 1. It will be obvious from Fig. 2 that a belt, passing over the pulley, D, may be slackened or tightened at pleasure through the means above described. When the belt is held taut by the weighted lever, keeping the countershaft raised, then necessarily motion will be transmitted; but as soon as the countershaft is caused to descend, then the belt will hang loosely, revolving with the pulley, D, but not with the driven pulley. In the opposite case, represented in Fig. 3, the raising of the countershaft, which is under the driven pulley, determines the slackening of the belt; and the latter remains stationary upon said driven pulley, and hangs loose from the driver. The belt in all cases remains in place relatively upon the pulley. As indicated in Fig. 3, the standards which support the countershaft are made radially adjustable so as to be placed in proper line of direction between the driving and driven pulleys. The counterposed lever may be governed by a cord and pulley or any suitable device. The abolition of loose pulleys is an advantage of importance, since the dangers peculiar to such machinery, as well as the difficulty always encountered in oiling the same, are well known. By the present device, the power hitherto used in turning a loose pulley is economized, as well as the wear incident thereto.

Patented May 4, 1875. For further information address the inventor, Mr. John J. Squire, or Branch, Crookes & Co., 114 and 116 Vine street, St. Louis, Mo.

NEW METHOD OF BENDING PIPES.

The usual mode of bending pipes to a true curve is to fill the heavy tubes with rosin and the light ones with lead, and, fastening them in a vise, to give the required curve by suitable lever pressure, subsequently hammering the metal into proper shape. This last operation is both difficult and tedious, and, even when performed by a skillful workman, does not leave the metal perfectly smooth nor free from dents, while the section of the pipe can never be left, by handwork, perfectly circular.

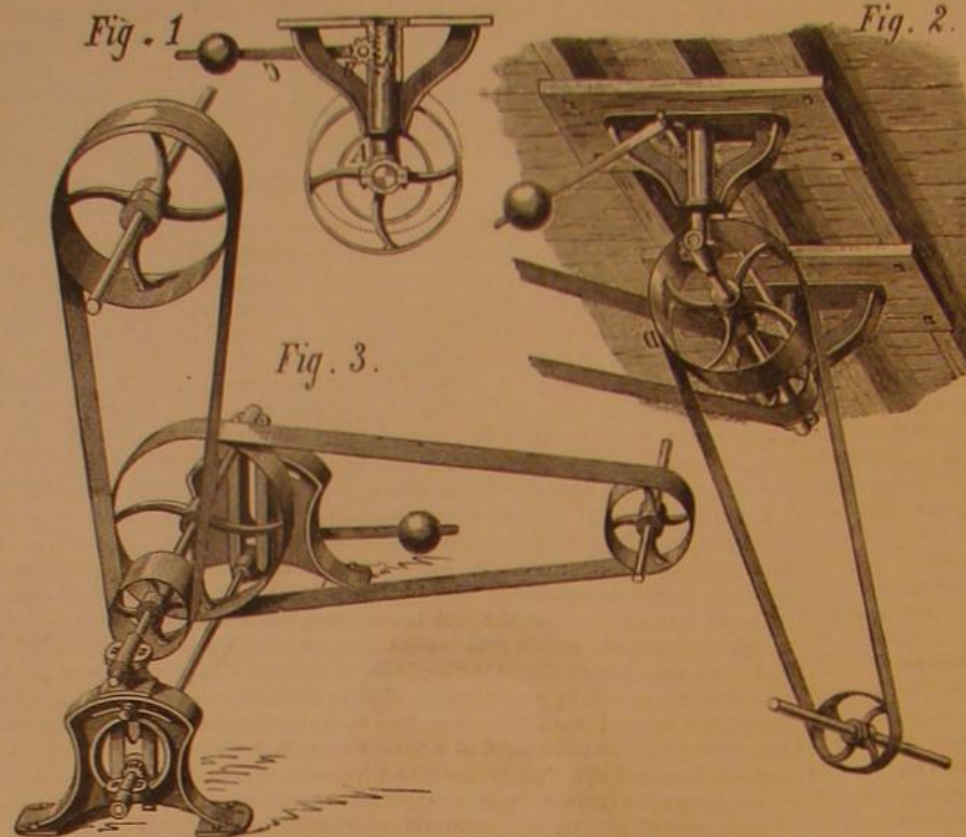


A new mode of bending copper and brass pipe is now the subject of patents pending in this country, in Canada, and in England. It consists, as shown in the engraving, Fig. 1, of the use of a spiral spring of ordinary square wire, which serves as a flexible mandrel, supporting the tube at all points during the bending process. After the curve is made, the spring, by turning it slightly in the direction of its coil, is compressed and thus easily drawn out.

Any size of pipe, we are informed, can thus be bent and,

as proved by several samples submitted to us, with perfect accuracy. The curve is true, the section a circle; no hammering whatever is needed, and there is no excessive crowding together of the metal on the inside, nor stretching of the same on the outside, of the curve. For square pipe, such as is used for gas fixtures, etc., the spring is reinforced by two strips of metal, as shown in Fig. 2, which are easily inserted and removed, and which serve to maintain the rectangular section of the tube.

The invention is one of considerable merit, and will doubtless soon find a widespread employment among coppersmiths,

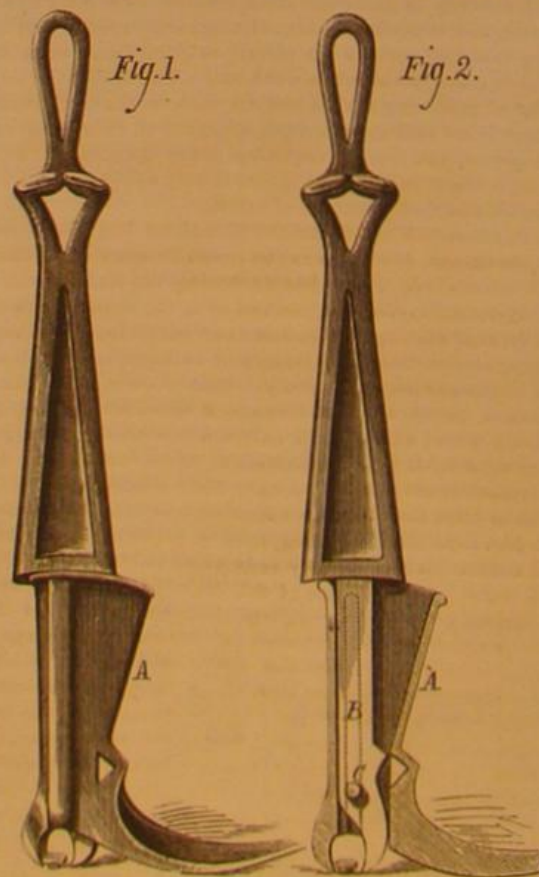


SQUIRE'S COMBINED BELT TIGHTENER AND COUNTERSHAFT HANGER

since its tendency is eminently labor-saving. For further particulars address the inventor, Mr. Morris L. Orum, care J. Snowden Bell, 702 Chesnut street, Philadelphia, Pa.

IMPROVED NAIL EXTRACTOR.

The object of the invention illustrated herewith is to provide a convenient means of extracting nails from wood work, without mutilating the latter or destroying the nail. The device is made in two parts. The lower boot-shaped portion, A, is hollow, and has formed on its inner side two vertical channels indicated by the dotted lines in Fig. 2. The upper portion consists of a handle and a downward extension, B, the lower extremity of which forms the movable jaw, the stationary jaw being cast on the portion, A. On the sides of part, B, are projections, C, which are inserted on the channels of portion, A, the malleable metal of which the latter is composed being previously heated and expanded to allow of the entrance. After the metal has cooled and contracted, it becomes of course impossible to detach the portions of the



implement, although their free motion within and upon each other is unimpaired. The forward projection of part A, serves as a fulcrum for the lever after the jaws have grasped

the nail, as shown in Fig. 2. In order to confine the movable jaw to its work, an angular projection is made on one side of the bar, B, which enters a suitable recess in part A. The handle slides over the curved top of the lower portion; and when the bar, B, comes in contact with the latter, a leverage of the entire length of the device is gained, which speedily, it is claimed, draws out the most deeply imbedded nails.

Patented April 20, 1875. For further particulars address M. D. Converse, 63 Park Place, New York city.

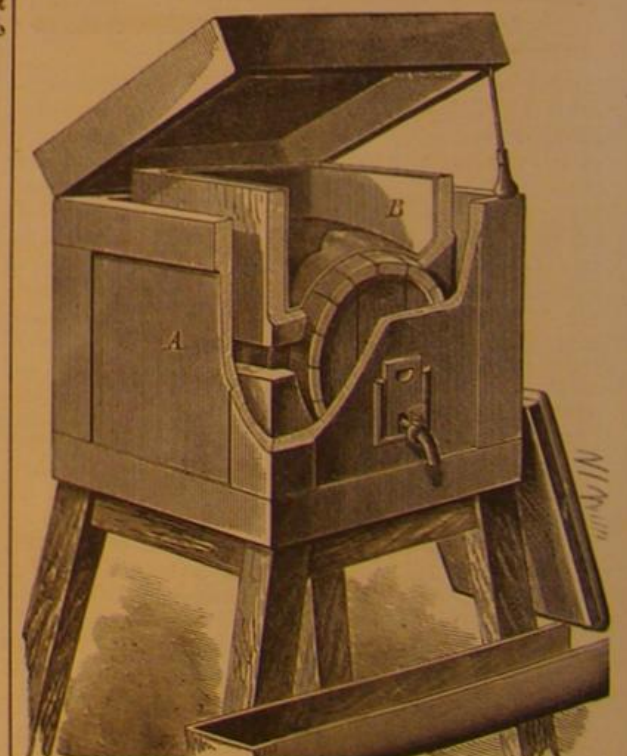
Value of Road Dust.

During a dry season, every country resident should secure several barrels of road dust. Those who keep poultry may secure by its use a valuable fertilizer, nearly as strong as guano, with none of its disagreeable odor. Place an inch or two of road dust in the bottom of a barrel; then, as the poultry house is regularly cleaned, deposit a layer an inch thick of the cleanings, and so on, alternately layers of each till the barrel is full. The thinner each layer is, the more perfect will be the intermixture of the ingredients. If the soil of which the road dust is made is clayey, the layers of each may be of equal thickness; if sandy, the dust should be at least twice as thick as the layer of droppings. Old barrels of any kind may be used for this purpose, but if previously soaked with crude petroleum or coated with gas tar, they will last many years. If the contents are pounded on a floor into fine powder before applying, the fertilizer may be sown from a drill. Road dust is one of the most perfect deodorizers of vaults—converting their contents also into rich manure. Place a barrel or box of it in the closet, with a small dipper, and throw down a pint into the vault each time it is occupied, and there will be no offensive odor whatever. This is simpler, cheaper, and better than a water closet, and never freezes or gets out of order. Mixing the road dust with equal bulk of coal ashes is an improvement, making the fertilizer more friable.—Country Gentleman.

BOHART'S BEER COOLER.

The annexed engraving represents a simple and inexpensive form of beer cooler, designed to receive the keg, which contains the liquid and from which it is drawn off for use. The advantages offered are that the cooling is effected with a small amount of ice and in as thorough a manner as may be desired, while the keg may be easily inserted and removed from the receptacle.

The device consists of an outer casing or box, A, provided with a hinged cover and supported by legs at a convenient height. Within and on the bottom are placed the skids, upon which the keg is set. Above the keg, and resting on its upper side, is a box, B, lined with sheets of zinc or other inoxidizable metal, which is curved so as to fit closely to the shape of the keg. The box, B, is packed full of ice and salt, and closed by a tightly-fitting cover. In the side of the box,



A, an aperture is made large enough readily to admit the faucet. A slide is provided, notched at its lower edge, which tightly closes the hole at the point of passage of the faucet pipe. The quantity of ice may be regulated according to the degree of coldness to which the beer is to be reduced, and, being placed directly upon the keg, is situated so as to exert its greatest cooling effect upon the liquid within.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. John N. Bohart, Denison, Grayson county, Texas.

EL BARON DE HUGHES.

Under this title we find in a recent number of *La Ilustracion Española*, a handsome illustrated paper published at Madrid, a finely executed portrait and a flattering notice of our ingenious countryman, Mr. E. D. Hughes, of Kentucky. The Spanish government has lately adopted the Hughes printing telegraph instruments, and their successful working gives so much satisfaction that the king has conferred a titular nobility upon the inventor. "The Baron of Hughes" is the new name of our fellow citizen.

By the help of photography we have reproduced the portrait of the baron, and present it herewith, together with some of the good words given by R. de Morines, the writer in *La Ilustracion*.

"Our readers will have learned from the city papers that the Spanish government has, at last, decided to adopt for service on its long telegraph lines, the printing instrument invented by Sir Hughes.

"The nature of our publication and the limited space at our disposal will not permit us to give a full description of the system to which we refer. We are obliged to omit details, and simply say that the principle upon which it is founded is the isochronous or movement in unison, of type wheels, obtained by means of a vibrating plate which serves as a regulator. Our readers must suppose one of the said type wheels to be located in the station at Madrid and the other at Paris; that the two revolve in unison; and that at the beginning of their movements, the letter A, for example, in both instruments, stands directly in front of a hammer, which, on the passage of the electric current through the bobbin of an electro-magnet, strikes upon a ribbon of paper, interposed between the hammer and the type wheel. If, at this instant, the operator at Madrid presses with his finger the key which establishes contact with the battery, the electric current will pass over the line, through the magnet bobbin, and into the earth; the plate will move and give motion to the hammer, which, by pressing the paper against the letter A, effects an impression thereof on the paper, provided the type has been suitably inked.

As the velocity of the electric current may be considered unlimited over a distance relatively very small, the same letter will, at the same time, be printed in Paris, if, as before stated, the letter A, in both instruments, stands at the same instant in front of the printing hammers. If instead of A the letter D stands in said position, then that letter will be printed, and so on.

"Such in brief is the principle of the system so ingeniously worked out by Sir Hughes. Its chief advantages are rapidity and correctness in transmission, the delivery of the message in ordinary print, and the great distance over which the messages may be directly transmitted.

"The genius of the inventor, his perseverance under all difficulties, twenty years of study and experiment, a hundred thousand dollars in money spent in realizing the first imperfect but still useful apparatus, the endurance, without dismay, of all the hardships and mischances that beset every man of talent who seeks to raise himself above the common level—these have crowned, with a most happy conclusion, a discovery which has yielded to its author glory, honors, and fortune.

"Sir Don Edward David Hughes, whose portrait we herewith publish, was born in 1831, in Louisville, Ky., one of the States of North America. From a very early age, he devoted himself to the study of the physical, mathematical, and mechanical sciences. At the age of 19 years he was professor of physics in the College of Kentucky, and in the same year (1850) began his studies upon the instrument which today bears his name.

"In 1855 the American Telegraph Company first adopted the Hughes system. In 1861 it was adopted in France, and, successively, in Italy and England in 1862, Russia 1865, Prussia 1866, Austria, Hungary, and Turkey 1867, Holland 1868, Bavaria and Wurtemberg 1869, Switzerland and Belgium 1870, Peru 1871, Buenos Ayres 1872, the English Submarine Company 1873, the Argentine Confederation 1874, Spain 1875.

"We give thanks for the example and zeal of the Government Ministers, and the worthy Director General of Telegraphs, in that, having overcome all obstacles, administrative and routine, they have introduced into our country so useful an improvement, at a time when it is so much needed by the daily increasing necessities of the telegraphic service. We tender our congratulations to them and the public, who will very soon begin to experience the advantages of this wonderful invention.

"Sir Hughes is a member of almost all the scientific academies of Europe. He received the great gold medal at the Universal Exposition at Paris in 1867. He is knight commander and holds the grand cross of the order of San Miguel and of the Iron Crown. He has been decorated with the cross of the Legion of Honor, of Medjidie, of Santa Anna, of San Mauricio, and San Lazaro, etc. The Spanish government has decorated him with the commandery of Carlos III. The greater part of the sovereigns of Europe have honored him by their personal visits.

"As we have already stated, Sir Hughes has had the good fortune to realize in life that which few men of his stamp ever enjoy, namely, the pleasure of being useful to humanity, and of receiving honors, glory, and a considerable fortune.

Nevertheless, Sir Hughes, like all men of real merit, is modest and simple, qualities which enhance his native worth and attract the sympathies of all who have the happiness of knowing or dealing with him.

"Taking advantage of his presence among us, we publish his portrait, and through the columns of our periodical we give him a welcome."

A California Tree for the Centennial.

Some time ago we mentioned the fact that Mr. Vivian was preparing a large piece of one of the Tulare county big trees to exhibit at the Centennial next year. The piece of timber selected will be sixteen feet long, and twenty-one feet in diameter at one end and nineteen feet at the other. The heart of this will be taken out, leaving only about one foot of the body of the tree attached to the shell or bark. This outside shell will then be divided into eight equal parts, each of which will weigh four thousand pounds without the bark. It is necessary to divide it into this number of parts in order to allow it to pass through the numerous tunnels between here and Philadelphia. The eight parts will weigh about thirty thousand pounds, and will require two cars for their transportation. One solid foot of this tree weighs seventy-two pounds, being ten pounds heavier than so much water. This timber was taken out of the General Lee, a tree two hundred and seventy-five feet high, and which, had it been sawn into lumber, would have produced a sufficient quantity to have built a very respectable young town or a large ship. It contained more than two hundred thousand feet of lumber, besides, probably, about two hundred cords of wood. The General Grant, a much larger tree than the



EDWARD DAVID HUGHES.
INVENTOR OF THE HUGHES PRINTING TELEGRAPH.

General Lee, and the largest in the world, growing in the same grove, is left standing, probably for the benefit of future.—*Visalia (Cal.) Delta*.

Progress of Telegraphy.—One Wire for Many Instruments.

The *Golos* announces the arrival at St. Petersburg of M. La Cour, assistant-director of the Copenhagen Physical Observatory, in order to submit to the telegraphic conference a new invention in telegraphy. That invention gives the possibility of transmitting despatches between two telegraphic stations through one wire only, and by means of many instruments, so that transmission by one instrument cannot impede the action of the other. M. La Cour, while engaged some years ago in investigating the passage of electric currents through conducting media, found that electricity is transmitted from place to place by undulations analogous to those of sound. In consequence of this discovery, he hit upon an arrangement of electro-magnets and tuning forks, by means of which a particular current passing through a tuning fork pitched to a certain note does not become merged in or confounded with other currents which, after passage through differently pitched tuning forks, are simultaneously transmitted along the same wire. This, of course, renders it possible to send many messages at a time through a single wire.—*The Telegraphic Journal*.

THE CENTER OF OUR POPULATION.—It has traveled westward, keeping curiously near the 39th parallel of latitude, never getting more than 20 miles north, nor two miles south of it. In the 80 years it has traveled only 400 miles, and is still found nearly 50 miles eastward of Cincinnati.

Salicylic and Benzoic Acids.

Professor Salkowsky of Berlin has recently made some experiments which are not so favorable to salicylic acid as those previously reported. The *Industrie Blätter* gives the following résumé of his experiments: Salicylic acid, in concentrated aqueous solution, puts off decay but is not able to prevent it. Salicylic acid does not possess any deodorizing properties, although it has been supposed to. Decomposing liquids when mixed with salicylic acid solution retain their odor unchanged. In fact it is difficult to see how it could deodorize, for this action can only be effected in one of three ways: first, by destroying the volatile substances that rise from the liquid; permanganate of potash, chloride of lime, and sulphurous acid deodorize in this way. Second, by absorbing these substances, as does charcoal, and to a less degree other porous bodies, like peat and plaster of Paris; to this class also belong those substances which precipitate aluminous matters. Third, by concealing the foul odor, as does carbolic acid. Salicylic acid does not possess strong chemical affinities, nor form precipitates, nor yet possess an odor of its own. The action of salicylic acid is not due to its splitting up into carbolic acid and carbonic acid, as Kolbe originally supposed. The untenableness of of this supposition is evident from the fact that salicylic acid acts when much less concentrated than carbolic acid. Besides, it is easily extracted from the mixture by means of ether, and no carbolic acid can be detected in it.

Benzoic acid possesses much stronger antiseptic properties than salicylic acid. According to the author's experiments, if fresh meat, either finely chopped or in larger pieces, be kept in a concentrated aqueous solution, no decomposition sets it at all for more than 3 months. The liquid remains perfectly clear and retains the odor of benzoic acid. Kolbe found benzoic acid less active than salicylic acid. "I thought at first," says he, "that the difference could lie in the different sources of the acids employed. Benzoic acid made from gum benzoin has a strong aromatic odor, which is due to a minute quantity of some other admixture which has not yet been studied. Benzoic acid prepared from the urine of cattle and horses has also an odor, but not so intense and rather different from the former. Now it was supposable that this minute admixture had an effect upon its antiseptic properties, but some of the latter acid, labeled *acidum benzoicum ex urina*, was just as active as the former kind."

As regards the practical use of salicylic acid externally, the fact that it does not entirely prevent decay is of little consequence, for, other things being equal, people always prefer that which offers perfect protection against decomposition. Benzoic acid is decidedly cheaper than salicylic, which is a strong point in its favor. Whether in its employment it possesses disadvantages over salicylic acid, or advantages over carbolic acid, can only be learned by clinical experience.

Both acids are alike unsuited for internal use as antiseptics or antizymotics, because when taken into the blood they are converted into the soda salts. It is evident that here the use of neutral substances is far preferable, such as pass unchanged through the system; in fact this is the principal condition of their effectiveness. As a type of these we may mention phenol (carbolic acid) and substitution products of phenol, all of which exert, to greater or less degree, a strong antiseptic action, such as thymol. The ether of phenol is also an antiseptic.

The Spiritual Scientist.

Most of the organs of the spiritualists in this country are filled with insipid ghost matter, very tiresome and useless to all whose brains have not been softened by the spirit craze. The *Spiritual Scientist*, a neatly printed weekly periodical, is an exception. Its editorial columns exhibit talent, while its conductors, with a boldness quite remarkable for a spirit paper, actually condemn, as unworthy of true believers, the printing and circulation of the unauthenticated trashy stuff delivered by common mediums. To its cotemporary the *Banner of Light*, it administers a severe rebuke for its agency in this matter, and alleges that for the past ten or twelve years that journal has poured out a weekly stream of pretended spirit communications, of which not more than two in a hundred had any evidence of being genuine, or contained anything beyond childish nonsense, the merest babblings of infancy. It thinks the time has now come to substitute the intelligent speech of adolescence, which it accordingly undertakes to do in its next article.

Subject: The American Association for the Advancement of Science, now in session at Detroit.

Disgraceful behavior of the Association and of individual members thereof, towards spiritual science, are charged on the following specifications:

"It," says the *Scientist*, "these learned children would simply confess their ignorance of spiritual facts, laws, and philosophy, we could have nothing to complain of. But what the whole spiritualistic press and all intelligent spiritualists so indignantly denounce is the fact that scientific men, like Davy, Faraday, Tyndall, and Huxley, pronounce upon these matters without being possessed of any data upon which to form an opinion. Worse, they sometimes have deliberately lied about observed phenomena, to avoid making

* Benzoic acid sells for 25 cents per ounce, artificial salicylic acid 30 cents per ounce, in New York city.

a favorable report. If any of them feels aggrieved at our language, let him say so, and we will prove its literal accuracy.

"The helpless creatures are only human moles. As they burrow in their 'dim galleries,' what can they know of the inner world, which their predecessors only discovered at the moment when communication was interrupted between them and their fellow grubbers?"

"See what will happen at this Detroit meeting: Their Entomological Club will have heated debate upon trapdoor spiders, and acrimoniously discuss whether the male *mygale aricularia* has a darker shade of brown than the female on the upper segment of the body, and more cilia to the square inch; after which, as an appetizer for dinner (champagne and fixings on the lake), mention will be made of that Dismal Swamp louse, which (see Trans. 1874) the surveyors found always pointing its nose to the north, whichever way they might lay it down. Professor Hilgard will enquire, across the room, of Professor Dawson, whether the Myriapoda with two antennae, so highly esteemed by the scolopendra tribes of India, are more nutritious than the date palm. Professor Youmans will propose to the Club the election to honorary membership of the "correspondent of the Department of Agriculture" whose discovery of mortality among bots, upon the application of a decoction of tansy he had appropriately noticed at page 384, Vol. VII, No. 39 of *Popular Science Monthly*. Professor E. B. Elliot will show that he was right and Professor H. E. Davis wrong in the number of young *lepidoptera* which, when placed end to end, will measure a mile, — the true figures being $0.174 \times 5432 = 944$.

"The anthropological subsection will no doubt give prominence to a discussion upon measles as a religious element among the Andamanese; and an adjournment could hardly be reached without a fight over the old puzzle, whether it is probable that the American stovepipe represents the form of the prayer cylinder of the lacustrians. If Professor Buchanan, who has forgotten more about anthropology than any of them ever know, should attempt to crowd upon them the complete study of man in all his relations, he will be coughed down and the floor granted to somebody who has a speech ready upon the reticulated button hole of the Bengalese Rajpoot's coat. And yet they are not happy.

"Have we done any injustice to the American and British Associations—for they are both alike? Consult the printed volumes of *Transactions*, in which may be found a record of some of the very papers above enumerated, and others about orange peel oil, fat women, hyena's dens, and the blastoderms of birds' eggs.

It is their own affair whether they study this or that science, and prefer to use the few hours they have on earth in discovering the nature of the respiratory organs of the shark or any other ignoble tomfoolery, to studying the spiritual part of Man and his intermundane communications, attractions, and perils."

[For the Scientific American.]

THE HEATING SURFACE OF BOILERS.

The questions sent to us in regard to boilers continue to multiply, and we imagine that we have received inquiries on all the points connected with the subject. We propose, therefore, to devote some space to answering these questions more in detail than is possible in our correspondence column; and after disposing of the topic indicated by the title of this article, we will give some directions in regard to setting boilers, proportioning them for engines of given size, etc.

There is some difference of opinion among engineers in regard to what parts of a boiler are to be considered in estimating its heating surface; but in the rules which are appended, the methods most commonly employed are adopted.

(a) Cylindrical boilers: These, forming the simplest class of boilers, consist of plain cylinders, sometimes with and sometimes without steam drums. The heating surface of such a boiler is half the surface of the shell, or it is equal to $1.5708 \times$ the diameter of the boiler $\times$ the length. It is to be observed that, in this and in the rules that follow, all dimensions are to be taken in feet; so that, in applying the rule, any proportions that are expressed in inches are to be divided by 12, before making the calculation. Thus: Suppose that a given boiler has a diameter of 36 inches and a length of 20 feet: its heating surface is the product of 1.5708 , 3 , and 20 , or about $94\frac{1}{2}$ square feet.

(b) Cylindrical flue boilers: A boiler of this class is a cylinder with two large flues. Its heating surface is half the surface of the shell, increased by the sum of the interior surfaces of the flues, or $1.5708 \times$ diameter of boiler $\times$ length $+ 6.2832 \times$ interior diameter of flues $\times$ length.

For the sake of illustrating this rule, suppose that a flue boiler has a diameter of 48 inches or 4 feet, and a length of 22 feet, and that the interior diameter of each flue is 15 inches, or $1\frac{1}{4}$ feet. Then the heating surface is equal to the product of 1.5708 , 4 , and 22 , or nearly $138\frac{1}{2}$ square feet, increased by the product of 6.2832 , $1\frac{1}{4}$, and 22 , or about $172\frac{1}{2}$ square feet, making the total heating surface 311 square feet.

(c) Cylindrical tubular boilers: As the name implies, these boilers are cylinders containing a number of tubes. To find the heating surface of such a boiler, take half the surface of the shell and add it to the interior surface of the tubes. Expressing this rule in a similar manner to the foregoing, it may be said that the heating surface of a cylindrical tubular boiler is equal to $1.5708 \times$ diameter of boiler $\times$ length $+ 3.1416 \times$ number of tubes $\times$ interior diameter of a tube $\times$ length.

Example: A cylindrical tubular boiler has a diameter of 42 inches or $3\frac{1}{2}$ feet, is 16 feet long, and contains 40 tubes, each having an interior diameter of $3\frac{1}{4}$ inches, or 0.283 feet. What is its heating surface?

Answer: The product of $1.5708 \times 3.5 \times 16$ is nearly 89 square feet.

The product of $3.1416 \times 40 \times 0.283 \times 16$ is about 649 square feet.

So that the whole heating surface is 737 square feet.

When the dimensions of a tubular boiler are given, the outside diameter of the tubes is usually stated, so that twice the thickness must be subtracted to obtain the diameter to be used in the calculation. The thickness of tubes by different makers varies somewhat, but those given below are average values, and can generally be used without serious error. The table gives dimensions of standard sizes of tubes, as well as a column of heating surface, which will greatly facilitate calculations.

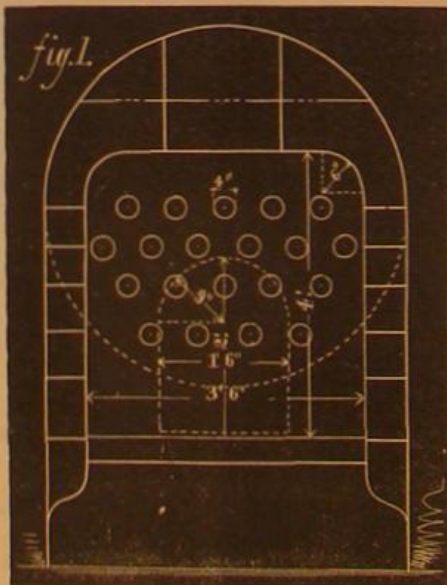
Outside diameter in inches.	Thickness in inches.	Internal diameter in inches.	Internal diameter in feet.	Heating surface in square feet, per foot of length.
1.25	0.072	1.106	0.0922	0.3273
1.5	0.083	1.334	0.1112	0.3926
1.75	0.095	1.560	0.1300	0.4589
2	0.095	1.810	0.1508	0.5236
2.25	0.095	2.060	0.1717	0.5890
2.5	0.109	2.282	0.1902	0.6545
2.75	0.109	2.532	0.2110	0.7200
3	0.109	2.782	0.2318	0.7853
3.25	0.120	3.010	0.2508	0.8508
3.5	0.120	3.260	0.2717	0.9163
3.75	0.120	3.510	0.2925	0.9817
4	0.134	3.732	0.3110	1.0472
4.5	0.134	4.232	0.3527	1.1790
5	0.148	4.704	0.3920	1.3680
6	0.165	5.770	0.4808	1.5708
7	0.165	6.770	0.5642	1.8326
8	0.165	7.770	0.6475	2.0944
9	0.180	8.640	0.7200	2.3562
10	0.203	9.594	0.7995	2.5347

To illustrate the use of the table, suppose it is required to find the heating surface of the tubes in a boiler which contains 60 tubes, each 3 inches outside diameter and 12 feet long. The total length of tubes in the boiler is 12 times 60, or 720 feet, so that the heating surface is 720 times 0.7853 , or about 565 square feet.

(d) Locomotive and vertical boilers: In this class, the furnaces are contained within the boilers. The heating surface of such a boiler is all the surface in the furnace increased by the interior surface of the tubes.

Locomotive boilers: The furnaces of boilers of this class do not all have the same form of cross section, so that the rule for determining the heating surface cannot be, generally, expressed precisely in detail. It may be said, however, that the heating surface of a locomotive boiler is equal to the length of the line bounding the cross section of the furnace $\times$ the length of the furnace $+ 2 \times$ the area of the cross section of the furnace — the area of the furnace door — the number of tubes $\times 0.7854 \times$ (the interior diameter of a tube)² $+ 3.1416 \times$ the number of tubes $\times$ the length of the tubes $\times$ the heating surface of a tube per running foot.

As an example of the use of this rule, suppose it is required to determine the heating surface of a boiler having the dimensions noted in Figs. 1 and 2—Fig. 1 being a cross

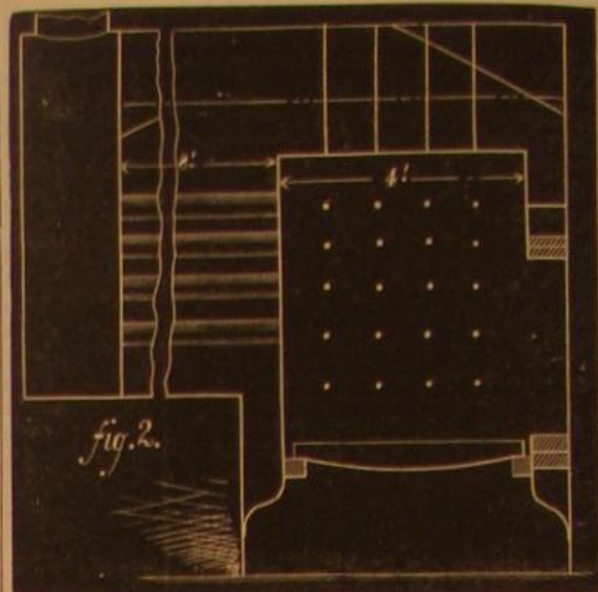


section of the boiler at the furnace, showing also the furnace door in dotted outline, and Fig. 2 being a longitudinal section. The length of the line bounding the cross section of the furnace is the sum of $3.5 \times 2 + 2.5 + 1$ multiplied by 1.5708 , or about 11.07 feet. The area of the sides and top of the furnace is 4 times 11.07 , or 44.28 square feet. The area of the cross section of the furnace is the sum of the products of $3.5 \times 3.5 \times 0.5 \times 2.5 + 0.5 \times 0.7854$, or about 13.89 square feet. The cross section of the tubes is the product of $20 \times 0.7854 \times (0.311)^2$, or about 1.52 square feet. The area of the furnace door is the sum of the products of $1.5 \times 1.25 + 0.3927 \times (1.5)^2$, or about 2.76 square feet. The interior surface of the tubes is the product of $20 \times 8 \times 1.0472$, or about 167.55 square feet. Hence the heating surface of the boiler is $44.28 + 2 \times 13.89 - 1.52 - 2.76 + 167.55$, or about $235\frac{1}{2}$ square feet. This example shows the general method to be employed for locomotive boilers, and the dimensions that are to be taken.

2. Vertical boilers: The furnaces of these boilers are ordinarily cylindrical, so that the rule for the heating surface is as follows: $3.1416 \times$ diameter of furnace $\times$ height of furnace $+ 0.7854 \times$ (diameter of furnace)² $\times$ number of tubes $\times$

$0.7854 \times$ (interior diameter of a tube)² $\times$ number of tubes $\times$ length of tubes $\times$ heating surface of a tube per running foot.

Example: Required the heating surface of a vertical boiler, having the following dimensions: Diameter of furnace, 24 inches, height of furnace, 18 inches, 40 tubes, each 2 inches outside diameter, 6 feet long. The heating surface is the sum of the products of $3.1416 \times 2 \times 1.5 + 0.7854 \times 2^2 \times 40 \times 6 \times 0.5236 = 138.23$, diminished by $40 \times 0.7854 \times (0.1508)^2 = 0.72$, or 137.51 square feet.



These rules might be extended, so as to include sectional and marine boilers, together with some special forms which are occasionally used: but it is believed that they are sufficiently comprehensive to apply to nearly all boilers employed in this country for stationary and portable engines. The simple manner in which they are expressed, and the illustrative examples accompanying them, will doubtless be appreciated by the reader.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The meeting this year is a light one in point of attendance; but the lack in this respect is in a measure compensated for by the absence of ponderously technical papers and the substitution of essays having a more practical bearing upon the scientific questions of the day. While a cardinal object of this association is the interchange of ideas of all kinds among its learned members, the nature of such interchanges should, we think, be subordinated to considerations of public instruction and benefit, and hence dissertations on abstruse points and technicalities unintelligible to all save those versed in the particular branch of Science involved, might well be reserved for dissemination through narrower channels, leaving a clear field for the discussion of subjects within the general public comprehension. It is impossible to publish such papers in their entirety, and equally impossible to prepare fairly intelligible abstracts. We give below a résumé of the essays thus far read.

Professor Lovering described an acoustic method of measuring the velocity of electricity. He stated that a wire from Cambridge to San Francisco, thence back through Canada to Massachusetts, about 7,200 miles in all, transmitted a message in two thirds of a second, and that some of this time was wasted through thirteen repeaters. The system proposed consisted in utilizing the vibrations of tuning forks, which may indicate intervals of one ten-thousandth of a second, or even less.

Professor Farquharson read an account of recent EXPLORATIONS AMONG INDIAN MOUNDS,

which resulted in the discovery of thirty skeletons, several copper implements, and a pulley or spindle wheel of terra cotta. In one skeleton two of the neck bones were found ankylosed, giving evidence of a disease rare at the present time among adults, and from which they only survive by very careful treatment.

Professor E. B. Andrews compared the Ohio and Virginia sides of

THE GREAT ALLEGHANY COAL FIELD.

On the Kanawha there are 3,100 feet of productive coal measures below the horizon of the Pittsburgh coal. The remarkable belt of coal seams found on the Kanawha, between Charleston and Kanawha, on Coal river, on the Guyandotte, and on the upper waters of the Twelve Pole, and on the Tag and Louisa forks of the Big Sandy, is the finest belt of bituminous coal in the United States. The professor traced the probable direction of the great West Virginia geosynclinal trough, and expressed the opinion that it had a connection with the ancient ocean to the southwest by the way of Tennessee.

Professor J. S. Newberry gave descriptions of some newly discovered

ANCIENT FISHES

found in the Devonian and carboniferous rocks of Ohio. Among these was the entire bony structure of the *dinichthys Terrellii*, the hugest of all the old armor-plated ganoids. The dorsal shield weighed 30 pounds. Drawings of another species of *dinichthys* were shown, in which the maxillaries and mandibles were set with teeth instead of being sharp-edged. Professor Newberry explained that the *dipnoans* of Africa and South America, the *lepidosiren* and *protopterus*, were descended from these ancient plated ganoids, and were the last remnants of a group of fishes which in the Devonian age not

only ruled the seas, but were the most powerful and highly organized of living beings. Many other interesting specimens were exhibited by Professor Newberry, all of which will be described in the reports of the geological survey of Ohio.

NEW YORK GEOLOGY.

Professor James Hall read a paper on the geology of the Catskill Mountains, and stated that explorations have proved that the range is composed of several nearly parallel synclinal axes, and the culmination portion, at Lookout and Roundtop, is caused by the slight convergence and junction of three of these synclinals, which are so closely crowded together.

Professor Cope defended the

THEORY OF EVOLUTION

by reference to North American tertiary mammals, commenting on the fact that the human skeleton contains so many characteristics of earlier forms; he said that the quadruman, and afterwards man, had won their way to pre-eminence rather by development of mind than by that of the physical system. It was not so much a case of the survival of the fittest as of the survival of the most intelligent.

There was a debate on the question of:

ARE POTATO BUGS POISONOUS?

Professors A. R. Grote and A. Kayser maintained the negative, and stated that they had boiled down the bugs, producing a colorless liquid, offensive in smell, but clear and alkaline. Other bugs were digested in alcohol. The distilled liquid administered to frogs produced no effect either when introduced into the blood or into the stomach. The tincture killed the frog when injected, but this was due to its acid properties. It was concluded that the bug is not poisonous, and the evil effects noted on burning the insect were probably due to the presence of Paris green.

Professor C. V. Riley replied to the effect that he felt assured of genuine poisoning from the bug, in cases which he had examined. Professor Cope related further experiments on frogs, and said that the frog liquid administered to the reptiles made them very sick. The most plausible suggestion offered during the debate was that the frog poison is probably volatile, and in the process of making decoctions and tinctures, the poison, when heated, escaped into the air.

A PROPOSED INSECT COMMISSION.

A memorial was submitted to the meeting and approved, which addresses Congress with relation to the establishment of a national insect commission. The document states that the damage done by the noxious insects in the United States amounts to \$300,000,000 per annum. The subscribers propose either the reorganization of the Department of Agriculture, under the control of the highest scientific authorities, or the appointment of a commission of five persons, to wit: Three entomologists, one chemist, and one botanist, eminent in their respective branches of science, to be chosen by the Council of the National Academy of Science, and approved by the Secretary of the Treasury, with salaries adequate for the responsible work. The duty of this commission would be to investigate the causes which affect injuriously agricultural interests, and to suggest the best means of diminishing the losses.

The results of such investigations should be embodied in brief reports, containing practical instructions and made accessible at a small price; or the results should be made useful, by personal education, to every farmer in the country.

LOCUSTS AS FOOD.

Professor Riley believes that grasshoppers make a good article of diet. He says that he fried them and roasted them, and that they have a pleasant, nutty flavor. They are equally good eating, either boiled or stewed. We congratulate the professor, both on his gastronomic discovery and on his courage. His name bids fair to be linked by posterity with that of the man who first ate an oyster.

More about insects, a branch of creation which seems peculiarly interesting to the assembled scientists this year, is found in the papers of Professor W. J. Beal and Thomas Meehan. The former discussed

CARNIVOROUS PLANTS;

and after detailing past discoveries, said that the *Martynia* of our vegetable gardens catches immense numbers of insects, one plant of small size destroying 7,200 of its prey. The hairs seem to have small glands at the ends, which secrete a sticky substance. The insect is soon killed and sucked dry.

Professor Meehan disputed several assumptions relative to the

INSECT FERTILIZATION OF PLANTS.

He concluded that the great bulk of colored flowering plants are self-fertilizers; that only to a limited extent do insects aid fertilization—that self-fertilizers are every way as healthy and vigorous, and are immensely more productive than those dependent on insect aid, and that, when plants are so dependent, they are the most fitted to engage in the struggle for life.

Professor Gillman gave a description of his explorations on the upper lakes, during which he found a large number of

ANCIENT HUMAN RELICS.

Many of the skulls were perforated at the highest point, the holes measuring between $\frac{1}{4}$ and $\frac{1}{2}$ inch. Several mounds opened gave evidence of the cremation of the bodies inhumed.

Professor Cope read a fine essay on the

DISTRIBUTION OF BATRACHIA AND REPTILIA IN NORTH AMERICA.

He said that the characteristics of these families are such

as to make them especially useful in the inquiry as to the actual relations between the structures of animals and the physical nature of the regions which they inhabit. The natural divisions of the batrachian and reptilian fauna in America were stated to be six, namely, two east of the plains, the northern or eastern, the southern or austro-riparian; the central, extending from the eastern boundary of the plains to the Sierra Nevada; the Pacific, west of that range; the Sonoran, including New Mexico, Arizona, and a portion of Northern Mexico. Lastly, the Lower California region, embracing the peninsula of that name. The eastern and austro-riparian regions embrace all of the batrachia (especially salamanders) and the turtles; the Sonoran embraces nearly all of the lizard; the Pacific region includes a nearly equal percentage of all the divisions excepting the tortoises. The relations of these distributions to physical peculiarities are as follows: First, as to temperature: The two Southern regions of North America are the austro-riparian and Sonoran. These regions include nearly all the North American genera, and three fourths of the species. In Central America and Mexico, it is the central plateau and the high mountains which support the North American forms, while the South American genera and species are distributed along the Sierra Caliente of the east and west coasts. Thus it is evident that temperature has a controlling influence in the distribution of reptilian life on the North American continent, and that conditions of humidity are effective in determining the distribution of batrachia, and to a less degree of reptilia.

The following officers were elected for the next meeting, which is to be held at Buffalo, N. Y.: President, William B. Rogers, of Boston, Mass.; General Secretary, Thomas C. Mendenhall, of Columbus, Ohio; Vice-President of Section A, Charles A. Young, of Hanover, N. H.; Vice-President of Section B, Edward S. Morse, of Salem, Mass.; Secretary of Section A, Arthur W. Wright, of New Haven, Conn.; Secretary of Section B, Albert H. Tuttle, of Columbus, Ohio; Treasurer, Thomas T. Bouve, of Boston, Mass.; Permanent Secretary, Professor Putnam

Abstracts of other papers read will appear in our next issue.

The Death of Donaldson the Aeronaut.

About the middle of July last, Mr. Washington A. Donaldson, the well known aeronaut, in company with a Mr. Grimwood, a newspaper reporter, started on a balloon ascension from Chicago. The trip was intended to be one of the many which constituted a part of the attractions of Mr. P. T. Barnum's traveling show; and accordingly, after an afternoon performance of the circus, Donaldson and his companion ascended amid the usual cheering of the multitude. All accounts agree to the statement that the balloon and its appurtenances looked dangerously weak. The globe itself was of cotton, and old and weatherbeaten, while the netting showed frequent marks of half-made repairs. Shortly after the balloon had departed, a violent storm arose, the track of which intersected that of the air ship, as indicated by the direction in which the latter was swiftly borne over Lake Michigan.

No tidings of the aeronauts were obtained until after the lapse of several days, when the captains of arriving vessels reported sighting the balloon, close to the surface of the lake and apparently dragging its car in the water. Reports of a similar nature followed, not unmixed, however, with conflicting stories of the safe landing of the travelers; but the latter on investigation proved untrue.

As the public is familiar with Mr. P. T. Barnum's ingenuity in converting all sorts of phenomenal circumstances into useful advertisements for his show, a very large number of persons, ourselves included, suspected that the disappearance of Donaldson was intentional, and that, in due time after the excitement had abated, he would return with some marvelous yarn, eminently attractive to the curious and gullible. The recent discovery of the body of Grimwood on the shore of the lake leaves no question, however, but that the daring aeronaut is actually lost, and that at last, after surviving voyages in paper balloons, and in balloons filled with hot air, after indulging in his taste for blood-curdling gymnastics on the trapeze while above the clouds, *ad libitum*, he at length has fallen a victim to the dangers which he had grown to despise.

In a certain sense, Mr. Donaldson's death is a loss to Science; for although his proclivities tended more toward the sensational, and his achievements were accomplished more by sheer rashness and pluck than through any desire for scientific investigation, still he possessed many qualities which eminently fitted him to be a pioneer in a branch of knowledge regarding which so much remains to be practically discovered. He had considerable inventive ability, and courage enough to attempt tasks before which the majority of men would shrink; and these qualities, coupled with an extended experience, gave fair promise that in the future his efforts might result in useful data toward the solution of the problem of aerial navigation.

DECISIONS OF THE COURTS.

United States Circuit Court.—Northern District of New York

PATENT BARREL HEAD LININGS.—GEORGE A. REED vs. LOUIS REED AND GEORGE FOLTS.

[In equity.—Before Wallace J.—October, 1874.]

The claim of letters patent for an "Improvement in Head Linings for Barrels," granted to George A. Reed, May 11, 1873, namely: "As a new article of manufacture, barrel head linings prepared in the manner specified, when bundled as shown and described"—is invalid.

As both head linings and hoops had been made by machinery, and were articles of trade, and as hoops had also been crimped by machinery, the patentee merely produced an article which was the result of more mechanical skill and care in its manufacture than that previously sold and used; but this result did not involve the faculty of invention.

Although the crimped machine-made head linings are an improvement upon the article used prior to their introduction, and, as such, have secured

the approval of the trade and become a valuable commodity of manufacture and sale, the improvement is not the proper subject of a patent. The sole merit of bundling the head linings is that it renders the commodity more attractive to purchasers, and more convenient for the purposes of sale. There is nothing in this result that is patentable. [James A. Allen, for complainant. John Van Voorhis, for defendants.]

NEW BOOKS AND PUBLICATIONS.

MANUAL OF QUALITATIVE CHEMICAL ANALYSIS. By C. Remigius Fresenius, Director of the Chemical Laboratory at Wiesbaden, and Professor of Chemistry, Natural Philosophy, and Technology at the Wiesbaden Agricultural Institute. Translated into the New System and Edited by Samuel W. Johnson, M.A., Professor of Theoretical and Agricultural Chemistry in the Sheffield Scientific School of Yale College, New Haven, Conn. Price \$4.50. New York city: John Wiley & Son, 15 Astor Place.

This book fills a place in our scientific literature that has for some time been vacant. Nearly all our manuals of analytical science have long been antiquated; and although several small treatises have been issued, in which the latest results of contemporary research have been recognized and the new nomenclature has been employed, the authoritative text book of Dr. Fresenius, to whom, more than to any other master, the progress of this science to its present nearly absolute perfection is due, was in danger of becoming obsolete. Professor Johnson deserves the thanks of the scientific world for the labor and care he has given to the publication of this important work, which now receives as it were a new life. No book on the subject which we have yet seen approaches this in perspicuity and excellence of method. It deals with each subject in a strictly scientific manner, accompanying the student from test to test, and noting down the results and the inferences therefrom with a certainty that amounts to demonstration. We commend it to all students of chemistry, not only for its accuracy and completeness, but for the inductive reasoning employed throughout, which is the very foundation of all scientific investigation.

THE PRIMER OF POLITICAL ECONOMY, in Sixteen Definitions and Forty Propositions. By A. B. Mason and John J. Lalor. Price 75 cents. Chicago, Ill.: Jansen, McClurg, & Co.

Although the authors of this excellent treatise are careful to assert that it is only a primer, we are bound to state that the most elementary truths contained in it are little known to many who claim to be well versed in the science, and especially to have some panacea for the widespread poverty and distress which has reigned in our manufacturing interests for nearly two years. The writers have no fear in placing before the world many unpleasant facts, and in deducing from them a policy which will restore prosperity to our trades. Every ignorant person in the country is now talking tariff and currency; and a little common sense, as embodied in these incontrovertible propositions, is especially welcome at the present time.

NOTES ON BUILDING CONSTRUCTION, Arranged to Meet the Requirements of the Syllabus of the Science and Art Department of the Committee of Council on Education, South Kensington, England. Part I, First Stage or Elementary Course. London, Oxford, and Cambridge, England: Hivingtons. Philadelphia, Pa.: J. B. Lippincott & Co., 717 & 719 Market street.

The author of this work (who modestly conceals his name) states that these notes are compiled for the use of students of building science; but the book is really a valuable text book on the art of practical architecture, treating the subject with thoroughness, and leaving nothing unsaid that could inform the pupil as to the best possible practice. It is well arranged and edited.

UTILITY OF THE SLIDE RULE, a Treatise on Instrumental Arithmetic. By Arnold Jilison. New York city: A. J. Bicknell & Co., 27 Warren street.

The use of ready reckoners saves an immense amount of labor in all trades; and by far the most compendious reckoner is the engineer's slide rule. A little slip of wood with brass mounting, easily carried in the pocket, it gives a means for effecting all kinds of mensuration of surfaces and solids, gaging, weighing metals and other materials, calculating powers of engines and capacities of appliances for transmission of force, and even for reckoning compound interest. Mr. Jilison has written a valuable little book, which fully describes all the uses of this instrument; and he has, moreover, applied the slide rule to many novel purposes, especially in the textile manufactures. We commend this pocket volume to all our readers.

A SUMMER IN NORWAY, with Notes on the Industries, Habits, and Customs of the People, etc. By John Dean Caton, LL.D., Ex-Chief Justice of the Supreme Court of the State of Illinois. Price \$2.50. To be had of all booksellers. Chicago, Ill.: Jansen, McClurg, & Co.

This book is a readable account of a holiday spent in a country which is, in many respects, one of the most interesting in the world. It is generally well written, and the author appears to be observant and accurate; and no doubt the slight touches of egotism with which the volume abounds are almost inseparable from a book of travels, which is nearly sure to be more or less of a personal history.

DESIGNS FOR MONUMENTS. By W. B. Franke, Architect. New York city: A. J. Bicknell & Co., 27 Warren street.

This book contains forty folio plates, showing over one hundred designs for cemetery monuments in all forms and styles. Many of the ideas embodied in the drawings are strikingly original and in good taste; while the variety exhibited enables any one to find a memorial suited to his purpose and his means. The details are all fully elaborated, making the plates serve as working drawings. It is a handsome volume, and does credit to the publishers.

CATALOGUE OF RAILWAY, MACHINISTS', AND MANUFACTURERS' SUPPLIES. By H. A. Rogers. New York city: H. A. Rogers, 19 John street.

This is a very handsome volume of 272 pages, on which is represented nearly every article that can possibly be needed in an engine or machine shop. The engravings are admirably executed; and the book, although but a trade catalogue, gives much valuable information as to many branches of the mechanical arts.

THE WATCHMAKER, JEWELER, AND SILVERSMITH, a Monthly Journal devoted to the Interests of Watchmakers, Jewelers, Silversmiths, Opticians, and Kindred Trades. Subscription, \$1.25 (gold) a year. London, England: 8 Cross street, Hatton Garden.

A readable, well arranged periodical containing much varied information on the trades to which it is specially addressed.

LASALLE'S POCKET MAP OF THE COMSTOCK LODE. Mounted in Pocket Book Form. Price \$2.50. San Francisco, Cal.: Le Count Brothers, 417 Montgomery street. New York city: F. F. Taylor, 16 Broad street.

A neatly executed map of the remarkable district of Washoe, Nevada, in which the intricacy of the mines and their immense capacity are forcibly shown. Some valuable explanatory statistics are added to the volume.

THE SILVER AND LEAD DISCOVERIES IN NEWBURYPORT, MASS., AND ITS VICINITY. With a Map. By Charles J. Brockway. Price 50 cents. Boston, Mass.: A. Williams & Co., 283 Washington street.

This is an historical account of the Massachusetts silver, gold, and lead ores, of which we heard so much a few months since. There does not, at present, seem to be great probability of Mr. Brockway's estimates of wealth being realized.

THE WOOL CARDER'S VADE MECUM, a Handbook of the Woolen Industry. By W. C. Bramwell. Terre Haute, Ind.: Express Printing Company.

An excellent practical treatise, containing much valuable information and some useful tables.

PURCELL'S RAILROAD POCKET BOOK. Price 25 cents. Louisville Ky.: Saxton Publishing Company.

A set of well compiled tables.

Recent American and Foreign Patents.

Improved Sulky Harrow.

Daniel F. Shaw, Hamilton, Mo.—This improved harrow may be readily adjusted to make a wide or a narrow cut, and to work as a diamond harrow or as a double-A harrow. It may also be readily raised from the ground to clear it of weeds, grass, stubble, etc., and for convenience in passing from place to place.

Improved Machine for Making Barrel Heads.

William W. Trevor, Lockport, N. Y., assignor to himself and Francis N. Trevor, same place.—This invention relates to machinery for circling barrel heads by revolving clamps and a circular saw, the clamps being contrived to move the pieces to be sawn up to the saw, and turn them around one revolution, and then move away at the same time that they open to discharge the finished head; and it consists of the apparatus for gearing the shaft of the clamps with the saw arbor to turn it thereby; also the apparatus for closing and opening the clamps; also mechanism for starting, stopping, and allowing the clamps to rest for changing the work; and also mechanism for causing the clamps to turn a little more than a revolution at each operation in combination with an automatic stop, to insure the cutting of the complete circle.

Improved Tower Clock.

Charles Pasoldt, Albany, N. Y.—The invention consists mainly in the separation of the hand-moving mechanism and its actuating power from that of the clock train, and its connection with an unlocking wheel of the main arbor by an intermittently operated planetary motion device, actuated at certain intervals by the hand driving weight, that transmits also motion to the hands on any suitable number of dials above or below the clock.

Improved Galvanic Battery.

Jerome Kidder, New York city.—This invention relates to an improved galvanic battery, with a series of cells in which the fluid is quickly and easily distributed to and emptied from all the cells, and also the action of the same on the elements in an instant interrupted and established, the same being guided reliably and securely to their proper positions in the cells. The invention also relates to a battery casing with a number of longitudinal and lateral partitions forming the cells and with outer higher walls. A longitudinal end reservoir, with horizontal gutter flange and corner spout, assists the filling and emptying of the cells, while a detachable top guide frame with corresponding subdivisions guides the vertically moving elements, applied to a common supporting plate to their respective cells.

Improved Fishing and Similar Floats.

William T. Quinn, Paterson, N. J., assignor of two thirds his right to Will Hague and John Hague, same place.—This is a float contrived to run deep in the water, and have considerable side draft. There is a rod along one side, to which a cord for drawing the float is attached by a ring, so that it will shift from end to end of the rod freely, according to which end of the float the draft is to be applied. This enables the float to be run out readily from the shore, and then be drawn forward and backward at the limit of the line, as a means of carrying fishing lines or running out the float to persons in distress, or to operate a decoy duck.

Improved Ice Velocipede.

Charles M. Day, Elizabeth, N. J.—This invention consists of a screw propeller, combined with a chair or other conveyance for running on the ice, and so arranged that the edges of the vanes or blades run in contact with the ice to impel the carriage, the screw being turned by foot, hand, steam, or other power. Springs support the weight of the carriage, so that the same does not come upon the propeller blades.

Improved Cultivator.

William Weaver, Greenwich, N. Y.—The frame is diamond-shaped, with its obtuse angle cut off. The point of draft attachment may be adjusted higher or lower, as may be required. By suitable arrangements, in digging potatoes, the forward plow will open the hill, hoes will turn the soil over, leaving the potatoes upon the top of the ground, and the rear plow, running a little deeper than the forward plow, will raise any potatoes that may be left by said plow. The hoes may be adjusted wider apart or closer together, according to the distance apart of the rows to be operated upon.

Improved Water Wheel.

Harvey W. Hawley, Walton, N. Y.—This water wheel may be used either in horizontal or vertical position, utilizing nearly the whole head of water, and allowing the adjustment of the buckets to different angles to the wheel, if desired. The invention consists of a water wheel with central web and solid or detachable buckets extending to equal distance and suitable angles therefrom.

Improved Sheet Iron Barrel.

Charles M. Wyvell, Scottsville, N. Y.—This barrel is formed in two parts, having their adjacent edges notched to each other, and secured by the hoops and locking strips. With this construction, the barrel, when empty, can be readily taken apart and nested for storage or transportation, and can be put together when required for use.

Improved Filter.

Henry F. Scherr, St. Louis, Mo.—This invention consists of a filter, composed of a lower reservoir for the filtered water, an upper receptacle with the filtering tube for receiving the water to be filtered, and of an intermediate filtering pan attached to the filtering tube to compel the water to pass first in down, and then in upward, direction through the filtering material.

Improved Anvil.

Edwin Hodgson, Springdale, Me., assignor to himself and Ansel J. Cheney, same place.—This invention consists in a rotary swage or anvil having a number of working faces, which is supported and seated upon a recessed block having its top portions properly conformed to said anvil in shape. To enable the anvil to be raised from the base block, and rotated for the purpose of changing the working face, it is pivoted to and between parallel vertically movable bars.

Improved Document Envelope.

John Pritchard, Maysville, Mo.—This invention consists of an interior fold, open at the sides and closed at the ends, that is applied to an outer inclosing wrapper by being firmly attached at one side and connected by an adjustable band at the other side. It expands and contracts with the thickness of the papers.

Improved Bee Hive.

Hiram Penoyer, Anna, Ill.—Two separate and detachable frame sections are hung into the central chamber from top frames, a sufficient space being provided between the sections for the passage of the air. Each section may be taken out separately, and thereby the swarming of the bees prevented by replacing the full section with an empty one.

Improved Fire Escape.

Andrew J. Culbertson, San Andreas, Cal.—By pulling upon a cord, a lever is operated to push the device from its seat above the window and allow it to drop down to the window sill, where it will be stopped by a ratchet wheel and pawl, and held until the person or persons to descend have taken their places upon the platform. The pawl is then turned back from the ratchet wheel and the device is allowed to descend, the rapidity of descent being regulated and controlled by a brake and hand screw.

Improved Bench Plane.

Charles Bridges, Lowell, Mass.—Devices are provided whereby a plane iron is instantly placed in the stock and guided exactly into its place, being also readily adjusted to any thickness of shavings by the screw bolt. The cutter edge can be squared to the throat or face of the plane by moving a screw slightly to the right or left in the recess of the partition, which is made wide enough for this purpose. The arm piece attached to the handle is adjusted in such a manner that, when the handle is slid forward on the plane stock, the wedge pieces and bottom ribs bind rigidly on the ends of the arm piece, define the position of the handle, and seat the rear part of the handle exactly on the circular rear partition of the stock. The thumb piece of the lengthened screw bolt is then turned up, and thereby the handle securely locked to the plane iron and stock, so that no detaching during use is possible. The invention is an improvement or device of the same inventor, patented December 8, 1874.

Improved Furnace Grate.

Samuel J. La Rue, Russell, Mo.—By vibrating a lever a shaft is rocked, and the grate bars are made to receive a swinging and slightly upward motion, which has the effect of clearing the coal or other fuel from ashes, and renovating the fire. Air cells in the tops of all the grate bars allow the air to circulate over the bars transversely and increase the combustion.

Improved Cutter Head.

Simon P. Randolph, Tehama, Cal.—This is an improved matching cutter for rabbeting machines, by which work may be accomplished without requiring frequent sharpening for keeping the grooves and tongues in proper size. The knives, which make a clean cut without splintering the edge, are curved at the forward end, and made with two lips, for cutting the groove part of the matching boards. The forward curve of the cutter causes the cutting edge to strike the wood square and avoid scraping.

Improved Wash Bowl.

Henry M. Weaver, Mansfield, Ohio.—This is a detachable valve plug, which is fitted into the waste pipe, and provided with sieves attached to its stem, to be raised by a fulcrum lever and connecting rod from the side of the bowl for emptying the same.

Improved Farm Gate.

Amos Callahan, Maryville, Tenn.—This invention consists in combining adjustable diagonal bars with a grate for the purpose of supporting its front end, and thus preventing or taking up sag, or adapting it to pass over an inclined or uneven surface.

Improved Bias Gage.

John A. Hamilton, Chippewa Falls, Wis.—This is a marking and cutting rule, to which is attached another rule or gage parallel to it, so as to be shifted, and having one end beveled, so that, when placed parallel with the edge of the goods to be cut into bias strips, it will gage the principal rule to the proper bias for cutting the cloth. The width of the strips is gaged by the distance of one rule from another.

Improved Brake Shoe.

William Robinson, Jr., Wilmington, Del., assignor to himself and Samuel Harris, same place.—The brake shoe is provided with a recess at the upper end, and with a slot at the lower end, which serve to connect the interchangeable and detachable sole part by a top hook, locking into recess, and by a perforated lug passing through the lower slot. The ear is firmly secured to the shoe by a suitable key.

Improved Oiler.

George F. Dutton, Farmington Falls, Me., assignor to Eliza C. Dutton, of same place.—This is an oiler having a chamber above the reservoir, in which is a glass tube which screws into the opening at the top of the reservoir, and which forms a tightly packed joint at the top of the chamber. The chamber is rigidly attached to the discharge nozzle, and is screwed on to the collar of the reservoir.

Improved Road Scraper.

Jacob W. Wilson, Summerford, assignor to himself and Addison Shanklin, London, Ohio.—This invention relates to that class of rotary road scrapers in which the scraper box and the handles are connected and disconnected for revolving the scraper by manipulating the handles. The latter are attached to the draft yoke eccentrically to the connection of the yoke with the scraper, in such manner that the scraper is detached by swinging the handles upward, and connected by swinging them downward. The invention consists of a guard hook, in combination with the connecting devices, to prevent disconnection by the downward movement of the handles.

Improved Marking Board for Pin Pools.

George H. Decker, Belleville, N. J.—This relates to such an improvement in marking boards for pin pool that the numbered balls may be taken out without the annoyance of dropping the same on opening the slide gates or hinged caps at present in use. The invention consists in recessing the marking board for the round or otherwise shaped plugs that contain the balls securely in concave recesses.

Improved Car Coupling.

John A. Acton, Jackson C. H., Ohio.—The invention consists of a drawhead with a crooked pin bar, that swings in a longitudinal top slot of the same, and is keyed at the rear end to a lateral shaft with ratchet wheel and pawl, and provided at the front end with the pivoted coupling pin. The release of the pin-controlling ratchet, either from the sides or top of the car, drops the pin through the link, which completes the coupling operation.

Improved Compound for Flavoring and Preserving Tobacco.

George E. Sterry, New York city.—This is an improved compound for sweetening, flavoring, and preserving tobacco, formed of powdered salt and licorice root.

Improved Hot Air Furnace.

Thomas Langstrath, Germantown, Phila., Pa.—The smoke pipe leads out of the top of the combustion chamber into a horizontal pipe, going through the furnace from front to rear, and on the latter side receiving a dust pipe, leading up from the ash pit, to carry off the dust when the ashes are shaken down. At the front of the horizontal pipe is a damper, to be opened to let in air to check the draft without opening the furnace door and letting cold air in directly on the hot plates.

Apparatus for Separating Gold from Sand, etc.

Thomas W. Irvin, Eureka, Cal., assignor of one half his right to Alex. Gilmore, A. Dolan, E. Brown, and Maurice F. Moloney.—This invention consists of suitable apparatus for drying and separating the sand, and conveying the same by an elevator to a system of connected channels and conductors, in which the heavier gold particles are separated from the sand by the current of an exhausting fan, and the current of air and its force is changed and regulated by adjustable valves, while additional chambers or receptacles collect the finer mixture of gold dust and sand for transmission to the amalgamator.

Improved Toy.

George F. Morse, New York city, assignor to himself and Joseph F. Tobin, of same place.—This is a recessed ball, mounted with a bell forming a part of the spherical shape of the same, and sounded by a spring clapper or other device within.

Improved Revolving Horse Rake.

John H. Randolph, Jr., of Bayou Goula, La.—This is an improved sulky rake, designed especially for pulling pea vines for hay, and leaving them in bunches to dry. By the provision of detachable stop blocks any pitch of the rake teeth may be given, and the stops can also be thickened to the required point by applying one or more additional pieces thereto. There are also improved devices for holding and tipping the rake head.

Improved Apple Corer and Slicer.

Charles E. Kimball, New York city.—The invention consists of quartering blades radiating from a common center, in which is a revolving shaft carrying a couple of bow-shaped knives, which, being turned after the quartering blades have been pressed into the apple, will cut out the core, after which the quartering blades, being driven down through the apple, will finally separate the cored quarters.

Improved Boiling Pot.

W. H. Hennaman, and W. F. Shaw, Jr., 19 S. Chester street, Baltimore, Md.—The invention consists in a sectional boiler having opposite flange grooves, sliding plate, and a cover hinged to the top of a vertical partition.

Improved Warming Apparatus.

John F. Reilly, Washington, D. C.—The invention consists in an overflow pipe and a longitudinal steam pipe between cover and pan, together with a steam coil extending under the warming plate and provided with discharge outlets.

Improved Crank Motion.

Charles E. Whipple, North Charlestown, N. H.—This invention consists of a connecting rod connected to the crank pin by a slotted hole, and extended beyond it and connected to another crank, which is pivoted eccentrically to the axis of an idle wheel, on which it is mounted, and is carried around with the connecting rod. By this arrangement, when the main crank pin is on the centers the connecting rod ceases to pull or push on it on account of the slot, but continues to pull or push on the auxiliary crank, which, not being on the center, carries the rod laterally against the main crank pin, and thus carries it past the center.

Improved Hook Bale Tie.

William Greet, Mooresville, Ala.—One end of the ball band is passed into a hole on a separate locking piece, back through another aperture, and then is doubled over. The other end is bent to form a loop, pushes through a hole in the locking piece, and is secured by a pivoted hook on the latter.

Improved Earth Auger.

Joseph E. Hall, Paxton, Ill.—The door is attached by points at the lower end and the stud screws at the upper end of the edges, engaging with the sockets and notches respectively, in the barrel, the edges being fitted inside of the edges of the barrel, and fastened by a screw. The lip is hinged to the under side of the bottom of the barrel in the clearance, where it does not obstruct the turning of the auger, and it is contrived to drop down on the bit when the auger is raised, and convert the auger into a sand bucket by closing the throat. The bit is attached by a dovetail-shaped shank on it, and a corresponding socket in the auger bottom, for readily detaching it.

Improved Miter Box.

Peter Johnson, Wauconda, and Nicholas H. Johnson, Blackberry, Ill.—The table is supported on pivoted base arms that may be folded to the under side of the table after use. A sliding spring-cushioned sleeve supports, on branch arms with end sleeves sliding on pillars of a revolving base plate, a saw guide frame, which extends downward below the supporting disk, and carries in forked guide ends the saw for cutting the miter.

Improved Tyre Tightener.

Henry A. R. Horton and Amos P. Hayes, McKinney, Tex., assignors of one half their right to John H. Owen.—The joint is composed of two nuts connected together by a bolt with right and left threads. In the center of the bolt there is an enlarged piece of octagon shape. The bolt, when screwed entirely up, enters into holes made in the ends of the felloes. In one end of the tyre a tongue is cut, and in the other end there is a slot into which this tongue fits. The miter joint, formed by tongue and slot, is intended to prevent the ends of the tyre from springing apart laterally. The joint is covered underneath by a clip made so as to fit up to the edges of the tyre. The ends of the felloes are cut into blunt wedge shape, and covered by thimbles, and the nuts are so shaped that the thimbles fit into them exactly.

Improved Clothes Wringer.

William T. Bunnell and Anson G. Ronan, Ottawa, Can., said Ronan assignor to said Bunnell.—When a handle roller is forced down, spring cams bear upon friction rolls and force the upper rubber roller downward in contact with the lower rubber roller, and in doing that the crabs in which the lower roll revolves are made to clasp the tub or vessel, while the handle roller serves as a guide to conduct the clothes between the rollers.

Improved Milk Cooler.

Oswel H. Willard, Randolph, N. Y.—The invention consists of milk pans and vats constructed with bottoms with diagonal pitch or inclination toward the lowest corner, at which the tightly-sealing milk outlet is arranged, that may be readily detached for allowing the separation of pan and vat for cleaning purposes.

Improved Cistern Cover.

Sebastian Haffter, Highland, Ill.—The invention consists of a flanged cast iron well cover, provided with supporting standards for the pump stock or pump chain tube, a hinged lid, and filtering basket below the lid. The cover admits ready access to the cistern for repairs, and allows the taking out of the pump stock or casing without removing the well cover.

Improved Metallic Truss Bridge.

James Valleley, Canton, Ohio.—The stay or brace pieces are formed of a wrought metal plate having its end portions in different but parallel planes, and joined by a middle portion, which is inclined at about an angle of forty-five degrees thereto. The said end portions constitute what may be termed the feet of the braces, and are perforated to receive the bolts by which they are secured in the arch. One foot is bolted to the upper and the other to the under plate of the chord, the length of the inclined middle part determining the distance between the plates.

Improved Clothes Pin.

Uriah D. Mihlis, Fond Du Lac, Wis.—The notch of a block is passed over the clothes line, and a key is forced down, clamping the line between its edge and the side of the notch in the block.

Improved Gang Plow.

Eugene P. Pulliam, Palmyra, Mo.—This invention includes simple devices which enable the altitude of all the beams to be simultaneously regulated.

Improved Shoe Fastener.

George P. Reeves, Helena, Montana Ter., assignor to himself and Charles Rumley, of same place.—This consists of a lacer applied by prongs to the leather or other material, and provided with a central concavity and surrounding ridge, open toward a hook-shaped part, which is turned back far enough to prevent the catching of the dress or other objects thereon.

Pure Water.

From the days of the old Romans down to the present time, political economists have sought for an abundant supply of pure water as the first great need of any great city. The question, today, when railroads and manufactures concentrate humanity at so many points, is of more importance than when settlements were made merely where nature has provided a full supply of the true water of life. Our great cities are all seeking an additional water supply, and in many the water now received is expensive and unsatisfactory in quality from the immense waste and deterioration consequent on a faulty system of piping. Many different materials have been used for the conveyance of water long distances. The old Roman aqueducts brought water of only the purity of ordinary streams, open to sun, air, dust, and like minor evils, a style not feasible in this day or country. The first American aqueduct of which we have cognizance, that at Portsmouth, N. H., in operation in 1790, brought water through heavy pine logs, and so continued up to a year or two since. Lead has proved dangerous for piping, and lined with tin has been found enormously expensive for a doubtful result; while plain cast and wrought iron rust and corrode; iron lined with cement, glass or porcelain, has been found impracticable, on account of a lack of elasticity; and galvanized iron, which it was hoped would solve the problem, has been found seriously affected by the various salts and alkalis held in solution by the water conveyed therein.

Again, the dependence of a city or large town on a single main of great size has been a cause of disaster from any defect therein, and the future water supply will be doubtless through a number of smaller mains, each independent of the other, thereby precluding any possibility of a general failure. The National Tube Works Company of Boston, Mass., and McKeesport, Penn., seem to have solved the problem as to a perfect pipe, furnishing a seamless lap-welded wrought iron pipe, of from one half to fourteen inches diameter, coated inside and out with an indestructible elastic enamel, and capable of withstanding a pressure of 1,000 pounds to the square inch. The coating resists all known corrosives, and is elastic enough for all working purposes, while all the connections are made by a sleeve joint that prevents any leakage.—*Boston Daily Globe.*

Business and Personal.

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

Owners of Steam Engines—We guarantee 25 per cent extra power or an equal saving in fuel, by applying the Ransom Syphon Condenser. T. Sault, Consulting Engineer, General Agent, New Haven, Conn.

Hotchkiss & Hall, West Meriden, Conn., Foundrymen and Workers of Sheet Metal. Will manufacture on royalty Patented articles of merit in their line. Small Gray Iron Castings made to order.

Advertising Agencies.—It is a fact that all those persons doing a business which requires extensive advertising, and who from the mode of conducting it are able to arrive at a close approximation of the results produced by each separate investment in this way, are universal in the opinion that better contracts can be secured through a well-established Advertising Agency like that of Geo. P. Rowell & Co., New York, than can be obtained from publishers direct, no matter how familiar with rates and papers the advertiser may be. It stands to reason that an agency, controlling patronage to the extent of from fifty to one hundred thousand dollars per month, should be able to secure favors which would not be accorded to any mere individual, even if we omit entirely the benefits which they must derive from their extensive experience.—[Exchange.]

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Moulder Wanted—Must be fully competent to take charge of Foundry for general machinery castings—mostly engine and mill work. References required. Apply to P. O. Box 99, Galt, Ontario, Canada.

Makers of machines for splitting fire-wood, send circular and price to Hoopes Bro. & Darlington, West Chester, Pa.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

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.

Bolt Headers (both power and foot) and 1 Power Hammer a specialty. Forsyth & Co., Man. Hester, N. H. See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 141.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

\$17 Foot Lathes. Geo. F. Shedd, Waltham, Ms. Scale in Rollers Removed—No pay till the work is done. Send for 34 page pamphlet. George W. Lord, Philadelphia, Pa.

1, 2, & 3 H.P. Engines. Geo. F. Shedd, Waltham, Ms. For Sale—Large lot second hand Machinery Tools, cheap. Send for list. I. H. Shearman, 43 Corns-street, New York.

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

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

"Lehigh"—For information about Emery Wheels &c., address L. V. Emery Wheel Co., Weissport, Pa. American Metaline Co., 61 Warren St., N. Y. City.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 28 Cornhill, Boston, Mass.

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

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Notes & Queries

A. J. B. can harden screw plates and dies by the process given on p. 75, vol. 23.—A. K. will find that imitation pearls are described on p. 250, vol. 30.—R. F. will find a recipe for liquid glue on p. 250, vol. 30.—R. K. W. will find a description of a good cheap telescope on p. 293, vol. 32.—F. J. will find a recipe for a cement for millstones on p. 251, vol. 31.—L. H. R. will find rules for proportioning safety valves on p. 330, vol. 32.—S. H. D. will find a rule for ascertaining the horse power of an engine on p. 33, vol. 33.—B. J. F. will find rules for ascertaining the required pressure of water in pipes on pp. 73 to 79, *Science Record* for 1873.

(1) H. E. says: I have tried the recipe for indelible ink, and cannot dissolve the prussiate of potash. I tried to dissolve it in benzine, to mix it with printer's ink; but it will not dissolve. I also tried alcohol: it would not mix with the ink. What is the matter? A. What recipe do you refer to? Yellow prussiate of potash is soluble in water. 2. Is there anything that will make printer's ink indelible? A. Carbonaceous substances, such as asphalt, with proper solvents, have been used for this purpose.

(2) F. A. asks: 1. By what process can I make a good nickel solution for nickel plating? A. Use a strong solution of the cyanide or double sulphate of nickel and ammonia, obtained by dissolving the salts in hot water until the solvent is nearly saturated. 2. What is the proper quantity of cyanide of potassium? You mention 1½ ozs. to 1 gallon. Would it not make a very weak solution? A. Use water 1 gallon, cyanide of potassium 12 ozs., cyanide of silver 1½ ozs.

(3) Y. P. asks: How long must I leave a pistol cylinder in a gold solution, so that the coating will last a year? A. About 24 hours will give a good deposit. It is not necessary to disturb it until finished. 2. Will an old watch case do to make the solution? A. Yes. A gold solution made with a battery is a good one for the purpose.

(4) F. H. J. asks: 1. Would a 1½ inches achromatic objective glass, of 30 inches focus, and a plano-convex lens, of ¼ inch diameter and 1 inch focus, answer in constructing a telescope as described on p. 7 of vol. 30? A. The 1½ inches objective is rather small for 30 inches focus. The plano-convex lens of ¼ inch diameter and 1 inch focus for an eyepiece will not answer very well. The eyepiece should consist of two lenses, both plano-convex and with the flat side to the eye, one of, say, 1 inch focus near the eye, and one of 2 inches focus at the distance of 3 inches from the first. 2. Which is the best for an eyepiece, a plano-convex or a double convex lens? A. Plano-convex lenses are better than biconvex. 3. How can I make a terrestrial eyepiece and a celestial eyepiece? A. A celestial eyepiece consists of one set, that is, two such lenses; a terrestrial eyepiece consists of two such sets. A celestial eyepiece shows inverted images. The additional pair of lenses in the terrestrial eyepiece reverts the inverted image to its natural position. 4. Would the above telescope, if fitted properly, be powerful enough to see Jupiter's moons and Saturn's belts? A. If a good one it may do to see the satellites of Jupiter, but not Saturn's belts. 5. What work on the telescope would you recommend for an amateur without a teacher? A. There are many books on the microscope, but few or none on the telescope alone. In some of the larger treatises on physics, such as Billman's, Ganot's, etc., you may obtain some special information on various points.

(5) H. L. G. says: The following question involves the principle of the hydrostatic paradox, that the pressure of fluids is according to the height and surface pressed upon, and not according to the quantity pressing. This is evident in case of water; but does it hold also in the case of air pressing upon itself under the same circumstances, either with or without forcing? Of course it would require a vacuum opposite to make the test. A. Yes.

(6) S. M. L. asks: What is the best material for belts to which slats three quarters of an inch in width are to be fastened, the belts to run over rollers three and five inches in diameter, the larger being the driving roller? A. Try a flat chain.

1. What is compressed air? A. It is air, the volume of which has been considerably decreased by

pressure. 2. Is it as elastic as steam, or more so? A. It is more elastic at low temperatures. 3. If compressed air be confined, would it lose its elasticity? A. No.

Would a wheel that would start itself on an axle and keep on continually revolving, moved only by an eccentric weight of its own, be considered perpetual motion? A. Yes.

(7) L. W. says: I am coppering cast and malleable iron by dipping in a solution of sulphate of copper; but the copper does not attach itself as permanently to the malleable iron as to the other. What is the remedy? A. Clean the surface well by dipping in dilute oil of vitriol, and scouring with sand.

(8) D. B. T. says: I have long had a theory that the absorption of air by water decreases its cohesion to an extent unthought of by our best scientists. It is a well known fact that water absorbs about four per cent of air under one atmosphere's pressure, and that the absorption goes on in the same ratio with every increase of pressure. It is easy to conceive of a condition of things when the air under an enormous pressure would penetrate the intermolecular spaces of the water, to an extent sufficient to dissociate its elements and probably form a new combination and produce a new gas. A. There is no doubt that the addition of air to the water of a steam boiler, and even to the steam itself, is effective in increasing pressure. This was verified by Professor Rogers of Philadelphia, Pa., who even made it a matter for a patent, and constructed an engine which illustrated the difference of admitting and excluding air. But that air, under great pressure, would be able to penetrate the intermolecular space of the water, so as to dissociate its elements and form a new combination or gas, is a totally unsupported hypothesis; and we fear that your drawings for a generator and engine to work this gas, if it exists, have been labor wasted.

(9) S. A. R. asks: What is the best material used for filling fireproof safes? A. Plaster of Paris and alum, usually.

(10) C. H. M. says: Your correspondent I. S. M. asks for a rule to find the size of hole in which a thread is to be cut, and at the same time gives the following: Deduct from diameter of the screw 1¼ times the pitch. Is not the following rule more accurate? As most of the threads used in this country are cut on a 60° angle, by taking the cosine of 30° the angle, that is, 0.8660, and multiplying it by the pitch, then doubling the result, and deducting it from the diameter of the screw, you will have the proper size for the hole. To illustrate the above rule: Let pitch be 0.10", diameter of the screw 1"; then 0.1" × 0.8660 × 2 = 0.1732; 1" - 0.1732 = 0.8268. By I. S. M.'s rule: 1 - 0.15 = 0.8500, giving a difference in size of hole of 0.0232. A. Below are the rules for proportioning the American standard screw, which is flattened at top and bottom. D = outside diameter of screw. d = diameter of hole in the nut. p = pitch of screw. n = number of threads per inch. (All dimensions in inches.)
$$p = \frac{16D + 10 - 2909}{1664} \cdot \frac{1}{n} \cdot \frac{1}{p} \quad d = D - 1.299 \times p = D - 1.299$$

If the thread is not flattened at top and bottom, $d = D - 1.732 \times p$. For a screw, not flattened at top and bottom, with any angle, α , of thread, $d = D - \cotangent \frac{\alpha}{2} \times p$.

(11) W. F. R. asks: Which will last longest in an upright boiler, cast or wrought iron grates? A. Cast iron, generally.

(12) E. P. says: In an article entitled "Work for Arctic Explorers," you make the following statement: "In longitude 112° W. of Greenwich, the explorers will have arrived between the north pole and the magnetic pole." I do not understand how this can agree with a previous statement: "When 40° E. of Greenwich is reached, the north pole will lie between the explorers and the magnetic pole." Has the magnetic pole magnitude, or was there a mistake in printing one of the above mentioned numbers? A. The magnetic pole in question has very considerable magnitude: it covers an area of many square miles. This, however, is not the sole cause of the paradoxical compass bearings mentioned in our article. You are doubtless aware that there is another north magnetic pole on the Siberian side of the geographical pole; and the lines of magnetic direction are still further complicated by magnetic conditions which have not yet been fully made out. The statements of our article on this point were founded as stated therein on the compass directions laid down on a provisional map constructed for the expedition lately sailed, by the hydrographer of the British Admiralty, showing the magnetic conditions which may be expected in all unexplored polar regions if the distribution of terrestrial magnetism based on the knowledge acquired up to the present time, and elaborated by Gauss, Sabine, and others, turns out to be correct. If the compass bearings of any point could be predicted from its geographical position, or its position from its compass bearing from a known point such a map would be unnecessary, and the difficulties of arctic exploration would be greatly lessened; they are seriously complicated when the voyager has to rely so largely on the guidance of an instrument, the behavior of which he is unable to predict with any certainty. The provisional maps supplied to the British expedition will doubtless prove of great assistance, though they lay down merely what is probable.

(13) F. R. B. says: I have an achromatic microscope, powers from 20 to 100 diameters. I would like to construct with it an astronomical telescope. What sized object glass would it require, and of what focus? Should it be achromatic? A. Object glasses for astronomical telescopes must be achromatic, and may be had of all sizes and focal length, varying from 2½ to 3 inches in diame-

ter and 3 or 4 feet focus to those of 27 inches diameter and 30, 40, or more feet focus.

(14) G. W. P. says: 1. I require from a magnetic engine as much power as a man would exert by opening and closing his thumb and forefinger 60 times a minute. Can I get this much from two Lédanbé cells? A. Yes. 2. How many, and what sized, magnets should I use? A. Make your magnets so that the weight of the wire and the iron are equal, and determine the size by experiment. Two magnets are sufficient. 3. Can I gain more power by using more battery, or by less battery and more magnets? A. Make the cores thin and the poles thicker and use more battery.

(15) A. S. asks: Can a lamp wick be lit by electricity? A. Not unless surrounded with gas.

(16) L. J. S. says: D. L. B. asks if a solid bar of steel or iron would sink in the ocean in the deepest part, or float when the amount of water displaced equaled in weight the bar of iron. I wish to say that the weight of a body, specific or otherwise, depends on its density. As water is only slightly compressible, how could it be made as dense as iron? If it were so compressible that it could be made as dense as iron, it would be no longer water but a solid. The pressure of water has nothing to do with bodies floating and sinking in it. A. We would be glad to know your reasons for this conclusion.

Would it expand the air beyond its present limits to lessen the gravity of the earth? Suppose, for instance, that the material of which the earth is composed were several times lighter, would not the air be much more rarefied and reach much beyond its present height? A. Yes.

(17) F. W. H. asks: Is it practicable to make a machine to run by a weight or spring, that will take the place of a Grove battery in plating small articles, such as watch cases, spoons, etc.? A. No.

(18) W. E. D. asks: 1. In an exhausted Lédanbé battery, which needs replenishing, the oxide of manganese or the gas carbon? A. The manganese. 2. Will not a sheet of lead or copper answer as well as carbon to put in the porous cell, to make the positive pole of the battery? A. No. 3. Is there any metal that will take the place of zinc or platinum for making the negative pole of a battery? A. Nothing so good as zinc. Platinum forms the positive pole. Iron can be used in place of zinc, but it is not so good. 4. Will not a porous cell made of common stoneware (unglazed) answer as well as the ones we buy? A. Yes. 5. Cannot the above cells be made at any pottery, and should they be glazed or unglazed? A. If glazed they will not be porous. 6. What kind of pitch or resin is used to seal Lédanbé batteries, and is it necessary to seal them? Will they not work as well if left unsealed? A. Shoemaker's wax will do. The sealing is done to prevent evaporation. They will work if not sealed, though not for so long a time.

(19) W. P. asks: What is the smallest magnet I can use, and what are the amount and size of wire required for it, to move a small latch of a door? A. A magnet 1 inch long will answer with 200 feet of No. 20 wire.

(20) F. W. R. says: In your article on the instability of the earth's surface, you state that the coast of Texas was rising at a comparatively rapid rate. This statement is certainly a very erroneous one, and I draw this conclusion from these facts: In 1841 I landed first in Texas, on Galveston Island. The place was but little elevated above the waters of the bay, but the street called Strand was above the ordinary tides; and was only overflowed after winds from certain quarters. It has been filled up to a height of several feet, and is now barely above high tides. Salt water was reached at a depth of four or five feet, and is, I think, still found at that depth. The tide reaches the town of Houston and marks about a similar point on the wharf. I have often heard it said that our coast was rising; but so far as my appreciation of it goes, the rise must be very slight during the last thirty-four years. A. You must consider that the coast of Texas along the Gulf of Mexico is between 300 and 400 miles long, and that the northeastern portion, adjoining Louisiana, is of the nature of the latter State. It has not been asserted that Houston is rising; but 300 miles south west of that place, near the mouth of the Rio Grande, it adjoins Mexico; and the condition is very different there, as the strata partake more of the volcanic nature prevailing in Mexico. It has been repeatedly stated, by those who visited that region 40 years ago and recently, that it is rising. It is a very common occurrence that a coast line descends or is stationary in one part; while, at a distance of 300, 200, or even 100 miles, a gradual rising takes place.

(21) S. K. L. says: A friend and I had a dispute as regards the ground wire of a telegraph. He says the ground current takes a direct line from one point in the earth to the other. I say it takes the course of the line wire. Which is right? A. It takes the course of a direct wire having no resistance.

(22) W. M. D. says: I wish to construct an electro-magnet and get as much force as possible with a given amount of material. Will 200 feet of No. 20 wire wound on 4 soft iron cores of U shape, each weighing ¼ lb. and each having 50 feet of wire, be as effective as 200 feet of No. 20 wire wound on 1 core weighing 1 lb. or as much as all the 4 small ones put together, the battery to be the same for the large one that is used for all 4 of the others at one time? A. Yes.

(23) F. R. says: I have a plating shop, and find great trouble with batteries. I was thinking of getting a friction battery to do gold, silver, and nickel plating with. How could I make a cheap one, to go by steam? A. You can buy magneto-electric machines for the purpose. You could hardly make one without great labor and expense

(24) I. H. R. asks: Can you tell me how to make an electro-magnet that will work very slowly? A. We cannot.

(25) W. R. B. says: Is there any method in use of blowing a church organ by the use of a heavy weight acting through a system of clock-work? A. Yes. A weight of 7,000 lbs. with a fall of 30 feet, and proper gears, will drive the bellows of an ordinary church organ for half an hour.

(26) C. E. J. says: 1. I have made an induction coil, 12 inches long and 6 inches in diameter, in the following manner: I took a piece of hard rubber tubing, 1 1/4 inches in diameter and 13 inches long; I put in 7 inch heads, 1/4 inch thick, of dry varnished walnut. I wound 4 layers of No. 16 cotton-covered copper wire for the primary coil, I then wrapped around the primary coil two thicknesses of manilla paper, thoroughly saturated in white paraffin, to insulate it from the secondary coil; my secondary coil was composed of between 7 or 8 miles of fine insulated green silk-covered copper wire, part being No. 30 and part No. 35 relay wire; and between each layer of wire, I wrapped a sheet of paraffined paper. My core consisted of a number of small iron wires soldered together and slipped inside of the rubber tubing; my condenser consisted of 24 sheets of 12 inches square tin foil, each sheet separated by a sheet of paraffined paper, the alternate sheets of foil being connected together. I have connected the condenser with the coil in three different ways, with about equal results; the longest spark that I ever got out of it was 1/4 of an inch. Please tell me the defects of this machine. A. For full particulars regarding the construction of induction coils, see page 115, vol. 53. The principal faults in your machine consist in the soldering of the wires forming the core, and in the construction of your condensers. The bundle of wires forming the core should neither be soldered together, nor surrounded with a metallic substance. One side of the condenser should be connected to each side of the break piece in the primary circuit, the object being to furnish a reservoir for the extra currents to flow into when the primary circuit is interrupted, and thus prevent the spark. You should use a Bunsen battery instead of a Smee. 2. If made properly, how long a spark ought it to give? A. The length of your spark will depend upon the size of your battery.

(27) G. E. G. says: 1. Is it practicable to allow for the expansion of shafting of 2 3/4 inches diameter and 220 feet long, running at 82 revolutions, when the temperature is from 65° to 70°, there being on the line two sets of bevel gears containing 30 and 36 teeth of 3/4 inches pitch, running shafting at right angles? A. Yes. 2. What should be the angle of gears containing 30 and 36 teeth, of 3/4 inches pitch? A. About 40°.

(28) C. H. says: A friend claims that four persons, holding their breath, may lift, with one finger each, a fifth person from the floor, he also holding his breath. I have tried it without success, but my friend says that he has seen it done at various times. What do you know about this experiment? A. We have told all we know about this matter (and it is very little) several times before. We have never seen the feat performed, but we have heard about it so often that we are inclined to think it may be true. As we have remarked before, however, it is certain that the person who is lifted does not lose any weight by holding his breath, neither do the lifters gain any strength by the process.

(29) W. J. B. asks: In heating a room, would it require more fuel to do it by ordinary steam, or to take ordinary steam and superheat it? In other words, would it be more expensive to continue to generate ordinary steam for a given number of hours, and use this for heating a room, or to convert ordinary steam into superheated steam, estimating the cost of the superheated steam from the time you began to superheat it, and not counting the cost of generating it in the first place? A. The second plan would be the most economical.

COMMUNICATIONS RECEIVED.

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

On Paris Green, and on the Keely Motor. By G. W. P.
On Repairing Bells. By C. S.
On Bee Culture. By E. C.
On Draft of Vehicles. By M. W. W.
On Large and Small Axes. By F. W. D.

Also inquiries and answers from the following:
A. J. K.—N. B.—E. T. H.—B. W.—W. B. P.—N. K.—H. B.—F. J. W.—J. C. T.—H. T.—J. K.—T. W.—J. D.—B. L.—W. P.—N. K.—O. P. R.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, the Editor declines them. The address of the writer should always be given.

Inquiries 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 inquiries analogous to the following are sent: "Who sells telescope lenses? Who makes machinery for grinding lenses? Whose is the best vertical boiler? Who makes a good flocking machine? Who sells the best plow for use on heavy lands?" 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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DESIGNS PATENTED.

8,554.—Cra. — Hooper et al., Portland, Me.

8,555, 8,556.—INKSTANDS.—C. Kitchell, New York city.
8,557.—CLOCK CASES.—W. F. Muller, New York city.
8,558.—STOVE KNOB.—J. F. Quimby, Troy, N. Y.
8,559.—TYPE.—J. K. Rogers, Brookline, Mass.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA August 7, 1875.

5,009.—J. G. Eberhard, Akron, Ohio, U. S. Name, August 7, 1875.
5,040.—M. McCall et al., Buffalo, N. Y., U. S. Cutting attachment to lead pencils. August 7, 1875.
5,041.—A. B. Drake, Painesville, Ohio, U. S. Fence post base. August 7, 1875.
5,042.—W. H. Lotz, Chicago, Ill., U. S. Hot air furnace. August 7, 1875.
5,043.—J. Keddy, New York city, U. S. Securing knob roses to doors. August 7, 1875.
5,044.—J. L. O'Connor et al., Monroe Village, Wis., U. S. Pruning shears. August 7, 1875.
5,045.—A. Berry, Waterloo, P. Q. Churn. August 7, 1875.
5,046.—J. Buel, Chattanooga, Tenn., U. S. Safety stirrup. August 7, 1875.
5,047.—S. P. Littlefield, Lynn, Mass., U. S. Station indicator for railway carriages. August 7, 1875.
5,048.—H. A. Schandevyl, East Sangus, Mass., U. S. Corset. August 7, 1875.

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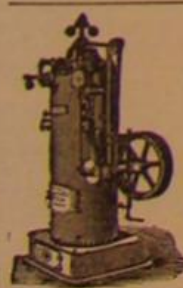
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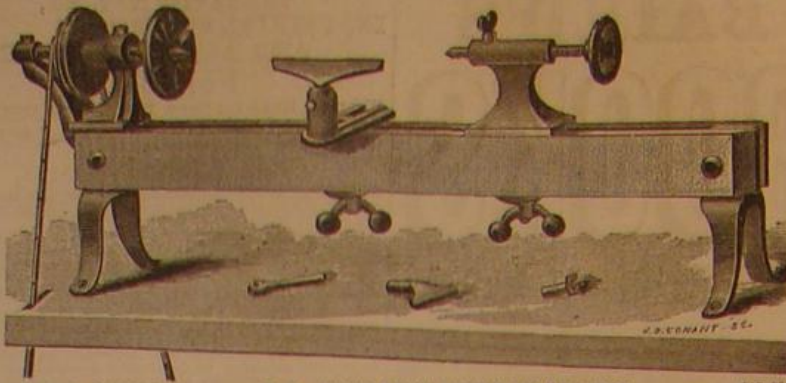
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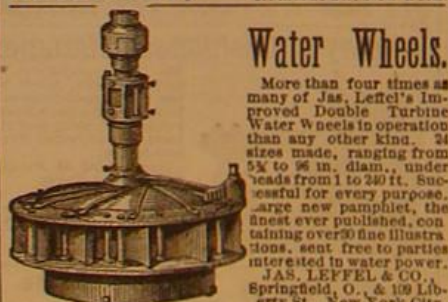
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Vol. XXXIII.—No. 11.
(NEW SERIES.)

NEW YORK, SEPTEMBER 11, 1875.

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THE CENTENNIAL BUILDINGS.

We have already placed before our readers views of the Main Building and the Art Gallery, now being erected for the Centennial Exposition, in Fairmount Park, Philadelphia, Pa.; and we herewith publish a view of the Horticultural Building, a large conservatory: an extremely ornate and commodious building, which is to remain in permanence as an ornament of Fairmount Park. It is located on the Lansdowne Terrace, a short distance north of the Main Building and Art Gallery, and has a commanding view of the Schuylkill river and the northwestern portion of the city. The design is in the moresque style, the principal materials externally being iron and glass. The length of the building is 383 feet, width 193 feet, and height, to the top of the lantern, 72 feet.

The main floor is occupied by the central conservatory, 230 by 80 feet, and 55 feet high, surmounted by a lantern 170 feet long, 30 feet wide, and 14 feet high. Running entirely around this conservatory, at a height of 20 feet from the floor, a gallery 5 feet wide will be erected. On the north and south sides of this principal room are to be four forcing houses for the propagation of young plants, each of them 100 by 30 feet, covered with curved roofs of iron and glass. Dividing the two forcing houses in each of these sides is to be a vestibule 30 feet square. At the center of the east and west ends are similar vestibules, on either side of which will be the restaurants, reception room, offices, etc. From the vestibules ornamental stairways will lead to the internal galleries of the conservatory, as well as to the four external galleries, each 100 feet long and 10 feet wide, which are to surmount the roofs of the forcing houses. These external galleries are to be connected with a grand promenade, formed by the roofs of the rooms on the ground floor, which have a superficial area of 1,800 square yards.

The east and west entrances will be approached by flights of blue marble steps from terraces 80 by 20 feet, in the center of each of which an open kiosque, 20 feet in diameter, is to stand. The angles of the main conservatory are to be adorned with eight ornamental fountains. The corridors

which connect the conservatory with the surrounding rooms, open fine vistas in every direction.

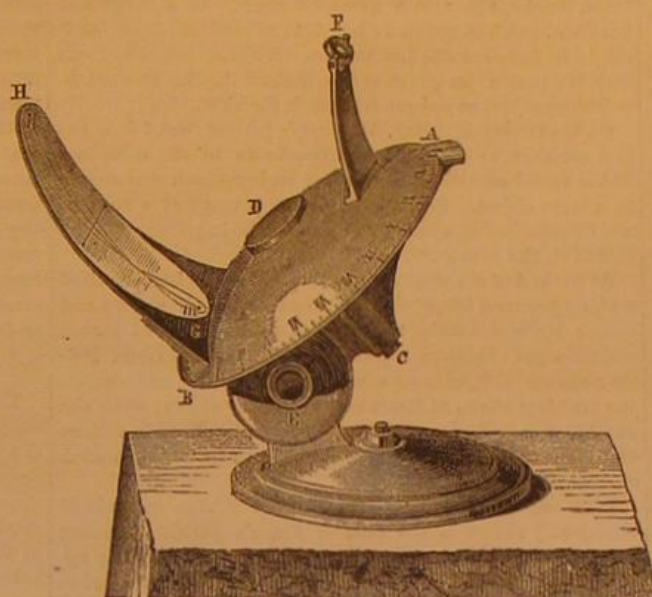
In the basement, which is of fireproof construction, are the kitchen, store rooms, coal houses, ash pits, heating arrangements, etc.

A SOLAR CHRONOMETER.

In the accompanying illustration is represented a solar

latitude of the place, by means of the point, E. F is a lens, located in the center of an exactly spherical concave plate and capable of adjustment toward the sun.

When the instrument is arranged so that the axis is inclined as above noted, the disk, A B, is turned so that the image of the sun produced by the lens, F, falls on the arc, *m n*. The hour is given by the pointer at A, and the corresponding hour mark on the disk. The instrument is said to be accurate within one quarter or one third of a minute.



FLECHET'S SOLAR CHRONOMETER.

chronometer, recently invented by M. Fléchet, from which, according to *La Nature*, the hour may be determined with accuracy. It consists of a rounded disk, A, divided into 24 hours and their fractional parts. This turns about an axis, C D, which is placed parallel to the earth's axis according to

adherence is, in point of fact, variable; on wet or damp rails it is not more than one half; but in the newly invented locomotive of M. Hermann, although the state of the rails or ground will always have an influence, as in the case of the machines in actual use, it will always be greatly superior. The experi-

The Steam Donkey.

At a recent séance of the French Academy of Sciences, some interesting particulars about a new locomotive of M. Fortin Hermann were given: Its propulsion is produced by the rising and falling of six articulated feet, which strike the ground or rails something like the feet of a quadruped. These feet are arranged in two groups, three support the fore part of the machine, and the other three the after part. The two middle feet are connected together by a horizontal shaft; the four others are independent, and strike the ground successively in such a manner that, while the middle feet move at a moderate pace, the others have a highly accelerated motion. Each of these groups of three feet is affixed to a single trunk. The force of the steam is applied in such a way as to drive these feet toward the ground.

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CENTENNIAL HORTICULTURAL BUILDING PHILADELPHIA PA.

ments made thus far prove that this new machine will drag on ordinary roads, or on rails, a train four times as heavy as the ordinary trains; the cost of this augmented train will not, it is said, vary materially from that of the ordinary machines with the usual trains when used on equal grades; but the increased adhering power of the new locomotive will permit of the employment of a lighter built machine for the usual trails, as well as the power to surmount steeper grades than are usual on the railways of the present construction.

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VOLUME XXXIII, No. 11. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, SEPTEMBER 11, 1875.

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THE EDUCATION OF SIGHT.

As the reader's eyes rest upon this page of the SCIENTIFIC AMERICAN, a very complex impression is conveyed to his mind. He perceives a contrast of light and shade, the white paper and the black ink. The dark portions exhibit various forms, which stand in definite positions with reference to each other and to the reader. The paper lies at a recognized distance from the reader's eye. It has form and size, a certain degree of smoothness, and certain roughness indicating lines of print on the reverse side. Further looking will discover a succession of black forms—letters, words, etc.—conveying the ideas now in the writer's mind.

How much of all this is strictly speaking, seen? How much is the result of ulterior processes?

Paradoxical as it may seem, the reader's eyes report only the first mentioned contrasts of light and shade; all the rest is extraneous. In other words, when we look at a complex object, say a landscape, the eye distinguishes light and shade only: the situation, direction, distance, form, size, etc., of the several objects which produce lights and shades, we have to determine by other means, for the discovery of which we are indebted to the patients of Cheselden, Home, Wardrop, Franz, and others, who were born blind and given the power of vision in later years by a surgical operation.

In all these cases, we believe, the cure consisted in the removal of an overlying growth which eclipsed the otherwise perfect organ of vision. In each case the patient was sufficiently mature to report the exact nature of the sensation aroused by the act of sight on the part of a perfect but uneducated eye—uneducated, that is, in respect to motion, and unaided by any knowledge acquired by the other senses. Their experiences, therefore, clearly demonstrate the scope of pure vision in all persons, and also the origin of the ideas of form, size, distance, etc., which seem to arise in our minds through simple seeing.

Of the earliest patient, Cheselden's, it is recorded that "he knew not the shape of anything, nor any one thing from an-

other, however different in shape or magnitude," and the same is substantially true of all the others.

Ten minutes after his eyes were opened, Home's patient was shown a round piece of card, and was asked the shape of it. He could not tell till he had touched it. The next moment a square card was shown him, and he said it was round like the other. He said the same of a three-cornered card. He was then asked if he could find a corner on the square card. It was only by much thinking that he decided that the card had a corner, after which he readily recognized the other three corners.

An exceedingly instructive subject was a lady operated on by Wardrop: she could merely distinguish a very light from a very dark room, so complete was her blindness. At first she saw only patches of light and shade; by degrees she learned the names of colors and was able to distinguish them, though unable to interpret the chaos of color impressions she received. On the seventh day after the operation, she was seen to examine some tea cups and saucers. She thought them queer, but could not tell what they were till she touched them. Similarly she saw but failed to recognize an orange. On the eighteenth day, a key and a pencil case, with which she was perfectly familiar by touch, were placed side by side on a table before her: she could not tell which was the pencil case, which the key. At the end of three weeks, she saw a grassplot simply as a large and beautiful patch of green in her field of vision. How far it might be from her she had no idea. Usually in cases of this sort, the patient imagines at first that all that he sees touches his eyes, just as objects felt touch the skin.

On the twenty-fifth day, Wardrop's patient was taken out in a carriage, and inquired continually as to the meanings of her visual sensations. A person on horseback was vaguely a large object. She asked: What is that? of a soldier; and of some ladies wearing red shawls she inquired: "What is that on the pavement, red?"

At the end of six weeks it was found that she had acquired a pretty accurate knowledge of colors and their shades and names, but was unable to judge of distances or of forms, and the sight of all new objects was still very confusing. Neither was she able, without considerable difficulty and numerous fruitless trials, to direct her eyes to any object: when she attempted to look at anything, she turned her head in various directions until her eye caught the object she was in search of.

That our power of "seeing" solids is also extraneous was clearly shown in the case of Franz's patient. Among the observations reported of this patient, the following applies here: A solid cube and a sphere, each of four inches diameter, were placed before him, three feet off and at the level of his eye. After attentively examining these bodies, he said he saw a quadrangular and a circular figure, and after some consideration he pronounced the one a square and the other a disk. His eye was then closed, the cube taken away, and a disk put in its place. On opening his eye, he observed no difference in these objects, but regarded them both as disks. The cube was now placed in a somewhat oblique position before the eye, and close beside it a figure cut out of pasteboard, representing a plain outline prospect of the cube when in this position: both objects he took to be somewhat like a flat quadrangle. A pyramid placed before him, with one of its sides turned toward his eye, he saw as a plain triangle. Placed so as to present two of its sides to view, the pyramid was a puzzle. After considering it a long time, he said it was a very extraordinary figure. It was neither a triangle nor a quadrangle, nor a circle; he had no idea of it and could not describe it. When he took the sphere, cube, and pyramid into his hand, he was astonished that he had not recognized them as such by sight, being well acquainted with them by touch.

What these patients had to learn in later life, more fortunate individuals born with unclouded eyes learn in infancy, but so forget the process that the acquirement seems to be innate, a simple function of the unaided eye. The mechanism involved in the process is described in every good treatise on human physiology: the metaphysics of the case are cleverly discussed in Taine's treatise "On Intelligence." Those of our readers who have taken issue with our remarks with reference to sight will find both aspects of the subject well worth pursuing in those works, to greater length than is possible in our limited space. The facts given are sufficient to sustain the position taken by us on this point in previous articles.

SOME NEW VOLCANO REVELATIONS.

The theory that our earth was successively a vaporous, a fluid, and a plastic mass, which, by cooling during billions of centuries, finally obtained a solid crust, in connection with the fact that during all this time she rotated round the sun and received on her equator solar heat (of which the poles were nearly deprived), leads necessarily to the conclusion that, in the neighborhood of the poles, the slowly forming solid crust must have become thicker than it is around the equator, because the solar heat was able to retard this cooling longer at the equator than at the poles. Such a crust is of course more easily perforated, by interior pressure acting outwardly, where it is thinnest; and volcanoes, which are the result of such perforation, must therefore be more numerous in the thinner places, such as around the equator, and scarce near the poles. This is confirmed by observation. Active volcanoes are not frequent around the poles; the only one near the north pole is in Iceland, while between the tropics such volcanoes are found in considerable numbers.

Another interesting consideration is that the amount of material ejected by volcanoes is enormous. The estimates of the volume of the lava ejected by Vesuvius, Etna, and

especially by the volcanoes of Iceland are appalling figures; and all these masses necessarily come from the interior of the earth, and must create in the neighborhood of the volcanoes (which may be considered as safety valves) empty spaces, which are filled up by a sinking of the crust. This logical conclusion has been verified by the observation that every active volcano is situated in the center of a region of depression, and never in one of upheaval, unless the material ejected by the volcano itself be so considered.

But a still more remarkable fact has been revealed by the calculations of astronomers making observations at different points of the earth's surface. It is that there are two points of depression, extending even over the ocean's surface, forming a kind of flattened poles, one the exact antipodes of the other. These points are the Antilles, in the West Indies, and the Sunda Islands (Java and its surroundings), in the East Indian Ocean. Each region contains a greater number of active volcanoes in a smaller surface than can probably be found anywhere else on the earth. But the reason why the ocean's surface partakes of this depression, at these two volcanic centers, is as yet a problem. Modern observations have already proved many irregularities in the form of the ocean's mean level, making the ocean's surface to be far from a perfect spheroid. As this surface must, according to the laws of hydrostatics, be always at right angles to the direction of gravitation, it proves that, at various points of the earth's surface, the lines of gravitation do not pass through the same central point, even on places of the same latitude. As gravitation is a general property of matter, depending on its mass, it proves that the mass in the interior of the earth is not homogeneous nor of uniform density, and that it is unequally distributed. As the interior is liquid, this distribution may be affected by cosmic influences, as for instance the relative position of the moon and planets; and any change effected in this distribution may react on the direction of gravitation on the earth's surface, and so on the form of the ocean, and thus slowly produce changes in its level, which may, in some cases, cause an apparent rising or depression of the land.

PROGRESS OF RAPID CITY TRANSIT.

The new Commissioners of Rapid Transit in this city are daily holding their sessions, and day by day their perplexities increase, if the published newspaper reports of their proceedings are correct. They are unable to agree either upon the plan of construction or upon the proper route. The original assumption that the Commissioners were committed to the election of some form of cheap elevated railway resulted in the production of a multitude of plans of that order: and the promoters of some of these plans are backed by influence which is not without effect upon the minds of the Commissioners.

The indications at present are that, if any plan of rapid transit is adopted now, it will be one comprising some form of cheap elevated structure to meet an immediate want, with little reference to ultimate economy. Not what is really best and cheapest, but what is least expensive at first, seems likely to win. The question, therefore, is not so much which of the temporary devices to adopt, as where the road shall be put.

All but two of the plans for elevated roads, laid before the Commissioners, propose to take possession of the public streets. Their projectors are no doubt able to demonstrate to their own satisfaction that such an occupation of the sidewalk or the roadway would be of signal advantage to a street which should be chosen as the route of their road: but can the occupants and property owners of any street be made to believe it?

If we are to have an extension of elevated rapid transit, which now seems quite probable, the public ought to insist that the new roads be put where they will do least injury to property and business, that is, between the streets, not over them.

The worst fallacy connected with this whole matter is the assumption that economy dictates a temporary structure of small capacity—a cheap affair to meet a pressing present need. The city of New York is in its infancy. Much as it needs rapid transit, and scarce as money is now, the metropolis of the country cannot afford to begin ill-advisedly, however cheaply, in a matter which must largely determine its future prosperity and growth.

The example and experience of the great city of London would be a very safe one for New York to follow. Rapid transit is chiefly effected in London by underground railways, which ramify in all directions; but as they are placed below the level of the streets, out of sight, their operation disturbs no one, while their advantage to the public is so great that every year witnesses their extension.

Sir Edmund Watkin, a member of Parliament and President of the Metropolitan (London) Underground Railway, and of the London and Great Eastern Railway, is now in this country; and a few days ago, at the request of the New York Rapid Transit Commissioners, he addressed them, giving a number of interesting particulars concerning the present status and operation of the rapid transit railway system of London.

The London Underground Railroad Company, he said, already had about sixteen miles of road in operation, and in a few months they would have twenty miles of completed road. They were negotiating for a still further extension of their routes, and would in time burrow under the whole city of London. These roads had proved to be a greater convenience to the poorer classes than to wealthy persons. The average fare collected was five cents, and the rate per mile was reduced by a system of commutation to one penny. Last year these roads carried 70,000,000 passengers. Heavy

locomotives were used, and 1,000 trains per day, each having a carrying capacity for 1,000 persons, were run over them. The rate of speed was thirty miles per hour, or twenty miles including stoppages. The cost was \$5,000,000 per mile, of which about four fifths was due to damages to real estate caused by cutting through blocks of buildings and tunneling under houses. In some places the roads ran under graveyards without disturbing the graves and the vaults above.

According to this statement, the cost of building and equipment of the London underground roads has been one million dollars per mile, and the expenses for right of way and land damages four millions dollars per mile. This enormous cost for land would be wholly saved in New York, because here the railway lines would be longitudinal with and run directly under the main streets, without invading private property. But in London, owing to the formation of the city, the underground roads pass athwart the streets and cut through private property in all directions. The citizens of London have ascertained by practical experience that the underground system is the best, have invested in it upwards of eighty millions of dollars, and are annually increasing the investment and extending the works.

Sir Edmund answered a large number of questions put to him by our Commissioners, and corrected several erroneous impressions prevalent here concerning the underground railways of London. He explained the construction of those railroads, and described at considerable length the difficulties encountered in building and running them. He said that 93 per cent of the passengers on the London underground roads traveled only short distances, and only 7 per cent of them were carried to the end of the various routes. This fact was regarded as very important, because it showed that, in selecting a plan of rapid transit, the convenience and facility of those who wish to ride for short distances only ought to be considered.

STEALING BRAINS.

Professor Weisbach, in the preface to the further edition of his "Treatise on Mechanics," makes the following remarks: "As I consider my reputation as an author of much more importance than any mere pecuniary advantage, it is always a pleasure to me to find my 'Mechanics' made use of in works of a similar character; but when writers avail themselves of it without the slightest acknowledgment, I can only appeal to the judgment of the public." What the distinguished author has so clearly laid down is generally recognized as a leading principle by writers and editors. Most writers, for example, are glad to have the widest publicity given to their productions, provided they receive credit for the same; and there are few reputable editors or publishers who neglect this courtesy in copying from books and other periodicals. Still more rarely do writers who are compelled from the nature of their subjects to draw material from all sources omit to state this fact, and give due credit to all from whom they derive information. Recently, however, a very flagrant instance of neglect of this most ordinary courtesy has come to our notice, in a work entitled "Handbook of Land and Marine Engines, by Stephen Roper, Engineer." No reference is made, in the preface of this book, to any authorities who have been consulted; and throughout the text, all credit for data and remarks is, with very few exceptions, omitted. Some illustrative examples are given below; and in every instance mentioned, for anything that the author says, it might fairly be inferred that the matter is original.

1. On page 81 is a stroke table, which is an exact reproduction of the original calculated by Mr. Auchincloss, to be found in "Link and Valve Motions," page 59.
2. On page 39 is a table of the properties of saturated steam, which originally appeared in the eighth edition of the *Encyclopædia Britannica*, and was copied, with due credit, in Wilson's "Treatise on Steam Boilers," and possibly in other works.
3. On pages 82, 84, and 88 are three tables from "Link and Valve Motions," which were original with the author of that work.
4. On pages 197, 216, 219, 220, and 285 are statements, illustrations, and examples, which were originally given in the "Cadet Engineer," on pages 156, 133, 136, and 24, respectively.
5. On page 227, we recognize a remark in regard to practical men, which originally appeared in the *SCIENTIFIC AMERICAN*, page 17, volume XXX. Other quotations from the *SCIENTIFIC AMERICAN* occur as follows: Page 258, the opening remarks of an article on page 305 of our volume XXXII; page 279, the entire article on "The Measurement of a Screw Propeller," which was published for the first time on page 240 of our volume XXXI; page 473, table and example from an article on "Feed Water Heaters," published on page 288 of our volume XXXI.

These are a few of the instances which we have marked. We could fill several columns with similar illustrations; but those already given, selected at random through the book, tell the whole story. In fact, we have never seen a more decided case of wholesale plagiarism, if we except an incident which occurred in our younger days, when the dullest boy in school mounted the platform and attempted to pass off one of Lord Bacon's most profound dissertations as an essay of his own composition. Happily, such instances of literary robbery are very rare, and we are inclined to think that Mr. Roper has sinned rather through ignorance than design. If so, he can even yet make some amends, tardy though they be, by publishing a supplement to his work, in which due credit is given to all authorities which

have been used. By doing this, he will both increase the value of his work, and the respect in which he will be held by his fellow men.

TRAUBE'S ARTIFICIAL CELLS.

In the early days of modern chemistry it used to be taught that the compounds produced under the influence of life were different in kind from those of the chemist's laboratory, and subject to different laws. A characteristic of "vitality," indeed, was thought to be its power to reverse or transcend the laws of "dead" matter, death being the surrender of the organism to the forces of inorganic chemistry. It was commonly and confidently predicted that the chemist, however skillful, would never be able to construct the magic compounds formed by the creative power of life: it was even declared impious to attempt it. But chemists were not to be deterred by such objections. They persevered. They built up from inorganic materials first one, then another, then thousands of the so-called organic compounds, and the old theory of vitality was for ever shelved.

A corresponding mechanical theory of life is still held by most physiologists. The mechanism of organic growth is declared to be something quite unlike anything that occurs in the domain of lifeless matter, something utterly beyond the skill and power of man to imitate. Even the lowest of organized structures, it is said, exhibits a power of choice in the selection of food, and an individual mode of development, which combinations of inert matter can never rival. Life is assumed to be something unique, something superior to the crude forces of dead matter; hence the structural forms built up through its agency must be unique; hence it is impossible for man to produce anything like them. The whole chain hangs upon the first assumption, for which proof is lacking.

Seeing that the physiology of growth hinges on the life history of the cell—all organized bodies consisting simply of a more or less simple aggregation of these organic elements—the success which Traube has had in imitating with dead matter the characteristics of living cells shows that it is altogether too early to dogmatize touching man's present or future inability to rival the physics as he has the chemistry of life.

The behavior of those groups of compounds denominated colloids and crystalloids by Graham, when their solutions are separated by thin membranes from each other or from solutions of crystalline substances, needs no description here. The established fact that dissolved colloids cannot pass through colloidal membranes formed the starting point of Traube's investigations. He was aware of the additional fact that the precipitates of colloidal substances are themselves usually colloidal. It followed, as a natural consequence, that a drop of one colloid, if placed in the solution of another suitable colloid, would be converted into a closed cell by the precipitate formed by the mutual action of the two colloids at their surface of meeting. For example, a drop of concentrated solution of gelatin plunged into a solution of tannic acid is immediately surrounded by a pellicle of gelatin tannate, the thickness of which depends upon the relative densities of the two solutions. This colloidal pellicle is impervious to the colloid solutions, while it allows water to pass through freely. Hereupon most significant phenomena arise. The gelatin within the cell is more concentrated than the solution of tannic acid in which it is immersed; it has in consequence a stronger attraction for water, and absorbs a portion from the weaker solution. To make room for the increased contents of the cell, the pellicle stretches, separating its molecules to such an extent that the outer and inner solutions come in contact, and a fresh precipitate of gelatin tannate is formed between the original molecules. Through the enlarged pellicle, water continues to penetrate, and the process of growth in the cell wall goes on so long as a difference in density exists between the contents of the cell and the surrounding liquid. A firmer pellicle is formed when a little lead acetate or copper sulphate is added to the gelatin. That the growth observed is not a mere stretching of the pellicle occasioned by endosmosis is proved by replacing the outside solution by water, whereupon the growth ceases, the formation of new molecules of precipitate being prevented. It will be remembered that the natural growth of living cell walls is by the same process of intussusception, or the deposition of new matter between the molecules already existing.

While the cell wall is growing, changes also go on in the interior. So long as a nucleus of undissolved gelatin remains, the artificial cell is spherical. When the enclosed gelatin is all dissolved, the contents become diluted by the inflowing water, the density being least at the top, the heavier solution settling to the bottom of the cell. When sufficiently dilute, the cell contents begin to dissolve the cell-wall at the top; the pellicle of that part becomes thinner and more extensible; as it yields, new matter is precipitated between its molecules; in short the cell grows upward, and often protuberances directed outward are formed, in imitation of living cell growth. Still more remarkable is the behavior of the pellicle of copper ferrocyanide precipitated round a drop of a concentrated solution of copper chloride in a solution of potassium ferrocyanide: or, better yet, according to Sachs, around a small piece of solid copper chloride in the ferrocyanide solution. In the latter case a green drop is immediately formed at the expense of the solution, the precipitated pellicle of which encloses the solid nucleus which is gradually dissolved by the permeating water. Cells so formed manifest active growth and a variety of differences not easy to explain. Some have very thin pellicles, are roundish, and exhibit a slight tendency to grow upward; they usually form a number of small wart-like outgrowths, and attain very considerable dimensions—from 0.4 to 0.8 of

an inch in diameter. Others have thick reddish brown pellicles, grow quickly upwards in the form of irregular cylinders, rarely branch, and attain a diameter of from 0.08 to 0.16 of an inch, and often several times that measurement in height. Sometimes combinations of these two kinds form a sort of horizontal tuberous rhizome-like structure, from which long stalk-like outgrowths arise upward and root-like protuberances downward.

Sachs insists that these pellicles of copper ferrocyanide do not always grow entirely by intussusception, as Traube supposed, but sometimes by eruption, as he terms it. In such cases a brown pellicle is formed round the green drop; water penetrates quickly through the pellicle to the enclosed copper chloride, stretches the pellicle rapidly, and at length ruptures it. The green solution immediately escapes through the fissure, but becomes at once coated with precipitate which appears either as an intercalated piece of the previous pellicle, or as an excrescence or branch of it, a process which is repeated as long as any copper chloride remains inside the cell. Besides these solutions already named, Traube experimented also with mixtures of tannic acid with copper and lead acetates, and soluble glass with the same substances, or with copper chloride, etc., and came to the conclusion that every precipitate, the molecular interstices of which are smaller than the molecules of its components, must assume the form of a pellicle when the solutions of its components come in contact.

These pellicle precipitates are peculiarly well adapted for the study of endosmotic processes. They behave very differently from other membranes, being often impermeable to the most diffusible substances, while allowing other compounds to pass through them; and every kind of pellicle has in this respect its own peculiarities. For instance, the gelatin tannate employed by Traube in most of his experiments is impermeable to potassium ferrocyanide but permeable to ammonium chloride and barium nitrate. The pellicle of copper ferrocyanide of the other experiments mentioned is impermeable to barium chloride, calcium chloride, potassium sulphate, and barium nitrate, but permeable to potassium chloride. Again, if a small quantity of ammonium sulphate is added to the solution of gelatin, and a small quantity of barium chloride to the tannic acid, the pellicle formed by their admixture is composed of calcium tannate with barium sulphate deposited upon it, diminishing its permeability: the two solutions can no longer diffuse, but the encrusted pellicle is still permeable to the smaller molecules of ammonium chloride and water. From facts of this sort Traube infers that, in the permeability of pellicle precipitates, we have a means of determining the size of the molecules of different solutions, since only those molecules can pass through a pellicle which are smaller than its molecular interstices, and therefore smaller than the molecules of the solutions which produce the pellicle.

SCIENTIFIC AND PRACTICAL INFORMATION.

OXUVITIC ACID.

MM. A. Oppenheim and S. Pfaff announce the discovery of a new acid named as above, and having the formula $C_6H_4(CH_2OH)(COOH)(COOH)$. It results from the action of chloroform on acetic sodic ether.

MANUFACTURE OF ARTIFICIAL ALIZARIN.

The process of manufacture of this substance, as practiced in Frankfurt, Germany, consists in heating for 3 hours, in earthen vessels, anthracene having its fusing point between 404° and 410° Fah. with one fourth its weight of bichromate of potash and 12 parts nitric acid of a density of 1.504. Anthraquinone is thus formed, and the crude resulting product is dissolved in 6 parts boiling nitric acid, of density 1.5. The dissolving of the anthraquinone is continued until, on cooling, no residue of that substance is precipitated. The solution then contains anthraquinone in a mononitrated state, which is precipitated by water; and on the solution becoming clear, the precipitate is dissolved in from 9 to 12 parts of a solution of caustic soda of specific weight 1.3 to 1.4, heated to about 383° Fah. When the precipitate is no longer augmented by the addition of hydrochloric acid, the heating is arrested. The mass is allowed to cool, dissolved in boiling water, and filtered, and the coloring matter precipitated in the hot solution by means of an acid. The yellow brown deposit is then ready, after washing, to be used for dyeing. The residue on the filter is principally anthraquinone, which is re-used. The manufacture of artificial alizarin is constantly increasing. The German production is estimated at some 1,198,000 lbs. per year.

NEW METHOD OF DETECTING ADULTERATION OF FATTY OILS.

M. Roth employs, as a re-agent for the above, sulphuric acid at 46° B. saturated with nitrous vapors by causing nitric acid to act upon large pieces of iron. At the end of six or eight days, the solution acquires a fine bluish green color, indicative of complete saturation. This re-agent solidifies either partially or entirely the olein of non-siccative oils. The purity of the oil may thus be determined by noting the time which it occupies in solidifying.

DETECTION OF PICRIC ACID IN BEER.

For this purpose, Brunner recommends acidulating the beer with hydrochloric acid, and plunging therein a fragment of woolen thread, and digesting the same in a *bain marie*. After the thread is removed, it is heated with a solution of ammonia. The latter is filtered, evaporated in a *bain marie* to small volume, and a few drops of cyanide of potassium are added. The presence of 0.015 grain of picric acid in a pint of beer is determined by a red color being produced, due to the formation of isopurpurate of potash.

FLOATING FIRE ENGINES.

The use of floating fire engines is rapidly extending in all commercial cities, where wealth, in buildings and merchandise, is always aggregated on the banks of the rivers, readily accessible to vessels, and with an unlimited supply of water at hand. Some improvements in these engines have recently been effected by Messrs. Merryweather and Sons, of London, England, and three of them, of the most powerful construction, have been supplied to the French Government. The long lines of shipping which bound this city, and the dangers of fire to which, from many causes, it is exposed, give especial interest to these useful machines at the present time.

On the trial trip of one of the engines, which is now on duty at Marseilles, France, the little vessel, full of passengers, left the pier at Charing Cross and steamed with the tide to Battersea bridge, which she reached in twenty minutes. She steamed a short distance beyond the bridge, and was then turned, running back against tide, and reaching the Charing Cross pier in 56 minutes from the time of starting. On her way back she was stopped at Millbank and successfully beached; the object of the maneuver was to show that she could approach inshore sufficiently close to enable men to convey hose on to land without having to pass through deep water. The total distance run by the float—in and out—was three miles and two thirds, the time occupied being 56 minutes, including the stoppage for the beaching operation. On her way up the river, time was taken between the Chelsea suspension bridge and the Cadogan pier, a distance of exactly three quarters of a mile. The time was exactly 4 minutes, giving a speed of about 12 miles an hour with tide, the time on the return against tide between the same points being 7 minutes, or at the rate of about 6 miles an hour. During a portion of the distance only one engine was at work, besides which she had a number of passengers on board, so that the average speed of about 9 miles an hour which she attained was a very successful result. On reaching Charing Cross pier, the pumping engines were set to work and a fine jet was thrown from a $1\frac{1}{2}$ inch nozzle to an estimated height of 180 feet. Two jets were then played from $1\frac{1}{2}$ inch nozzles and afterwards four jets from 1 inch nozzles to an estimated height of 160 feet. The whole performance was in every way satisfactory.

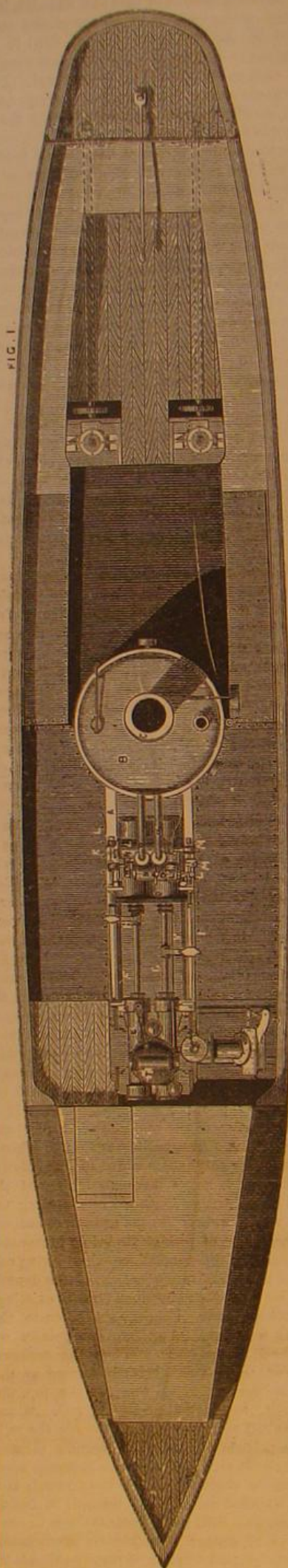
Turning now to Figs. 1 and 2, it will be seen that the vessel is a neat boat 45 feet in length, 8 feet beam, with 2 feet draft forward, and 2 feet 10 inches aft, and having a total depth of 4 feet 6 inches. Her builders were in some measure restricted as to the dimensions of the boat, as a vessel of larger dimensions cannot be conveniently loaded on ship-board in one piece for transport. The boat, however, is not cramped, as there is ample room for coals, hose, stores, and cabin compartment. The propelling engines are two in number, each working a gun metal screw 28 inches diameter. The cylinders of those engines are each $5\frac{1}{2}$ inches in diameter, with a 6 inch stroke, the number of revolutions being 280 per minute, and the steam pressure 75 lbs. per square inch. These engines work independently of each other, in order to facilitate the maneuvering of the float, which will have to run in and out among shipping; and during the recent trials on the Thames it was jocosely called the blockade runner. By adopting twin screws the vessel is able to travel in shallow water, a very desirable feature in running up creeks. The boiler is on the Field principle, and is arranged to drive the propelling engines and steam fire engine simultaneously, if required, and this would happen in the case of a fire among shipping, wherein this engine might not only have to be engaged in towing out a burning vessel, but in pumping upon her at the same time. The boiler has a large water and steam space; and considering the quantity of water it has to convert into steam at 75 lbs. pressure, and notwithstanding the large cubic contents to be filled by steam before reaching that pressure, it effects this object in the very short time of 10 minutes. The boiler contains 426 Field tubes, giving 236 square feet of tube surface, and $35\frac{1}{2}$ square feet of fire box surface, and is mounted with the usual fittings, having one pressure gage for the stoker and another for the engine driver, a spring safety valve and another on an improved principle, gage cocks, whistle, etc. It is fed by feed pumps attached to each propelling engine, by another long stroke feed pump on the fire engine, also by an arrangement by which the whole supply of the fire engine pumps (116 gallons) can be forced direct into the boiler by one stroke, and, lastly, by a Giffard's injector.

The steam fire engine, while limited in weight and space, is simple, and of sufficient strength to stand the rough usage to which such machines are usually subjected. The pumps have a steady stroke of 24 inches. There is no dead point in the course of the pistons, and the engine will start with the latter at any position in their stroke as soon as steam is turned on. Another advantage is that the engine can be worked at full speed, or at any intermediate speed, in the event of a limited supply of water, or as slow as one or two strokes per minute. This enables the attendant, in case of need, to pump direct from the main pumps into the boiler—a feature peculiar to these engines, and of great value when, by neglect, the water is short in the boiler, or for the purpose of lowering the pressure of steam on suddenly stopping the engine. The pump is arranged to throw any class of water, whether it be muddy or floating with sea weed, shavings, etc., the valves being specially adapted for such purpose—an important feature.

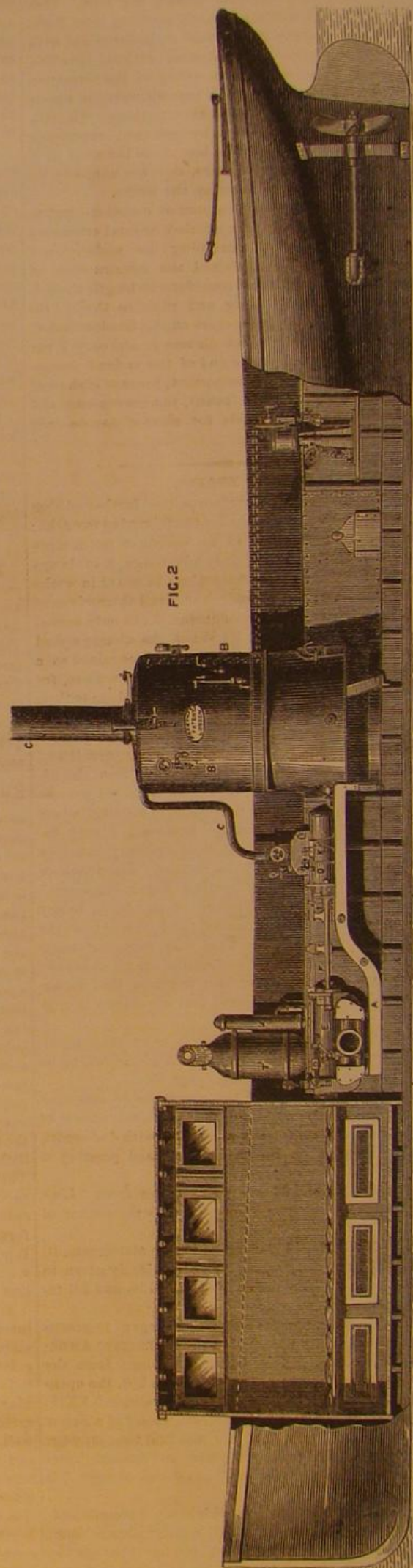
Our engravings represent general and detail views of the float and its engines, Figs. 3 and 4 being respectively a plan and a sectional elevation of the vessel, and Figs. 1 and 2 a plan and elevation of the pumping engine. In these views,

A is the framing, forming the bedplate of the engine. The frames are supported on a series of bearers fixed in the boat, and are also connected with the boiler, thus forming one rigid structure, and which does not exhibit any vibration of the vessel, when all the machinery is in full operation. B is the boiler, constructed on the Field system; the tube and top plates are of the best boiler iron, the shell of steel five sixteenths of an inch thick. The top and tube plates are fitted with eight screwed stays; the top plate has four hand holes, and the water casing around the fire box has six mud holes, and blow-off cocks. The chimney, C, is hinged for raising and lowering, and is fitted with counterbalance and

lowest part of the valve chamber, instead of in the highest part, as is usual in most pumps; and as all water runs freely out of the pump when at rest, the latter are not liable to be disabled by frost. The valve openings are large and quite free, having no gratings to impede the passage of solid materials, while the valves and seats are readily removed for inspection or repairs. The pump pistons are self-lubricating, and when at work never require the application of the oil can. F F are wrought iron stays, coupling the steam cylinders direct to the pump in a rigid manner, thus relieving the frames of all strains during pumping. The piston rods, G, connect the steam pistons with the pump pistons, and are



MERRYWEATHER'S FLOATING FIRE ENGINE—PLAN OF VESSEL



MERRYWEATHER'S FLOATING FIRE ENGINE—ELEVATION OF VESSEL

chain. The steam cylinders, D, are each $8\frac{1}{2}$ inches diameter and 24 inch stroke, and are cast in one piece. They are fitted with wrought iron covers and gun metal glands, and are fixed to the frames by strong brackets and bolts. E is the main pump, which consists of one solid gun metal casing, formed in such a manner that the barrels are not cut or cored when pumping sandy water, and having the valves so constructed that any grit drawn into the pump does not pass into the pump barrels, but is discharged at the next stroke through the delivery valves. These valves are placed in the

formed of solid steel throughout without a joint. The cross-heads, H, are keyed on the piston rods, and carry gun metal clip brasses, H', which slide along, and give a partial revolution to the motion bars, I, and these bars actuate the valve levers. The main piston slide levers, K, fit easily on the motion bars, and are actuated by the tappet clutches, K'. Levers, L, are fixed to the motion bars, I, for moving the small leading piston slides, L'. The starting levers are seen at M, and at N are the main piston equilibrium slide valves for reversing the flow of steam into the cylinders, these slides

being so constructed that, when they are in the middle of their stroke, the steam ports are quite closed, preventing the inlet of more steam, and the exit of the exhaust steam, and thus bringing the steam and pump pistons to rest. At one end of each of the piston slide rods, N', is attached a small piston working in a cylinder, to which steam is admitted by the leading piston valves, L'. The power used to move the slide is merely nominal, not throwing the least strain on the motion bars, I, and as a proof of this a slide can be pushed, arrested, or forced forward by hand while the engine is working.

O is the starting steam valve in the steam pipe, O'. The

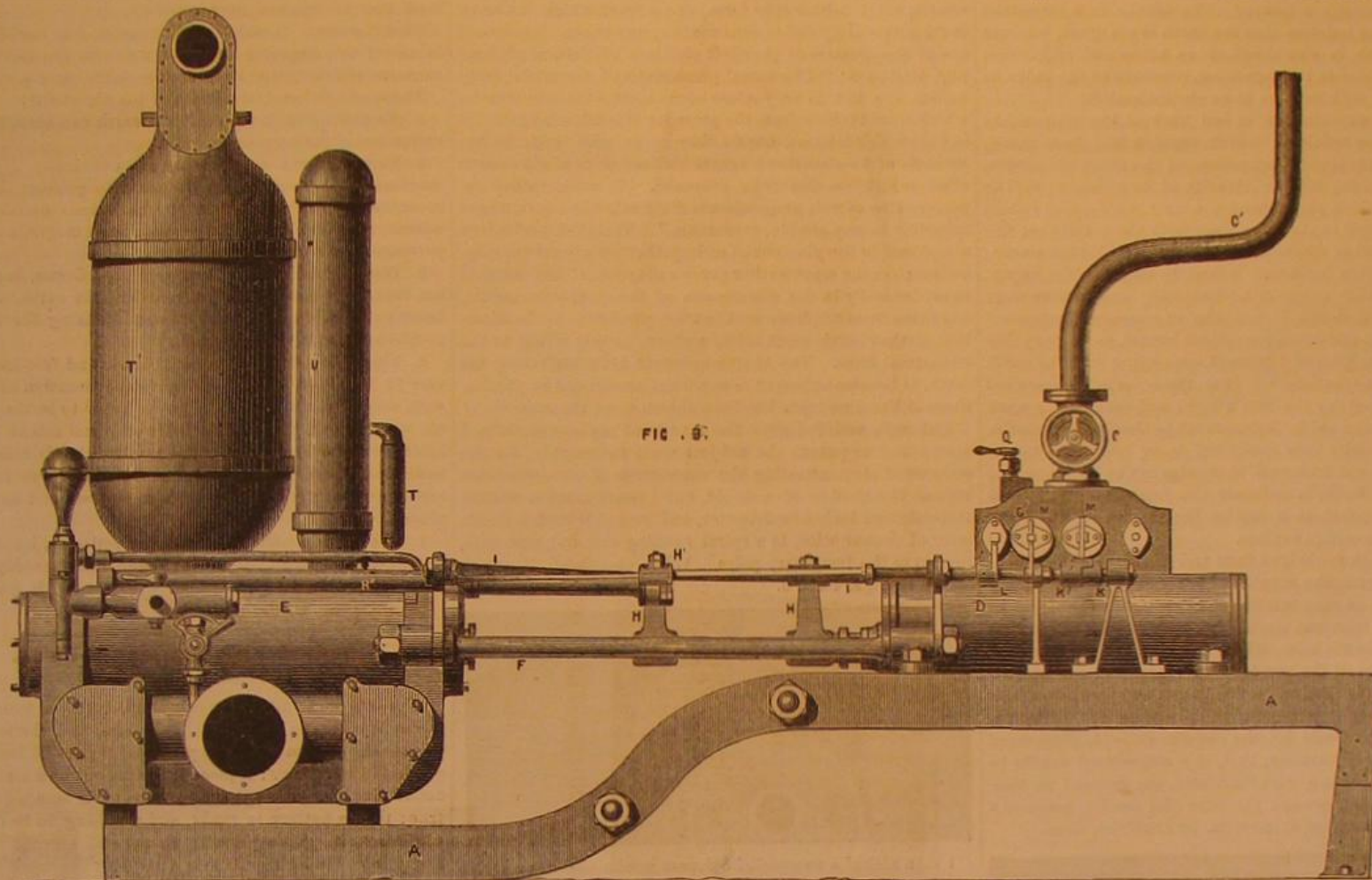
Economy in the Use of Fuel.

In a paper on economy in the use of coal, lately read before the Royal School of Mines, Berlin, the following synopsis of interesting historic facts is given: The progress in the economical consumption of fuel in the last 50 years has been enormous, and has been effected in great part by metallurgists; and here again we find the scientific men taking the lead. In the economical application of the heat developed by fuel, the Bessemer process is enormously effective, not more than 10 lbs. of coal being requisite for the production of 1 cwt. of steel from pig iron by this method, while in the older process, still in use for fine qualities of steel, 250 lbs.

is to find any material infusible enough to answer as a lining in the furnace where it is consumed. Some idea of the importance of these improvements will be had from the fact that the economy in fuel effected in England alone, in the year 1872, as compared with 1871, by the progress made in the introduction of more perfect apparatus, represented more than 4,000,000 tons of coal.

Heavy vs. Light Tools.

The great end at which all improvements aim is the maximum of power combined with the minimum of material and weight. A man shoveling dirt with a shovel one pound



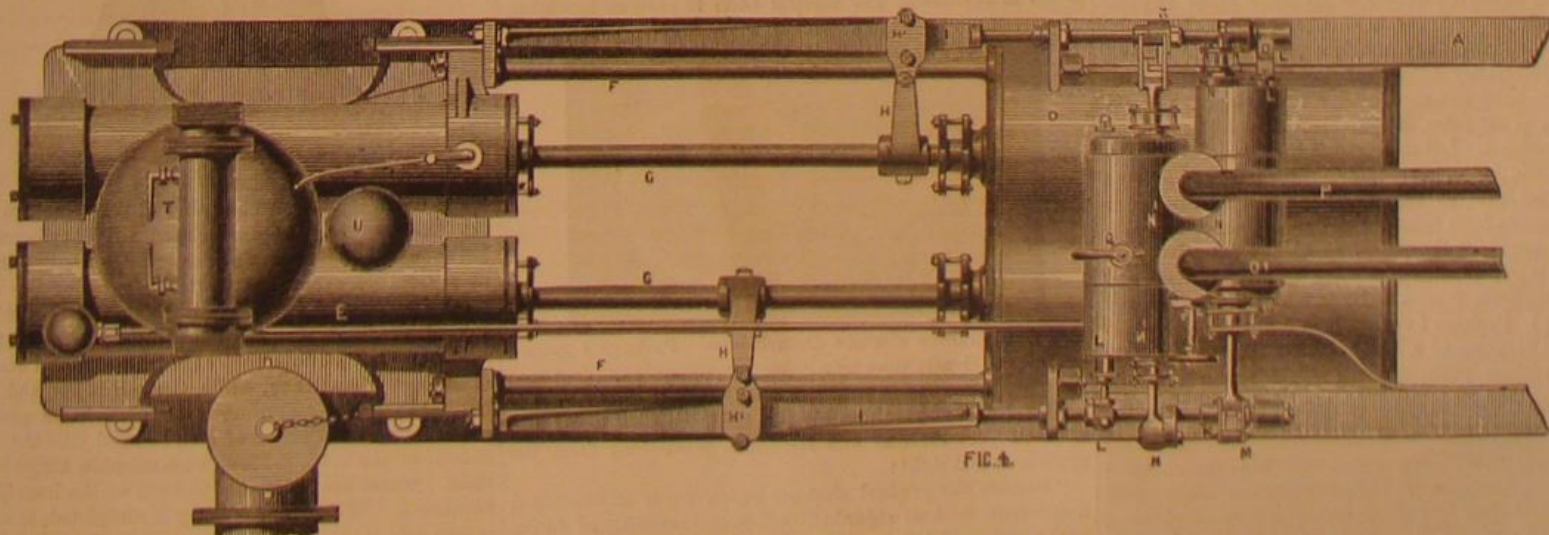
MERRYWEATHER'S STEAM FIRE ENGINE—ELEVATION.

exhaust pipe, P, passes down the chimney into a hollow baffle, having an aperture upwards, through which the exhaust steam passes into the chimney, affording the necessary blast. Q is a small steam valve for admitting steam to the small cylinders, Q'. The feed pump, R, is easily accessible. There is a pipe from this feed pump to the fresh water tanks. The plunger is of steel, and covered with brass, the diameter being 1 inch and the stroke 24 inches. The plunger is fixed to the crosshead, H, on the driving side. S is a check valve in the feed pump pipe to the boiler. T is a patent air vessel automaton feed apparatus for keeping up the required amount of air in the air vessel, T', to insure a steady jet of water at the nozzle. U is the suction air vessel, and V a pipe from the main pumps to the boiler, the water passing direct through the feed pump. The feed water tanks are placed at

are needed. Siemens, by making the heat which would escape through the chimney of an ordinary furnace warm the fuel and the air necessary to combustion, obtains an economy of two thirds the weight of fuel. It was Faber de Faure, an accomplished Bavarian metallurgist, who first made practical use of the gases which formerly escaped in immense quantities from the tops of blast furnaces; and the enormous blast engines, the hoisting engines, pumps, and hot blast stoves, even the roasting kilns of such establishments now-a-days require no fuel except this long neglected waste product. Bischof, another German engineer and metallurgical author, was the first to produce gas artificially for smelting purposes, and this was certainly one of the greatest advances ever made in our art. By first turning it into gas, fuel can be much more perfectly consumed than in the

heavier than it should be will lift 6,000 pounds more in a day of ten hours than he would do with a suitable shovel. All this strength is wasted.

The same is true of machinery. So simple a thing as an unlubricated pulley is felt in the furnace, and the cost of the coal is augmented. Every useless pound in a truck or carriage takes vitality from the horse which draws it, and costs the owner many extra dollars for his keeping. The man who pulls an oar in the great boat races at Saratoga puts himself in training and reduces every ounce of surplus flesh. The racing horse carries not one extra ounce of fat to burden him in the effort to win. Yet working men will carry through half their lives fifty pounds more flesh than is needed for the best working condition, a burden which tells against their efficiency and personal comfort through



MERRYWEATHER'S STEAM FIRE ENGINE—PLAN.

each side of the fire engine under the deck; there is also another tank immediately under the engine. The coal bunkers extend along each side of the boiler, as far back as the propelling engines; there is therefore an ample supply of fresh water, and a large capacity for carrying coals.

The pumping power of this little float is very great, being 1 000 gallons per minute through a jet 1½ inches in diameter to a height of 212 feet. It is arranged to pump 4 jets, and these, each 1 inch diameter, can be thrown to a distance of 200 feet.

BUTTER is said to be a very sensitive reagent to reveal the presence of copper.

solid form, and hence can be made to give us, as in the Siemens furnace, in which only gas is used, a much higher temperature than is practically attained by the combustion of coal in the ordinary way; but perhaps the greatest advantage of gas is that substances, in general scarcely regarded as fuel at all, can be employed for the production of gas with the most brilliant results, a matter of the greatest importance, especially in a region destitute of true coal like California. Lundin, a noted and thoroughly educated Swedish metallurgist, has taught us how to produce gas from wet sawdust, entirely without preparation, of such power that wrought iron may be melted with it, and the great difficulty

many years of their industrial life. These may seem little things; but whatever wastes power, increases expenses, and burdens the laborer is not a little thing.

THE new direct Atlantic telegraph cable has been successfully laid, and messages have been transmitted at a high rate of speed between New York and London. But the ice bergs have, it is supposed, injured the cable, and the contractors are now fishing up and cutting out the fault.

THERE are twenty-three miles' length of pneumatic tubes now in operation in London, used for sending telegraph messages.

Correspondence.

Terrestrial Magnetism.

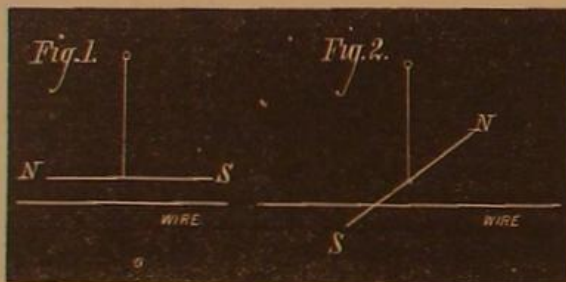
To the Editor of the Scientific American:

In your issue of August 14 appeared an interesting article on the subject of terrestrial magnetism, so-called, in which the views entertained by Humboldt, Hansteen, and Gauss were clearly outlined. During the past year, I have devoted considerable attention to the phenomena of the earth's electricity, and my experiments have demonstrated that there is no such thing as terrestrial magnetism in the sense in which the term is usually employed. To use the term terrestrial magnetism is to indicate that the earth is a magnet, whereas the force which is characterized as terrestrial magnetism stands, with relation to magnetism, precisely as the galvanic current stands with relation to an electromagnet.

I began my experiments in full view of the phenomena set forth in the article to which allusion has been made, namely: The observed declination of the magnetic needle, and its inclination, and the intensity of its action, as well as the facts that these phenomena not only vary in one place from another, but in the same place with time, and that the needle is subject to disturbances from natural phenomena, such as the aurora borealis. I had, in addition, the important premise that currents of electricity are continuously flowing round the earth (I use the expressions "currents" and "flowing" merely as convenient terms), as is every day demonstrated in lines of telegraph connecting with the earth and without the battery.* That these earth currents are mainly generated by the sun's light and heat falling upon the surface of the earth, there cannot be the slightest doubt. That the electricity thus generated is of two well known forms, thermic and frictional, there also can be no doubt; nor would it be difficult to estimate the immense volumes on electricity generated in a day by the impact of the light waves upon the earth's surface.

With these acknowledged facts and observed phenomena, in connection with the results of some experiments of my own, it became an easy matter to show that the surface of the earth is an immense electric helix, or a series of sections of helices or electric belts, whose right angles are the poles.

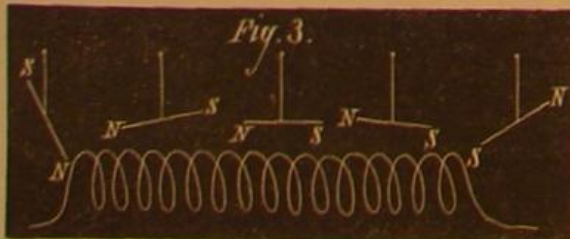
Taking as a basis the two facts that earth belts of electricity exist, and that their direction is east and west, we are at once brought face to face with the phenomena of deflection of a magnetized needle by the electric current, discovered by Ørsted in 1819, namely, that, if a magnetized needle be suspended parallel to a wire conductor, the moment an electric current is sent through the wire the needle assumes a position at right angles to the wire, or nearly so, thus:



In Fig. 1 is seen the suspended magnetized needle with its poles parallel to the wire. In Fig. 2 is seen the result when a current of electricity is sent through the wire. And here we have in miniature the cause of the direction of the compass needle. The wire in Fig. 2 represents the earth currents flowing east and west; and, as in this experiment, the compass needle is beyond doubt caused to point north and south by the earth currents, which, flowing east and west, must inevitably cause the needle to assume a right angular direction, which, as we know, is north and south.

But we have not yet made sufficient progress. We have, it is true, satisfactorily accounted for the direction of the needle, but we have not accounted for the dipping of the needle, which, at the poles, is equivalent to its assuming a direct vertical position. Let us examine further.

As the electric belts, surrounding the earth, and moving east and west (at least as rapidly as the diurnal revolution of the earth), must form belts or circles of less and less diameter as we approach the poles, so at the poles we must have the effects of the ends of a helix or coil of wire; and what are these effects from a helix in which the electric current is flowing? Perhaps I cannot better answer and illustrate than by a diagram of a helix with a compass needle suspended in various positions with respect to the longitude of the helix.



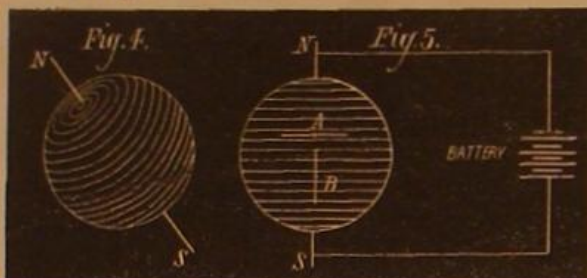
In Fig. 3 it will be observed that, at the longitudinal center of the helix, corresponding to the earth's equator, the needle, being equally affected by both terminals of the helix, preserves a horizontal position, but that, as we approach the terminals, the needle dips and finally inclines to enter the helix. In this simple form we have all the phenomena of the direction and dip of the compass needle, the electric cur-

*In long ocean cables, these earth currents are so strong that they often seriously interfere with the working of the instruments.

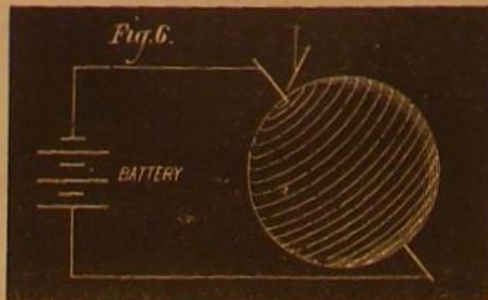
rent, flowing in the coils of the helix at right angles to the needle, corresponding exactly with the electric belts encircling the earth, which flow at right angles to the needle and produce precisely the same results.

The effects of the currents flowing in a helix, it is thus seen, are in every way the same as the effects of the electric currents encircling the earth east and west. The theory that the phenomena of the magnetic needle are due to the existence in the earth of a great magnet or a series of magnets, is not only utterly improbable, in view of the phenomena observed, as it renders the phenomena impossible; but it is utterly and wholly superfluous, since we have in the electric earth belts ample force, and a force which we know could not possibly fail to produce the phenomena. Deschanel, one of the greatest of practical students of natural philosophy, well says: "The actual phenomena of terrestrial magnetism are not in very close agreement with the results which would follow from the presence of such a magnet" in the earth's interior, nor do they agree well with the hypothesis of two interior magnets inclined at an angle to each other, which has also been proposed. It would rather appear that the earth's magnetism is distributed in a manner not reducible to any simple expression." Thus the problem is abandoned in the glamour of an hypothetical terrestrial magnetism; yet the same author gives a diagram of the lines of equal intensity in the phenomena of the magnetic needle, and these lines are from east to west, precisely as the direction of the electric earth belts, and are closely allied to the isothermal lines. The thermal electric belts encircling the earth, it became apparent to me, must correspond to the isothermal lines, and this has been shown to be the case.

Although satisfied with the results of my experiments, I determined to pursue the subject more thoroughly, for the purpose of demonstrating the correctness of my deductions beyond the shadow of a doubt, and I constructed a wooden globe sixteen inches in diameter, and wound it with a single layer of copper wire, in a spiral running east and west with respect to the imaginary poles. When completed, it was as shown in Figs. 4 and 5.



I then placed a suspended compass needle near the surface of the globe, so that, when no current was traversing the lines, the needle stood in the position shown at A. The instant the battery was applied, however, so as to give the electricity the direction of the earth's belts or currents, the needle assumed the position shown at B, pointing to the north and south poles of our miniature world. Thus in our great world, as in this miniature world, the earth's electric currents, moving in the direction of east and west, deflect the magnetic needle to right angles, so that it points north and south. By varying the strength of the current from the battery, by changing the position of the needle with respect to the north and south poles, and by so connecting the battery with different parts of the helix surrounding the miniature globe as to preserve the isothermal lines of force, so as, in a word, to imitate all the varying strengths and disturbances of the earth's electric currents, I was charmed to witness in the minutest details all the inclinations, declinations, and disturbances of the needle that we witness on the earth, due to the intensities of the electric belts in various localities,



and to numerous electric disturbances. Perhaps I cannot show more clearly than by a quotation, not only the fact that the phenomena of the magnetic needle are due to the electric earth belts, but that these electric belts are continuous, and in large part thermal and frictional, proceeding from the sun's heat and light:

"Besides the gradual changes which occur in terrestrial magnetism, both as regards direction and intensity of force, in the course of long periods of time, there are minute fluctuations continually traceable. To a certain extent, these are dependent on the varying position of the sun; but over and above all regular periodic changes, there is a large amount of irregular fluctuations which are invariably connected with exhibitions of aurora borealis. They are sensibly the same at stations many miles apart, and they affect the direction and amount of horizontal much more than of vertical force" in the magnetic needle.

As we approach the poles of our miniature globe with the needle, it gradually loses its horizontal direction, dipping downward, just as we observe when we approach the poles of the earth, until we reach one of the poles, when it becomes vertical and tends to plunge into, and to one side of, the helix, as indicated in Fig. 6.

The problem is clear enough when we recall to mind that as we travel northward upon the earth from the equatorial electric belt, the north pole of the needle inclines downward at the rate of about 1° for 1° of latitude, until we reach the north magnetic pole, latitude 70° 5' N., longitude 96° 45' W., at which point the needle points directly down to the earth.*

Of the many interesting details of the phenomena observed in my experiments, it is impossible to treat in the space of a single article. At some future time I hope to present the facts more in detail.

What we have learned and what we now know, so far as human knowledge based upon practical experiments can extend, may be summed up as follows:

That the earth is not a great magnet, but that the phenomena of the magnetic needle are due to the electric earth currents, which flow at right angles to the earth's axes.

These are, in brief, the bases of the argument:

1. No placing of magnets in the earth can account for the variations of the magnetic needle.
2. Even if, by a cumbersome and overdrawn hypothesis, magnets could be placed in the earth to produce the effects observed at different places, the variations would still be unaccounted for, for the reason that such magnets would be permanent and without fluctuation.
3. The magnetic theory is utterly superfluous, for the reason that the electric belts surrounding the earth, which we know exist, could not exist without causing the magnetic needle to point north and south.
4. These electric belts, being thermic and frictional, must vary in localities, and according to the situation of the sun with respect to the earth. This we know to be the case, for we not only find the thermic belts of equal intensity, as exhibited in the direction of the needle, closely allied to the isothermal lines, but we find that the needle's perturbations are dependent upon the situation of the sun and auroral displays.
5. The electric belts, not only theoretically, but by actual practical experiment, as we have seen, satisfactorily account for all the observed phenomena.

Washington, D. C.

Repairing the Independence Bell.

To the Editor of the Scientific American:

Working in a railroad repair shop, I saw a machinist fit pieces into broken locomotive cylinders, and the idea of repairing the bell on the same principle suggested itself. The process is as follows: A piece is slotted out by a machine (see dotted line in engraving) and the surface is scraped perfectly true; then a pattern is made, and a casting in bell metal is made from it. This piece is planed and scraped to fit perfectly into the slot. This is done with the same nicety as making a patch for a broken locomotive cylinder. To fasten it in its place, an oven is constructed with a door large enough to admit the bell. The bell will stand upside down, on an iron truck, with a wheel under it, so that it can be put in and taken out of the oven conveniently. The oven must be heated by a clear fire, free from smoke, and the flames are



not to touch the bell. The bell and the piece are to be put into the oven, and the door closed, till they become heated hot enough to melt silver solder. Then remove the bell and piece from the oven, and treat the sides of the crack and piece with muriatic acid, prepared as silversmith's acid for soldering. Then coat the sides of the crack and piece with silver solder. Do this part expeditiously, and free the surfaces from dross; then, while the bell is hot and the solder in a soft adhesive state, insert the piece in its place. Have at hand two large pieces of iron (shaped like the inside and outside of the bell), red hot, with suitable tongs for holding them. These are to be used to keep up the heat if necessity requires it. When the soldering is completed, allow the bell to cool off.

I do not propose that the bell be used very roughly when repaired by this process; but I have no doubt it would be a great pleasure for the people to hear the old bell peal forth with clear tone once more.

Ashley, Pa.

Ascertaining the Altitude of Clouds.

To the Editor of the Scientific American:

Your correspondent, C. G. Forshey, claims that, by a method which he relates, he has ascertained the altitude of some thunder or storm clouds to be as great as 13 miles.

For amusement, I have often computed the distance to

*It will be noticed that, in the illustrations, I have merely indicated the electric poles without reference to the axes of the earth, which are slightly different.

some object struck by lightning from a passing cloud, by applying the familiar laws which govern the speed of light and sound; and while thus engaged, I found that, by the application of the same laws, I could also determine, with nearly the same accuracy, the height of the cloud whence the lightning proceeded.

When a flash is seen, it starts from different parts of a cloud, frequently from directly overhead; and after collecting its complement of volume and force (the work of an instant), it leaps to the earth from a quarter of the cloud often quite distant and unlooked for. Upon seeing a flash, starting, say, overhead, I begin counting seconds. After an interval, perhaps of 7 or 8 seconds, rumbling thunder is heard, first overhead, then in various portions of the cloud, differing in loudness according as the different initial forks of lightning differ in distance; then all following the wake of each electric chain, until, in 15 seconds, it concentrates in the final crash. Distance to the object struck, about $3\frac{1}{2}$ miles; height of the cloud, about one mile and a half. When an object is struck close by, these sounds proceed in reversed order. The prolonged rumbling sounds, heard before and after a stroke of lightning, are not all reverberations, but are in great part true detonations of the electric fluid while it is gathering up from the different and very unequally distant quarters of the cloud, before its discharge to the ground.

By my method of computation I find storm and thunder clouds to range from two miles high down to the very ground. I submit my plan with the hope that it will be fairly tested.

J. M. S.

Lynchburg, S. C.

The Keely Gas.

To the Editor of the Scientific American:

I notice, in an article headed "Gems from the Keely Motor," in your issue of July 24, the following statement: "It is a vapor of so fine a quality that it will penetrate metal, and is lighter than hydrogen." I contend that such a substance would be contrary to the laws of Nature.

It is well known that the molecules of all substances increase and decrease in size in proportion to the specific gravity of the substance, the lighter substance containing the larger molecules. This may be demonstrated by pouring as much water into a glass as it will hold, then taking a liquid of a heavier specific gravity than water, and adding a portion to the water in the glass. We find that the quantity added before the glass overflows will be in proportion to the difference between the specific gravities of the two liquids. If you then repeat the experiment, but add a liquid lighter than water, you will find that the volume will be increased and the glass will overflow, the quantity overflowing being exactly the same in volume as that which you added. This is explained in the following way: On filling the glass with water, a portion only was filled, there being vacancies between each and every atom of water; on adding a heavier liquid, the atoms of said liquid, being smaller than the atoms of water, pass between them, filling up the vacancies; and until a sufficient quantity has been added to fill those spaces, it does not increase the volume of water; but on adding the lighter liquid, the atoms of which are larger than those of the water, they do not pass between them, but immediately increase the volume and overflow the glass.

If this be correct, and I have good reason to think it is, it at once proves the impossibility of such a substance as this so-called cold vapor is described to be; for it is plain that it would be impossible for the larger atoms or molecules of the cold vapor to pass between the smaller molecules of metal. Were the specific gravity of the cold vapor heavier than metal, instead of being lighter than the lightest known substance, it would be more practicable.

Monticello, Pa.

E. G. ACHESON.

The Remarkable Electric Phenomenon.

To the Editor of the Scientific American:

Regarding the statements relating to the singular electric phenomena described on page 100 of your current volume, as being in some respects opposed to hitherto observed facts, I decided to investigate the case thoroughly, and ascertain in the first place what the facts were, and then see whether they were in accord with previous observations. For this purpose, I sent one of my assistants to the house where the electrical displays occurred, furnished with the proper instruments for making careful and accurate measurements of the resistances of the rods, pipes, and other conductors about the premises.

The first measurement taken was to ascertain the resistance between the two pipes leading to and from the heater. This was found to be less than 0.01 of an ohm, and most of that was probably due to the connections of the galvanometer. Of course this proved conclusively that no sparks ever passed between these pipes, and Mr. Baldwin, the occupant of the house, said that the published statement was wrong in this regard.

The resistances of the supply pipe, overflow pipe, waste pipe, and lightning rod were then measured, with the following results: Resistance of the lightning rod = 161 ohms; of waste pipe = 284 ohms; of overflow pipe = 15 ohms; of supply pipe = 0. The house stands on a hill on the dividing line of a slate and limestone formation, and the lightning rod has been placed in the fissure of the rock to the depth of perhaps 6 or 7 feet, and is therefore partially insulated; and its normal resistance is doubtless much more than 161 ohms, which was found while everything was wet, a rainstorm having come up just before the tests were made. A resistance of 161 ohms in the lightning rod, however, is sufficient, in my opinion, to occasion all the phenomena of discharge which have been observed during heavy storms. The sup-

ply pipe is iron, and leads directly to a spring half a mile distant, where the best earth connection in the country is found. Owing to the insulating quality of the foundation upon which the house rests, the house constitutes one side of a leaky condenser, of which the slate and limestone form the dielectric, and the earth the opposite side. When a thunderstorm occurs, the whole house is charged in a greater or less degree; and as the earth connection of the lightning rod is insufficient to carry all the electricity which it receives, the electricity is discharged through every available channel, of which the supply pipe is the best. In light storms, the phenomenon would not be noticed; it becomes very marked in heavy ones.

In this case the supply pipe was the safety valve of the house. The proprietor of the house was advised to connect the lightning rod to the supply pipe by a large copper wire, which will probably terminate the curious phenomena which have been observed.

I trust the time will soon come when lightning rods will be erected by persons possessed of sufficient electrical education as to be able to tell whether they have a resistance of 161 ohms or of 0. Probably no important business at the present time, is as a rule, entrusted to a class of men so utterly ignorant of their duties as this one. In every case where a building supplied with a lightning rod is destroyed by lightning, the parties who put up the lightning rod ought to be prosecuted. A vigorous course of treatment of this sort would soon convince these people that a reasonable amount of study of the laws of electricity is necessary for their own safety as well as that of their patrons.

I wish that every electrical phenomenon which occurs could be promptly and carefully investigated by competent, practical electricians. Why cannot the scientific departments of our colleges undertake this service? It would furnish a fund of accurate information which would prove of very great practical value.

New York city.

GEORGE B. PRESCOTT.

Purification of Hen Houses.

Advice like the following, which we find in the *Live Stock Journal*, is always in order:

As the hot season advances, poultry keepers should not neglect the purification of the fowl houses. Proper sanitary measures must be taken, or health and successful poultry raising cannot be expected, nor is it deserved. Lime is an excellent purifier, and, when carbolic acid is added to the whitewash, will effectually keep away vermin from the walls. After every cleaning of the floor it should be sprinkled with carbolic acid; dilution, twenty of water to one of acid. This is one of the best disinfectants and antiseptics known, and is not used as much as it deserves. The roosts should be sprinkled with it every week. This whitewashing should be done twice at least, better three times, a year. The nests of sitting hens should be sprinkled with carbolic acid to keep off vermin; and the coops also, where young broods are kept for a time, should be purified in this way. If a hen gets lousy, the dilute acid will destroy the lice, if put under the wings, and on the head and neck. Wood ashes are excellent to be kept in fowl houses for hens to dust themselves with. They are much more effectual than sand; but sand should also be kept for a bath. Without proper attention to these matters, poultry keepers cannot expect to succeed.

BORING BITS.

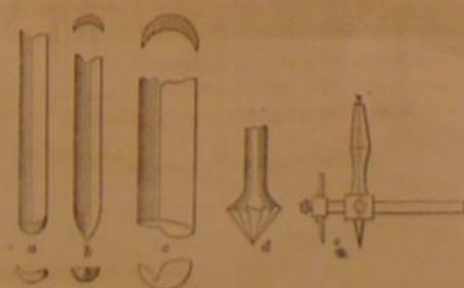
In continuation of our article on augers, published on page 133 of our current volume, we give the following illustrations and description of the various kinds of boring bits in use. The engravings are selected from the pages of Knight's "Mechanical Dictionary."

In Fig. 1 and succeeding illustrations, various forms of bits are given. The gouge bit *a* (Fig. 1), before the invention of the pod, spoon, and twisted bits, resembled the half of a reed split longitudinally, and had a sharp end like a gouge.

The change to the spoon bit, *b*, was merely giving a conoidal end to the tool, which enabled it to enter more accurately at a given spot. This is the dowel bit used by coopers.

The nose bit or shell auger, *c*, has a long barrel, and the large sizes are used by the pump makers, and called pump bits.

Fig. 1.



Boring-Bits.

The chamfering bit, *d*, for opening holes so as to admit the conical heads of the ordinary wood screw, consists of a conical reamer with teeth.

The expanding center bit, *e*, consists of a shank and center point, and a chisel-shaped cutter, whose distance from the center is regulated by slipping the bar, like that of a beam compass, in the socket of the head, a set screw maintaining it at its adjustment. This serves for cutting out disks, or for cutting circles for inlaying.

J. B. Ford & Co., publishers, New York city.

For cutting hard wood, such as the finger and key holes

Fig. 2.



Boring-Bits.

of flutes, bits are employed with a square point and two diametrical cutting lips, *g* (Fig. 2); the smaller one approaches very closely the character of a drill.

The French bit, *h*, for hard wood, is a drill, and as such is used in a lathe head. The center point and two sides merge into an easy curve, which is sharpened all the way round and a little beyond the largest part.

The German pod bit, *k* (Fig. 3), has a long elliptical pod and a screw point. It makes a taper to the end of the hole unless it is driven clear through.

The spiral ribbon, *m*, is a bar having a half round section. This is twisted so as to throw the flat side to the exterior to form the outside of the cylinder; the inside is not filled up by the metal, but makes a hollow spiral, and the bottom end has a single cutting lip.

The twisted flat bar, *n*, assumes the form of a doubled threaded screw, no vertical vacancy existing in the twist.

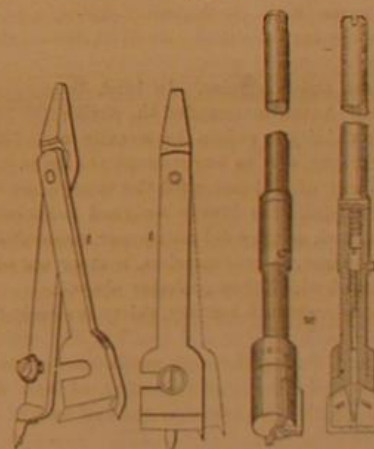
The spiral rib bit, *o*, is known, especially in England, as the American bit and has a cylindrical shaft, around which is twisted and brazed a single fin or rib.

Behind the worm, as in example *p*, may be a small diametric mortise for the reception of a detached cutter which has the nicking point and cutting lip of the ordinary center bit. The cutter is kept in its central position by a square notch which embraces the central shaft of the bit, against which it is forced by a wedge.

The grooved bit, *s*, has a cylindrical stem and spiral groove.

One form of expanding bit, *t*, Fig. 4, has a central portion which has the point, and a hinged portion which carries the scribe and the router. The movable portion is set by a screw, so as to regulate the radius of the hole.

Fig. 4.



Expanding-Bits.

Another form, *u*, has three radial cutters, which are expanded by means of a taper wedge and an axial screw. The latter is operated by a screwdriver, whose end is introduced into the socket, the threaded end of which is the means of securing it to the brace.

A Roman Tunnel in Algiers.

Several civil engineers, engaged with the surveys for a water conduit from Touja to Bougie, have made a very interesting and important discovery. A mountain which was situated in the proposed line of the conduit was to be tunneled for a length of 500 yards; and in searching for the most suitable place the engineers discovered an ancient tunnel 6 feet 8 inches in height, and 19 feet 7 inches in circumference. It is supposed that this is the same tunnel mentioned in an epigraph found at Lambéoc, according to which the tunnel was built in the reign of Antonius Pius, the plans being proposed by a veteran of the Third Legion, named Nonius Datus. Finding works like this after a time of 2,000 years, we cannot but be greatly astonished at the power, energy, and genius of a nation which produced, with the limited means available at those times, such gigantic structures.—*Stummer's Ingenieur.*

Successful Swimming Across the English Channel.

Captain Webb, after failing in his first endeavor to swim from Dover, England, to Calais, France, has succeeded in his second attempt, and has traversed the distance, some twenty-one miles, in twenty-two hours and forty-three minutes. This is certainly the most wonderful feat of swimming ever accomplished. Captain Webb wore no life-preserving apparatus whatever, but swam without clothes.

It is not difficult to imagine a man possessing muscular power sufficient to sustain such extraordinary exertion, but that it could be exercised during so long a sojourn in the water, the effect of which is to cool the body below its normal temperature, and so largely diminish the vital force, is surprising.

IMPROVED COOKING CHAMBER.

We illustrate, in the annexed engraving, a new chamber or covering for the top of cooking stoves, whereby all odors, steam, smoke, and other emanations from cooking are drawn off from the apartment in which the cooking is done. By means of the same device, it is claimed that the heat of the stove during hot weather may be conducted away, and in cold weather may be utilized for warming other portions of the house. The chamber also serves as a hot closet for drying fruit, and as a plate warmer; and through its use, we are informed, boiling can be done with less fire and in a shorter space of time than upon the open stove.

The box is made of sheet metal. The heat may be led into the chimney by a short pipe, as represented in the engraving, or the pipe may be extended into another room and terminate in a suitable register. The top and back of the chamber are united; the upper portion has a grating floor, A, so as to form a separate compartment, access to which is had by the door, B, and which may serve as a receptacle for warm plates or for other uses. At the back of the lower chamber, and also on top of the box, shelves are placed for setting cooking utensils upon. The sides are movable, and slide back and forward. To these, the front doors are hinged. By pushing back the sides and opening the doors, the whole chamber is thrown open, giving free access to the top of the stove. A frame is supplied, which fits on top of the latter and serves to hold cooking vessels. The apparatus can be attached to any make or pattern of stove by elongating the ribs or frame and by enlarging the doors. It can be easily taken apart and packed for transportation.

Patented April 13, 1875. For further information address the inventor, Mr. John D. Smedley, Syracuse, N. Y.

Excommunicated Insects.

Apropos of the efforts in progress to destroy the phylloxera and other insect scourges in France, a writer in *La Nature* gives a curious bit of information relative to the way in which such pests used to be proceeded against when Science, save so far as it could be made to agree with theological dogmas, had no existence for the world. In 1120, the Bishop of Laon formally excommunicated all the caterpillars and field mice. In 1488, the grand vicars of Autun commanded the parish priests of the vicinity to enjoin the weevils to cease their ravages, and to excommunicate them. In 1535, the Grand Vicar of Valence cited the caterpillars to appear before him for trial. He kindly assigned them counsel for their defense, and, as they did not appear, proceeded against and sentenced them, *in contumaciam*, to clear out of his diocese, a command which they probably obeyed.

During the seventeenth century, thirty-seven similar judgments, against both insects and quadrupeds, were issued. One is on record, during the eighteenth century, fulminated against a cow; and there is still another, of later date, due to a judge of Falaise, who condemned and hanged a sow for killing a child.

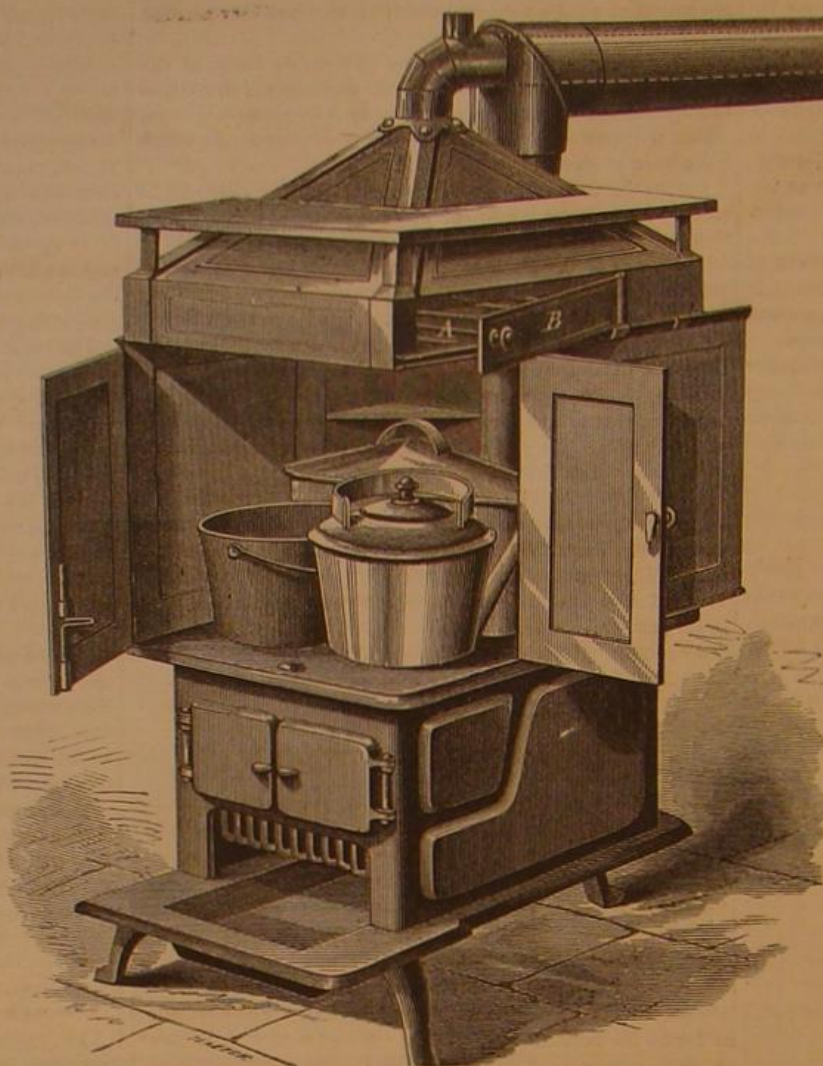
IMPROVED ORNAMENTAL MOLDING MACHINE.

The object of the invention illustrated herewith is to combine several valuable improvements suited to molding machines in the simplest form.

By the arrangement here shown, a staunch and unyielding frame is secured, that will admit of great speed of the running parts, and prevent any twist or cramp that would tend to increase the friction in the boxes from an imperfect or yielding floor upon which it may be placed. The boss or foot of the frame is cast separate from the trunk or post, and the two are fitted and bolted together, or they may be both cast in one piece. These together make the main frame of the machine, to the sides of which the yokes or box frames are attached. The boxes are connected together by a broad plate, A, which has V-shaped edges that fit into correspondingly shaped grooves in the perpendicular ribs cast upon the sides of the main frame, and the yokes are thus held to the frame by gibs, B. The yokes carrying the cutter shafts are moved up and down by means of the screws operated by the hand wheels and bevel gears. The screw and hand wheels rest in stands that are attached to the main frame near the top. By this movement the cutters are brought to any desired height in relation to the top of the table of the machine, thereby readily adapting the cutters to the work in hand. By this mode of construction the belts and all other working parts of the machine are on the outside of the frame, convenient to the hand of the operator when adjusting, oiling, or repairing. At

the top of the frame are two girts or arms firmly attached, one upon the front and one upon the back. Upon these rests the plate or top of the machine, which is secured to them by screws.

In the top, around each cutter head, are nicely fitted a series of rings that are removable when the operator desires to place the cutters so as to have them operate upon the under side of the piece to be cut or molded. The apparatus is thus rendered less liable to accident when applying the work.

**SMEDLEY'S COOKING CHAMBER.**

It is claimed that the machine is capable of being run at a high rate of speed, with scarcely any perceptible jar or vibration, giving an easy, smooth, rapid cut, and that consequently a greatly increased amount of work can be done with less labor.

The machine and its improvements are covered by four patents, the latest dated April 9, 1873. For further particulars address the patentee and manufacturer, Jonathan P. Grosvenor, 12 Fletcher street, Lowell, Mass.

Carbonic Acid Gas as a Motive Power.

On this subject, Professor de Repentigny (of St. Therèse College, Canada) writes us that he has discovered a method by which the gas may be obtained in large quantities, and at a very moderate cost. There exists in Canada a peculiar for-

residue remaining, consisting chiefly of a solution of copperas, along with sulphate of manganese, lime, and other impurities, he treats with ferrocyanide of potassium for making Prussian blue.

Soundings in the Gulf of Mexico.

The U. S. Coast Survey steamer Blake, Lieutenant Commander C. D. Sigsbee commanding, has recently returned to Washington, after an excellent winter's work in running lines of soundings in the Gulf of Mexico. These deep sea examinations are the first ever made in that portion of the ocean, and consequently, in points of novelty, are on a par with those of Commander Belknap of the bed of the Pacific. Steel pianoforte wire, No. 22 gage and weighing but 14½ lbs. to the mile, was employed as a sounding line with uniform success, even in heavy seas.

The results show that the slope of the delta of the Mississippi is gradual, and that the deepest water in the vicinity is on a prolongation of the axis of South Pass. At the end of that line, 120 miles distant from South Pass lighthouse, the depth was 1,632 fathoms. The limiting lines of the system of lines, which was run by the Blake, extend (magnetic) east, half mile south of Pass à l'Outre, at the end of which was found 426 fathoms, and southwest of Southwest Pass, which ended in 608 fathoms. On the latter line was found the only abrupt irregularity of the bottom found off the delta. Up to April, the currents immediately off the passes set generally to the westward, after which they appeared to set gradually to the eastward. On May 4, the Blake commenced a line between Southwest Pass and the Rio Grande. Until half the distance between the ends of the line had been passed, the depths were not great; but afterward the water deepened, the greatest depth on the line being 900 fathoms. About 105 miles from the Rio Grande, at seventeen miles from the Southwest Pass lighthouse, the water had deepened to 32 fathoms, after which it shoaled gradually to as little as 18 fathoms, and 30 fathoms was not reached again until ninety-four and a half miles from the lighthouse.

On May 6 a sounding was got in 47 fathoms, the sounding rod bringing up hard bottom—enameled shells, etc.—(the only instance in which hard bottom was obtained during the season Tortugas was neared). At a sounding in 583 fathoms, in latitude 27° 07' north, longitude 94° 35' 15" west, the sounding rod brought up dark mud, or ooze, which emitted so offensive an odor as almost to drive the people from the forecastle, where the sounding operations are carried on. The odor soon passed away.

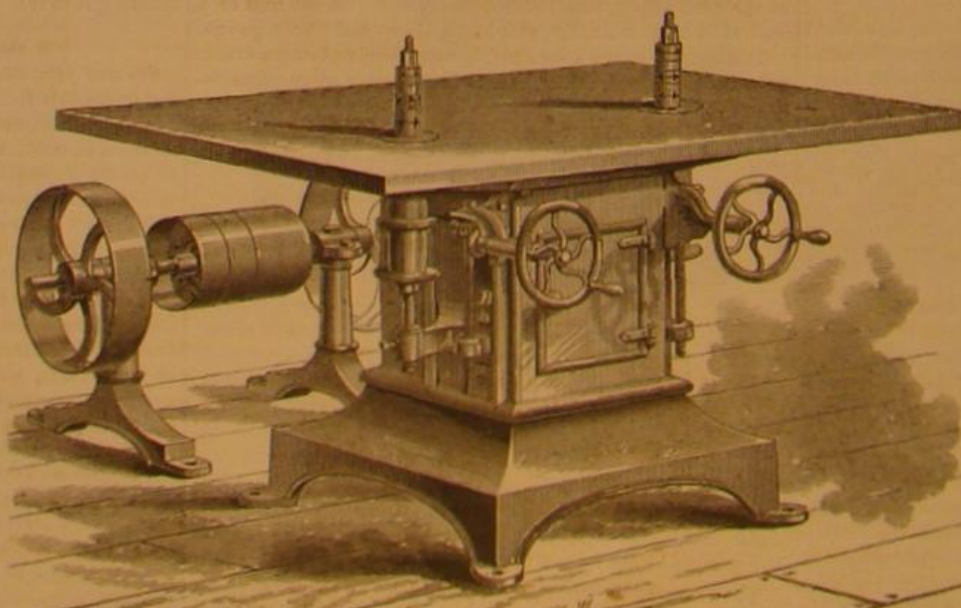
On May 9 commenced the longest line run during the season, that from the Rio Grande to Tortugas, a distance of about 760 miles; 100 fathoms was not reached until about forty miles from the Rio Grande; the water then deepened rapidly. At about 100 miles from the Rio Grande the depth was 839 fathoms, whereas the previous and following soundings were respectively 1,386 fathoms and 1,648 fathoms. This was the only marked peculiarity of the bottom found on the line; soundings varied from 1,600 to 2,100 fathoms, the bottom being undulating, apparently. No northern extension of the bank of Yucatan was discovered. The greatest depths were 2,008 fathoms, 2,025 fathoms, and 2,119 fathoms. The average specific gravity of the water of the Gulf is about 1.0265.

The following is an example of the quickness with which the Blake does her work: On one occasion she got the following results in actually one hour from the time of stopping the engines to sound to the time of steaming ahead again: A sounding in 1,500 fathoms, with a specimen of the bottom, water specimens, and temperature, at the surface and at the following depths in fathoms: 100, 300, 600, 900, 1,200, 1,500. There were but seven men on the watch to accomplish this.

During the summer the Blake will work in the Gulf of Maine, when the new machine will be tried, as also a new sounding rod by Admiral Porter, and another by Mr. Wilson of the navy yard.

Metal Glass.

Another hard glass, to which the above name has been given, has been produced at Count Solm's works, near Buntzlau, Germany. The tests withstood appear to be about the same as those to which the Bastie glass was subjected, with the exception, however, that the metal glass is indifferent to cold water when highly heated. The Bastie glass breaks under similar conditions. The treatment to which the glass is subjected in the new process is not made public; but it is probably, like the Bastie method, a system of annealing.

**GROSVENOR'S ORNAMENTAL MOLDING MACHINE**

mation known as gray iron sand, which contains a large portion of carbonate of lime. He says: "It is very common in this section, and may be found in immense quantities." When treated with dilute oil of vitriol, a complete solution of the sand ensues, accompanied by a copious liberation of carbonic acid ($\text{FeCO}_3 + \text{H}_2\text{SO}_4 = \text{FeSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$). The

COCHLIOSTEMA JACOBIANUM.

This singular plant, with agave-like foliage, and somewhat orchid-like blossoms, is one of great beauty. A plant belonging to the same genus was introduced in England some few years ago, and more than one of the principal nurserymen flowered it successfully. M. E. André, however, who, in the *Revue Horticole*, recently gave a figure of what he deems to be a new species, appears to think that the elder species is now entirely lost to the English gardens; but whether he has sufficient proof that such is the case we doubt. Our engraving will serve to convey an excellent idea of the agave-like foliage of the plant described as a new species by M. E. André. An engraving, however, can give no idea of the beauty of its inflorescence. The petals of the flowers, which are of a soft velvety purple, measure $1\frac{1}{4}$ inches across, while the sepals are of a pale rosy white. The spoon-shaped bracts are of a deep bright salmon color, the whole of the stalks being of a paler tone of the same color, flushed at the joints with a full brownish pink. The flowers exhale a delicate perfume, similar to that of certain *oncidiums*, to the blossoms of which they present a superficial resemblance. The beautiful flowers of *C. Jacobianum* have the defect of being exceedingly evanescent, as noticed in the previously known species which has flowered in England. This defect, however (which is peculiar to nearly all commelynaecous plants), is more than counterbalanced by the profusion with which the flower spikes are seemingly produced on well grown plants. In the new (?) species described by M. E. André, he relies for its distinctness on the following differences from the old one: First, by the far less hirsute character of the flowers; and secondly, by the uniform green of the leaves, the elder species having them either strongly blotched or bordered with purple. He also relies on the much larger general dimensions of the plant. It is presumed that so large a plant can only be an epiphyte upon some of the forest giants that clothe the deep slopes and valleys of equatorial America. In a shaded part of the stove house it is not difficult to flower, and its multiplication may be effected by the separation of the small lateral buddings until seeds shall have been obtained. It is well worthy of a place in the orchid house.

MESEMBRYANTHEMUMS.

These beautiful flowers belong to South Africa, where there may be found no fewer than 250 species or thereabouts. For the sake of convenience, Haworth has divided mesembryanthemums into forty-three sections and sub-sections. *M. debile* and *crassifolium*, though thought by some to be Australian species, nevertheless belong to the Cape, and probably went first to Australia from there or from England. *M. cordifolium* (the ice plant), so well known in country districts, was sent to England a few years ago by Baron Müller; but it is likely that some plant-loving emigrant took it out to Australia. The majority of mesembryanthemums are easily grown, and make first-rate window and rockwork plants. Common garden soil suits them perfectly; the kinds represented in the accompanying illustrations, and their immediate congeners, may be placed among fancy sorts—little gems well worth cultivating on account of their quaintness and variety rather than as subjects for purposes of general decoration. For those who are fond of uncommon forms among plants, but who have little time or space to devote to their culture, these are plants well worth attention. *M. minimum*, of which we give an engraving, belongs to the sphaeroide section, a group in which there are four others, *m. truncatulum*, *obconellum*, *nuciforme*, and a new species which is much larger than the others, and which has been named *m. truncatellum*. These plants never form a stem, and increase in size by bursting through the fleshy top, when the outer part shrivels up, and the new formation takes its place. The flowers, which issue from the center, are pale rose. Plants like these require to be potted in very sandy soil, and require to be well drained, when they will grow well. *M. testiculare*, of which an illustration is also given, is a rare and beautiful plant, with a skin as smooth as silk, and very glaucous. It is sometimes called *m. octophyllum*, but we never yet saw it with eight leaves. It is somewhat delicate, and should be potted in half silver sand, the other half being loam and brick rubbish, and should be kept near the glass in a dry house. *M. fissum* is closely related to this species, but it is more easily cultivated than *m. testiculare*. Among the most interesting of the mesembryanthemums are *m. tigrinum* (tiger's chap), *m. lupinum* (wolf's chap), *m. felinum* (cat's chap), *m. erminum* (rat's chap), *m. murinum* (mouse's chap), and *m. mustellum* (weasel's chap), all exceedingly interesting, and easily cultivated kinds; their flowers, which are all yellow, open in the afternoon. They form valuable plants for rockwork in summer, standing well out of doors in the south of England from May until October. They are easily propagated by pieces pulled or

cut off and laid in the sun on moist sand, where they root freely in a few weeks, and often keep on flowering as though nothing had happened.

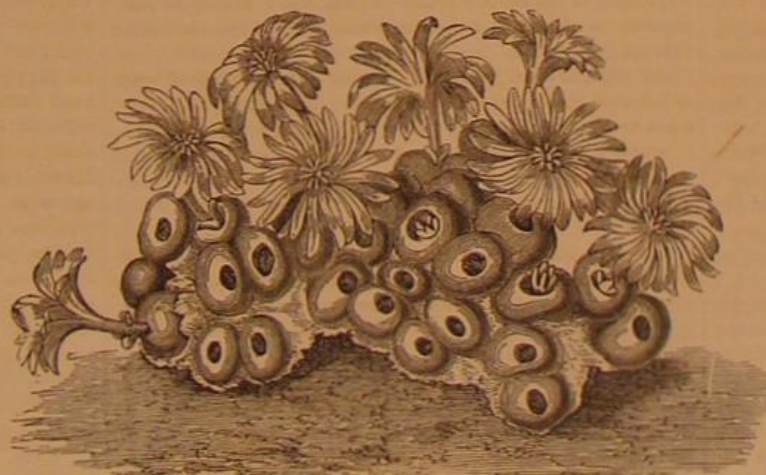
A Profitable Source of Picric Acid.

G. C. Wittstein calls attention to a new source of picric acid. This is a long and well known drug, the resin of *zanthorrhæa arborea*, a plant which is a native of Australia. It is known as acaroid resin and as the yellow resin of Botany Bay in New Holland (*resina acaroidis* and *resina lutea Novi Belgii*). The advantages of using this substance for the manufacture of picric acid are twofold. First, the mate-



COCHLIOSTEMA JACOBIANUM.

rial is cheap; second, the yield is large. About one hundred and fifty grains of the pulverized resin were placed in a beaker glass, and 750 grains crude nitric acid, of specific gravity 1.16, poured over it; the beaker was covered with a glass capsule and digested at a gentle heat. The mass soon swelled up, and a deep brown crust formed over the liquid. This crust needed to be broken up from time to time with a glass rod. After about three hours, nitrous fumes ceased to be evolved, and the mass was allowed to cool. The next day, he found the bottom of the beaker covered with a thick layer of yellow crystals. Above this was a brownish red tarry mass, which hung together in a lump. This was taken out and again digested with 375 grains nitric acid; but there was almost no action, at least no more nitrous acid was formed,



MESEMBRYANTHEMUM MINIMUM.

and no crystals were deposited from this second liquid on cooling, showing that it is unnecessary to treat the resinous mass with nitric acid a second time. In the present case it was desirable to lose as little as possible of the product



MESEMBRYANTHEMUM TESTICULARE.

sought; hence, after the crystals that formed had been taken out, the second liquid was added to the mother liquor and evaporated to dryness. The first crystals were added and

the adhering nitric acid driven off at 212° Fah. The total residue weighed 100 grains, almost $\frac{1}{2}$ of the resin taken; it was yellow and crystalline, and contained nothing amorphous but single crystals of oxalic acid. The picric acid thus obtained, after recrystallizing to secure the oxalic acid, weighed 75 grains. Hence, the yield is 50 per cent of the crude material.

Fused Boracic Acid.

Fused boracic acid, which approaches glass in some of its external characteristics, presents some properties worthy of note. In the viscid state it may be drawn out into threads, which solidify rapidly, and from this point of view its ductility rather resembles that of silica than of glass. Its hardness, between 4 and 5, places it between fluor spar and apatite; it scratches glass, and is with difficulty attacked by sand, and even by emery, dry or with oil. It takes seven to eight times as much time in grinding as glass under the same circumstances. This resistance to friction, which does not accord with its hardness, depends doubtless, as M. Damour has recognized in the case of other minerals, on a speciality of structure. Melted boracic acid, in mass, becomes slowly hydrated in contact with water. In powder it is acted on rapidly, as shown by Ebelmen. If the powder is sprinkled with water, its temperature may rise to 100°. Boracic acid is chiefly remarkable for the persistence of its temper. If poured upon a cold metallic surface, glassy plates are obtained, the under surface of which, chilled by the metal, is more strongly tempered and more expanded than the upper. Hence results a flexion which may be strong enough to cause the rupture of the plate and its projection in fragments. If poured into oil it may be obtained in small masses with short tails, under the same conditions as Prince Rupert's drops. A tempered plate of boracic acid, with parallel surfaces, acts upon polarized light like tempered glass; but while the latter loses this property by re-heating, boracic acid preserves it with great tenacity.—*V. de Luyne*.

Eighty Miles an Hour in Pneumatic Tubes.—The Atmospheric Post between Paris and Versailles.

The National Assembly of France holds its sittings in Versailles, a kingly residence distant some eleven miles from Paris. The latter is the real seat of government, and it was therefore of great importance to introduce a means of communication by which official documents could be transmitted between the two places, at any moment when required, with great rapidity. For this purpose the pneumatic method has been put into operation, with much success, and it is stated that letters and packages are now sent through, in either direction, in eight minutes' time, being at an average velocity of more than eighty miles an hour.

To produce this enormous velocity—the tubes being only four inches in diameter—requires the use of three steam engines having an aggregate of one hundred and fifty horse power, besides other extensive apparatus, which we will briefly describe, quoting from a recent number of the *Engineer*.

A report on the system of M. Crespin, on the application of pneumatic power over long distances, has been reported upon by M. Tresca, of the Conservatoire des Arts et Métiers, with the Academy of Sciences, and the report is now published. We copy from the *Engineer*.

When it was found necessary to connect Paris and Versailles by means of a pneumatic tube, it was impossible to make use of the method adopted in Paris, which only gives the required speed over a distance of about 1 mile. The problem was to apply the same force along a line from 11 to 12 miles in length. This result has been obtained by the adoption of an apparatus called a relay, which, placed at various points along the line, acts upon the train and urges it at full speed to the next station. The column of air within the tube is set in action by forcing or by exhaustion, and the two operations are employed concurrently, but in a novel manner.

As in the pneumatic telegraph, M. Crespin uses a series of boxes to form a train; the impulse is given by forcing the air in at one end of the tube and exhausting it at the other; the pressure accumulated in the reservoirs comes into action at the moment the train passes a relay, and continues until the arrival of the train at the next post, when it is taken up by another reservoir, and so on to the end.

The line is double, up and down, and each is divided into sixteen sections of 3,650 feet in length, and each section has its relay. The necessary motive power is obtained from three stations, one at each end of the line, the other in the middle. The last is the most important, and comprises two engines of fifty horse power each, with pumps capable of exhausting the 280 cubic yards contained in the part of the line it serves in ten minutes, at the same time storing it in the reservoirs under the pressure of one atmosphere, necessary to supply successively behind the train 188 cubic yards

of air, representing 11 miles in length. The two stations at the ends of the line have each two engines of twenty-five horse power, with pumps, which in ten minutes exhaust nearly 3 miles of line, and which at the same time compress in the reservoirs sufficient air to fill, at the moment required, double that length of line.

The reservoirs at each of these three stations are connected together by means of cast iron tubing, 5 inches in diameter, placed in the same excavation as the main tubes, at a depth of 2½ feet, and opposite to each relay a branch is connected with a reservoir, containing 20 cubic yards of air for the service of the relay in both directions. The relays are placed under the main tubes in a small chamber closed by a trap similar to those used for sewers. The exhaust relays are placed at two points, each one quarter of the length of the line from the end, and consequently with half the length of the line between them. The exhaust receivers are much larger than the others, and they are connected with the central establishment by means of cast iron pipes 4 inches in diameter, which contribute to regulate the action of the exhausting engine. In order to insure regularity in working, large reservoirs are also placed at each end of the line, and all the accumulators of pressure are in communication with each other. At the central station, the capacity of the pressure reservoirs is 80 cubic yards, and those at the termini half that amount. The exhaust reservoirs have a capacity of 97 cubic yards at the central station, of 60 cubic yards at each intermediary station, and of 52 cubic yards at each terminus. The last named are not in communication with the rest, and thus 5½ miles of tubing are dispensed with.

With this arrangement no obstacle can arrest the movement of the trains; the pressure in the reservoirs is an atmosphere higher than that of the ordinary air. The train is introduced through a kind of sluice gate, or chamber, closed by means of a valve at the entrance of the line, and the train is furnished with a piston fitted with leather, which has precisely the contour of the tube. When the train is in place, the valve is opened and the pressure turned on. With a pressure of one atmosphere behind, and a partial vacuum in front, the train starts with a speed of 130 feet per second, or 7,800 feet per minute; and at the moment of passing the first pressure relay, at 3,650 feet from the terminus, it opens behind it a large valve, which places the line in communication with the reservoir of 20 cubic yards placed at the foot of the relay, and this second current of air takes up the work. When the train arrives at a station, an electric bell informs the attendant at the station last past, and he closes the valve there.

In order to suspend the current of air of one relay, after the train has entered the next section, the pressure itself is made use of to set in motion a piston in the cylinder; this piston moves, of course, at the same rate as the current of air, and it is so calculated that the piston stops at the end of the section. Admission is thus cut off, but the tube is full of compressed air. When the train has passed the third and fourth sections of the line, and has arrived at the first vacuum relay, the compressed air which follows the train acts on a piston freed by the train, and this piston enters rapidly into a cylinder with a valve, which puts the up line in communication with the exhaust of 60 cubic yards at this station. The compressed air escapes rapidly through a safety valve placed above the exhaust relay. As soon as the train has passed the fourth section, the current of air of the relay presses on the exhaust valve, closing the line, and the train proceeds at the same rate as before; but by a special arrangement, the speed slackens towards the terminus to avoid any shock. The time occupies in the transit is eight minutes.

The pneumatic tube itself is formed of wrought iron tubes brazed, 4 inches interior diameter, with a thickness of ¼ inch, and weighing about 26 lbs per meter run = 8 lbs. per foot. They are joined together by means of six bolts with an india rubber washer between. In places the tube is curved, but the radius generally exceeds 19 feet.

The working of the line is regulated throughout by electric signals, and a special wire connects all the pressure relays, and tells whether they are in action or not. The carrier pistons are of iron, with an interior diameter of 3½ inches, and 9 inches in length; the boxes are placed in a case which is slightly conical. On the outer surface of the carrier pistons are fixed two strips of metal which are turned to 3.95 inches, and started longitudinally so as to produce rotation, this arrangement causes the wear to be equally distributed, and, should a grain of sand get into the tube, it prevents stoppage by friction. The piston is also hollow and similarly provided, and between the two strips of metal there is a series of openings into the interior to receive any dust which may arise from the wear of material. The packing leather is fixed solidly between two washers by means of a bolt at the end.

The exhaust relay consists of a piston which enters a vertical cylinder, and draws with it a disk, which closes the pneumatic line, and a valve, which opens a large rectangular orifice communicating with the reservoirs. The top of the cylinder in which the piston moves is connected by a tube with the back part of the valve above mentioned, and above the valve is a grating closed by a clack. The piston is held down by means of a bolt until the passage of the train, when the adjoining pressure relay comes into action. The piston thus released has then its upper portion in relation with the exhaust and the lower acted upon by the pressure of two atmospheres and therefore it rises rapidly into the cylinder and closes the line, at the same time opening the lower valve by which the exhaust is effected; all the air at a pressure superior to that of the atmosphere has been expelled by the safety valve placed above, so that the aspiration only draws off air at the normal pressure. The pressure relay is the

main feature of the arrangement; but should it not act, the train is only retarded, not stopped.

Each of the pressure relays is in immediate communication with its reservoir of 20 cubic yards for accumulating the pressure. These reservoirs are formed of iron plate like ordinary boilers, and are tested to about 570 lbs. per square inch; they are made cylindrical in form, the ends being closed with a single plate; they are 16 feet 6½ inches long and 6 feet 6½ inches in diameter; the exhaust receivers differ from the others by having their ends concave without and convex within. The tubes which connect the relays of pressure are about 5 inches in diameter, and those of the exhaust 4 inches. The pumps make forty strokes a minute, are single action, with cylinders 3 feet 3½ inches in diameter, and 4 feet stroke; they draw or force nearly 1 cubic yard of air at each complete stroke of the piston.

[For the Scientific American.]

THEORIES OF THE EARTH'S INTERIOR.

It has long been known that, as we descend towards the center of the earth, the temperature rises at the rate of one degree Fah. for about 50 to 60 feet of descent. In artesian wells and other deep excavations, the increase of heat has been noted and mathematically calculated; but so many elements of error enter into the computation—among which are heat due to friction of the implements used in excavation, animal heat of those engaged in the work, and currents of air from the surface—that the results can be considered, at best, as only approximations to the truth. If the heat increased uniformly from the surface to the center, it would be sufficient, at a depth of two or three hundred miles, to melt the most refractory substances to be found at the surface. Hence the general conclusion is that the solid crust of the earth cannot be over two hundred miles in thickness. But Hopkins calculates, from data furnished by the precession of the equinoxes, that the crust of the earth has a thickness of eight or ten hundred miles, while Hennessey's investigations, in a similar way, assign six hundred miles as the maximum thickness of the crust.

Till within a few years, all below this crust has been supposed to be in a state of igneous fusion, and our earth to be, for the most part, in a liquid state. This conclusion has long been looked upon as a necessary result of the nebular hypothesis which is now so generally accepted. The fact that molten matter appears at the surface, in the form of volcanic ejections, trap dikes, and the like, and that warm, hot, or boiling springs are variously distributed over the globe, has given foundation and sufficient authority to these views. But these phenomena are not conclusive proof that the interior of the earth is in a state of fusion; for, according to Mallet—though in substance previously enunciated by others—the crushing force, due to the lateral pressure caused by shrinkage of the earth's crust, is sufficient to melt the hardest rock; and the pressure that would crush 7,200 cubic miles of rock would generate heat enough to cause all the volcanicity on the globe. According to other authorities, the melted matter of volcanic eruptions may be produced by local chemical action in the earth's crust. Again, the diversity of composition in the ejected matter would tend to the conclusion that all cannot come from a single and uniform molten mass. Many veins of rock, also, which were formerly looked upon as injected into or through the surface strata from the melted mass below, are now regarded by many eminent geologists as of aqueous origin, and formed by the percolation of heated water holding solid matter in solution through the surrounding rocks into a fissure, and its subsequent evaporation, which left the rock material to gradually fill the fissure.

Recent observations of Hopkins have shown that the melting points of various bodies, as wax, sulphur, and resin, are greatly and uniformly raised by pressure; and, from analogy, the opinion is now gaining ground that the interior portion of the earth, though heated far above the point of fusion, may be solid from the great pressure to which it is subjected. While it is now considered true that sufficient pressure on ice—which expands in freezing—will change it to water, pressure upon any substance that contracts in the process of congelation, like rock, would, on the other hand, aid in its solidification. Hence the conclusion is that the pressure existing at great depths would make solid the molten mass at a temperature at which, under a less pressure, it would have remained liquid.

There are two hypotheses based on the supposition of a solid nucleus. The first, maintained by William Hopkins, Scrope, Shaler, and others, supposes solidification to have commenced at the center of the liquid globe, and to have advanced towards the circumference. Before the whole mass was congealed, the portion near the surface became of so great a consistence as to prevent the sinking of the cooled and heavier particles, thus giving rise to a superficial crust, from which consolidation would proceed downwards. Between the nucleus and the crust is conceived to be matter still in a state of more or less perfect igneous fusion, either forming a continuous sheet of comparatively slight depth, or deposited in isolated reservoirs or subterranean lakes. It is interesting to notice, in connection with this hypothesis, that a similar one was reached from the study of terrestrial magnetism. Halley "supposed the existence of two magnetic poles situated in the earth's outer crust, and two others in an interior mass, separated from the solid envelope by a fluid medium, and revolving, by a very small degree, slower than the outer crust."

The second hypothesis is credited to Dr. T. Sterry Hunt. He accepts the first hypothesis so far as to admit a solid nucleus and a superficial crust. But he conceives it to be improbable that the cooling of the crust should have commenced at so early a period that the molten matter beneath it was too

deep to become entirely solidified by subsequent refrigeration. He holds that only a thin belt of partially fluid matter exists between the solid exterior and the core, and argues, with Sir John Herschel, that this layer is not matter still unsolidified, but the under portion of the crust encroached upon by internal heat, "disintegrated and modified by chemical and mechanical agencies, impregnated with water, and in a state of igneo-aqueous fusion." Keferstein whose work, published in 1834, has been generally overlooked, considers the liquid stratum, or seat of volcanic action, as part of the sedimentary formations which have been subjected to a peculiar kind of fermentation, which crystallizes and arranges the elements in new forms with an evolution of heat as the result of chemical action. But Hunt rejects as irrational the idea of subterranean combustion or fermentation as a source of heat.

Professor Hall denies that we have any positive evidence of a former molten condition of any considerable portion of the earth, but denies it absurdly, on the lack of the visible exposure of any considerable part of the primitive crust. Sir William Thomson argues that the phenomena of precession and mutation demand greater rigidity of the earth than would be possible with a comparatively thin crust. This is opposed by Delaunay, but is again recently defended by Thomson.

The question respecting the earth's interior lies at the very foundation of the disputed theories of mountain formation, of earthquakes, and of volcanic action. S. H. T.

The Steam Yacht Hermione.

The steam screw yacht *Hermione* has been recently constructed for Captain W. H. Gordon, R. N., by Messrs. Edwards and Symes, yacht builders, Cubitt Town, London. She is one of the fastest of her size and construction afloat; the following are the principal dimensions: Length, 55 feet, breadth, 11-0 feet, depth 5 feet 4 inches; diameter of cylinders, 8 inches; length of stroke, 9 inches; heating surface, 325 square feet; grate surface, 13 square feet. When the engines were worked about three quarter power, the speed was 13 miles an hour, or 11-28 knots, the number of revolutions 220 per minute, and mean effective pressure in cylinders 80 lbs. per square inch. The power developed would thus be 80-4 indicated horse power, and the constant in the Admiralty formula $C = \frac{H \times D^2}{L}$ would be 120, an exceedingly good I.H.P.

result for so small a yacht. From these results it is anticipated by the builders that, when the engines are worked to their full power, namely, 120 indicated horse power, at least 14½ miles or 12-58 knots will be obtained. The yacht is constructed entirely of teak and mahogany, coppered, and copper fastened, and is fore-and-aft schooner rigged, and, considering her great power and speed, has good accommodation for crew forward, while she has a neat polished mahogany cabin aft, and her fittings throughout are of a superior quality. The engines are high pressure surface-condensing, with inverted cylinders, and fitted with separate variable expansion valves, and screw reversing motion of most compact and effective construction. The condenser and pump are small, being only required to condense the steam for supplying the boiler; but when working at half speed a good vacuum is obtained, or by means of a suitable cock the exhaust can be turned into the chimney. The propeller shaft is of steel, cased in gun metal and fitted with one of Hirsch's patent propellers, which works very satisfactorily, and with little vibration. The boiler is of locomotive construction of steel with brass tubes, and has been proved to 200 lbs. per square inch. It is fitted with a superheater and has given very good results, making steam well. We may here mention that the above firm have recently constructed the beautiful little steam launch *Black Angel*, 33 feet keel, 5 feet 6 inches beam, built entirely of mahogany, copper fastened, for Messrs. Willans and Ward, and fitted by them with Willans' patent three cylinder engine, which worked very satisfactorily, driving the boat at a speed of 13 miles per hour. The total weight of boat and machinery was under 2 tons. The engines are very neat, and most compact and handy. Messrs. Edwards and Symes have likewise in construction the first ferry boat for the Thames Steam Ferry Company for heavy goods traffic, plying on the Thames between Rotherhithe and Wapping.—*Engineering*.

Pictorial Tiles.

A comparatively new mode of employing tiles for the lining of rooms has been introduced by Messrs. Simpson, who have decorated the interior of several important buildings in this manner. The tiles are placed together in their unglazed state, and a picture is painted upon them in colors suitable for firing. They are then taken asunder and put into the furnace, and then subjected to great heat and glazed. If this is successfully accomplished, the tiles can now be fixed against the wall of the room and present an absolutely indestructible decoration, which can be washed as often as it is needed, though from its high glaze it is not easily apt to catch dirt.

Copying Pencils.

Pencils are now sold by stationers, the marks of which may be copied in the same manner as writing made by the pen with ordinary copying ink. The method of preparing the leads is as follows: A thick paste is made of graphite, finely pulverized kaolin, and a very concentrated solution of aniline blue, soluble in water. The mixture is pressed into cylinders of suitable size and dried, when it is ready for use. Gum arabic, it is said, may be substituted for the kaolin

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

A permanent and handsome reddish color may be given to cherry or pear tree wood by a coat of a strong solution of permanganate of potash, left on a longer or shorter time, according to the shade required.

Chloroform, which has undergone decomposition by exposure, can be easily purified by shaking it up with a few fragments of caustic soda.

Fruit is kept in Russia by being packed in creosotized lime. The lime is slaked in water in which a little creosote has been dissolved, and is allowed to fall to powder. The latter is spread over the bottom of a deal box, to about one inch in thickness. A sheet of paper is laid above, and then the fruit. Over the fruit is another sheet of paper, then more lime, and so on until the box is full, when a little finely powdered charcoal is packed in the corners, and the lid tightly closed. Fruit thus enclosed will, it is said, remain good for a year.

Pounded alum will purify water. One teaspoonful of alum to four gallons of water will cause a precipitation of the impurities.

To estimate the quantity of shelled corn on the cobs in any given space, level them, and measure the length, breadth, and depth; then multiply these dimensions together, and the product by four. Cut off the last figure, and the result will be the number of bushels of shelled corn and the decimal of a bushel.

Bee moths can easily be killed in large numbers by setting a pan of grease, in which is a floating ignited wick, near the hives after dark. The moths will fly into the light and fall into the grease.

The best way to catch hawks or owls is to set up a high pole with a steel trap on the top. The birds often alight directly in the trap.

Pictures may be transferred to painted surfaces in the following manner: Cover the ground with an even coat of light colored carriage varnish, which should be allowed to set (nearly as dry as if for gilding). If the print to be transferred be colored, soak it in salt and water; if not colored, use water alone. Remove superfluous water by pressing between blotting pads, and then place the picture face down upon the varnish, pressing it smooth. When the varnish is dry, dampen the paper and rub it off with the finger. The picture will be found upon the varnish, and another coat of the latter should be added to bring out the effect. This process answers equally well for glass or metal surfaces.

For the protection of iron and steel tools against rust, Vogel recommends a solution of white wax in benzine. The latter, heated, will dissolve half its weight of wax. This will preserve the metal, even from the action of acid vapors. Apply with a brush.

Round steel wire rope will bear more than double the weight required to break iron rope of similar diameter.

The following rule for strength of iron pipes is based upon the fact that a 10 inch pipe, one inch thick, will stand the pressure of 100 yards head of water. The coincidence of one inch of metal to every 10 inches diameter and 100 yards pressure should be remembered. For every inch in the diameter of pipe, increase or deduct $\frac{1}{10}$ of an inch; and for every yard of pressure, increase or deduct $\frac{1}{10}$ of an inch.

In calculating the strength of iron columns, the safe plan is to find the diameter of a solid column necessary to bear the compression, and then distribute the same area of metal in tube form or a hollow column.

A mixture of peroxide of manganese and water glass is recommended to be applied to cooking stoves when they are red hot, as it is said to make a good blacking, not as liable to burn off as common black lead.

According to recent experiments of MM. Kundt and Lehmann, the velocity of sound in pipes filled with water increases with the thickness of the sides of the tubes.

To make yellow wax into white wax, the former is boiled in water, spread out into thin layers, and exposed to the light and air. This is repeated until all the color is gone.

Cuttings of many kinds of plants, not usually increased with facility by amateurs, may be rooted easily in a Wardian case in the sitting room.

An Alloy of Copper Adherent to Glass.

An alloy of copper which will adhere to glass or porcelain is made by mixing from 20 to 30 parts of copper in powder, (obtained by the reduction of the oxide by hydrogen or by the precipitation of the sulphate by zinc) with sulphuric acid and then with 7 parts of mercury. The mixture is triturated and mingled with care. The acid is removed by washing in hot water, and the mass allowed to dry. At the end of 10 or 12 hours, the latter becomes quite hard and susceptible to a fine polish. On heating it softens, but on cooling does not contract. This alloy may also be used for joining delicate objects which will not withstand very high temperatures.

Chloral as an Anæsthetic.

Hydrate of chloral, administered hypodermically, has recently been used as an anæsthetic with success in the hospital at Bordeaux, France. The operation was a resection of the internal and external nasal nerve, involving some fifteen minutes' work and, necessarily, excessive pain to the patient. The drug took effect in eight minutes, and complete insensibility on the part of the sufferer resulted.

Bricks made in Japan, and paying 20 per cent duty, are now imported into San Francisco. The quality is superior. Japanese brick makers can beat the world in the cheapness and excellence of their productions.

[American Chemist.]

Prices of Metals.

The prices of many of the dearest may be considered also as "fancy prices," and actually a whole pound of some of the metals named could hardly be obtained at even the extravagant figures annexed. In compiling the following table, we have taken the prices of the rarer metals from Trommsdorff's and Schuchardt's last price lists; we have assumed the avoirdupois pound as equal to 453 grammes, and the mark as equal to 24 cents gold.

An inspection of the table is not without interest; it is evident that the prices of the metals bear no relation to the rarity of the bodies whence they may be derived, for calcium, the third in the list, is one of the most abundant elements. Even that excessively sparingly distributed metal, indium, the most recently discovered element, stands tenth in the list, below strontium. The metals of the alkalies seem to occupy a remarkably low place in the table.

Metal.	Value in gold per lb. avoirdupois	Metal.	Value in gold per lb. avoirdupois
Vanadium, fused.	\$172.40	Tellurium, fused.	\$196.20
Rubidium, wire.	\$361.60	Chromium, fused.	\$196.20
Calcium, electrolytic.	\$445.20	Platinum, fused.	\$122.21
Tantalum, pure.	\$445.20	Manganese, fused.	\$108.72
Cerium, globules.	\$248.20	Polybdenum.	\$4.31
Lithium, globules.	\$225.75	Magnesium, wire and tape.	\$5.79
Lithium, wire.	\$205.44	Potassium, globules.	\$13.60
Erbium, fused.	\$171.97	Silver, bar.	\$16.30
Indium, fused.	\$1630.08	Aluminum, cubes.	\$12.64
Strontium, electrolytic.	\$1576.44	Cobalt, cubes.	\$3.90
Indium, pure.	\$1321.66	Nickel, cubes.	\$21.65
Ruthenium, fused.	\$1215.28	Sodium, crude.	\$1.90
Columbium, fused.	\$1032.84	Bismuth, crude.	\$1.00
Rhodium, electrolytic.	\$924.12	Mercury.	\$28.30
Barium, electrolytic.	\$824.12	Antimony.	\$28.30
Thallium, electrolytic.	\$724.12	Copper, recent quotations.	\$25.00
Osmium, electrolytic.	\$624.12	Gold, recent quotations.	\$196.20
Palladium, electrolytic.	\$524.12	Iron, recent quotations.	\$10.00
Iridium, electrolytic.	\$424.12	Lead, recent quotations.	\$5.00
Uranium, electrolytic.	\$324.12	Zinc, recent quotations.	\$5.00
Plutonium, electrolytic.	\$224.12	Aluminum, recent quotations.	\$1.00
Titanium, fused.	\$124.12	Iron, recent quotations.	\$10.00

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT ELEVATOR.—OTIS TUFTS *et al.* vs. THE BOSTON MACHINE COMPANY.

[In equity.—Before Shepley, Cir. J.—January, 1875.]

Shepley, J.: This is a bill in equity brought for alleged infringement of letters patent issued to Otis Tufts, dated August 9, 1859, and extended seven years, for improvements in hoisting apparatus, and adapting that apparatus for use as a passenger elevator for carrying persons to and from the different stories in hotels and other buildings; and also of letters patent dated May 25, 1861, for improvement in the mode of suspending and operating the elevator; also, for infringement of letters patent dated December 11, 1866, for improvements in the mode of adjusting the length and tension of the ropes of an elevator; and of letters patent dated December 11, 1866, for an improvement in elevator guides. All of these patents were duly assigned to complainants.

The twelfth claim in the patent of August 9, 1859, No. 25,061, is the one on which the infringement is claimed, and is as follows: "I claim passing the shipping rods and the cord or rod that operates the friction brake through the car or platform, for the object and purposes set forth."

The shipping rods are described in the specification as passing up through the car the whole height of the building and operating a shipper, by which the driving belt is shipped from a fast to a loose pulley when the power is to be thrown off. The cord is also described as passing down through the car or platform, so as to be accessible within the car, which operates to apply a counterpoise spring, so as to put on a friction-strap brake, its office being to check or perfectly stop the descending motion of the car at the will of any person within the car or on the gallery.

The great advantage (claimed) of running the shipping rods and the cord or rod up through the car itself is that they are thus rendered accessible to the conductor, or any person within the car, without incurring the danger of protruding the hand or arms beyond the same while in motion. If the shipping rods and the cord or rod are construed broadly as a claim for passing any rod or cord, by means of which the appropriate mechanism is operated to move the car up and down, or hold it at rest, through the car or platform, instead of outside the car or platform, it is void for want of novelty.

George V. Hecker has, in his flour mill in Cherry street, New York, an elevator which was put in twenty years ago, and which has been in successful operation since that time. A chain passed through the roof and floor of the cage or car, which operated upon a friction clutch and a brake. The conductor or operator within the car could, by means of this chain, operate the shipping apparatus and the brake without incurring the danger of protruding the hand or arms beyond the car while in motion. This chain is connected with a brake in such a manner that the brake could be thrown off by pulling on the chain, or put on by relaxing the pull upon the chain. A weight then causing the brake to produce friction on the friction pulley. The pull upon the chain, by raising the weight, first relieved the friction of the brake, and then threw into gear a friction clutch, and the car ascended by the force of the motor applied through the friction clutch. When it was desired to stop, the pull upon the chain was relaxed, and the weight threw the clutch out of connection and the cage stopped, held in place by the brake. When it was desired to descend, a slight pull was made upon the chain, sufficient to relax the pressure upon the brake, but not to throw the friction clutch into gear. The car then descended under control of the brake, by force of gravity, at a speed dependent upon the will of the operator who controlled the brake. Within the car was a lever with one long and two short arms, with a friction pulley on each of the short arms, which device was for the purpose of making necessary pulls upon the chain, which passed through the inside of the car. The friction clutch is a well known substitute for a shaft with a fast and loose pulley, a belt, and a belt shipper. It is manifest, therefore, that, in view of the state of the art, the twelfth claim in the patent can only be sustained by giving to it a much narrower construction than that claimed for it, and one strictly in accordance with the language of the claim, namely:

"Passing the shipping rods and the cord or rope that operates the friction brake through the car and platform, for the objects and purposes set forth."

The defendants do not infringe the twelfth claim thus construed, or any other claim of the patent of August 9, 1859.

Infringement is also alleged on the first and second claims of the patent of May 25, 1861, which are as follows:

"1. Constructing an elevator or hoisting apparatus with a series of two or more hoisting ropes or chains having independent attachments, and winding simultaneously upon the hoisting drum," was not new at the date of this patent. Letters patent of Great Britain to Frederick Levick and Joseph Fieldhouse, sealed January 15, 1854, describe a hoisting car or carriage with two hoisting ropes wound around the same spirally grooved drum. The ends of both of these ropes are attached to a connecting chain, which passes under a pulley attached to the top of the car. Another chain is attached to the first described chain in such a manner that the chain surrounds the pulley. If one breaks, the other, with the chain, forms a loop around the pulley, and sustains the car. The second chain converts the attachment into an independent attachment of each rope, and when one rope breaks, the other rope will continue to sustain the weight of the car. Mr. Renwick, the expert, correctly states that—

"The ropes act precisely as if they were attached to the two ends of a horizontal lever whose center, upon which it could turn, was secured to the top of the car."

In the patent of 1861 the patentee, Tufts, says: "I do not confine myself to the precise method herein described of effecting the automatic adjustment of the strain upon the hoisting ropes, as I sometimes accomplish the same by a rocking lever, when two ropes are used."

It is plain that, in the Levick and Fieldhouse elevator, the two ropes, when intact, have equal strain upon them, and that, if one of the ropes should break, the weight of the car would be supported by the other rope. If the chain should break under the pulley the car would fall, as it would in the form last described or the Tufts elevator, if the attachment to the car at the center of the rocking lever should fail.

It is contended that the purpose of the two ropes in the Levick and Fieldhouse machine was to keep the cage in the center of the shaft, and that, therefore, the Levick and Fieldhouse patent does not anticipate the first claim in the patent of 1861. The answer to this is, first, that, whether they were placed there for the purpose of greater safety or not, they effected that result; and, secondly, that the patentees evidently contemplated the use of the beneficial results to be attained by the use of two ropes instead of one, as there is no conceivable use for the cross chain before described, except in case of the breakage of one rope, to form a loop around the pulley, thus attaching the surviving rope to the car.

In the elevator which was placed in the mill of the Parsons Paper Company, at Holyoke, Massachusetts, in 1856, there were two hoisting ropes, having independent attachments to opposite arms of a rocking lever; they jointly and equally took the strain of the weight of the car, and each rope was sufficient to sustain the load put upon the machine. This elevator has been in constant use, and when one rope has broken the elevator has been worked several days with the remaining rope. The ropes in the Holyoke elevator did not, it is true, wind around a drum, but were passed around a series of pulleys, and the free ends of the ropes were attached to counterpoise weights, but these of winding up a rope to which a weight is attached are well known substitutes for each other.

Without advertent to the other patents which have been introduced in evi-

dence, and relied upon in defence in this branch of the case, enough has been stated to show that the first claim of the patent of 1861 is void for want of novelty.

The second claim in this patent, namely, "equalizing the strain upon the series of ropes or chains of my improved elevator or hoisting machine by automatic adjustment, substantially as described," can only be construed as a claim for the described means of performing this function, and for well known substitutes for or equivalents of those described means. The means the patentee describes are three. One of these modes is by means of a rocking lever, or system of rocking levers, to the ends of which the suspensory ropes are attached. The Holyoke elevator and the Levick and Fieldhouse elevator both anticipate this claim, (the latter having a rocking lever, and the other a device which operated in the same way and produced the same result. If the claim is valid, defendants are not proved to have infringed it, for there is no evidence in the record tending to show that the contrivance used by the defendants—of a series of pistons fitting into a set of cylinders with connecting pipes, the cylinders being filled with an incompressible fluid—were, at the date of the patent, not a substitute for either of the means of adjustment described in the patent.

The patent of December 11, 1866, No. 60,441, so far as the second claim concerned, which is the one alleged to be infringed, relates to "means for manipulating relative adjustment within reasonable limits of the series of ropes or chains, which are independently attached to the winding drum and to the car of the elevator, so that an equal degree, or very nearly equal degree, of tension can be had upon each rope or chain of the series, by proper attention or manipulation on the part of the party having such elevator in charge."

The patentee states in his specification that considerations of saving in the first cost of construction render it desirable in many instances to substitute for an automatic adjustment of the ropes or chains a means for adjusting them from time to time, as occasion may require; in other words, that the means of manipulative adjustment in the patent No. 60,441 were intended as a substitute or alternative means for the automatic adjustment described in the patent of May 25, 1861, No. 25,061. The defendants have put into their elevators means of mechanical manipulative adjustment, but they do not perform the function described by Tufts as a substitute for the automatic adjustment, because the tension on the ropes or chains cannot be varied by any manipulation of the parts. Owing to the presence of the equalizer, the means of automatic adjustment in the defendant's elevator, the nuts or the struts may be screwed up or down to their fullest extent on any rope, without any variation of the tension on that or any other rope. As defendants do not infringe, it is not necessary to consider the question of novelty of this claim.

The patent of December 11, 1866, relates to means by which an elevator is so guided as to prevent the cage from tipping, and the motion consequent upon contact with the ways by which the elevator is guided. The claim is as follows:

"I claim combining the suspended car of an elevator with the ways or rails which confine it, by means of guides kept by springs constantly in contact with said ways or rails, when said guides are so arranged as to be capable of motion toward and from the rails."

In the provisional specification, filed April 6, 1868, in the office of the Commissioner of Patents for Great Britain, accompanying the petition of Louis Têtar Van Kiven for a patent, which did not proceed to the great seal, but which specification was printed by Kyrie & Spottiswoode, is a clear and accurate description, which contains the features of this claim. Respondents' exhibit No. 13 is a model of the device described in the Van Kiven specification. It fully anticipates every feature of this claim.

Complainant's bill dismissed.

[James B. Robb, for complainants.
Cauten Browne, for defendants.]

Recent American and Foreign Patents.

Improved Lint Room Floor.

John N. Stitt, Sardis, Miss.—This lint floor consists of small rods arranged with spaces between, and on joists sufficiently wide to spring a little by the weight of persons walking on the floor—the object being to allow the dust which settles down to the floor to escape, and thus avoid soiling some of the cotton which comes in contact with the floor.

Improved Cultivator.

Edward Nauman, Uniontown, Ohio.—The cultivator is supported at its front end by a small wheel, whose position or angle to the frame may be changed at will by means of a rod which extends back and rests on a notched bar connecting the handles, whereby the wheel may be held locked in any desired position. This construction enables the plows to be held up to the row of plants, when plowing upon inclined ground, by the action of the wheel.

Improved Gas Generator.

James C. Mitchell, Lancaster, N. H.—This invention relates to certain improvements in the manufacture of illuminating gas, designed to utilize any kind of fuel for the production of the gas, and applicable to limited manufacture, as for private families, etc. It consists in a retort placed within a furnace, or a common stove, if desired, and having an airtight door of peculiar construction, and a communication direct with the furnace, by means of which construction the gaseous contents of the retort may be drawn into the furnace and burned when the airtight door is to be opened for drawing and recharging the retort. It also consists in the peculiar construction and arrangement of the tops of the purifiers and an airtight door to the retort, and the combination with the feed pipe to the gas holder of a ball valve to prevent back pressure.

Improved Plow.

Henry Krog, Sr., Washington, Mo.—The connecting ends of the share landside bar, and seat are welded together, while the outer ends of plates on the share and bar are riveted or bolted together.

Improved Hoop Fastening.

William Spalding, Petersburg, Mich.—This consists of a triangular plate clip, which covers the outer end of the hoop. It has points, which are passed through the hoop and clinched on the inside.

Improved Saw Setting Device.

Lewis A. Greely, Elmira, Ohio.—This is a block of steel, on the working side of which is a projecting face, a fulcrum, and a set screw, which latter passes through the gage and is turned or graduated from the back side. The screw may be turned so as to project more or less, as may be desired, according to the degree of set of the teeth. The gage is held against the saw with the hand in such a manner that the set screw rests or bears against the saw, and the fulcrum against the base of the tooth. The tooth is then bent over the fulcrum until the point touches the face, which is accomplished by means of a hammer and anvil or screw wrench.

Improved Means for Raising Water into Railroad Tanks.

Tyree Rodes, Wales Station, Tenn., assignor to himself and T. A. Atchison, same place.—The invention consists of a grapple attachment, which is hinged to the cow catcher beam, and used at either side of the locomotive, the grapple taking hold of a wire rope stretched on running gear along the track, and operating thereby the tank pump, until a post near the end of running gear strikes the clamping lever and drops the wire rope.

Improved Veneer Cutting Machine.

Curtis T. Fairchild, Hartford, N. Y., assignor to Burrell, Ives & Co.—The improvement in this machine is a presser roller, arranged for adjustment independently of the knife, but feeding along with it. It bears upon the log so far above the said knife that, before the edge of the part split off comes in contact with the knife, and is subjected to the lifting force thereof, the said presser roller will force the said piece down upon the main body of the log so hard that it will overcome the force of the knife, and be thereby prevented from being forced off.

Improved Folding Seat for Horse Cars.

Cevadra B. Sheldon, New York city.—This consists of an extra seat contrived to be carried under the main seat when not required for use, and to be readily shifted into position for use above and in front of the main seat on a jointed and folding standard, rising up so that it will project from under the main seat between the passengers sitting on it without inconvenience to them. The extra seat is so jointed to the top of the standard that it turns up edge-wise at right angles to the longitudinal direction of the seat for affording the necessary freedom to the sitters on the main seat to rise up or sit down. The object is to afford seats which may be temporarily brought into use when more persons are in the car than can be seated on the ordinary seats.

Improved Registering Machine.

Collins M. Cady, Peninsula, Ohio.—A lever has on its end a stub, upon which the measure is placed to depress that end of the lever. The other end of the lever operates a pawl by means of a connecting bar. The tallying mechanism consists of two ratchet wheels, a forked plate, an eccentric, a dial, and hands, and a central post, with which the inner ratchet wheel and eccentric and unit hand revolve. The rim of the eccentric bears against the fork, and oscillates the plate, and at every revolution of the inner ratchet it throws a pawl which is attached to the forked plate into communication with an outer ratchet wheel, and turns that wheel one tooth. The movement of the ratchet is indicated on the dial, one hand for each ratchet, one being carried by the central post and the other hand by the outer ratchet.

Improved Rotary Hair Brush.

William G. Nutsford and William Glasgow, Chicago, Ill.—The invention relates to rotary hair brushes which are operated by hand; and consists in the construction of the frame and parts connected therewith, so that the brush has full play as to height, while it may be turned and revolved in any position to be applied to all parts of the head.

Improved Log Turner.

Charles P. McWane, Dublin, Va.—The device consists particularly in the arrangement of the rope-winding shaft parallel to the ways on which the log carriage travels, and of the saw shaft at right angles thereto, and of the means for connecting the two shafts to cause their simultaneous rotation.

Improved Grain Roller.

William H. Burns, Chicago, Ill.—The invention consists of a movable shoulder of the roller below the flexible transfer belt that is stretched by suitable mechanism over shoulder and roller, for the purpose of adjusting the circumference of the roller, from shoulder edge to stationary roller edge, to the exact width or size of the panel.

Improved Harrow.

Samuel G. Jones, Mowqua, Ill., assignor to himself and James M. Jacobs, of same place.—The harrow has wings which may be swung closer or wider apart, as may be required for different work, also spreaders governed by adjustable cross bars.

Improved Motive Power.

Phillip B. Greene, Centerville, Iowa.—This invention consists of a circular platform fixed to tilt on a center pivot by the weight of a horse, and a heavy roller, which he draws around a track at the margin of the upper side, to the under side of which platform are attached a number of hanging cam plates, which by rising and falling with the platform actuate pawls, which give continuous rotary motion to a vertical shaft by means of a ratchet wheel on it, in which the pawls work in succession as the platform is depressed and raised.

Improved Windmill.

Edward Dewald, Coyville, Kan.—The connection of a governor with hinged wings produces a continuous adjusting of the same to the velocity of the wind, and keeps up a uniform speed of the wheel, forming a sensitive self-regulating mechanism for windmills.

Improved Safety Attachment for Pocket Books.

Thaddeus Potter, Jackson, Miss.—Devices are provided whereby books are swung out and engaged in the lining of the garment, and, while thus engaged, guard against loss or theft of the book. By drawing up the slide the books are entirely disengaged and the book released from the pocket.

Improved Wall Paper Exhibitor.

William H. Hazard, Easton, Pa.—This is an improved device for exhibiting wall paper, which avoids the necessity of constantly unrolling and rolling up the rolls of the paper, and the consequent injury to it in exhibiting it to customers.

Improved Weighing Scales.

Henry M. Weaver, Mansfield, Ohio.—The invention consists in the direct application of the platform-carrying and weight-supporting knife edges to separate weights of different proportions. These weights are joined by arms and pivot rod, so that the result is obtained of allowing the object to be weighed being placed upon any part of the platform; and also the weights, having to each other quicker and slower oscillations, tend to stop each other, and thus bring the index sooner to a rest. The casing is provided with an adjustable device for setting the index to the zero point of the stationary dial. To one or each of the weights is attached one or more smaller weights, which, being adjustable, can be used to increase or decrease the capacity of the scale, and also adapt it to any given dial plate.

Improved Clasp for Uniting Webs of Cloth for Japanning.

Benjamin Atha, Newark, N. J.—The two ends to be connected are laid across a bar on the side opening into grooves, and pressed down at one edge into the grooves at one end of the bar. A key is then inserted over them, and driven along to the other end, drawing the cloth ahead of it, and securely binding it in. The unfastening is instantly effected by pulling out the key.

Improved Horse Hay Fork.

Thomas M. Edwards, East Hampton, N. Y.—This invention is an improvement in the class of horse hay forks wherein the hinged prongs are connected with the sliding bar, to which the hoisting rope is attached. In the sliding bar is formed a slot, in such a position that, when the bar is pushed fully down, the end of a spring pawl will enter it, and thus lock the bar and stock together.

Improved Cupola Furnace.

James Blakeney, Springfield, Ohio.—The twee is composed of a circular flat plate, with curved elutes and a covering plate. These plates are made in sections of suitable length for convenience in handling and for strength, and built into the wall of the cupola, the chutes being inclined relatively to the direction in which the air is blown into it to arrest the circular motion, and direct it into the center of the cupola. A case extends around the cupola, and incloses the space in which the air is conducted to the twee. The bottom of this chamber is made a little irregular to form hollows at suitable intervals, to cause the metal to flow to escape openings in case it overflows through the twee. The openings will be closed with fusible plugs of lead, to be melted out by the molten metal.

Improved Safety Seat for Harvesters.

William E. Mattison, New Brunswick, N. J., assignor to William E. Mattison and Edwin Gulick, of same place.—This invention is an improved safety seat for reapers and mowers, so constructed that, should the driver be thrown from or leave his seat, the mechanism that drives the cutters will be thrown out of gear, and the cutters will cease to vibrate, so as to guard against the danger of his being cut by the cutters should he be thrown upon or in front of said knives, or should the machine be started while he is in front of them. The invention consists in shoulders formed upon, and a foot rest attached to, the connecting bar, in combination with the said bar, a bent lever, the bar, the seat, the springs, the platform, and shifting lever; and by this construction, the weight of the driver's feet will hold the bar locked and the mechanism in gear, even should the driver be jolted up from the seat; but should he be thrown from or leave the machine, the slightest jar of the machine will throw the cutting mechanism out of gear.]

Improved Steam Cylinder for Cotton Press.

John F. Taylor, Charleston, S. C.—This invention relates to certain improvements in single acting steam cylinders, designed to operate the toggle arms of a cotton press; and it consists in a cylinder having at the top, near the end of the stroke of the piston and upon the inner periphery, a series of recesses of a greater length than the width of the piston; and also upon the same level a series of holes communicating with the outer air, which admit the air to fill the space above the piston on the downward stroke, and allow the escape of the same upon the upward stroke, the said recesses serving to equalize the steam upon both sides of the piston when the latter is upon the same, to break the momentum; and the air holes, being closed when the piston is on the recesses, cooperate with said recess to assist in breaking the momentum, by forming in the top of the cylinder an air cushion.

Improved Apparatus for Measuring Liquids.

Emile E. P. Clausolles, Barcelona, Spain.—This invention relates to certain improvements in meters or apparatus for measuring liquids, also adapted to be used as an engine or force pump. It consists of three or more lantern bellows, constructed of thin annular disks of metal, which said bellows operate successively upon the arms of an elbow lever, so as to cause the end of the main arm or central shaft of said lever to revolve in an orbit and operate a valve, which renders the action of the apparatus automatic. The top of the central shaft is secured by a ball and socket joint, and to the top of the same is attached a stud which, by engaging with suitable gearing, moves the index hand of the registering device.

Improved Car Coupling.

Belton Mickle, Holly Springs, Miss.—This invention relates to certain improvements in car couplings; and it consists in the combination of a gravity catch having a slotted hole, through which a transverse pin passes to support it, and a drawbar having a central longitudinal slot in which the catch swings, and open recesses upon each side of said slot, in which the projecting ends of the transverse pin are supported. By means of this arrangement, the catch readily adjusts itself to the vibrations of the cars, and may be easily and quickly detached when desired.

Improved Animal Poke.

Henry Walton, Jesup, Iowa.—This invention relates to certain improvements in animal pokes, or devices to be attached to unruly cattle to prevent them from breaking through fences, etc. It consists in a bar having at its lower end a ring to be fastened in the animal's nose, and at the upper end a projecting stem or tongue which takes in the fence when the animal attempts to break through, and pulls the ring in the nose. The said bar is extended a sufficient distance above the animal's head, and is prevented from turning by a crossbar resting upon the face, the main longitudinal bar being held in position against lateral displacement by rings which pass over the horns, and are attached to said bar by adjustable rods.

Improved Calendar.

David J. Miller, Santa Fé, New Mex.—This invention relates to certain improvements in calendars; and it consists in a system of movable pegs, in combination with the attachment hereinafter explained, marked and arranged in headings, columns, and rows, the whole constructed in a block of wood or other suitable material, headed with the year current and divided into twelve divisions, each representing and headed with the name of a month, and each month divided into seven columns of six pegs, the columns headed with the names of the day of the week, and the pegs marked with the numbers of the days of the month and of the days of the year in their order: each date peg having attached to it, on the back or immediately adjoining, a sliding slip or piece of metal or other material also marked, and each being susceptible of bearing also other marks or indicators, as of celestial phenomena and other occurrences capable of easy visible representation.

Improved Cultivator.

Gershom Wilkinson, Quincy, Ohio.—By suitable construction, should the plows strike an obstruction, the upper ends of the standards will be forced forward, raising a lever and allowing the plows to swing back, so as to pass the obstruction. The plows may be adjusted wider apart and closer together by adjusting the positions of bars. To the outer bar of each pair is attached a lever, upon which is placed a slotted plate. The plates have hooks upon their side edges, turned in opposite directions. When the plates are in position, by loosening the clamping nut they may be raised to support the plows farther from the ground, and, by inverting the plates, which brings the other hooks into working position, they may be lowered to support the plows at a less distance from the ground.

Improved Adjustable Sack Holder.

Henry W. Clark, Red Bluff, Cal.—A slotted upright has cleats on the back, flush with the sides of the slot. An arm adjustable on the upright has a spiral spring on its upper side. The under side of another arm, constructed and made adjustable in a similar manner, rests on the spring. A semicircular metallic spring, attached to the lower arm, holds the bag. The arms are adjusted to suit the length of the bag, and so that the bottom of the empty bag will nearly touch the bed. While the bag is being filled, the weight will bear it down to the bed, while the spiral spring will allow the bag to settle.

Improved Wedge for Splitting Rock, etc.

Thomas Cosbey, Fort Scott, Kan.—This invention consists of a metal wedge, whereof the middle portion is hollow or open from one of the tapered sides to the other, to dispense with certain portions of the metal of a solid wedge which are not needed, and thus to economize in the cost. The object is also to make the device lighter and more convenient to handle; and also to provide a hole by which it can be grasped by the fingers or by hooks when it has fallen into a deep cleft of a log or rock, from which it is very difficult to remove a solid wedge.

Improved Harrow.

Adolphus W. Davis, Dwight, Ill.—This improved harrow is so constructed as to adjust itself to uneven ground, and it will allow either of its sections to be raised from the ground without affecting the others.

Improved Process of Making Imitation Woods.

George V. Hann, New York city.—This is a process of making imitation woods by first graining a surface with a mixture of acetic acid, logwood, and iron oxide, and then staining with a mixture of shellac, alcohol, logwood, and red sanders.

Improved Convertible Rocking Chair and Swing.

Sigmund Feust, New York city.—This invention consists of a chair with hinged rocker and leg sections, which are capable of being rigidly applied as rockers for a chair or as side arms for a swing seat. Below the hinged seat of the chair is a box for the reception of the suspension cords attached to the frame of the chair, they being stored in such a manner within the receptacle as not to prevent the closing of the seat.

Improved Bed Lounge.

Abraham Morris, New York city.—This relates to an improved bed lounge, which is provided with a side or guard rail and legs, that are, simultaneously with the opening or folding of the section, carried into the required position. The invention consists of a side or guard rail pivoted to the extended legs swinging therewith. The guard rail supports also, by guide groove in connection with a face strip of the main head piece, the detachable head piece of the folding section.

Improved Wrench.

Thomas F. Dunn, Saccarappa, Me.—This consists in combining two or more wrenches, by means of a longitudinal slot, in one. By this means, the lever on either of the wrenches is materially increased, and when one of the wrenches is placed endwise on the nut, the wrench, which is passed through the slot, may be used as a handle to obtain leverage.

Improved Cultivator.

Joseph C. Jenkins, Lebanon, Tenn., assignor to himself and James G. Jolley, same place.—This is a combination, with two cultivators or gang plows, of a medium coupling, consisting of blocks and a pivoted bow. This gives the plows an opportunity to accommodate themselves to the movements of the horse, and enables the plowman readily to turn or lift each frame laterally, so as to avoid stones or stumps.

Improved Adjustable Handle for Harrows.

Samuel D. Riegel, Adelphi, Ohio.—This improved handle for harrows is so constructed that it may be instantly adjusted to enable any desired part of the harrow to be raised from the ground to pass obstructions, or to clear the harrow of rubbish, and to enable the harrow to be held in or to the right or left of the line of draft.

Improved Compound for Preserving Fish.

Henry Sellman, Hoboken, N. J., and Herman Reessing and Julius Wolf, New York city.—The fish are preserved and at the same time flavored by being packed with a compound of vinegar, allspice, pepper, onions, horseradish, bay leaves, cloves, ginger, coriander seed, Chili pepper, and capers.

Improved Button.

William Hornieb, Newark, N. J.—This invention consists of a button which is made with a loop-shaped re-enforcing wire, retained by the metallic shells of the same, for strengthening the fastening fabric.

Improved Door Check.

Horace B. Church, Jefferson City, Mo.—This invention is an improvement in that class of door checks which are formed of a sliding spring bolt and an elastic block secured in a socket in its outer end. The socket for the elastic block is separate from the sliding bolt, and both are connected together by means of an arm which extends downward and holds the socket horizontal. A smaller and cheaper bolt and case is thus employed, and the socket piece may have any required size of friction surface without necessitating any corresponding change in size of the bolt.

Improved King Bolt for Wagons.

William Truax, Hamilton, Mich.—The king bolt is made without a head, and is placed in a hole that passes through the axle tree, sand board, and bolster. The lower end of the king bolt rests upon a plate fitted to the lower side of the axle tree, and secured in place by bolts that fasten the sand board to the said axle tree. By this construction the king bolt will be held securely in place, and, being made without a head, will not wear the bolster and the wagon box.

Improved Butter Package.

Cevdrea B. Sheldon, New York city.—This invention consists of a wide hoop-shaped jacket of non-conducting material, pressed on the tapering metal body of the package, both for re-enforcing it as to strength, so that light thin metal may be used, and for protecting the metal from the rays of the sun while the packages are in transportation. The bottom is made of stamped sheet metal, and has a flange turned up outside of the lower end of the body, serving for a strengthening band to the thin substance of the body, also for soldering to the body.

Improved Carbureter.

Edward J. Daschbach, Pittsburgh, Pa.—This invention consists of a carbureting chamber surrounded by a feed tank, in which the gasoline or other hydrocarbon substance is maintained above the feed passage into the carbureter by atmospheric pressure, so that a regular automatic feed is obtained by the oil in the carbureter, and the carbureter is provided with an inlet pipe projecting below the oil inlet.

Improved Windmill.

Jacob D. Christie, Schraalenburg, N. J.—The invention consists of the adjustment of a wheel shaft having a hinged supplementary vane, on a quadrantal turntable, to any angle with the main vane. The wheel is provided with adjustable weights of sliding rods, that act on a brake mechanism of the shaft, to change the position of the wheel shaft toward the main vane. The separate adjustability of the wheel and shaft from the main vane, in connection with the regulating mechanism of the wheel, is claimed to give a uniform motion and even speed at varying velocity of the wind, and admits, also, the exact setting of the mill to the power required for certain purposes.

Improved Car Coupling.

John M. Marlin, Willett, Pa.—This consists of pivoted and spring-acted side bars, that are guided by rigid top and bottom drawhead bars, to retain on their flanged and concave front ends the coupling pin, until they are forced apart by the entering link, for dropping the link for coupling. The link is wider at the central part, to prevent its entering too far into the drawhead.

Improved Street Car Coupling.

Heinrich Krüger, Jr., New York city.—This is a coupling hook for street cars, by which the draft bar and single tree are supported at such height that the infusing or entangling of the legs of the horses on the stopping of the car is prevented without changing the point and direction of draft. The invention consists of a braced and spring-acted lever that is pivoted to supports of the car bottom frame, and carried up against the dashboard, so that the coupling hook and draft bar are raised with the same while being lowered by the strain thereon.

Improved Shelving for Stores.

Henry T. Bestor, San Francisco, Cal.—In this improved construction of store shelving, the carrying girder is set back, so that the front finish comes flush with the front of the supporting posts, to allow of metal bars being suspended on the face of the finish for the intermediate support of the shelves, and so that covering columns may be applied in a simple way to hide the rod.

Improved Car Coupling.

John Q. A. Young and James D. Young, Cedar Mill, Oregon.—This invention relates to improvements on the car coupling of H. E. Smith, patented August 25, 1874. The invention consists of a bottom recessed drawhead, with jaw-shaped front end, and of an interior horizontally pivoted lower jaw, that lock the enlarged head of the coupling pin. A cam on the lateral shaft of the uncoupling lever binds on a rear swell of the lower jaw, for securely locking the coupling link, the shaft and cam being introduced to the cavity of the drawhead by a corresponding side slot.

Improved Bale Tie.

Henry J. Wright, Society Hill, S. C.—This invention relates to the construction of ties for baling cotton and other articles, and consists of a tie made of two parts, to one of which the band is attached, which lock together and tie the band.

Improved Egg Box.

Othello Sutphen, Albany, N. Y.—This is a spring-suspended egg box, having guide slots, in combination with pivot pins. The pins serve as guides and pivots for the different positions of the egg box, so that an easy vertical and side motion is allowed to the same.

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

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Barry Capping Machine for Canning Establishments. T. H. Bailey & Vall, Lockport, N. Y.

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Notes & Queries

A. K. B. will find a recipe for solder for gun barrels on p. 353, vol. 27.—R. S. will find that galvanizing wrought iron is described on p. 346, vol. 31.—A. J. and others will find directions for etching on glass on p. 409, vol. 31.—S. J. P. will find directions for modeling in clay, wax, etc., on p. 58, vol. 24.—S. N. will find directions for making gravel walks on p. 50, vol. 32.—R. J. will find directions for filling and polishing black walnut work on pp. 315, vol. 30, and 347, vol. 31.

(1) W. O. H. says: A friend claims that, if a balloon could be made so as to sustain the pressure from the outside, and the air were pumped out so as to form a vacuum on the inside, that it would rise. I claim that it would not. Who is right? A. Your friend.

(2) A. J. S. says: Are you aware of any one who has ever actually discovered perpetual motion? If it has not yet been discovered or revealed, do you really believe that perpetual motion, pure and simple, would be of any pecuniary advantage to its discoverer? A. No one has ever discovered perpetual motion. You can judge of the probability of such a discovery if you bear in mind that the principle involved is the same as when one tries to lift oneself in a tub, by pulling at the handles. Some of the perpetual motion inventors put cog wheels or levers between their hands and the tub handles. But the result is the same. It is always a perpetual no go. No reward has been offered.

(3) G. L. L. says: What use, if any, can be made of old photographic collodion? A. If the solvents have not already evaporated, and the solution contains no volatile acids, the ether and alcohol may be readily removed by subjecting the solution to distillation in a glass retort over a water bath, with a very gentle heat. The solution, however, should not be allowed to evaporate to dryness.

(4) H. M. asks: How can I bleach shellac? A. By filtration of the solution over animal charcoal.

What are the average weights of a cubic inch of copper and tin, respectively? A. Copper about 0.32 lb., tin about 0.217 lb.

How is the inside area of a cylinder found? A. To find the surface of a cylinder: (circumference of base x altitude) + twice the area of base. To find solid contents: Area of base x altitude.

(5) A. S. asks: Is there any solvent besides cyanide of potassium, for sulphide of copper? A. The sulphide of copper dissolves readily in strong aqua fortis (nitric acid) on application of heat.

(6) H. B. C. asks: What kind of a solution should I make to plate with tin, having tin as a positive electrode? A. Electro-metallurgists consider the sulphate to be the best solution for this purpose; but the reduction of tin by galvanism cannot be considered an advantageous process. The best method for tinning metallic surfaces is that of immersing them in a bath of molten tin, the surface of which is kept free from oxide by means of a layer of chloride of ammonium (sal ammoniac). An even and regular coating of the metal is thus obtained speedily and with little trouble.

(7) M. S. asks: 1. Are the oxygen and hydrogen, used in stereopticons, dangerous? A. They are explosive only when mixed and ignited. 2. Of what color are the screens that are used for the same purpose? A. White. 3. Are they painted or varnished? A. When intended to remain stationary, they are occasionally covered with an even coating of whitening with a little size.

(8) C. T. S. asks: What process will make ordinary white quartz crystals, resembling amethyst? A. Take borax 5 parts, saltpeter 5 parts, pearlash or fixed alkaline salt, purified with niter, 33 parts, pure white sand, cleansed by washing, 57 parts. First reduce the sand in a glass or flint mortar to a fine powder, then add the other ingredients and grind them well together. To 10 lbs. of the above add 1 1/2 ozs. of manganese oxide and 1 drachm of zaffre. Melt in a small clay crucible, and cover the surface of the crystal by immersion.

(9) H. asks: Of what size, and of what cheap material, should a hot air balloon be made to raise a weight of 150 lbs.? A. A closely woven variety of light cambric is best for this purpose. It is not customary (where the proper material is used) in this style of balloon to use any varnish whatever. If the case requires it, however, a light solution of boiled linseed oil in turpentine may be used.

(10) G. W. N. asks: Which is the positive pole and which the negative, in a battery? A. In all forms of battery, the binding screw attached to the zinc plate is always negative, and the connection of the opposing element, whether it be copper, carbon, or platinum, is always positive. If a small mariner's compass be placed immediately under a copper wire running north and south, (that is, parallel with the needle of the compass when in a state of rest and not subject to any disturbing influence), over which a current is passing from north to south, the needle of the instrument will immediately be deflected, its north pole moving to the east, and its south pole to the west. If the current be reversed, the needle will move in the opposite direction.

There is a boat fastened to a dock by a rope. P. says that a man standing in the boat will not be obliged to exert so much force to pull the boat to the dock, as one who stands in the dock and pulls the boat toward him. N. says the man will have to exert the same amount of force in both cases. Who is right? A. N.

(11) D. A. C. asks: Is there an agent which will bleach or clarify, by burning or fumigation, vegetable substances? I want an agent that will bleach tobacco in the process of curing or drying the plant. Sulphur will do it to a certain extent, but it imparts an odor which injures its market value. A. Tobacco may be readily bleached by means of either sulphurous acid or chlorine; but in the operation it undergoes a partial decomposition, new salts being formed. This destroys the properties for which the tobacco is most valued.

(12) J. H. L. asks: For some time past I have been trying to bleach what is called *cera de Campeche*, a wax made by a large bee near the Pacific coast in the neighborhood of Autlan; it is of a dark yellow color and a strong smell; it becomes quite soft and sticky by working with the hands. How can I do this? A. Beeswax may be bleached by nitric acid; but chlorine, though it destroys the color, cannot be employed for this purpose with advantage, for it was observed by Gay Lussac that a substitution of chlorine for a portion of the hydrogen occurs under these circumstances. When candles made from such wax are burned, irritating vapors of hydrochloric acid are evolved. Beeswax has been commonly bleached by exposing it in thin layers to the action of sunlight for some time. Try the action of a solution of chlorine gas in water, or, what is perhaps less objectionable, a solution of chloride of lime (bleaching powder).

(13) A. P. asks: Is there any magnetic needle or other instrument that will show where to dig for water, and where springs exist? A. There is no such instrument in existence.

(14) C. K. asks: What degree of heat is acted upon and absorbed by a liquid, such as an oxyhydrocarbon oil, contained in an iron or copper vessel of about equal width to its depth, heated by live steam of about 40 lbs. pressure? A. As you fail to state the particular oil in question, we cannot give you its specific heat. The temperature of the oil would, in no case, be higher than the steam or hot water surrounding the vessel containing it. Whether the oil vessel were completely or only in part filled with the oil, the conditions being the same in both cases, the temperature would eventually mark nearly the same degree, although in the former case the expenditure of a larger amount of fuel would be required to accomplish such a result.

(15) J. E. H. asks: Is there any known way by which skippers in smoked meat can be destroyed without injury to the meat? A. Try the action of a small quantity of the iodate of calcium or salicylic acid.

(16) T. W. C. says: I have a friend who uses a process in which a quantity of water must be maintained at a temperature near to but always above the freezing point. To procure this he uses considerable quantities of ice. Could the same effect be economically produced by the Carré freezing apparatus? A. Yes.

(17) A. B. C. and others ask: Which wheel of a truck slips in going around a curve, the inside or the outside one? A. This question is frequently asked by our correspondents, and is very fully answered by a writer in the *Railroad Gazette* as follows: That wheel will slip on which the pressure is the least. For a single truck with an equally distributed load, other things being equal, on a flat track (that is, one in which there is no super-elevation of the outer rail), the inside wheel will slip, for the following reasons: 1. Because the direction of the resultant of the weight and of the centrifugal force is more in the direction of the outer than of the inner wheel. 2. Because, on account of the parallelism of the axles and the play allowed the wheels, the flanges of the latter are against the outer rail and away from the inner one in the passage around the curve, and this is true whatever may be the speed. This brings the point of application of the resultant (corresponding to the loaded point on a beam) nearer the outer than the inner bearing. On a curve, the outer rail of which has been elevated for a given speed, at this speed the resultant above mentioned is perpendicular to the plane of the rails, and hence at that particular speed the first of these causes is inoperative, while the second, remaining in force, causes the inner wheel to slip as before. At any higher speed, the first cause again comes into play, and allows the inner wheel still greater facility for slipping, and the more so the higher the speed. On the other hand, for a speed less than that for which the rail was elevated, the centrifugal force, being diminished, brings the resultant more in the direction of the inner rail than before, and at some speed would make its direction such as to exactly counteract the effect of the second cause, and would thus render the wheels equally liable to slip. At less speeds the outer wheel would slip. In the case of a long train, the wheels at the ends are nearly in the condition of those of a single truck, while those near the middle, being drawn to the inner rail by the action of the forward and rear portions of the train, will sooner come into a condition in which the outer wheels will slip. In this, the coning of the wheels has been considered as a part of the elevation of the outer rail, either increasing or diminishing it as the flanges press against the outer or the inner rail.

(18) W. X. says: I have two 1/2 inch pipes, one glass and the other lead, which I wish to unite so that the joint will be neat and bear the pressure of a column of water fifteen feet in height. In what way can they be best united? A. Use as a solder the following alloy, which fuses below the boiling point of water: Bismuth 2 parts, lead 1 part, tin 1 part.

(19) E. J. F. says: How can I cut fine edgings on paper, such as the borders on valentines or bouquet papers? A. These borders are stamped by a die cut in metal.

(20) H. P. O. asks: Please give me recipe for good and permanent red and black dyes were which I can dye cotton and linen thread? A. If F

red, use cochineal, lac dye, madder, or logwood with a tin mordant. For black, use logwood; galls with an iron mordant.

How can metal be cemented to glass? A. See p. 27, vol. 30.

(21) C. A. F. asks: How can a silk fish line be made waterproof? A. Take 2 parts boiled oil, 1 part gold size, mix, shake well, and it is ready for use. Apply with a piece of flannel, let dry thoroughly, and apply another coat. Use 3 coats in all.

(22) C. S. W. asks: What is the best way of preparing starch for use on linen collars, etc.? A. Wheat starch is generally considered the best. It is made as follows: Steep wheat flour in water for a week, draw the liquor off, and wash the residue on a sieve; drain in perforated boxes, cut up into lumps, and dry in the air or on a stove.

(23) J. D. says: Please give me a recipe for wax for tracing designs in hair lines on zinc with a pen, which will protect the zinc from acid used to etch the design on the metal? A. If you use nitric acid, try a mixture of equal parts of asphaltum, Burgundy pitch, and beeswax; melt them in an earthen pipkin, stir well, and pour into cold water. Use warm.

(24) A. L. H. asks: What is a good method of cleaning tin, copper, brass, etc., without scratching the same? A. On tin, use potash lye and rub with a hard substance. On copper and brass, use spirit of tar.

(25) C. E. G. says: I claim, in arguing the merits of the Keely motor, that water is a spent substance, and cannot again produce power unless the equivalent is laid out on it. A. You are right.

(26) V. H. says: 1. On p. 74, vol. 28, you give correspondent K. W. a varnish for photo paper trays, consisting of a mixture of petroleum naphtha and paraffin. Can the varnish be applied to wooden trays? A. Yes. 2. How many parts of each ingredient should be used? A. Put in paraffin till the petroleum naphtha will dissolve no more.

(27) W. U. asks: What are the rules for calculating the permutations and combinations of numbers? A. The number of permutations of n things = $1 \times 2 \times 3$, etc., $\times (n-1) \times n$. The number of arrangements of m things, taken n in a set, = $m \times (m-1) \times (m-2)$, etc., $\times (m-n+1)$. The number of combinations of m things, taken n in a set = $\frac{m \times (m-1) \times (m-2)$, etc., $\times (m-n+1)}{1 \times 2 \times 3$, etc., $\times (n-1) \times n$.

(28) L. H. R. says: I wish to know whether the following conjectures are probable: Scientists, in giving the heights of mountains, clouds, balloons, etc., say they are so many miles above the level of the sea. Is the level of the sea the same all over the surface of the earth? Is the surface of the ocean at each part of the globe at the same distance from the center of the earth? I think it would be so if there were no revolution of the earth around its axis; but since there is, the centrifugal force thereby produced would cause the looser particles (water) of the earth to be heaped up at the equator, making the level of the ocean at this part higher than at parts north and south of it. And further, in my opinion, the water would not only accumulate here, but would accumulate in proportion to its quantity or mass thereby making the Pacific Ocean of higher level than the Atlantic. Is this actually the case? A. If you measure the height of the sea level by its distance from the earth's center, it is not the same everywhere, but is higher under the equator and lower at the poles. This is called the flattening of the earth, and is, in round numbers, $\frac{1}{298}$, which means that the polar axis is $\frac{1}{298} \times 8,000$, or about 26, miles shorter than the equatorial diameter therefore the ocean's surface at the equator is 13 miles higher than at the poles, and the Mississippi river runs, in a certain sense, actually up hill. The height of the mountains is always estimated from the nearest sea level. There are, besides this, other irregularities in the ocean level, of which we have treated elsewhere in this issue.

(29) J. C. W. asks: 1. If any one will look steadily for a short time at such an anemometer as is used by the United States Signal Corps, consisting essentially of hollow hemispheres, and will notice the direction in which the cups revolve, he may after a time apparently see the motion reversed, and the cups going in a direction exactly contrary to that in which they really move. A good position to take with reference to the anemometer is about 50 yards from it, and nearly up to the level or horizontal plane in which it moves. No doubt others have noticed the deception, as it is very apparent when once observed. A little perseverance in the effort may perhaps be necessary at first in order to perceive the change as it seems to be. A. This optical delusion has been often observed, and is simply caused by the difficulty of deciding which balls are the nearer. If we take the further off for the nearer, the motion of course appears reversed. The same thing may be observed in some windmills, when looked at by the edge of the arms. 2. Another illusion may be produced by a very simple experiment as follows: Procure a round paper box about two or three inches in diameter, and, if its bottom does not bulge upward in the center, make it do so by pressing it in with the thumbs. Any sized round box of almost any material that is not affected by mercury will doubtless answer the purpose, but the kind mentioned is easily procured in the form of a large pill box or a collar box. After pressing the bottom inwards, as directed, pour into the box about one ounce weight of clean bright quicksilver, and give the box and contents a rotary motion until the quicksilver revolves rapidly around the circumference of the box in the depression caused by the convexity of the bottom and its junction with the perpendicular walls of the box. It is best to lay the box flat on a horizontal table while rotating it; and when the quicksilver seems to be

a revolving ring of liquid metal, let the box rest and watch the motion as the metal subsides. If there is about enough quicksilver to make a complete ring of the size of a goose quill (no precision needed), the liquid metal will seem obviously moving in a direction exactly opposite to its real course so as to deceive almost any beholder. The effect is due to the wavy motion of the quicksilver. A. The observation that the waves in mercury, when running in a rough channel, will propagate in a direction opposite to the current has been made before, but your simple manner of illustrating it deserves commendation.

(30) C. C. K. asks: Is there a south polar star similar to the north polar star? A. The north polar star in the Little Bear is not exactly over the north pole, but at a small distance. At the south pole the nearest star is 10° further off, and is in the constellation Hydra.

How do explorers tell the heights of mountains? A. Explorers as well as aeronauts measure the heights of mountains by means of the barometer, which gives tolerably reliable indications, as the air pressure decreases with the height we ascend. Your way of telling the height of clouds would be good if you only were sure that the cloud you see is the one from which the rain descends.

(31) M. H. R. says: It is a common observation among country people that a new moon is a wet or a dry one, according to the upright or horizontal position of its horns, and also that the moon affects the weather by its rising farther north or south than usual. Are not all of the changes of the moon, as to position in regard to itself or the earth, subject to a natural and, generally speaking, unerring law? A. The position of the horns of the moon depends on the relative position of moon and sun: if immediately after the noon, she shows herself vertically above the setting sun, the horns will be upright; if southward of the sun, the horns will be more nearly horizontal. That the moon affects the weather, causing an atmospheric tide wave as well as an ocean one, is undoubted; but the "unerring law" has not yet been discovered. Let us hope that the continued labors of the Weather Bureau will in time solve this problem, which is quite complex. The course of the moon is repeated, eclipses and all, every 21 years; but we have not the same weather every 21 years, which shows that other influences have to be taken in account, which observations in the future may reveal to us.

(32) J. H. asks: Can anything be added to ink made from nutgalls and sulphate of iron that will cause it to be black when first used, without injury to it? A. Try an addition of logwood.

(33) S. L. L. asks: Has the name carbonic acid recently been changed to carbonic dioxide? If so, why? A. Carbonic oxide is the compound formed by the combination of carbon with one equivalent of oxygen (CO). Carbonic acid is carbon in combination with two equivalents of oxygen (CO₂). The former is sometimes called the monoxide, and the latter the dioxide, of carbon.

(34) C. P. asks: I want to know the cheapest and simplest apparatus for compressing air in a receptacle of two quarts capacity. I would like to get the density of five or six atmospheres. A. Use an air pump.

(35) J. S. asks: Will paper keep a number of years, free from damage, even if placed in an excessively damp and dark hole, if it be inclosed in an airtight lead or glass case? A. If the paper be placed in a perfectly dry glass vessel, which is afterward hermetically sealed, it will be preserved indefinitely, or as long as the glass envelope remains intact.

(36) J. A. asks: Can I use a tin baking pan for a photographing bathing sink without injury to the chemicals? A. No.

(37) H. M. asks: Does the sun's heat shrink or expand seasoned wood? A. The expansion of the woody fibers by heat is more than counterbalanced by the shrinkage due to the consequent evaporation of the moisture and other bodies in the sap cells, therefore the wood, as a whole, shrinks.

(38) E. T. D. asks: Which is the most certain and quickest mode of discharging colors from cotton prints and delaines? A. Use chloride of lime.

(39) N. A. B. asks: How can I determine the electromotive force of a galvanic battery? A. To one not familiar with the science of electrical measurements, such determinations may be somewhat problematical. The following method of Poggenдорff's, for the measurement of electromotive force, is perhaps the simplest and most comprehensive. In this method the more powerful battery, E₁, is joined up in circuit with a resistance coil, r; and the other battery, E₂, and a galvanometer are connected to the same coil, so that both batteries send a current through r in the same direction; by increasing the resistance of r it is easy either to make the current of E₁ overpower that of E₂, or to obtain such an equilibrium that E₂ shall remain inactive, and no current pass through the galvanometer in either direction. When this is effected, we have the following ratio: As the total resistance of E₁ and r is to the resistance of r, so is the electromotive force of E₁ to that of E₂, or E₁/E₂ = R/r.

Can metallic silver be obtained by heating the nitrate in a crucible? A. Yes, by the addition of a small quantity of borax and resin.

(40) S. R. A. says, in answer to correspondents who ask how to destroy ants: Take a paste-board box with a good lid, so that it can be made dark; cut a small hole near the bottom, put in about two tablespoonfuls of sugar, and set it away in some dark corner of the cupboard. Allow it to remain two or three days; take a quantity of hot

water in a dish pan. You can guess the rest. Repeat the process until the supply of ants is exhausted. The same bait will last all the summer. Allow the ants to run out at the hole they entered, and then knock them off by striking the box, with the hand, a quick light blow.

(41) J. E. A. says, in answer to several correspondents: The reason why the screws now in use do not utilize the power is because the pitch of the screw doubles from the outside in nearing the shaft half way. If you turn a thread upon a rod a little more than half the altitude deep, then turn it down to one half the diameter, the pitch will be twice what it was before. If the pitch of the blades of a screw be at a greater angle than 1/4 of a circle, or 45°, it would impede its revolution. If a screw be 24 feet in diameter and the pitch 45° from the outside, then it would be an entire loss of power; if 23 1/4°, there would be loss at all but the outside 6 feet. By setting the pitch in the inside or nearest the shaft, and twisting the blade from the outside to the required pitch, there would be no loss of power. Another principle is that the revolution of the screw and the pressure of the blades against the water would cause the water to flow away from the end of the blade; this would cause the screw to fall back, and not hold what it would naturally gain. This can be easily remedied by having the blade of full width at the end, and turning it over a few inches, making a rim on the back side of the blade: the water will then only flow away backwards from the side, as it should do.

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

A. M. S.—No. 3 is a tannate of gelatin, and will doubtless answer all your requirements. It is probably made by steeping sheet gelatin in a solution of tannin, and then subjecting it to pressure.—F. W. P.—It is mica.

J. G. H. asks: How is the pretty imitation of pearl in ladies' dress buttons and parasol handles produced on tin or other metallic sheeting?—E. M. asks: How is a dry or magic shampooing powder made?—C. M. K. asks: Are the trimmings called Hamburg edgings made by machinery or by hand?

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 Keely Motor. By W. J. J.
On the Spider's Web. By T. H.
On a Glass Oil Can. By A. B.
On Western Lands and Emigration. By T. E. L.
On Keely Transactions. By G. H.
On Boiler Incrustations. By B. B. S.
On Fishing Sinkers. By P. B. T.
On Large and Small Axes. By T. W. P.
On Gold Coinage. By J. R.
On Bee Culture. By L. E. C.

Also inquiries and answers from the following:
J. M. S.—J. C.—W. A. C.—F. W. D.—G. A. D.—M. E.—R. A. C.—J. S. C.—K. W. C.—J. W. M.—G. R. B.—F. N. M.—D. P. H.

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 inquiries analogous to the following are sent: "Who sells a self-registering device for indicating the flow of water over a weir? Who sells books on aeronautics? Who sells drive well tubes? Who is the best ice-making process? Who is the best burglar alarm? Who sells lamp chimney cleaners? Who makes the best rock drills? Where can steatite (soapstone) be bought?" 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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DESIGNS PATENTED.

5,520.—CARPET.—J. Fisher, New York city.
5,561.—CARPET.—T. J. Stearns, Boston, Mass.
5,562.—BIRD CAGE.—F. T. Fracker, New Britain, Conn.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
August 7 to 19, 1875.

5,049.—C. Munn, Cairo, Ill., U. S. Veneer cutter. Aug-
ust 13, 1875.
5,050.—T. Kater, Hamilton City, Ont. Pianoforte. Aug-
ust 13, 1875.
5,051.—C. W. Lewis, Boston, Mass., U. S. Compound
for destroying insects. August 13, 1875.
5,052.—H. M. Wells, Toronto, Ont. Window blind fast-
ener. August 13, 1875.
5,053.—T. O. A. Bayley, Hamilton, Ont. False top for
box stoves. August 13, 1875.
5,054.—D. S. Bailey, Dover, Me., U. S. Elevator. Aug-
ust 13, 1875.
5,055.—A. R. Koerber, Berlin, Ont. Reed orchestration.
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5,056.—W. Abercrombie, Hamilton, Ont. Sash clamp.
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5,057.—C. F. W. E. Dittmar, Boston, Mass., U. S. Gun-
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5,058.—T. B. Wilson, Manchester, England, et al. Fur-
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5,059.—W. H. Wright, Sangeries, N. Y., U. S., et al.
Railway truck. August 13, 1875.
5,060.—A. Sanborn, Higganum, Conn., U. S. Swivel
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5,061.—G. E. Nutting et al., New York city, U. S. Steam
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5,062.—R. Thomas, Toronto, Ont. Cooking stoves.
August 13, 1875.
5,063.—C. D. Van Allen, Guelph, Ont. Regulating air-
dash churn and washer. August 13, 1875.
5,064.—J. P. Foote, Baltimore, Md., U. S., et al. Rudder
brace. August 13, 1875.
5,065.—W. H. Gonne, Chatham, Ont. Sash pulley. Aug-
ust 13, 1875.

5,036.—B. F. Lowell, Boston, Mass., U. S. Horse hay rake. August 13, 1875.
5,037.—E. Marsland, Sing Sing, N. Y., U. S. Liquid meter. August 13, 1875.
5,038.—G. Holgate, Oshkosh, Wis., U. S. et al. Preserving vegetable and animal substances. August 13, 1875.
5,039.—W. H. O'Dwyer, New York city, U. S. Wagon seat springs. August 13, 1875.
5,040.—W. Halsted, Trenton, N. J., U. S. Locomotive spark arrester and extinguisher. August 13, 1875.
5,041.—R. Malner, Orillia, Ont. Rotary tea caddy. August 13, 1875.
5,042.—J. Blauvelt, Blauveltville, N. Y., U. S. Self-adjusting step ladder. August 13, 1875.
5,043.—W. S. Evans, Orville, Ohio, U. S. Gage attachment to scissors. August 13, 1875.
5,044.—M. L. Orum et al., Philadelphia, Pa., U. S. Flexible mandrels for bending pipe. August 13, 1875.
5,045.—O. B. Thompson, White Ash, Pa., U. S. et al. Carriage. August 13, 1875.

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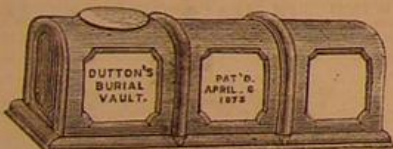
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Vol. XXXIII.—No. 12.
(NEW SERIES.)

NEW YORK, SEPTEMBER 18, 1875.

\$3.20 per Annum.
(POSTAGE PREPAID.)

THE NEW POST OFFICE, NEW YORK CITY.

On Saturday, August 28, the Post Office Department of New York city moved into the new and handsome structure erected at the south end of the City Hall Park. We give herewith an engraving (Fig. 1) showing the south and west fronts, and giving a good general idea of the outer appearance of the structure.

The new post office is by far the finest edifice in this city.

The immense size, beauty, symmetry, and strength of the building, and all its splendid internal arrangements, can only be adequately realized by a close inspection. Ground was first broken on August 9, 1869, and it will have cost, when completely finished, about \$8,000,000. The general plan is an immense triangle, inclosing an open triangular court. The light from this court extends down through three glass tessellated floors to the sub-cellar. The court is entire-

ly open down to the first story. All the upper stories are well lighted and ventilated by this open space. The building, which is fireproof throughout, occupies 21 city lots, has a frontage on Broadway of 340 feet, on Park Row of 320 feet, on the City Hall Park of 200 feet, and at its southern side a frontage of 130 feet. The height from the sidewalk to the lantern crowning the dome is 195 feet. The first two

Continued on page 178.



Fig. 1.—THE NEW YORK POST OFFICE.

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VOLUME XXXIII., No. 12. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, SEPTEMBER 18, 1875.

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THE WOODBURY PATENT.

In our number for January 9, 1875, we gave an account of the strange proceedings before the Patent Office, conducted under the immediate auspices of the then Commissioner of Patents, Leggett, by which that officer granted a patent for an old device that had been in common use for about a generation. This is now known as the Woodbury planing machine patent: the particular claim allowed by Leggett being for a device to press down or hold the lumber while passing through the machine. The patent as granted by Leggett is so drawn as to render every form of planing machine or lumber-dressing machine an infringement of the patent; consequently, if the patent can be sustained, it will be a "Big Bonanza" for its owners; every person who builds a house, or puts up a picket fence, or walks upon a wooden floor, must pay tribute to this patent. A large amount of money was spent in obtaining the patent; and as soon as it was granted, a still larger sum was subscribed, and a joint stock company was organized to endeavor to sustain it. Leading lawyers were retained, and intimations circulated expressive of the determination of the company to exhaust every possible resource which money could command to enforce the patent. Users of planing machines were given to understand that their interests would lie in supporting, not in opposing the patent. By quietly submitting, they were promised the enjoyment of licenses under the patent for a small sum; but in case of opposition, they were liable to loss both of business and property. Some of the users succumbed to this pressure, and took licenses. But the great mass of lumber dealers resisted, and joined in a united effort to test the validity of the patent, in a legal manner, before the courts, forming, for this purpose, a National Committee of Defense. It is now alleged that certain members of the executive committee of this association have turned traitors, have accepted bribes from the Woodbury Company, and are now working, not to defeat, but to uphold the patent.

The following letter, published in the *Northwestern Lumberman*, gives a résumé of the situation:

THE CASE OF WOODBURY VERSUS THE PLANING-MILL MEN.
BOSTON, July 26, 1875.

This case, one of the greatest in the whole annals of patent litigation, is still undecided, and, as the months roll on, even gains in interest.

In 1874, Joseph Page Woodbury invented, or claimed to have done so, a flexible pressure bar as an attachment to planing machines, to supersede the heretofore commonly used roller. The advantages claimed for it were that, owing to the close proximity in which it could be placed to the rotary cutter, it prevented any tendency in the board to split or crack, and, from its ready and varied adjustment, admitted of the speedy insertion of any thickness of board or plank.

On April 29, 1873, some twenty-five or more years after his invention, Mr. Woodbury secured a patent in which he claims for his invention four points embodying the principles set forth above. Since the time of securing this patent the Woodbury Patent Planing Machine Company (Mr. Woodbury himself died some months since) have demanded from

all users of the aforesaid pressure bars the following royalty:

"The company has determined to charge a preliminary fee of \$10 on each machine using said invention, and that all planing, tonguing, and grooving machines, and all molding machines, which cost \$300 and upwards, using said invention, shall be considered first class machines, and to pay a royalty of \$200 per annum, payable quarterly; and if said quarterly license fees are paid within the first fifteen days from and after the first day of January, April, July, and October, respectively, a discount of twenty per cent shall be made. All other planing machines and molding machines to be considered second class machines, and to pay a royalty of \$100 per annum, payable quarterly, subject to the same terms of discount as the machines of the first class; and the company has determined to grant no licenses until the damages and royalty from the date of patent, April 29, 1873, to March 2, 1874, have been fully settled and paid."—*Extract from pamphlet of Woodbury Patent Planing Machine Company.*

"So much for Buckingham!" Immediately on the issue of the Woodbury demands, the leading lumbermen, who were users of these pressure bars, and which they had been using unquestioned for the past twenty-five years (and they claim that similar bars had been in use before the invention of said Woodbury), formed themselves into a National Executive Committee of Defense, with W. N. Greene, of Bronsons, Weston & Greene, Burlington, Vt., as chairman, N. M. Jewett, of Jewett & Pitcher, Boston, Mass., as treasurer, and W. W. Crapo, of Crapo & Co., Flint, Mich., these being the general officers. This association, to defend the manufacturers and users of planing machines against the claims to royalty demanded by the Woodbury Company, soon grew to vast proportions, and now includes the leading lumber and planing mill men in all the principal lumber cities of the Union, numbering in all some six hundred and fifty firms. Then the Woodbury Company endeavored to compromise with the executive committee, hoping thereby to get injunctions against all other users of planing and molding machines, as they would not be strong enough to make a defence; whereat the manufacturers of planing and molding machines, foreseeing the danger and loss to their customers, pledged themselves to support the association, and urged its continuance in the courts. All of which Mr. H. B. Smith, of Smithville, N. J., treasurer of the Manufacturers' Defense Association, most concisely sets forth and ably advocates in his journal, *The New Jersey Mechanic*, of July 1, 1875.

The association have secured for their counsel the Hon. Caleb Cushing, Hon. Wm. M. Evarts, Hon. E. Pierpont, Hon. B. K. Curtis, and John T. Drew, Esq. The Woodbury Company have Benj. F. Butler, with some others of note.

The association have published pamphlets and papers pithily presenting their position in the case, one of the most witty and concise of which is quoted: "If a man can file a claim to an invention in 1848, have it rejected in 1849, and withdraw his fee and papers in 1852, and then obtain a patent in 1873 under one clause of a law, while he violates another clause, and enlarges his claims and increases his combinations, we certainly think Noah might, through some descendant, get a patent on steamships on a claim of having been the inventor of the ark."

So the case now stands, having developed itself into a very pretty controversy, in which we must confess our sympathies are wholly with the manufacturers and users of planing machines. "But with the strong rests the victory."

One of the later developments of the case here is the withdrawal of two of the prominent lumber firms from the association, to form a combination with Almy and some other inventor of a bar similar to Woodbury's, they to work in union against the association of which they were former members, in consideration, it is reported, of receiving a liberal share of the stock.

It appears, further, that the Attorney General of the United States has issued an order for *scire facias* proceedings against the Woodbury Patent Planing Machine Company on account of fraud in its procurement. It is suspended until October 15, 1875, to enable the Woodbury Company to file rebutting evidence.

The Woodbury Company has brought suit against several parties using machines. The first case is that of Hancock & Greeley, Cambridgeport, Mass., the trial of which is likely to come on in the course of a year.

SHALL WE EAT THE HORSE?

We have spoken from time to time of the progress of hippophagy in Paris, regarding the same as an experiment which there was no particular need of putting into practice here. It may nevertheless be demonstrated that, in not utilizing horse flesh as food, we are throwing away a valuable and palatable meat, of which there is sufficient quantity largely to augment our existing aggregate food supply. Supposing that the horse came into use here as food, it can be easily shown that the absolute wealth in the country would thereby be materially increased. In France the average price for horse meat, as compared with similar cuts from the steer, is about two fifths less. A horse is there sold to the slaughterer for from \$10 to \$15.

Estimating from this that \$10 is the gross value of every horse in the United States, over and above his worth for working purposes, it remains to be seen how much of that sum may be set apart as to be derived from his utilization for food alone. As will be seen further on, the French butchers derive a revenue from hide, hoofs, hair, etc., and, as is well known, the same portions of the animal find industrial uses here. Placing the value of these parts of the carcass at \$7, we find that \$3 is the net value of each horse for alimentary purposes. In round numbers there are about ten million horses in the country. According to the above showing, we must add three dollars to the value of each horse, since, in addition to his value as a worker or as a raw material for manufacturing, he now has a new one as food. Consequently the aggregate value of all the horses is increased by \$30,000,000. But this accretion to the wealth in the country is of course not convertible into actual money, for, so long as the working value exists, the food value as well as the manufacturing value are practically at zero; neither could be realized without great loss, and hence both are negated. But there is a certain easily ascertained an-

nual proportion of the horses of which the working value becomes less than the sum of their food and manufacturing values, and this proportion includes the class of which the working value is more than their manufacturing value, but less than the above sum. We may estimate roughly that one tenth of all the horses reach this condition yearly. Then, on this million animals, the food value is directly realizable, and therefore the wealth of the country may be considered as actually increased by the \$30,000,000 derivable therefrom.

Moreover, in order that the horses should be available to the butcher, they must not be diseased or worn out. By this the owners are directly benefited, since, while on one hand they are obliged to sell their horses in fair condition, they are saved the expense of keeping the animals when the latter become used up and are unable to do but light work, though requiring more attention and more feed. So also with colts, which, whether they become good or bad horses, cost about the same to raise. If the animal bids fair to turn out poorly, he can be disposed of at once and at a remunerative price. The result of this weeding out in youth and destroying when old, coupled with the facilities which the former affords of selection of the best types, will naturally conduce to the improvement of breeds and a general benefit to the entire equine population of the country.

We can adduce no more striking example of the art of utilization than the mode in which the French deal with their superannuated chargers. On the 1st of January last, France contained fifty horse abattoirs, and during last year consumed 2,850,144 lbs. of horse, mule, and ass meat. The flesh of each horse weighs about 350 lbs. The skin is sold to the tanner for \$2.50. The hair of the mane and tail fetches three cents. The hoofs are bought by comb, or toy, or sal ammoniac, or Prussian blue, makers. The tendons are taken to glue factories. There are about ninety pounds of bone, worth sixty cents. The intestines, for purposes of manure, or as food for dogs, cats, and pigs, bring five cents. The blood is purchased principally by the sugar refiners, but also by fatteners of poultry and fertilizer manufacturers. Twenty pounds of dried blood, which is the average, are worth forty-five cents. The fat goes to the soap kettle, or is transformed into genuine "bear's grease," which, delicately perfumed and elegantly put up, fetches some exorbitant prices in the apothecary stores of the United States; or else it is used as harness grease or as lamp oil. The yield is from twelve to eight pounds, at a value of ten cents a pound. Finally, it is said that even the waste flesh is allowed to decompose, and the maggots gathered as pheasant food, but this seems rather apocryphal. These utilizations are of course entirely outside the food supply.

MR. DAWSON'S IDEA OF EVOLUTION.

According to the reporters, the mantle of Agassiz has fallen upon Principal Dawson of Montreal: Agassiz dead, Dawson remains the great American opponent of Darwinism. The honor may be thrust upon him unsought; nevertheless it is not wholly undeserved. At least, in his zealous opposition to the drift of the scientific thought of the day, he has no American rival—that is, in the scientific field.

We do not think the less of him for that. Next to the man who suggests a new and better way of interpreting the facts and phenomena of Nature, the most useful man is he who most intelligently opposes it. It is through such opposition that errors are weeded out, and exact truth ultimately prevails. Occasionally the victory of a good theory, like the undulatory theory of light, may be delayed, and a bad theory kept in power by too strong an opposition; but the damage done thereby is more than offset by the good effected through the criticisms which innovating theories meet at the hands of those who stand by the old. It is for this reason that we rate the opposition of a man like Agassiz next in usefulness to the constructive work of men like Spencer and Darwin. When such opposition fails to shake a new theory, we may rest assured that it is not based upon a delusion.

But the opposition must be genuine to be useful. It must not call something else by the name, and expect the crown of victory for demolishing the substitute. That is a trick of theologians, rarely resorted to by men of Science; but, we fear, it is precisely what Principal Dawson has, consciously or unconsciously, been indulging in. We may be wrong, but to our mind his faculty for misapprehending the position and arguments of intelligent evolutionists is something marvelous in a man of his acknowledged scientific ability. In Dr. McCosh it would not be so surprising.

We refer to his address at Detroit, in which he reviews at great length the geological record of life's origin, and insists that the facts are overwhelmingly against the theory of specific evolution through natural causes. What he understands by evolution is nowhere distinctly affirmed, though it is clearly indicated in numerous passages. That it is very different from the understanding of the living disciples of evolution is plain enough from assertions like the following:

Discussing the insufficiency of evolutionary hypotheses, he says: "We have all no doubt read those ingenious, not to say amusing, speculations in which some entomologists and botanists have indulged with reference to the mutual relations of flowers and haustellate insects. Geologically, the facts oblige us to begin with cryptogamous plants and manubulate insects; and out of the desire of insects for non-existent honey and the adaptations of plants to the requirements of non-existent suctorial apparatus, we have to evolve the marvelous complexity of floral form and coloring, and the exquisitely delicate apparatus of the mouths of haustellate insects."

Believing Dr. Dawson to be an honest man, the only inference we can draw from a sentence like the last is that he utterly misapprehends the views of modern evolutionists. Certainly nothing in the writings of Wallace, or Darwin, or Lubbock, or Gray can be found to sustain such an ultra Lamarckian method of development. To be guilty of such a misstatement of the position of another is to forfeit one's claim to any respect as a scientific critic. Even Agassiz' mantle will fail to cover errors so gross and obtrusive.

THE NEW DEPARTMENT OF AESTHETICS.

Professors of the humanities have ever been inclined to look down upon the pursuits of naturalists as little becoming the refinement and dignity of gentlemen and scholars. They have delighted to picture such as turn their attention to the inferior world as eccentric fellows, chiefly employed, like the unfortunate spouse of Lady Jane in the "Ingoldsby Legends," in bug-chasing and poking into all sorts of dirty places for the ugly things that squirm in filth and darkness, solving the infinite (unlike the Bfeilmann) as one eternal—evolution!

We fancy that the cultivators of polite literature will therefore be taken somewhat aghast by the address of the retiring President of the American Science Association, especially by that part in which he serenely asserts that the chief requirement of the modern naturalist is an inborn and highly developed aesthetic faculty.

In the physical sciences everything depends on accurate observation, with strict logical consequences derived therefrom. In biology, on the contrary, while the basis of knowledge equally depends on accurate and trained observation, the logic is not formal but perceptive. Consequently the first requisite for excellence in this crown of the sciences is aesthetic perception.

Savages are usually keen observers, but they would not make good biologists: they lack artistic tact. The native Australians furnish an illustration. In them the absence of this faculty is complete. Oldfield relates that when one of them was shown his own portrait he called it a ship, another said it was a kangaroo, not one in a dozen identifying a portrait as having any connection with himself. Professor Le Conte gives a higher illustration of the same incapacity in a well known class of travelers. Having penetrated to the inmost chamber of the temple of Art, even the Hall of the Tribune at Florence, they stand in the presence of the most perfect works of art, and gaze upon them with the same indifference that they would show to the conceptions of the mediocre artists exhibited in our shops. Perhaps they even wonder what one can find to admire in the unrivaled collection there assembled. They may be highly educated, and good and useful members of the social organism; but they lack the aesthetic sense which enables one to enter into spiritual harmony with the great artists whose creations are before them.

Such unesthetic and unappreciative persons would not delight a Ruskin, as students of Art; nor would a professor of rhetoric be hopeful of making poets of them. Professor Le Conte maintains that they would make no better students of biology. The aesthetic character of natural history makes it for ever beyond them, just as it prevents the results of its cultivation from being worked out with logical precision.

This view of the fundamental difference between biological and physical science claims accord with the views of such masters of biology as Helmholtz and Huxley. To the genius of the artistic interpreter more than the patience of the collector its future progress will be due. A rising giant has invaded the domain of polite literature, and the humanities must make room!

LIGHTNING RODS.

We published, in our last number, a very interesting communication from Mr. George B. Prescott, the electrician of the Western Union Telegraph Company, concerning an alleged electrical phenomenon, observed during a thunderstorm, within a private dwelling, and described by a correspondent in our paper of August 14, 1875.

The phenomenon in question consisted of electrical discharges from the water and gas pipes of the dwelling, which was furnished with a lightning rod. The question was as to the cause of the electrical manifestation. Mr. Prescott believed that it was due to the defective connection of the lightning rod with the earth; but in order to satisfy himself fully in the matter, he took the trouble to send an assistant to the locality, and subject the premises, pipes, and rod to actual electrical tests with the galvanometer.

The result was that the lightning rod was found to be so sadly defective in its ground connection that it could not conduct the electricity into the earth, except feebly; and whenever a thunderstorm occurred, the house became charged with electricity, and the current, being unable to pass down the rod, made its way through the building to the water pipe, and escaped through it into the ground. The details given by Mr. Prescott are quite interesting. He advised the immediate connection of the rod with the water pipe, which would thus serve as an extensive conducting terminal for the rod, ensure the safety of the building, and put an end to the electrical manifestations among the pipes before mentioned.

This case is a representative one, as the rod was put up in the same defective manner as are the majority of rods, that is, the bottom of the rod was simply stuck down a few feet into the ground or rock, and thus practically insulated.

We have repeatedly advised our readers that a lightning rod, in order to serve as a protection for a building, must have a large conducting terminal in the earth. This termi-

nal may consist of an iron water pipe, as in the present case, or a very considerable extension of the rod itself into wet or damp earth; or a trench, filled with iron ore or charcoal, may be made available.

The aggregate annual losses of life and property in this country, by the striking of buildings by lightning, is immense, but might be almost wholly prevented if properly arranged conductors were generally employed. But it is evident that a more intelligent class of lightning rod men are needed in their erection; and it is probable that electrical instruction must also be given in our common schools before much improvement can be expected.

If a man, employed to put up a tin pipe to conduct the rain water from the roof to the cistern, were to solder up the bottom of the pipe, thus preventing any flow, his work would be rejected, and he would be stigmatized as a fool. But this is substantially what our lightning rod men are doing every day. They put up rods for the alleged purpose of conducting the electric fluid, but seal or insulate the bottoms of the rods so that the fluid cannot flow into the ground; and the majority of employers are so ignorant of the subject that they are unable to detect the fraud.

The known laws that govern the flow of electricity are almost as simple as those relating to water. If a proper connection exists between the rod and the earth, the building will be protected, for electricity will flow through the rod with the same certainty that water will pass through an open leader from roof to ground. But if the bottom of the pipe be sealed, the water cannot run; and if the bottom of a lightning rod be sealed or insulated, the electricity cannot flow.

Tests of lightning rods with the galvanometer, as directed by Mr. Prescott, will always show whether they are safe or not. But it may be taken for granted, without a test, that a rod is unsafe which merely has its bottom stuck down a few feet into dry earth. We repeat, the golden rule for safety is to have the bottom of the rod placed in connection with a large mass of conducting material in the ground.

ANOTHER VIEW OF MR. CROOKES' LAST DISCOVERY.

In a recent issue we gave a summary of Mr. Crookes' recent observations on the behavior of delicately suspended pith balls when acted on by a beam of light. In a vacuum the pith balls, and disks of cork similarly suspended, seemed to be repulsed by the light under conditions which demonstrated, Mr. Crookes asserts, a hitherto unrecognized power of light.

Similar observations with substantially the same apparatus were made fifty years ago, so that the discovery is not new if true; it simply reasserts what was generally believed when the Newtonian theory of light prevailed, namely, that luminous radiations are capable of exerting a direct push upon matter. It is strikingly inconsistent, however, with the now dominant theory of light; and according to some careful observers, it is equally inconsistent with fact. Professor Osborne Reynolds suggests that the action of the pith balls or disks is due to the evaporation of some fluid on the surface of the disks, the recoil of the evaporating particles, as they leave the disk, driving it back.

A better explanation, because better sustained by experimental evidence, is that given by Professor Dewar, of Edinburgh, who claims that the heating of the disks is the efficient cause of the action observed. In his investigation Professor Dewar used substantially the same apparatus that Mr. Crookes employed, simply changing the composition of the disks and interposing certain substances having well known effects upon the radiations.

Placing a candle before the apparatus so as to cause a large deflection, he first interposed a vessel of ordinary glass, and the deflection was diminished. On filling the vessel with water, the disks ceased to be deflected. Now it is well known that water, though transparent to light, is almost opaque to heat.

The experiment was then reversed. A smoked piece of rock salt was interposed, shutting off the light but allowing the heat to pass through. The disk remained deflected: so likewise when a solution of iodine in carbon bisulphide was used, a substance opaque to light but transparent to heat. These experiments show that it is not the luminous radiations which have power to move the pith balls, but the obscure radiations commonly known as heat rays.

The next question was: How do the heat rays produce the motion? To test this, disks of rock salt (transparent to heat) and glass (transparent to light) were substituted for those of pith or cork. When a beam of light was thrown upon the clear salt no motion ensued, the radiations passing through unabsorbed. When the light was received on the glass, part was arrested, the glass was heated, and the disk was deflected. The effect was reversed when the back of the rock salt disk was coated with lampblack. The radiations were absorbed by the lampblack at the surface of contact; the lampblack was heated and, by conduction, heated the salt, and the result was (at first) repulsion. Were the lampblack a good conductor, it would heat through first, and then there would be repulsion from that side, or apparent attraction. This in a vacuum: at ordinary pressure the motion is always forward from the side of the disk most heated.

Other experiments were made with disks of sulphur, clear and ordinary; and with transparent disks coated on one side with white phosphorus, which is opaque to the ultra-violet rays. In the latter case, when the disks were acted on by light, chemical action ensued with disengagement of heat, resulting in a motion of the disks away from the side heated. The reverse was demonstrated by bringing ether near a disk; and doubtless the same effect would have been produced by a piece of ice. The chilling substances caused a radiation

of heat from the side of the disk toward it; the distant side became the heated one, and apparent attraction was the result.

Professor Dewar's explanation of these phenomena is simple, and does not involve any new or inexplicable power in radiations. The apparent attraction of the disks by light under ordinary pressure is caused, he says, by convection currents. The air or gas in front of the disk is heated, and, rising, tends to cause a vacuum; the disk consequently advances, pushed forward by the power that drove the ship of the "Ancient Mariner":

"The air is cut away before
And closes from behind!"

In a vacuum the effect is different: the disk is repulsed instead of attracted—repulsed by the recoil of the residual molecules of the gas, which leave the heated side of the disk at an increased velocity after impinging upon it in the course of their travels.

What takes place is this: The particles of the gas are flying about in all directions, with a velocity which depends on the temperature. When they impinge on the heated disk, they go off with a greater velocity than those which go off from the colder side, and hence there is a recoil of the disk. When the gas is at all dense the particles get a very short way before they are met by another and sent back, and so the velocity gets to be a common velocity before any visible action takes place. When the gas is rare, the particles may get a long way off before they meet others, and so the action becomes perceptible.

The vacua employed by Professor Dewar were formed by the charcoal method, the density of residual gas being reduced to one four-millionth of its density at ordinary pressure. In such a vacuum, the average path between two collisions is about 1 foot against an average of one four-millionth of a foot at ordinary pressure. It will be seen, therefore, that the particles may have relatively a very long way to travel after leaving a disk.

For the benefit of those who have dreamed of securing a profitable direct motive power derived from solar radiations, it may be added that the total work done by the radiations in these experiments did not amount to the five-millionth part of the available energy received by the movable surfaces.

EXPLOSIONS IN GUNPOWDER MILLS BY ELECTRICITY.

A correspondent remarked, some time since, that the mysterious explosions of some powder mills may probably be due to an electric spark given off by persons dressed in woolen clothing, who, when the air is dry, may (by friction of their clothing or feet) produce from their finger ends a spark of electricity sufficient to ignite a gas jet. He submitted the question whether it would not be possible that men at work in powder mills may create so much electricity in their bodies that, when their hands come in contact with metallic conductors, it may be, if not sufficient to ignite powder, enough to ignite some inflammable gas generated from the chemicals.

This letter has drawn the attention of the London *Chemical Review*, which states that in England they have often seen in American journals the statement that an electric spark, sufficient to ignite gas, may be given off by the human hand; but the editor says that he never heard of such cases on his side of the water. We know that the air in England and all the countries of Western Europe is very damp, owing to the prevailing west winds and the absence of extensive areas of dry land, blowing over which the wind would become very dry, as are our west winds, coming over our prairies.

It is asked what inflammable gas may be generated in the manufacture of gunpowder? To this, it may be answered that, in the manufacture of fulminates for percussion caps, inflammable vapors, as nitrous ether, etc., are given off, while the dust of gunpowder and even of charcoal, when floating in the air in a proper quantity, may form an explosive mixture. Even the dust from the mineral grahamite, which in its character is very similar to gunpowder charcoal, has repeatedly exploded in the mines in Western Virginia, when mixed with air in the right quantity. It is well known among electricians that a weak electric spark will more easily explode gunpowder than a strong, intense spark; the latter will scatter a heap of gunpowder without igniting it, but, when the spark is weakened by substituting for a part of the conducting metal a less conducting material, such as water or a moistened thread, then ignition will readily take place.

We acknowledge that we have no positive evidence that powder mills have actually been exploded by electricity; but the possibility of such a cause was only suggested in our paper, and it must be admitted that this suggestion is not unworthy of serious attention.

Resignation of Commissioner of Patents.

The daily papers announce the resignation of Mr. J. M. Thacher, the present Commissioner of Patents, to take effect October 1. His successor has not yet been announced by the President, but the name of R. H. Duell, of Courtlandt county, N. Y., is mentioned as the probable appointee. Mr. Duell is reputed to be a lawyer of considerable ability as well as a first class politician. He was formerly a member of Congress.

NEW RUSSIAN GUN.—A great cannon, lately built at the works at Oboukowsky, has cost \$65,000, and weighs 40 tons. It is a breech loader, entirely in crucible steel, 20 feet 6 inches long; its largest ring is 57½ inches in diameter, and the tube has thirty-six grooves.

Continued from first page.

floors and the basements below are occupied by the post office, and the third and fourth floors by the United States courts and offices (the interior of the United States Court is shown in our Fig. 2). There are ten elevators for mail matter, and four for passengers. The building looms up grandly above the structures in the vicinity, and attracts and interests the attention of every beholder. The solid walls of the post office contain half a million cubic feet of granite. Every credit is due to the great ability shown by A. B. Mullett, formerly United States Supervising Architect, in perfecting the plans of the building, and giving to New York an edifice that will be a continual source of pride to it.

The business transacted in the post office in this city is something marvelous, being nearly double that of any other city in the Union. The average number of domestic letters received and distributed daily is 300,000; the number of foreign letters received, 30,000; the number dispatched, 35,000; and the number of local letters received and distributed, 120,000. There are 5,795 lock boxes for letters, and 372 lock boxes for newspapers. At the post office and stations there are about 1,300 employees, and 390 carriers are employed. In the post office proper there are 600 clerks.

Experience has shown that Mondays and Thursdays are generally the heaviest days. To properly manage a business so vast and so complex as that transacted in the New York post office requires the highest order of executive ability, combined with a quick perception of details needed to systematize the work so as to make one harmonious machine.

THE ELEVATORS.

One of the most noticeable features of the interior of the building is the telescopic hydraulic elevator. Eight of these are used for handling the mails, and four for passengers. Of the latter the two principal ones are located in the wells of the grand spiral stairways which occupy the pavilions at either extremity of the north or park front. The elevator cars are of elaborate design and finish. Their most striking peculiarity, however, is their mode of operation. Imagine an iron telescope about 18 inches in diameter and 30 feet long when closed; set the small end up, with a car resting on the eye piece. Now this telescope, being strong enough to resist great internal pressure, has its three polished wrought iron slides working through watertight stuffing boxes; and it is obvious that, when water is forced into it, the slides will be forced out and up, and the car, resting on the upper one, will in consequence be elevated. To lower, the confined water is permitted to escape, when the weight of the car and slides causes a prompt descent. These operations are controlled by a threeway valve, actuated from the car by a guide rope in the usual way; and by its means the speed in either direction can be instantly adjusted to any rate, from an almost imperceptible motion to 100 feet a minute with perfect ease and steadiness.

The engraving, Fig. 3, represents one of the large passenger elevators extended to its full height. Their range is from the first to the fourth floors, a distance of about 80 feet.

These elevators were built by Messrs. Davidson & Mars, of 26 Courtland street, New York city.

The foregoing engravings are all executed by the new process of the Photo-Engraving Company, No. 62 Courtlandt street, this city, an account of which we give in the subjoined article.

Photo-Engraving.

The production of metallic plates engraved by the aid of light, for use in printing, was attempted as early as 1813, by Niepce, about twenty five years before the art known as photography was invented. Since then, many attempts at photo-engraving have been made, and numerous specimens of more or less merit have been exhibited; but it is only within the last few years that this art has been brought to such a degree of perfection as to serve a useful purpose.

Among the various inventors in this field, John C. Moss, superintendent of the Photo-Engraving Company, of this city, seems to have achieved the highest success. Being both a practical photographer and a printer, his experience gave him great advantage in his endeavors to prepare plates, by means of photography, to be used on the ordinary type press. He commenced his experiments with great enthusiasm, in the spring of 1858; but it was not till ten years later that he had so far succeeded as to get his process into prac-

tical working; and then the want of means compelled him to carry on his operations in the same apartments where he lived, in Jersey City.

After prosecuting his work for a year or more under these embarrassing circumstances, and subsequently, for a few months, in a loft on Cedar street, in this city, his plates had

attracted so much attention that he was induced to unite with others in the organization of a company for the purpose of carrying on the work upon a large scale. Accordingly the Aetinic Engraving Company was formed. But this did not prove a financial success; and after a year and a half it was abandoned.

There are some inventions which, though of great value, are slow in winning their way to public favor. This proved to be one of them. There existed in the minds of many publishers a strong prejudice against process engraving, due to the fact that several processes had been introduced, of which they had made trial with very unsatisfactory results. Time was required to prove that Moss' process was not like the others.

Another and perhaps greater obstacle was met in the reluctance of artists to adapt their style of drawing to the requirements of this new art. They had been accustomed to make their drawings with pencil and brush, often hastily, leaving the work to be perfected and finished by the slow and tedious toil of the wood engraver. Now they were asked to furnish pen and ink drawings, executed with the care and exactness necessary to secure the desired result. Their first attempts were generally failures, increasing the indisposition to change.

But Mr. Moss had pursued his invention too long to be disheartened by these obstacles and delays. A new organization—the Photo Engraving Company—was formed, something more than three years ago. Expensive apparatus and machinery have been introduced, important parts of which have been invented and constructed expressly for this use; workmen have been carefully trained to perform their respective parts; a corps of artists, patiently instructed, have become skillful in the style of drawing required by this method of engraving; and the process itself has, in several respects, been essentially changed and improved.

One of the methods devised by Mr. Moss to save labor in the production of pen drawings is this: The copy from which a drawing is to be made is photographed double the size of the plate required, on arrowroot paper, and then fixed and well washed, but not toned. Directly upon this print the drawing is made with a pen and india ink. When the outlines and all the important parts of the drawing are complete, a saturated solution of corrosive sublimate in alcohol is flowed over the drawing, which bleaches away the photographic color without at all injuring the lines in ink. The finishing touches are then added, when the drawing is ready to be reduced and engraved. Thus the tedious operations of sketching and tracing are obviated, and a degree of accuracy is secured which it would be difficult to obtain by any other means.

It should be observed here, however, that drawings are not required for all the engraving done by this company, since a large part of their work consists in the direct reproduction of woodcut, lithographic, and steel plate prints, either of the same size as the originals, or of reduced or enlarged sizes.

Up to the present time this company has engraved over 50,000 relief plates, measuring over 500,000 square inches; and it is estimated that, with about 60 employees, they are annually performing an amount of work that would require for its accomplishment at least 1,000 skillful wood engravers.

The view of the New York Post Office Building, on our first page, was engraved by this process from a pen drawing made by one of their draftsmen.

The English Polar Expedition.

News has been received in England from the polar expedition, which sailed early in the summer. Both ships had arrived at Disco, Greenland, after a pleasant voyage, and preparations for pushing further north were in active progress. During next spring six sledges will start for the pole. One sledge will leave the party and return every week or so, transferring its surplus provisions to the others. When the exploring party is thus reduced to one sledge, that will push on alone and reach the pole by itself. If this is done satisfactorily, and all the surveys are completed, the expedition will be able to return to England during the autumn of 1876.

MR. PROCTOR, the celebrated English astronomer, who lectured in this country two years ago with so much success, is about to come again. He is an able and interesting speaker.

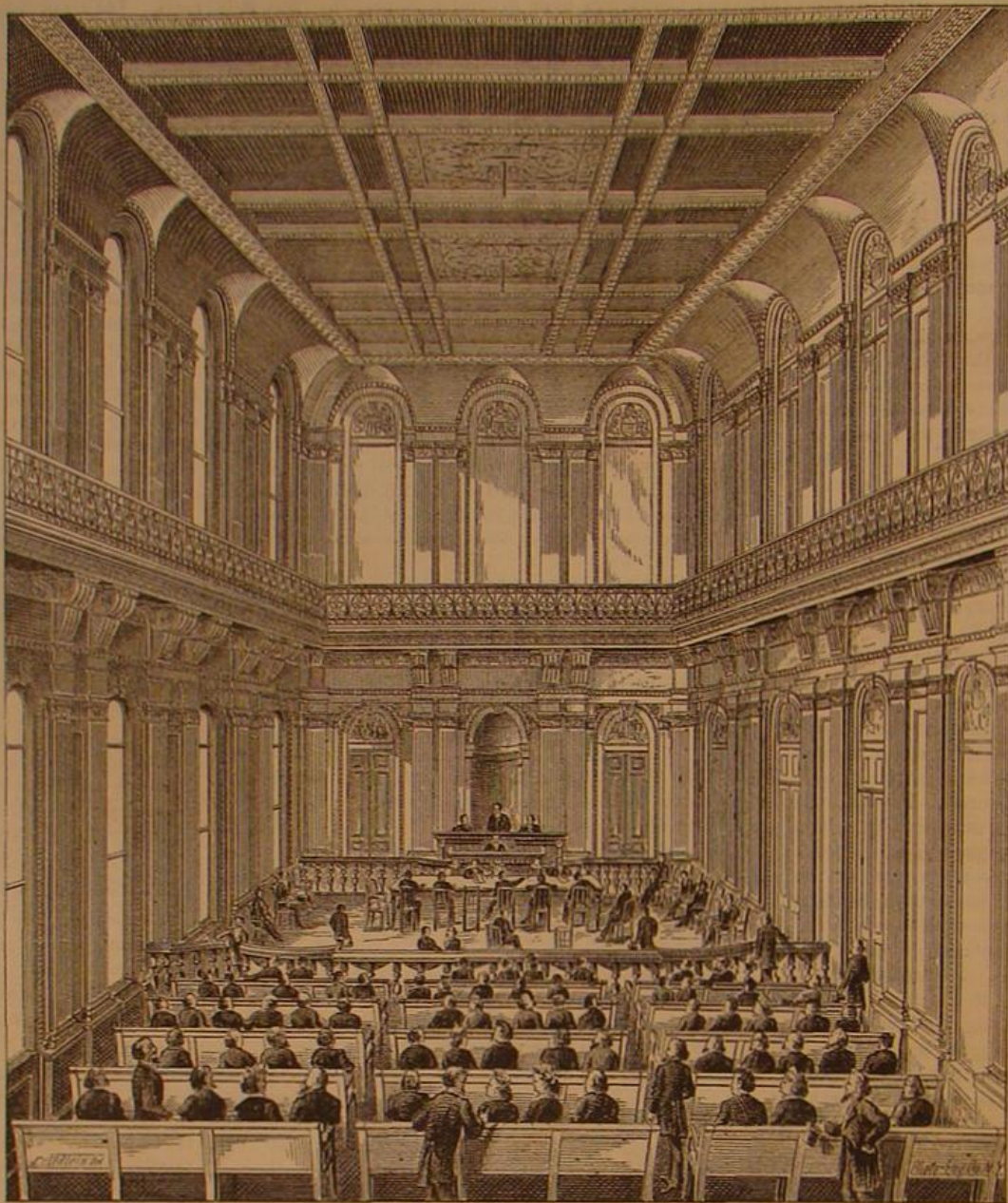
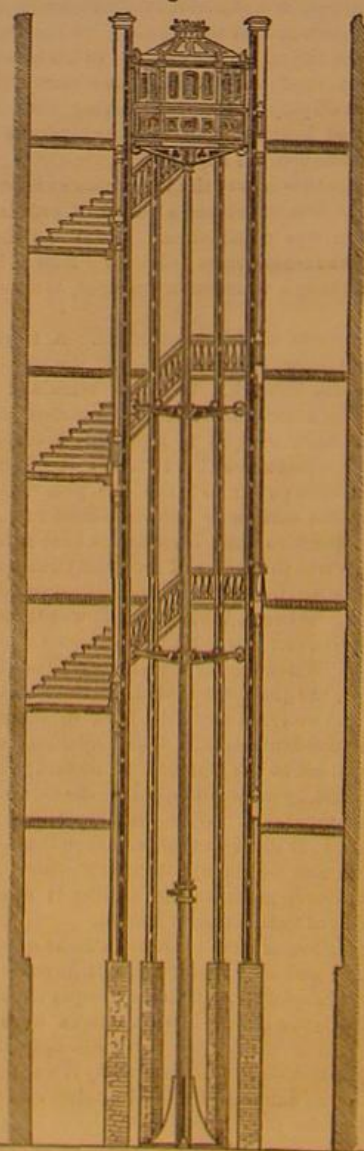


Fig. 2.—THE UNITED STATES COURT, POST OFFICE BUILDING, NEW YORK CITY.

Fig. 3.



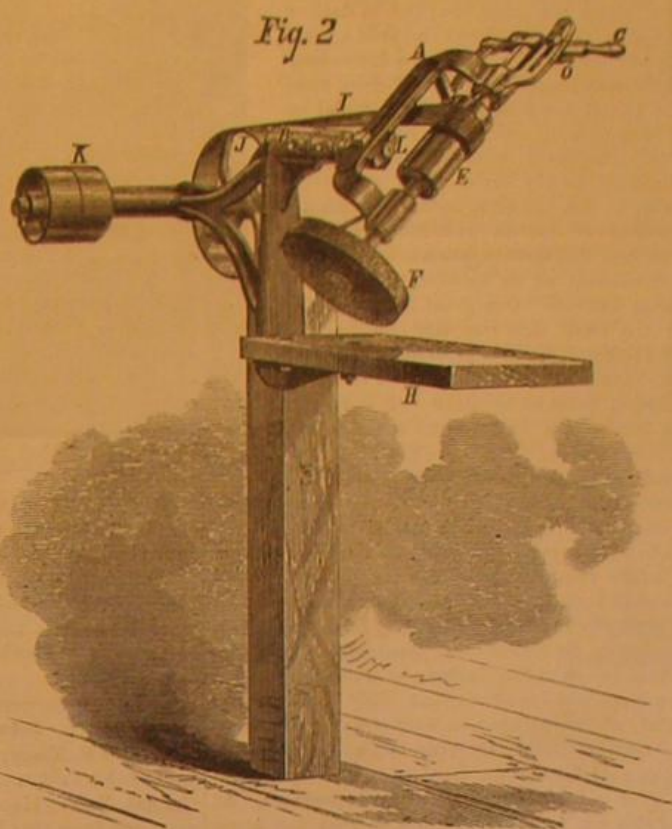
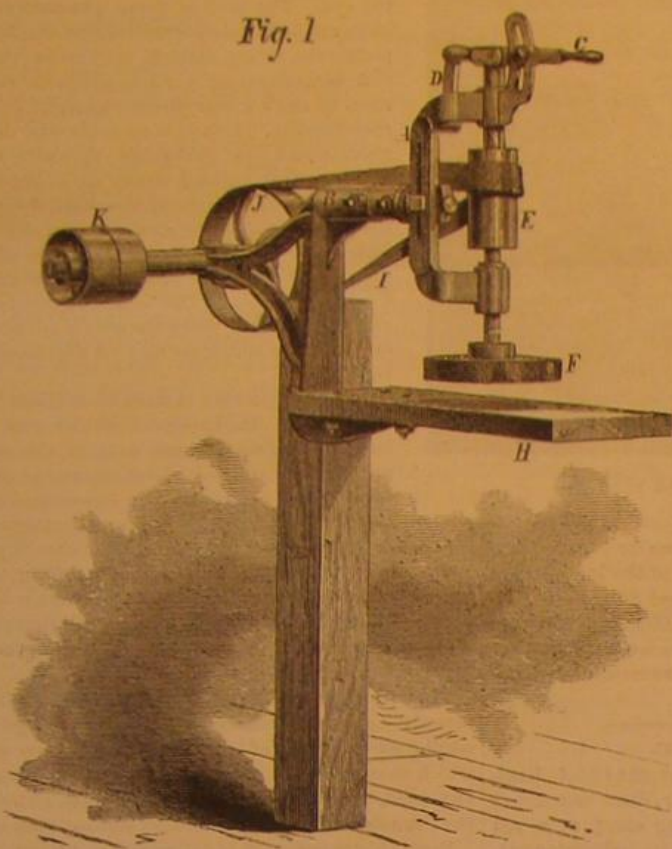
THE HYDRAULIC ELEVATORS, NEW YORK POST OFFICE.

IMPROVED UNIVERSAL GRINDER.

The new emery grinder herewith illustrated is so constructed as to facilitate operations upon a large class of work done by machinists, stove fitters, and others, which cannot conveniently be performed upon horizontal machines. The principal feature of the device is the manner in which the wheel may be adjusted to work at any angle by simple mechanism, involving the use of no extra pulleys and belting.

ly among these may be mentioned the means by which homogeneity of structure is attempted to be secured. In ordinary practice steel is at present, to a large extent, cast into ingots which are honeycombed more or less by bubbles of gas distributed through the structure; and after solidification has taken place, it is attempted to displace these bubbles by the process of cogging, hammering, and rolling the material while in a heated state. During the earlier stages of this

procedure. In casting ingots it not unfrequently happens that the bubbles of gas are largely formed near the outer surface; and during the processes of reheating, these bubbles are apt to be opened up by the wasting of the surface, thus affording opportunities for the entrance of dirt and the formation of scale within the bubble cells, and, as a necessary consequence, interfering with the obtaining of a solid homogeneous mass. Under these circumstances, and inasmuch as



SANFORD'S UNIVERSAL GRINDER.

Fig. 1 shows the grinder arranged for acting upon vertical work; in Fig. 2 the wheel is represented inclined.

The wheel shaft is mounted in bearings in the frame, A, which, by means of a set screw passing through a slot, is secured to a shank which enters a socket on the standard, B. The shank, by loosening the set screws which confine it in the socket, can be drawn out to tighten the belt which, acting on a pulley on the wheel mandrel, rotates the wheel, or it can be turned in the socket so as to set the latter at any angle. By means of the slot and set screw in the frame, the wheel can be adjusted nearer to or further from the table, as desired. The mandrel has several inches traverse in the frame, so that the pulley can be pressed down or lifted from the work by means of the simple lever arrangement at C. The lever may be set and held at any position by means of the nut shown, or the former may be counterweighted and operated by a treadle beneath the table.

In order to grind flat surfaces the wheel is lowered down to them. A conical wheel is used for grinding holes in stove plates, etc., an aperture being made in the table or an auxiliary platform thus provided being secured on top of the latter. For edging plates, the table can be made of sufficient size to sustain the whole weight of the plate, so that the attendant can bring a more even pressure on the wheel with little labor and without danger of injuring it. The wheel can be inclined so as to grind bevel edges with readiness; and by suitably formed grinders, moldings can easily be ground.

The machine is manufactured by the Tanite Company, of Stroudsburg, Pa., who may be addressed for further particulars.

COMPRESSED STEEL.

The manufacture of steel in large masses, although it has made vast strides during the past few years, is still characterized by many features requiring improvement, and especial-

treatment, the steel is tender and requires to be dealt with carefully; but in proportion as its homogeneity increases, it becomes fit to resist more severe handling, the increase in its toughness, doubtless, to some extent, marking the expulsion of the gas bubbles and the welding together of their sides under the various compressing processes the material undergoes. It is undoubtedly true that this mode of treatment, when skillfully carried out as it is at our large works, gives excellent results, and produces a most valuable structural material; but it is equally true that it is far from being free from objections, while it is in some respects opposed to what may be theoretically considered the rational mode of

it is at present scarcely possible to prevent the formation of the gas bubbles in the ingots during the process of casting, so long as the ordinary plan of teeming them in metal molds is adhered to, it is not surprising that the idea early suggested itself of getting the desired homogeneity by subjecting the metal to compression while in a liquid state, instead of allowing it to solidify before attempting to remove the bubbles. Such a mode of procedure is certainly a rational one, if we allow for the moment that the casting of perfectly solid ingots is at present unattainable in regular practice; and notwithstanding the practical difficulties attendant upon its being carried into effect, it is somewhat surprising that greater progress has not been made in its general application.

The plan of increasing the solidity of castings by compressing the metal while in a molten state is very far from being new; and as applied to copper, it has been in use in Manchester, England, for about twenty years past. As regards steel, the credit of suggesting its compression in the fluid state belongs, we believe, to Mr. Bessemer, who embodied the idea in one of his earlier patents; but in England it has in practice been worked out almost solely by Sir Joseph Whitworth, who for some years has been engaged in developing the system, and of whose success we shall have to speak presently. It was in France, however, we believe, that the process was first practically carried out on a large scale, Messrs. Révillier, Biétreix & Co., of St. Etienne, having adopted it in 1867, and having built steel works specially arranged for it in connection with furnaces for making steel by the Siemens-Martin process. According to the plans adopted by Messrs. Révillier & Co., the metal was run from the furnace into a ladle, which, by means of a turntable crane, was conveyed to the ingot molds, and the metal teemed into the latter. The molds were placed on an ingot carriage, and after filling they were run under a hy-

Fig. 1.

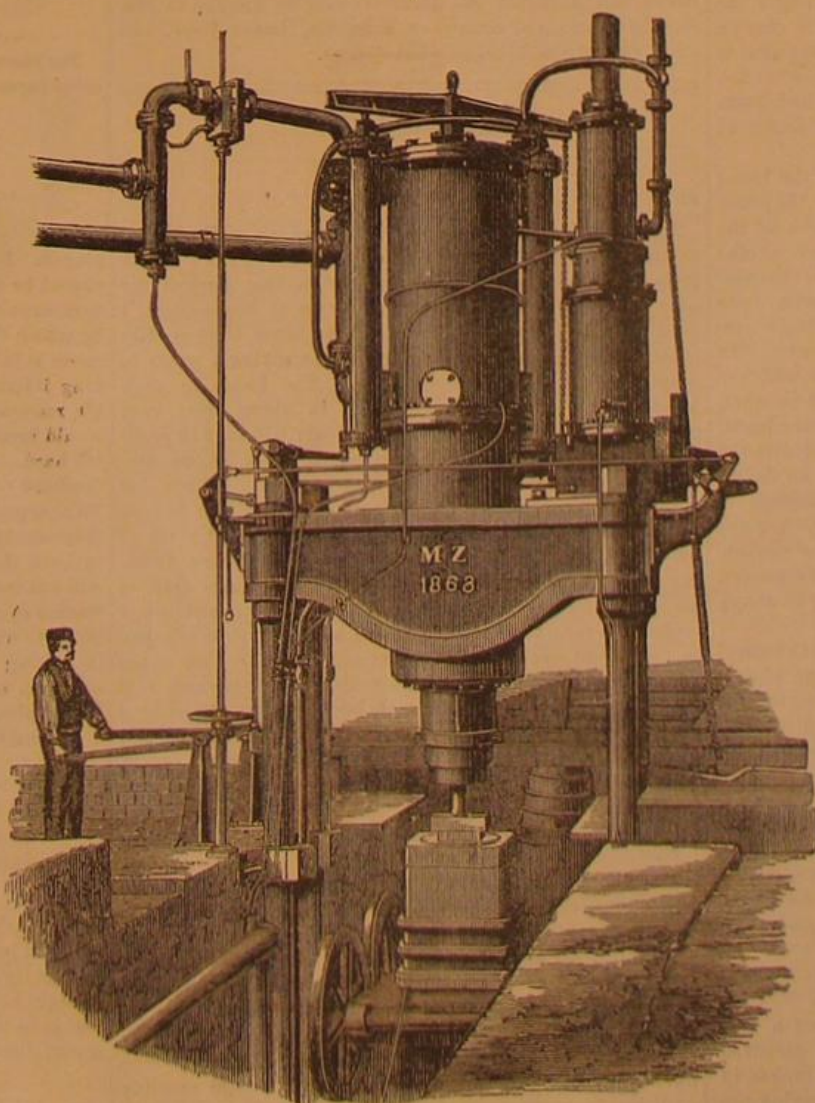
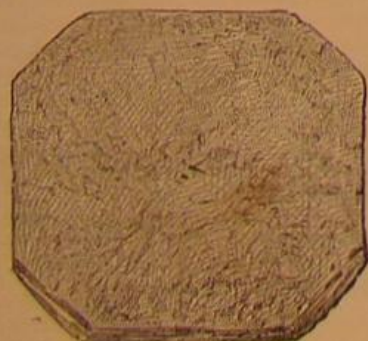


Fig. 3.



HYDRAULIC PRESS FOR COMPRESSING STEEL.

draulic press, and the metal subjected to compression until its temperature had fallen below that at which bubbles would be reformed. We do not know whether or not Messrs. Révillier and Co. are still using the compressing process, nor what success has attended their latest experiments with it, but we know that during their earlier use of it they produced some very compact sound ingots, but also many failures. Not content with treating ingots, Messrs. Révillier and Co., also compressed—with varying success—more complicated castings, such as tyres, rings for guns, etc., but in dealing with such a manufacture they had to contend against the difficulty of running the metal at a lower temperature than was consistent with efficient compression, the initial temperature of the metal on leaving the furnace being reduced by its transfer by the ladle, etc. The result was that, to obtain the necessary liquidity in the molds, they were compelled to resort to the use of a metal containing a higher percentage of carbon and hence a lower melting point, but this metal again was unfitted for tyres, etc., on account of its hardness and brittleness, and hence failures. One great difficulty connected with the affair thus was that by the Siemens-Martin process it was not possible to deliver a mild steel into the ladle at a temperature so much above its melting point as to allow of it at length reaching the molds at a temperature suitable for undergoing compression. With the Bessemer process less difficulty is experienced in this way, the initial temperature being higher; but even where Bessemer steel is compressed, as at the Neu-erg Works in Austria, it is found to be very important to keep up the temperature of the steel before compressing by heating the ingot molds before the steel is teemed, and by getting the molds under the press as promptly as possible after they have been filled.

The arrangements for compressing steel which have for some years been in use at the Neu-erg Works were planned by Herr Von Stummer-Traunfels, and they have proved very successful, while they are also very simple. At Neu-erg the steel from the converters is run into a receiver which is lifted by a powerful hydraulic crane on to a suitable carriage, and is then run on to a bridge over the press pit. At the bottom of this pit is a line of rails, so that the ingot molds mounted on carriages can be brought under the bridge to be filled with steel from the receiver and then promptly run under the press.

The ingot molds are, as usual, made for conical ingots, the section at the lower part being the ordinary one of an irregular octagon—or rather a square with the corners chamfered off—while at the upper part this section changes to circular, the upper portion of each mold being cylindrical, internally, for a length of about 6 inches, so as to form a guide for the press plunger. Externally the molds are circular, and they are turned slightly conical, while steel hoops are shrunk on them to enable them to resist the internal pressure. The conical form of the ingots would of course cause the fluid metal to exert an upward pressure, leading to separate each mold from its base, and to resist this the molds are furnished with strong flanges by which they can be secured to their bases. The mold bottoms, we may add, have a slight depression in the center, and in this is placed some fire clay on which the metal falls when teemed. This arrangement is employed to prevent the bottom from being injured by the pouring of the metal, it being important to keep the bottom sound, as it might otherwise give way under the action of the press.

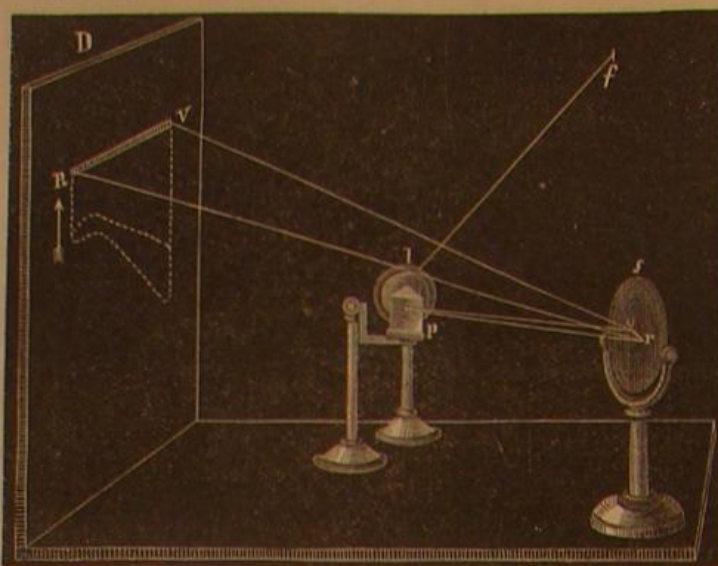
Each ingot mold is mounted on its own carriage, the latter carrying it at such a height that, when run under the press, the top plate of the carriage, on which the bottom of the mold rests, is clear of what we may term the anvil of the press, this being a strong casting fixed on firm foundations. The pressure imposed by the press varies from 400 to 700 tons, and it is evident that the ingot carriages could never be made to resist such a pressure. To avoid the necessity for this, the lengths of rails on which a carriage rests when under the press are balanced so that, when they are merely loaded with the weight of the ingot, mold, and carriage, they are maintained on a level with the other rails; but when the press is brought to bear on the ingot, they descend and allow the top plate of the carriage to take a solid bearing on the anvil just mentioned. On the pressure being removed, the rails rise again and the carriage can then be run on to make room for another. The general arrangement of the press and press pit at Neu-erg is shown by the annexed perspective view (Fig. 1.)

It should be mentioned that, when an ingot is being teemed in the press pit, a kind of funnel of wrought iron plate is placed in the mouth to prevent the latter from being injured by the molten metal. When the mold has been filled, this funnel is withdrawn, and a short plunger is inserted by means of tongs specially constructed for the purpose. The mold is then run under the press and subjected to pressure for from half a minute to one minute, it being found that this period is amply sufficient to insure the desired result. We may add that no difficulty is experienced from metal endeavoring to squeeze out around the plunger. Any metal so endeavoring to escape becomes at once so cooled as to solidify.

At the Vienna Exhibition of 1873, some excellent specimens of compressed steel were exhibited by the Neu-erg Works, and amongst others the broken ingot from a photograph of which the annexed Fig. 2 has been prepared. This ingot was shown side by side with another broken ingot of the same steel, but uncompressed, an engraving pre-

pared from a photograph of this second ingot being shown by Fig. 3.

If these two figures be compared, it will be seen that, whereas in the ingot represented by Fig. 3 there are a great number of bubbles near the outside—and in fact only pro-



RICCO'S EXPERIMENTS ON COLOR VISION.

ected by a thin skin, which might be injured in the reheating furnace—in the compressed ingot, shown by Fig. 2, there is one bubble only, and that at the center of the ingot, where it would most probably be thoroughly closed during the subsequent treatment of the ingot, or where, if it continued to exist, it could do little harm. Altogether we believe that the practice at Neu-erg has been very successful.—*Engineering.*

Edward H. Tracy, C. E.

Edward H. Tracy, for several years past the Chief Engineer of the Croton Aqueduct of this city, died recently at Carmel, N. Y. He began his engineering career as a rod man, and from that humble position rose, by industrious attention to the duties assigned him, to be an assistant engineer under John B. Jarvis, on the Chenango canal in this State. Subsequently, under the same chief, he assisted in the construction of the main line of our great aqueduct. He was afterwards engaged in several other important works, involving dock and railway construction. For the last five years he has been Chief Engineer of the Croton aqueduct.

Chloroform as a Preservative.

At a recent session of the British Pharmaceutical Society, Mr. J. B. Barnes stated that vegetable infusions may be preserved indefinitely by the addition of a minute quantity of chloroform. A mucilage of gum acacia and a malt infusion have been satisfactorily experimented upon, and the action of the chloroform appears to be to destroy the ferments. Mr. Barnes considers that the discovery may be applied to preserving solutions of citrate of ammonia, lemon juice, and other very alterable organic substances.

Correspondence.

Bee Culture.

To the Editor of the Scientific American:

I can confidently recommend bee culture, as well adapted to the sphere of women both in city and country. I speak from experience, having been engaged in this pursuit for over twelve years. In my first attempts at bee culture, I used the old fashioned box hive. These hives were readily constructed with little or no reference to giving a profit in surplus honey obtained from them. The losses in such hives, from various causes, especially in winter, were very great, and profits were small at the best; \$10 to \$12 profit from the sale of surplus honey from such hives in one season was considered an extraordinary yield. I have for several years used a hive of my own invention. It is constructed with special reference to securing a good yield of surplus honey, in the most convenient marketable form. My hive is so arranged and constructed that I am able to prevent or contrive the natural swarming of bees, and, when desired, to turn their whole force to storing surplus honey in the parent stock instead of swarming out, as they often do (to their great damage) under ordinary management. It is surprising to note how much more honey will be stored by a stock that does not swarm (yet has the same increase of bees) than by one that casts one or more swarms. I often obtain from 200 to 300 lbs. honey in small glass boxes from a hive in a season.

There is in my opinion no pursuit which offers greater inducements to women as bee culture. There are very many whose occupation confines them indoors nearly the whole time, excluding them from the air and sunshine, to the great injury of their health; while at the same time, after this great sacrifice, they barely succeed in obtaining a livelihood. To such, bee culture offers special inducements, such as health and a greater recompense for labor performed. I hope that ere long bee culture will receive from my sex the attention it deserves. I am acquainted with many who have lately commenced in the business who are meeting with great success.

West Gorham, Me.

LIZZIE E. COTTON.

On Color Vision.

To the Editor of the Scientific American:

It is known that a certain length of time is necessary to the perception of light, and that the sensation in the eye does not disappear instantaneously with the disappearance of the luminous object. It is also the opinion of physiologists that the perceptions of the different simple colors require different times; as does likewise the persistence of the sensation remaining in the eye. The laws of these phenomena have not however been yet determined, and the following experiments, in my opinion, may serve that purpose: A ray of sunlight, fl , is made to enter a dark room through a narrow vertical slot, f , by means of a *porte lumière*. It falls in an horizontal direction and meets a lens, e , a flint prism, P , which disperses it, and a mirror turning about on a horizontal axis, which reflects the rays in the same direction, above the prism, on a white screen placed at a convenient distance to obtain an horizontal spectrum, $R V$, well enough developed to exhibit at least the principal Fraunhofer lines. The whole apparatus should be so arranged that, when the mirror is slowly made to oscillate, the spectrum may be displaced parallel to itself.

If now the mirror is made to oscillate with a certain velocity, the spectrum will be seen to become curved in an unexpected manner, the extreme red and, still more, the violet remaining behind. On moving the mirror in the opposite direction, the

spectrum oscillates with it, gliding and darting like a fish in the water. It will be noticed that the convexity of the anterior outline of the spectrum is in the yellow, which color precedes the others in the motion. On keeping the eye fixed on a point of the screen, it will be observed that the spectrum widens, and that the expansion is greatest in the violet and decreases towards the red.

The same result is obtained by projecting the spectrum directly upon the screw and observing its image in a mirror oscillating in front of it. With the proper diaphragms, which should be black and opaque, some colors may be intercepted, and only two allowed to pass in coincidence with the Fraunhofer lines; this renders comparisons easier.

From this experiment it follows that yellow is the color which most quickly affects the eye; then come orange, red and green, blue, indigo, violet. The persistence of vision is greatest in the violet and successively diminishes in the indigo, blue, green, yellow, orange and red.

This may be verified also with white light. In fact, on moving a watchglass reflecting the sun before a black background, and keeping the eye fixed on it, the little solar image will be seen converted into an elegant colored curve, in which the following colors are usually found: yellow, green, blue, indigo, violet.

Modena, Italy, August, 1875.

A. RICCO.

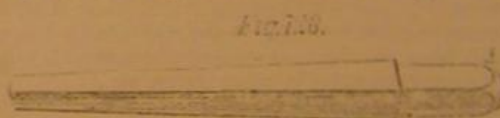
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXXI.

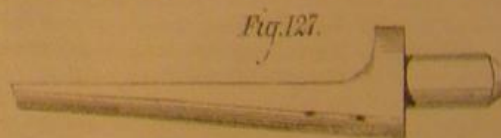
REAMERS.

For reaming out taper holes, such as are employed to receive taper pins, the square reamer shown in Fig. 126 is em-



ployed. It is a piece of plain taper square steel. This tool should be dipped endwise in hardening, and tempered to a dark brown, leaving the square end, A (on which the wrench, by which the reamer is revolved, fits), of a blue color; because it is at times necessary to force it into its cut by striking it lightly with a hammer (a proceeding necessary with all reamers having appreciable taper upon them), which would break the edges of the square end off if they are left too hard. The edges are beveled off, as shown, to prevent the head of the square end bulging from being hammered. To sharpen it, the flat sides are ground, taking care to keep them straight and the thickness even on the two diameters, so that the sides being straight and the reamer square, it will cut taper holes whose sides will be straight. If the reamer is not ground square, two only of the edges will be liable to cut, causing the reamer to wobble, and so impairing its cutting power and rendering it liable to break. This description of reamer is sometimes used to cut out holes in boiler plates which do not come fair after being punched.

The half round reamer shown in Fig. 127 will, however,



work much more steadily in holes which do not come fair, and will bore at all times more true, though it will not cut so rapidly as a square reamer, when employed to bore a straight hole into a taper one. The method of making this tool is to turn it up and cut away half the diameter, tempering as directed for the square reamer.

MACHINE REAMERS.

Reamers for use in a machine or lathe are of the form shown in Fig. 128. The serrations forming the cutting edges

are made at and near one end only, and do not run to the full length of the reamer. There are two and sometimes more flutes, A, provided to convey oil or water to the cutting edges and receive the cuttings. This description of reamer is employed to take out a very light cut only, and must run very true in the machine. Fewer cutting edges and flutes, running the entire length of the reamer, may be employed for heavier duty or for brass work, being much better qualified to

Fig. 122.



carry off the cuttings; but in that case, the backing off of the teeth should be performed at a distance from the end of the reamer equal to its diameter, so that no cutting duty will be performed by the teeth beyond that distance; otherwise, from spring, play in the spindle of the machine, or from other causes, the reamer will cut the holes of a diameter larger at the end at which it entered. All reamers should be well supplied with oil for heavy cuts on steel or wrought iron, and soapy water for fine finishing cuts on those metals; oil may also be used for brass work, providing the cut is very light and the cuttings can find very free egress.

SHELL REAMERS

Shell reamers, such as shown in Fig. 129, are excellent tools for sizing purposes, that is, for taking a very light cut intended merely to smooth out the hole, and insure correctness in its bore or size. They are short reamers, having a conical hole running through the center which is fitted to a cone mandrel as a stock; thus three or four different sizes of reamers may fit to one stock. Through such stocks there should always be bored a hole into which a pin may

Fig. 129.

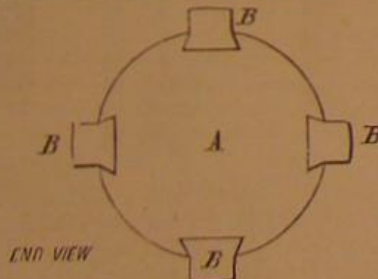
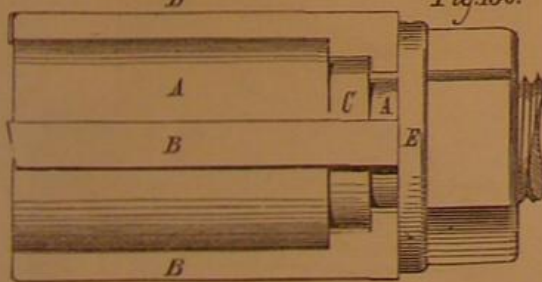


be driven, projecting at each side of the stock to nearly the diameter of the shell reamer, in which there should, on each side, be filed a semicircular groove to receive the pin. Thus the reamer will be prevented from slipping upon the mandrel, as it is otherwise very apt to do.

Many attempts have been made to produce adjustable reamers having movable cutters, so that the size of the reamer may be varied by a change of cutters, and economy in sharpening and renewing is attained. None of these efforts, however, have met with such success as to cause their universal application. Of course such a tool is only applicable to sizes above an inch in diameter, because the division of a reamer of less than that size into two or more pieces weakens it so that it would not bear the necessary strain.

The best form of adjustable reamer of which I have any knowledge is that of one I designed and made for use on cast iron work, though I have no doubt it would apply equally well to work in brass, wrought iron, and steel. It proved a very serviceable tool, and is easily made, as a reference to Fig. 130 will show. A represents the stock, and D the cut-

Fig. 130.



ters, C being a regulating washer, and D and E the tightening nut and washer. Each of the cutters, B, fits into a dovetail and taper groove in the stock, the shallow end of the groove being at the cutting end; so that, if the regulating washer, C, is reduced in width, the cutters will slide forward and enlarge in diameter. The washer, C, is thus a means of adjusting the diameter of the cutters; and when the same is once adjusted, the nut, D, will lock it always to that precise diameter. If, therefore, several sets of cutters of different heights are fitted to one stock, and turned up, while in the stock, to the requisite diameter, with the washer, C, in its place, we have a set of standard cutters which may always be placed in position and locked up by the nut, D, without measurement, since their sizes cannot vary. By providing another washer, very slightly thicker than the standard, the reamer will, in the case of each set of cutters, bore a hole to a driving fit, while a washer a trifle thinner will cause the cutters to bore a hole of an easily working fit. Thus the sizes of the cutters are regulated by the washer, C, and not by measurement by the workman; they are therefore at all times positive and equal. The cutters are backed off on the ends only, their tops being merely lightly drawfiled after be-

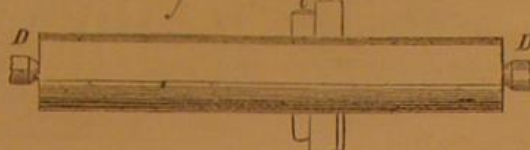
ing turned up, or they may be left one thirty-second of an inch too large, and ground off after hardening, by the grinding process already described. The cutters should be forged of the best cast steel, and tempered to a straw color.

BORING BARS.

The boring bar is one of the most important tools to be found in a machine shop, because the work it has to perform requires to be very accurately done; and since it is a somewhat expensive tool to make, and occupies a large amount of shop room, it is necessary to make one size of boring bar answer for as many sizes of hole as possible, which end can only be attained by making it thoroughly stiff and rigid. To this end, a large amount of bearing and close fitting, using cast iron as the material, are necessary, because cast iron does not spring or deflect so easily as wrought iron; but the centers into which the lathe centers fit are, if of cast iron, very liable to cut and shift their position, thus throwing the bar out of true. It is, therefore, always preferable to bore and tap the ends of such bars, and to screw in a wrought iron plug, taking care to screw it in very tightly, so that it shall not at any time become loose. The centers should be well drilled and of a comparatively large size, so as to have surface enough to suffer little from wear, and to well sustain the weight of the bar. The end surface surrounding the centers should be turned off quite true to keep the latter from wearing away from the high side, as they would do were one side higher than the other.

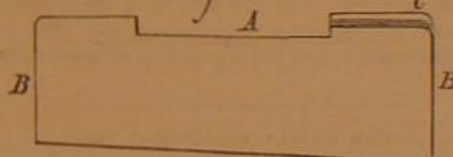
The common form of the smaller sizes of boring bar is that shown in Fig. 131, A A being the bar, D D the lathe cen-

Fig. 131.



ters, B the cutter passing through a slot or keyway in the bar, and C a key tapered (as is also the back edge of the cutter) to wedge or fasten the cutter to the bar. It is obvious that, if the cutter is turned up in the bar, and is of the exact size of the hole to be bored, it will require to stand true in the bar, and will therefore be able to cut on both ends, in which case the work may be fed up to it twice as fast as though only one edge were performing duty. To facilitate setting the cutter quite true, a flat and slightly taper surface should be filed on the bar at each end of the keyway, and the cutter should have a recess filed in it as shown in Fig. 132,

Fig. 132.



the recess being shown at A, and the edges, B B, forming the diameter of the cutters. The backing off is shown at C, from which it will be observed that the cutting duty is performed by the edge, C, and not along the edge, B, further than is shown by the backing off. The recess must be made taper, and to fit closely to the flat places filed on the bar. Such a cutter, if required to be adjustable, must not be provided with the recess, A, but must be left plain, so that it may be made to extend out on one side of the bar to cut any requisite size of bore; it is far preferable, however, to employ the recess and have a sufficient number of cutters to suit any size of hole, since, as already stated (there being in that case two cutting edges performing duty), the work may be fed up twice as fast as in the former case, in which only one cutting edge operates. This description of bar may be provided with several slots or keyways in its length, to facilitate facing off the ends of work which requires it. Since the work is fed to the cutter, it is obvious that the bar must be at least twice the length of the work, because the work is all on one side of the cutter at the commencement, and all on the other side at the conclusion of the boring operation. The excessive length of bar, thus rendered necessary, is the principal objection to this form of boring bar, because of its liability to spring. There should always be a keyway, slot, or cutter way in the exact center of the length of the bar, so as to enable it to bore a hole as long as possible in proportion to the length of the boring bar, and a keyway or cutter way at each end of the bar, for use in facing off. If, however, a boring bar is to be used for a job which does not require to be faced off at the ends, the keyway should be placed in such a position in the length of the bar as will best accommodate the work, and should then be made tapering in diameter from the keyway to the ends, as shown in Fig. 133, the end, A,

Fig. 133.

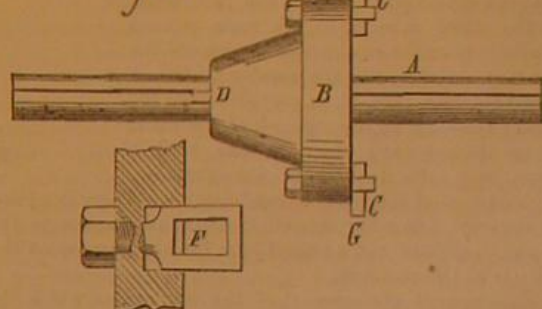


being made parallel to receive the driving clamp. A lug, however, by which to drive the bar, is sometimes cast at A. This form of bar is stronger in proportion to its weight, and therefore less liable to spring from the cut or to deflect than is a parallel bar. The deflection of a bar, the length of which is excessive in proportion to its diameter, is sufficient to cause it to bore a hole of larger diameter in the center of its

length than at the ends, providing that the cutter is not recessed and does not cut on both sides, that is to say: when the cutter has the edges, B B, in Fig. 132, bearing against the diameter of the hole, they serve to steady the bar and prevent it from either springing away from the cut, or from deflecting in consequence of its own weight. The question of spring affects all boring bars; but in those which are used vertically, the deflection is of course obviated.

Here it may be mentioned that no machine using a boring bar should be allowed to stop while the finishing cut is being taken, for the following reasons: The friction, due to the severance of the metal being cut, causes it to heat to a slight degree, and to therefore expand to an appreciable extent; so that, when the cutter makes its first revolution, it is operating upon metal at its normal temperature, but the heat created has expanded the bore of the work, and hence the cut taken by the second revolution of the cutter will be slightly less in diameter. This heating and expanding process continues as the cutting proceeds, so that if (after the cutter has made any number of revolutions) the bar is stopped and the cylinder or other work being bored becomes cool, when the cutter makes the next revolution it will be operating upon the bore unexpanded by the heat, and hence will cut deeper into the metal until, the metal being reheated by the cut during the revolution, the boring proceeds upon expanded metal as before the stoppage; thus arresting the continuous progress of the cutter will have caused the cutting of a groove in the bore. Boring bars of this description, for use in bores of a large diameter, are made with a head of increased diameter, as shown in Fig. 134, A A representing a bar turned

Fig. 134.



true from end to end, and having a keyway cut along its entire length, and B the cutter head, held in upon any point in the length of the bar by being keyed to it at D. A number of cutting tools are carried by the head, B, and fastened to it by the strap, as shown at C, and enlarged at E, F being the slot to receive the tool. It will be observed that there is in the head a recess to receive the clamp, which recess should be made deep enough to leave a clearance between it and the shoulder of the clamp, to accommodate any variation in the thickness of the cutters. Several cutters may be provided to the head, so that the work may be fed up rapidly; in such case, however, great exactitude is required in setting them, because there is no practical method of making them with a recess to insure their even projection from the bar, since the cutters are narrow, and generally cut across the whole end face, G, so that each grinding affects their distance from the bar, and hence the size they bore.

A rude form of the head, B, may be made by simply cutting a slot or slots across it, and fastening the tool or tools therein, by means of wedges and packing pieces if necessary. The only advantage possessed by this bar is that it will bore a round hole, even though the bar may run out of true, by reason of either or both of the centers being misplaced, or even though the bar itself may have become bent in its length. In addition, however, to its disadvantage as to excessive length, it possesses the further one that, unless a line drawn from the two centers upon which it revolves is parallel both perpendicularly and horizontally to the lathe bed, the hole bored will be oval and not round; or if the bar is not parallel horizontally with the shears, the hole will be widest perpendicularly, and vice versa. To remedy these defects, we have the boring bar with the feeding head, which is similar to that shown in Fig. 134, save that the work remains stationary while the cutters are fed to the work by operating the head, B, along the bar, which is accomplished as follows: Either along the keyway or groove, or else through and along the center of the boring bar, there is provided a feeding screw, passing through a nut which is attached to the sliding head, B. As the bar revolves upon its axis, the screw is, by means of suitable gearing, caused to revolve upon its own axis, as well as around the axis of the bar, thus winding the head along the length of the bar, and thus feeding it to the cut. If the screw runs along the center of the bar, it is usually operated by gear wheels, the movement of the feed being continuous at all parts of the revolution; but if the screw is contained in a groove cut in the circumference of the bar, a common star feed may be attached to the end of the bar, in which case the feed for the whole revolution is given to the sliding head during that portion only of the revolution in which the outer arm of the star is moved by the projecting bolt or arm which operates it. From these directions, it will be readily perceived that a bar of the latter form, but having the screw in its center, is the most preferable. Care must be taken, however, to keep these bars running quite true; for should either center run out of true, the hole bored will be larger in diameter at that end; while on the other hand, should the bar become bent so as to run out of true in the middle of its length, the hole bored will be large in the middle if the work was chucked in the middle of the length of the bar; and otherwise, it will be larger at one end.

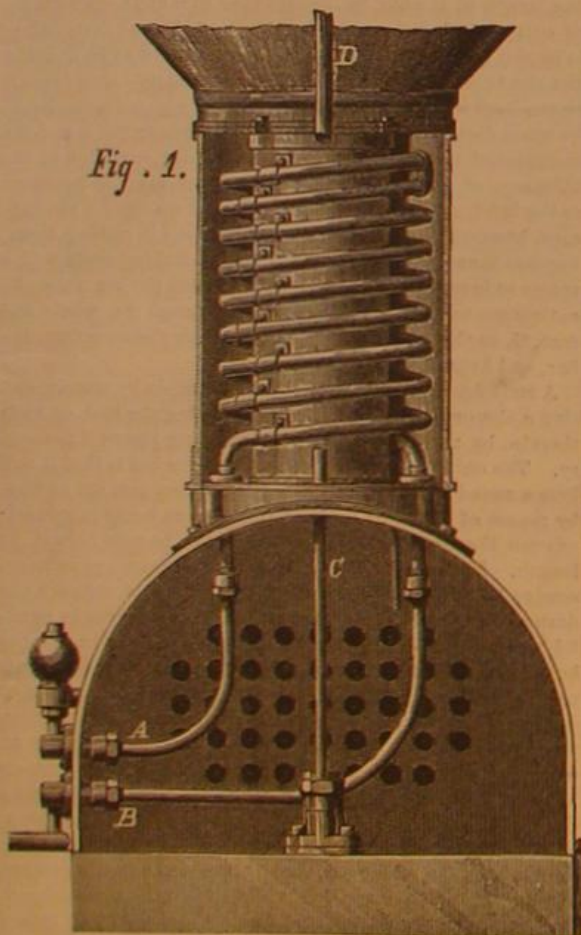
NEW LOCOMOTIVE FEED WATER HEATER.

The advantages arising from the use of hot instead of cold water, in feeding steam boilers, whether stationary or locomotive, are too apparent to need rehearsal, more especially where the hot water for that purpose is produced by utilizing heat which would otherwise be wasted, the most important results being the saving of fuel, prevention of the contraction and expansion of flues and flue plates, and the ability to maintain steam.

In the adaptation of a locomotive engine to heat its own feed water, four difficulties have always stood in the way; first, to use the waste or exhaust steam without lessening the draft of the chimney; second, to avoid the cumbersome and complicated devices necessary for heating the water in bulk; third, to prevent obstructing the smoke arch; and fourth, to so construct and arrange all parts of the apparatus as to obviate derangement and leakage, either from contraction and expansion, or the jarring of the engine. These difficulties have been overcome by the device illustrated in the annexed engravings.

In Fig. 1, which is a detailed sectional view, it will be seen that an insulated steam chamber is constructed about the smoke stack. Into this chamber leads the feed water pipe, A, which is coiled around the stack, conducting the water to the top of the compartment and then down and out to the boiler, at B. The exhaust is divided, a branch pipe, C, being employed to conduct a part of the steam into the chamber for heating the feed water in the coiled tube, while the main exhaust discharges up the smoke pipe to promote the draft of the engine in the usual manner. A small eduction pipe, D, is provided near the top of the chamber, through which the waste steam passes, and there is also a drip pipe near the bottom of the chamber, for carrying off the water of condensation. There is a joint in the stack below the bonnet, to afford easy access to the top of the heater, and a second joint for like purpose at the bottom of the chamber.

An improved arrangement of the water pipes which the company is now making, is to remove them from the interior of the smoke chamber and place them outside, where they pass through suitable saddles.

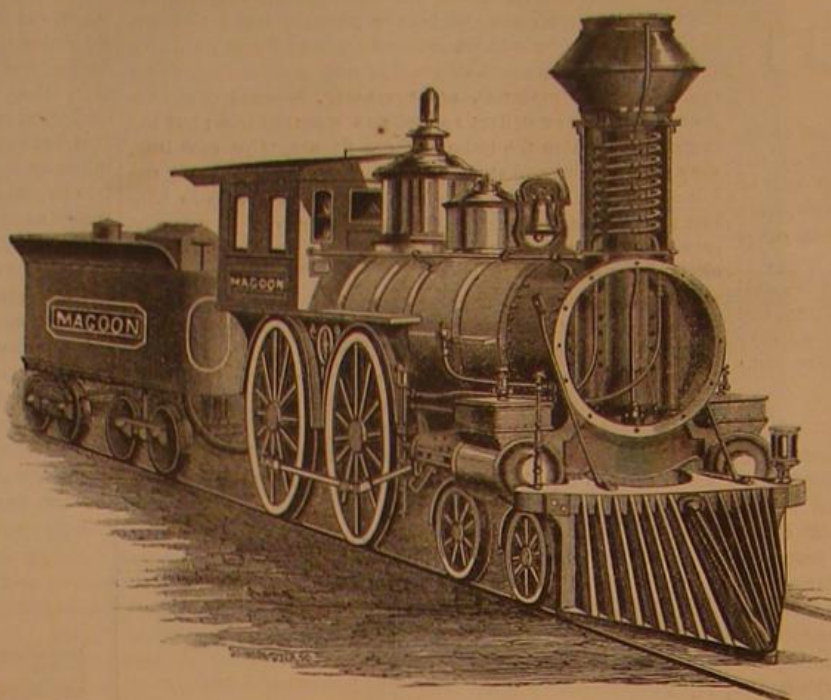


MAGOON'S LOCOMOTIVE FEED WATER HEATER.

According to certificates and testimonials submitted, it appears that the saving of coal attributed to this device, on one locomotive (the Saxon, of the Boston and Maine railroad), was about three quarters of a ton per day for four months in succession. On a small engine on the same road, the saving was nearly half a ton per day. The most recent tests show an economy of over 35 per cent of the fuel used, the value of which must evidently reach a very large aggregate in the course of a year, in the case of a road employing many locomotives. Fig. 2 gives a slightly different arrangement of the feed water pipes. The actual economy in fuel resulting from the use of this invention, coincides with the calculated economy of feed water heaters in general, as given in the SCIENTIFIC AMERICAN of November 7 last.

No difficulty is experienced in making the coiled pipe to withstand any necessary pressure, as proven in the cases before alluded to and in others. The coil is made at least one sixth part larger in interior diameter than the pump

plungers; and the check valve is slightly larger than the coil in order to give free passage for the water into the boiler. If constructed in this way, and properly stayed to the saddle and smoke stack, the device will be as permanent as any other part of the machine. Proper allowance is made for contraction and expansion of the stays and coil. We have obtained the foregoing particulars as to the construction from the Magoon Heater Company, 54 Sears Building, Boston, Mass., who are the manufacturers of the invention.



MAGOON'S LOCOMOTIVE FEED WATER HEATER.

New Aniline Violet.

A new pigment called violet gentiana, for producing the aniline colors of Martins and Meldensohn of Berlin much cheaper than the other violets in use, has for some time been on sale. A series of trials are said to have given the following results: When dissolved in thirty times its weight of hot water, brought quickly to the boiling point, and kept boiling for five minutes, and then passed through a sieve, it leaves little residue.

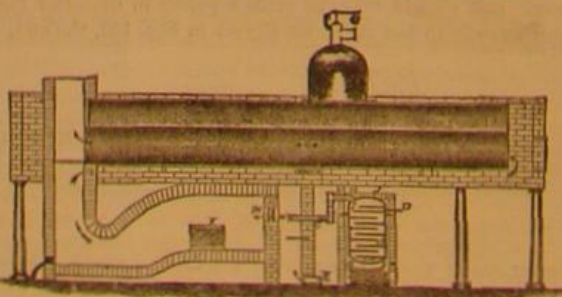
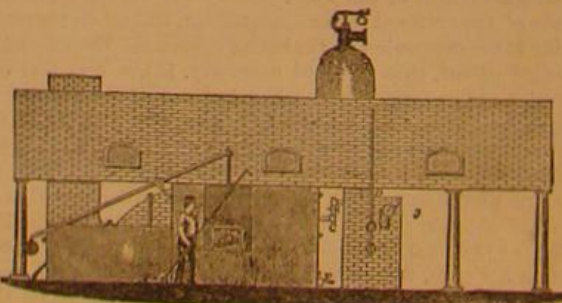
To dye 25 lbs. of woolen yarn, take 1 lb. of tartaric acid and a corresponding quantity of coloring matter; boil and skim the mixture. Pass the yarn three times through the dye, and it will assume a very uniform tint. The color obtained is as solid and as brilliant as that obtained from dearer violets.

The Patent One-Tailed Shirt.

An illustration of the absurdity of some of the official examinations made at the Patent Office is seen in the patent granted to J. H. Meyers for an alleged improvement in shirts. It consists of a common shirt with the sleeves and the back tail omitted. These parts, says the patentee in his specification, any person can readily supply; but the bosom, neck band, yoke and front tail, he thinks require more trouble to make; so he sews these together, and the Patent Office grants him a patent therefor "as a new article of manufacture." But there is nothing new about it. It is simply an unfinished garment, and an old pattern at that. With equal propriety the Patent Office might grant a patent for a shoe, as a new article, which consisted merely of the strings and the upper, with the sole left out. Verily, the Patent Office is a queer institution.

FURNACE WORKING WITH PETROLEUM.

Professor Henry Wurtz was recently called on to examine



and report upon the value of the system of Dr. C. J. Eames of obtaining from crude petroleum simultaneously both the heat and the power needed for metallurgical operations upon iron. We extract the following from his report. The upper

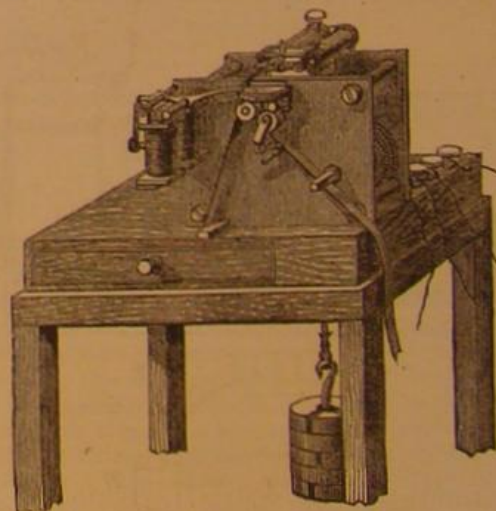
engraving shows an ordinary reheating furnace for iron, such as the experiments were made with; but the form is by no means the best for developing the full merits of the new system, but answers tolerably well for the experiments made. This is an external, and the lower a sectional, view. In the latter, A B J D indicate the Eames vapor generator, called simply the generator, the main feature of the new apparatus and process. A is a cast iron vessel, with horizontal shelves projecting alternately from opposite sides, over which shelves

the oil, entering at D, at the average rate—for this one furnace, when heating 3,000 lbs. of iron at a charge, and making steam for the rolls besides—of 30 gallons or 200 lbs., as a maximum per hour, flows downward in a thin layer, dripping from shelf to shelf. It thus meets a slow opposing current of steam heated to incandescence, and kept at a pressure of about 10 lbs. per inch, and which passes upwards from the superheating coil, B, inclosing the fire. Every trace of oil is taken up and swept on to a mixing chamber which occupies the former fire space, where it meets the air blast entering at the point, E (the former ash pit). It will be observed that the former bridge wall of the furnace is built up solid to the crown, except the space at H G, called the combustion chamber, an important and essential part of the inventions. This consists simply of a cellular tier of firebricks placed on end, and extending all across over the old bridge wall. Within these cells the combustion begins, and it is found that, if this combustion space has a horizontal thickness of more than 18 inches, the firebricks fuse down. It is intended to represent one of the piles of scrap iron, with its top and bottom covers, of which, however, six, averaging 500 lbs., each, are introduced at a charge, in regular working. The course of the flame under, and back through, one of the flues of the boiler above, and thence into the stack,

is sufficiently indicated by the arrows.

ELECTRICAL SPEED RECORDER.

The accompanying engraving represents an electrical speed recorder, constructed by Mr. W. Groves, of London, England. The instrument consists of a train of clockwork, driven by a weight, and employed to move the strip of paper upon which the speeds are recorded. Two electro-magnets are attached to the frame, and opposite their poles an arbor is pivoted, carrying a soft iron armature; and in connection with each armature is a bent and pointed lever, the ends of which pass through holes in the ink trough when the armature is attached. These points carry on them sufficient ink to make a dot on the paper. The trough is divided into two compartments, one containing red and the other black ink. The former is used to mark half seconds, and the latter to record the speed. The holes in the trough are made so small that capillary attraction prevents the ink from flowing through.



One electro-magnet is connected with a clock beating half seconds; and as the pendulum passes over a mercury cup placed immediately under the point of suspension, the circuit with the battery is completed, and the half seconds are marked in dots at the edge of the strip. The other electro-magnet is placed in connection with the contacts for marking the speed dots; and by counting the numbers of half-second marks between each black dot, the speed is given between each contact lever.

Newspaper Circulation and Advertising.

George P. Rowell & Co.'s *Advertiser's Gazette*, after naming some papers which have reduced their rates for advertising, adds: "There are many large weeklies which are at present demanding for advertising more than double the price to which their circulation entitles them."

We have no doubt but that that is so. There has been a great falling off in the subscription list or a great many papers; but it is not so with others. The SCIENTIFIC AMERICAN has several thousand more circulation now than it had last year at this time; and it is continually increasing, but its rates for advertising have not been advanced. For machinery, tools, patents, and every want of contractors, civil and mechanical engineers, surveyors, artisans, manufacturers, and all similar industries, this paper is unequalled as an advertising medium.

SWANS.

The nest of the swan, says Mr. H. R. Robertson, is a thick and rather untidy mass of sticks, reeds, flags, and rushes. From the fact of the birds naturally preferring the most secluded spots by the water, we more often find a swan's nest on a small island than on either bank of the river; the osier beds are perhaps the localities most favored by them. The eggs are six or eight in number, and are hatched in five or six weeks. The young birds are termed cygnets, and are covered with a grayish brown plumage, which is not entirely lost till the beginning of the third year. Though the swan is, in general, very gentle and inoffensive, the male bird will defend the nest with great courage, and advance to the onset with ruffled pinions and every demonstration of anger; nor is it, from its muscular powers, an antagonist to be despised. While the cygnets are very young, one or two of them will sometimes climb up on to their mother's back, who never sails along more proudly than when her dusky brood is thus cradled between her snowy wings.

Swans do not breed until they are several years old, and they mate strictly in pairs; the technical terms for the male and female are cob and pen. The cob, or male, has a thicker neck and a larger berry at the base of the bill than the pen, or female; he also swims more buoyantly, from having more volume of lungs. Maturity in both cob and pen is shown by the size of the berry and the depth of the orange color of the bill.

Taking swan's eggs from the nest, and certain other birds', was an offence severely with in England in old times. We find, in an act of Henry VII., that "no manner of person, of what condition or degree he be, take or cause to be taken, be it upon his own ground or any other mans, the egg of any fawcon, gos-hawk, laners, or swans, out of the nest, upon paine of imprisonment of a yere and a day, and fine at the kings wil, the one halfe thereof to the king and the other half unto the owner of the ground where the egg was so taken."

The swan feeds on aquatic weeds, the spawn of fish, and coarse grass growing by the sides of the water; it is furnished with a gizzard of extraordinary muscular power, which enables it to grind the weeds, however fibrous, to a pulp.

All writers on the subject agree that the swan is very long lived, some saying that it attains thirty years, while others assert that it sometimes survives a century.

"Man comes and tills the earth and lies beneath,
And after many a summer dies the swan."

The particular species that is the subject of the present article is often semi-domesticated on lakes and ornamental waters, and is known as the tame or mute swan—*cygnus olor* of the ornithologists. It is said not to have been originally a native of the British islands, but is found in the eastern portions of Europe and the adjacent parts of Asia, where inland seas, vast lakes, and extensive morasses afford it a congenial home. In Siberia and some parts of Russia it is common, and it abounds on the shores of the Caspian Sea. It is doubtful when this most elegant bird was introduced into Great Britain, where it is such a universal favorite.

Wild swans may be often observed flying in a wedge-like form high in air, but they very rarely settle. This species, *cygnus ferus*, is neither so large nor so graceful as the tame swan.

For its value as an article of food, the swan is now almost entirely disregarded. Two or three are still fattened every Christmas time for Windsor Castle, where, in accordance with old usage, they make their regular appearance on the royal table. On only one occasion have we ourselves ever had the opportunity of proving the taste of our ancestors in the matter, and we are inclined to class the royal bird along with the royal fish, the sturgeon, as really inferior in flavor to many a plebeian dish. In color the flesh is extremely dark, and if we may speak from our solitary experience, we should describe it as somewhat dry and decidedly coarse in fiber;

the bird in question was a young one, which had been carefully fattened, and kept till tender after being killed.

Willful Ignorance of Common Things.

A little knowledge may be a dangerous thing, but a knowledge of little things is useful and therefore desirable. At the recent meeting of St. Saviour's District Board of Works, Dr. Albert J. Bernays submitted his report as public analyst. In the course of his remarks he described the results of his various analyses of food, chiefly of milk, the adulteration of



SWANS

which he believed was on the increase. He had also analyzed several samples of bread and butter, and had generally found them to be pure. In conclusion, he suggested that a museum of common things should be attached to every board school, so that the rising generation might acquire a knowledge of them, and the uses for which they are intended. Dr. Bernays deserves great credit for his admirable suggestion. It is wonderful how ignorant the commoner class of people are of things in every day use. For them not to be able to distinguish between a hawk and a heronshaw is excusable perhaps. But there are many who hardly know a mangold or a swede when they see it, who would fancy oilcake was a larger and perhaps a coarser kind of toffee, and who might be at a loss to tell a field of potatoes from a field of turnips. Again, there are those who, following some mechanical occupation, are content with the knowledge of that only, and prefer to remain ignorant of kindred occupations. A glazier, for instance, will have nothing to do with carpentering. The

something of brickwork, and the bellhanger of ironmongery. We are aware that the selfish spirit of trades unionism steps in here, and lays it down imperatively, *ne sutor ultra crepidam*. As the cobbler to his last, so the carpenter to his bench, the blacksmith to his forge, and so on through the category of mechanical workmen. But what an advantage it is to men to be what is generally called handy! As the all-round cricketer of fair average merit is more successful in the long run than the brilliant bat who is a poor field and an indifferent bowler, or the unerring bowler who neither bats well nor fields well, so the workman, who is a fair average carpenter, bricklayer, ironmonger, bellhanger, etc., may be more useful generally than the one who purposely confines his knowledge to one particular class of work. Put such a generally useful man down in the backwoods of Canada and we think the point of our case will be illustrated at once. Now if, in these museums which Dr. Bernays proposes to attach to board schools—why not to all schools?—there were specimens not only of comestibles, but of ordinary implements in everyday use; if, further, one or more paid instructors were attached to every such museum—such instructors would very soon become self-supporting—whose business it was to teach our rising generation the uses of these implements and the characteristic features of this or that food, it is no great evidence of wisdom to foretell that the said rising generation of Englishmen would be infinitely less ignorant and infinitely more handy and self-reliant than is the present. The man who tells you he cannot do this or that kind of work, and does not try, to do it, is little short of a fool.—*Land and Water.*

Preservation of Wood Telegraph Poles.

Tar is employed, but it is necessary to apply it hot, and to avoid boiling it too long, lest it should lose the essential oils, which alone aid it to penetrate the wood. The latter should be first considerably heated to remove humidity and to open the pores; the tar is then applied, and, penetrating it, forms a strongly resisting covering. One thick coating produces a very bad effect; it is necessary to apply several light coats, a process somewhat difficult and requiring practice. If this mode is not adopted, a covering will be simply laid over the surface of the wood, which will be separated by damp, and, being brittle, will be easily broken away. The fungus filaments would then be free to attack the wood, and destruction would take place almost as rapidly as if the tar had not been laid on. The process above described can hardly be carried out without special appliances. The best mode is, first to heat the wood, then to immerse in a bath of tar the whole of that portion to be placed in the ground, and to leave it in the bath for 24 hours at least. The tar should be heated to boiling point.

Carbonization has also been applied with very good results. By raising the wood to a sufficient temperature, coagulation takes place, and any dangerous spores are consumed. But it is better to burn the wood imperfectly than to carbonize it to such an extent as is usually done. When the burnt portion is too thick, it loses its cohesion, and becomes broken during transport, so that the wood is again exposed to the air. It is better to obtain a thin and uniform covering by soaking the wood in acidulated water (five parts of water and one of sulphuric acid) and heating it lightly without exposing it to the flames. The more acid is added to the water, the less heating will be required, and it is preferable to obtain a thoroughly solid coating, by heating it for a longer time, at a less elevated temperature. This method is all the more worthy of attention because the sulphuric acid penetrates the wood to a certain depth, and partially preserves it from the attacks of the fungus.



THE SWAN'S NEST.

carpenter will tell you that the setting of a grate or bell-hanging is no business of his. The ironmonger is utterly careless about bricklaying, and the bricklayer returns the compliment. Each of those classes of mechanics advisedly remains or professes to remain in utter darkness as to the occupations of his fellows. True, a jack of all trades may be master of none, but there is no earthly reason why a mechanic should not be able to adapt his manual talents to more than one kind of work. The hand that can use a saw or plane, that can adjust beams and joists with the greatest nicety, is surely able to fix a grate, to hang a bell, to use spade and trowel, pick or level. The ironmonger must know

PAINT skins, boiled with linseed oil, and having, while hot, a quantity of sand and lime stirred in until the requisite thickness is obtained, make a durable cement for leaky roofs.

MAGNETISM.

In ordinary observation, magnetism is scarcely known except as existing in iron, and especially in steel, and as related in some obscure manner to the earth. But there is reason to believe that it is one of the most extensively diffused agents in Nature. It can be traced not only in iron, but also in every substance into which iron enters into composition. It is found in nickel, cobalt, chromium, and other substances, and even in some gases. Wherever a galvanic current exists in Nature, whether produced by chemical action, or appearing in the thermo-electric form as originating from the effects of heat at the place of union of different substances, magnetic effects can be elicited. On the larger scale, it is certain that the whole earth acts as a combination of magnets, and there is reason to think that the sun and the moon also act as magnets.

The laws of magnetic force, however, have been experimentally examined with philosophical accuracy, only in their connection with iron and steel, and, by inferences bearing considerable probability, in the influences exerted by the earth as a whole. The ferruginous minerals of the formula Fe_2O_3 possess the property of attracting iron and its filings, and are called natural magnets or lodestones.

Experience has demonstrated that the attractive action of magnets takes place in a vacuum and through all bodies, whether gaseous, liquid, or solid, when they are not themselves magnetic. All the properties of natural magnets may be permanently communicated to needles or to bars of steel properly tempered, which are then said to be magnetized, and take the name of artificial magnets.

If a small iron ball, A (Fig. 1), be suspended by a flexible thread, and successively presented to various points of the surface of a magnetized bar, although it may be kept at the same distance from the bar in every case, the deviation of the ball, A, will undergo considerable variation as it is changed from point to point.

In the section, M N, perpendicular to the middle of the axis of the figure, P P', the attractive action is zero; in either direction from this position the pendulum is more deviated from the vertical as it is placed nearer to the ends of the bar.

The same fact may be demonstrated by rolling a magnetized bar in iron filings (Fig. 2); or better still, (Fig. 3), by covering a magnet with a thin cardboard which is lightly tapped with the fingers, while iron filings are scattered over its surface from a sieve. The directions which the lines of filings take prove that the middle section, M N, produces no action whatever, and that, towards the ends of the bar, in the axis of the figure there are two points, P P', which are centers of the strongest attraction.

The middle section, where there is no reaction, is designated as the neutral line, and the centers of attraction, P P', are called the poles of the bar. Every magnet, whether natural or artificial, possesses at least two poles. When the magnetization is regular, the magnet has but two poles, which are situated in the axis of the figure and near its ends. When the minerals containing iron, or the steel bars, have more than two poles, they are said to be irregularly magnetized, or that they have consequent points. In every case, however, two consecutive poles are separated by a neutral line or a line in which there is no action.

If a magnetized bar is suspended horizontally by means of the stirrup, C (Fig. 4), made of paper or copper, and supported by a thread without torsion, the whole system partakes of a movement set up by the magnetic influence of the earth. After a certain number of oscillations, the bar becomes quiet in such a position that its axis is directed from north to south.

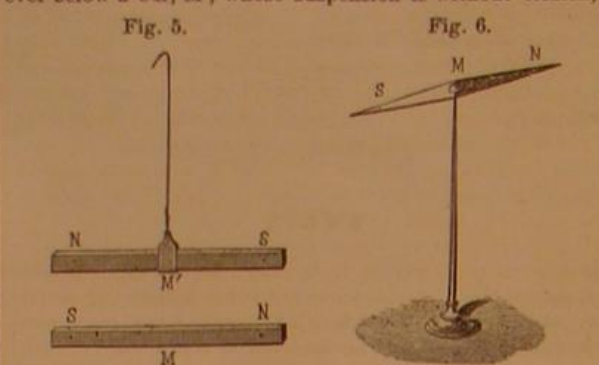
If the same bar is used several times in succession, it always comes to rest in the same position, and the same end always turns toward

the north. Several bars suspended in the same manner, and at a certain distance from one another, always place themselves in parallel directions. The vertical plane which passes through the axis of a bar freely suspended, when in its position of equilibrium, is called the magnetic meridian. The magnetic meridian does not coincide with the terrestrial meridian; the angle comprised between these two planes in a given place is called the declination. The declination is said to be east or west, as the half of the bar turned toward the north places itself east or west of the terrestrial meridian. The declination also changes in value and even in sign, according to the place of observation; and it undergoes, besides, continual variations at the same place.

The end of the magnet which turns toward the north is called its north pole, the opposite end its south pole.

If the poles of a freely suspended bar magnet are successively brought near the poles of another bar, the suspended magnet will be turned out of the magnetic meridian. The direction in which it is displaced in each case shows that poles of like names repel each other, while, on the contrary, poles of unlike names are mutually attractive.

If we place a string bar, M (Fig. 5), in any position whatever below a bar, M', whose suspension is without torsion,



the latter bar immediately turns in a horizontal plane, and, after a few oscillations, comes to rest. In this position the axes of the two bars are parallel, and the poles of unlike names are placed one above the other, on the same side of the suspension thread.

The terrestrial globe may therefore be considered as a great magnet, with one of its magnetic poles placed in its northern, the other in its southern hemisphere. The two hemispheres of the earth are thus like the two halves of a bar magnet—the northern hemisphere possessing the magnetic properties of the south pole, and the southern hemisphere exercising the same action as the north pole of a natural or artificial magnet.

If a magnetized needle is supported on a metallic point by an agate cup, M, placed on its center (Fig. 6), the needle is then free to turn in a horizontal plane. When left to itself, it oscillates under the influence of terrestrial force, and finally comes to rest in such a position that the line joining its poles, which corresponds with its center of figure, is in the magnetic meridian of the place.

By placing (Fig. 7) a bar of soft iron which presents no

trace of magnetism in the neighborhood of the poles of a bar magnet, the former, under the influence of the magnet, acquires the property of attracting iron filings, and becomes itself a real magnet, with its two poles and its neutral line. In soft iron, magnetized by induction, the poles stand in a direction opposite to those of the bar; and its neutral line, instead of occupying the middle position, is placed in the neighborhood of the end which is opposite the bar.

This magnetization, or inductive polarization, is only temporary, and completely disappears the moment the bar and the soft iron prism are separated some distance from each other. The phenomena are the same when a soft iron prism (Fig. 8) remains suspended by the attraction of one of the poles of a bar magnet.

This temporary induced magnetism of soft iron prisms may be shown in another manner. If a soft iron prism is suspended from the north pole of a strong magnet (Fig. 9) it becomes capable of supporting a second prism; the second prism is in turn inductively magnetized, and will support a third, and so on. In this magnetic chain, the indirectly magnetized prisms always touch each other with poles of contrary names, and the action becomes weaker

as the distance from the bar increases. But now, if the bar

is detached from the first soft iron prism, all traces of polarization disappear in the several prisms, and they immediately separate from each other.

We have seen that a prism of soft iron, presented to the north pole of a magnet, becomes itself a real magnet by induction, the contrary poles attracting each other, and the soft iron remaining suspended against the force of gravitation. If, when a prism is suspended in this manner, the south pole of a second bar (Fig. 10) is brought near it, all

magnetic adherence ceases; the soft iron prism detaches itself, and falls.

In this experiment, the second bar tends to develop in the prism a magnetization whose polarity is opposite to that developed by the first bar. The soft iron being thus submitted to the two contrary influences, resumes its natural state, loses all trace of polarization, and should necessarily obey the action of gravitation. Experience has demonstrated that when a bar magnet is broken, each of its parts, whatever may be their number, forms a complete magnet, with its two poles and neutral line. The magnetization induced in a piece of soft iron is less as the distance through which the bar acts is greater. From the preceding facts it appears that the action of a magnetic pole, on a series of soft iron cylinders submitted to its influence, very much resembles the induction exercised by an electrified sphere on a series of insulated conductors. Under the influence of the magnetic pole, the soft iron cylinders are polarized, and the polarization endures while the influence lasts. In the same way, the ends of the insulated conductors, placed in the vicinity of an electrified sphere, are charged with electricity of contrary names; this polarization lasts as long as the inductive action of the sphere is maintained, and completely disappears when the sphere is removed or discharged.

There is, however, a great difference between a magnetized bar and an electrified sphere. The contact of the soft iron by no means enfeebles the magnetic properties of the bar; but the magnetism, whatever its nature may be, does not, by apparent contact, pass from the bar to the piece of soft iron. On the contrary, when an electrified sphere is touched with an insulated conductor, a part of the electricity of the sphere is spread over the conductor, and the electric properties of the sphere are enfeebled.

Plants and Animals found in the Human Mouth.

According to Dr. C. N. Peirce, in an essay in *Dental Cosmos*, the following variety of organisms is found in the oral cavity, as shown by the microscope: 1. *Oidium albicans*. 2. *Cryptococcus cerevisiae*. 3. *Leptothrix buccalis*. 4. *Leptomitrus*. 5. *Bacteria*, vibrios, and monads. 6. *Paramecia*. 7. *Heterogeneous mass*.

OIDIUM ALBICANS, OR WHITE PLANT.

As revealed to the observer, it seems to consist of thickened epithelial cells, mingled with numerous minute spores or seeds, from the midst of which long, thread-like, jointed and branching plants arise, mycelium, intertwining with each other. The question as to whether this vegetable growth is the origin or sequence of disease has not yet been settled. So far as I can learn of its prevalence or predisposition, it occurs most frequently in the mouths of persons living in situations where the air is impure and diet unwholesome, or where previous gastric or intestinal disorder has interfered with the health and vigor of the infant. It is found alone or simultaneously on the inner edge of the lips, where the mucous membrane begins, on the inner side of the cheek, on the gums and palate, on the upper and lower surface of the tongue, in the throat, and in the oesophagus, down as far as the cardia, or upper opening of the stomach.

CRYPTOCOCCUS CEREVISIE—Cell or Capsule.

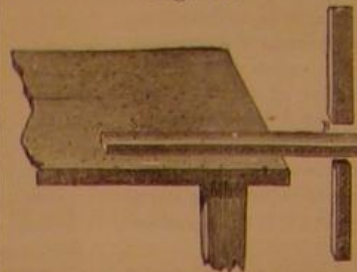
This plant is composed of round or oval cells, which present in their interior one or two little corpuscles resembling somewhat an oil globule. They are propagated with great rapidity when in contact with decomposing substances at a favorable temperature. This cryptococcus is so similar to that found in yeast, beer, ale, and sour milk that it may be considered practically identical, the principal difference noticed being a variation in the size; while in shape, manner of propagation, and apparent globule within, the modifications are but slight. It is developed in the morbid secretions of the mouth, the oesophagus, and stomach; it is also introduced into these situations by the drinking of beer.

In the black fur of the tongue of persons laboring under typhus, or in the oral secretions where persons have been long sufferers from organic disease, it is also found. Vogel thinks it of great importance to regard this plant only as an accompaniment and not as the cause of disease.

LEPTOTHRIX BUCCALIS—Slender hairs in the mouth.

This consists of slender structureless fibers, of various lengths, and straight or curved as the fiber is long or short. One end is free, the other is planted in or projecting from a fine granular mass, though a limited number are always noticed floating in the secretions, detached from any substance. They are found singly or in bundles, and multiply with great rapidity. Scarcely any portion of the mouth is free from them. They appear on the surface of the tongue, in depressions of the teeth, and cavities of decay, on the neck

Fig. 10.



and surfaces of the teeth; indeed, everywhere within the oral cavity that lodgment can be found for a particle of food.

They are found also growing from the surface of accumulations of tartar, whether such accretions be upon the necks of the teeth, in the cavities of decay, or on artificial dentures. There is probably no situation where they grow with greater rapidity than on the surfaces of the plate, either upper or under. The soft cheese-like substance that so quickly accumulates there is most prolific in their production, though from this situation they are neither so long nor attenuated as those taken from an inflamed mucous membrane. While great care in cleanliness limits their number, it is impossible to entirely eradicate them or prevent their development.

LEPTOMITUS—Slender Threads.

This growth, as the name indicates, is neither so long nor so slender as the leptothrix. It also has occasional branches, and marked transverse striae, which complete its morphological difference from the plant just described. It is found upon the tongue and in the pharynx of persons suffering from pneumonia, pleuresia, phthisis, apoplexia, and chronic gastritis.

BACTERIA AND VIBRIOS.

These organisms form some of the most minute objects which the microscopist has the opportunity of examining, and it is with the greatest difficulty their structure can be accurately determined. They are both found in the fluids of the mouth, but the profusion in which they exist is modified by the care exercised in keeping the fluids of the oral cavity free from decomposing substances. In the fangs of teeth where the pulps are devitalized, they are found to rapidly develop. Nor is their presence in this locality confined to such teeth as have defective crowns giving communication with the fluids of the mouth; but in a number that were examined where there was devitalization of the pulp without any loss of the hard tissues from caries or otherwise, their presence was readily detected. Upon opening into such cavities, they were, as usual, very offensive from the degenerated pulp, and on examining this putrid material these living organisms were observed in abundance.

MONADS.

With these two low forms of life we must associate what are known as monads, or, as Bastian calls them, plastide particles. These are invariably found in the same solutions with the former, and are supposed by some observers to result either by direct growth and development, or by aggregation and coalescence into bacteria and vibrios.

"Naturalists have been in doubt as to whether they should be regarded as independent living things of the lowest grade, having an individuality of their own, or whether, rather, they should be looked upon as developmental forms of some higher organisms, either animal or vegetable."

The discovery of these low forms of life in the mouth is not of modern origin, as we shall see from the following by Leuwenhoek. In 1682, at the age of fifty years, he wrote respecting his teeth: "It is my custom every morning to rub my teeth with salt, and afterwards to wash my mouth, and, after eating, I always clean my large teeth with a toothpick, and sometimes rub them very hard with a cloth. By these means my teeth are so clean and white that few persons of my age can show so good a set; nor do my gums ever bleed although I rub them very hard with salt; and yet I cannot keep my teeth so clean but that, upon examining them with a magnifying glass, I have observed a kind of white substance collected between them, in consistence like a mixture of flour and water. In reflecting on this substance, I thought it probable (though I could not observe any motion in it) that it might contain some living creatures. Having therefore mixed it with rain water, which I knew was perfectly pure, I found, to my great surprise, that it contained many very small animalcules, the motions of which were very pleasing to behold. The largest sort of them had the greatest and quickest motion, leaping about in the fluid like the fish called a jack: the number of these was very small. The second sort had a kind of whirling motion, and sometimes moved in the direction of a spiral, and undulated; these were more in number. Of the third sort I could not well ascertain the figure, for sometimes they seemed roundish but oblong, and sometimes perfectly round. These were so small that they did not appear larger than a speck. The motion of these little creatures, one among another, may be imagined like that of a great number of gnats or flies sporting in the air. From the appearance of these to me, I judged that I saw some thousands of them in a portion of liquid no larger than a grain of sand, and this liquid consisted of eight parts water and one part only of the before-mentioned substance taken from the teeth.

"With the point of a needle I took some of the same kind of substance from the teeth of two ladies who I knew were very punctual in cleaning them every day, and therein I observed as many of these animalcules as I have just mentioned. I also saw the same in a white substance taken from the teeth of a boy about eight years old; and upon examining in like manner the same substance taken from the teeth of an old gentleman, who was very careless about keeping them clean, I found an incredible number of living animalcules, swimming about more rapidly than any I had before seen, and in such numbers that the water which contained them (though but a small portion of the material taken from the teeth was mixed in it) seemed to be alive."

PARAMECIA.

Having now considered all the growths deemed vegetable found in the mouth, I have still one other organism to describe, as to the true place of which in Nature there is no

division of sentiment, it belonging undoubtedly to the animal kingdom. I allude to the paramecia, a genus of infusoria. They are only found in the oral cavity in cases of extreme uncleanness; and though increasing rapidly in infusions adapted to their growth, they are somewhat limited in this situation, owing to the constant changing of the secretions. About fifteen varieties have been described. They have a soft flexible body, variable in form, though usually oblong or oval, and more or less depressed. In most of them, numerous rows of vibratile cilia are noticeable, projecting from their integument.

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

Vienna bread and Vienna beer are said to be the best in the world. Both owe their superiority to the yeast used, which is prepared in the following manner: Indian corn, barley, and rye (all sprouting) are powdered and mixed, and then macerated in water at a temperature of from 149° to 167° Fah. Saccharification takes place in a few hours, when the liquor is racked off and allowed to clear, and fermentation is set up by the help of a minute quantity of any ordinary yeast. Carbonic acid is disengaged during the process with so much rapidity that the globules of yeast are thrown up by the gas, and remain floating on the surface, where they form a thick scum. The latter is carefully removed, and constitutes the best and purest yeast, which, when drained and compressed in a hydraulic press, can be kept from eight to fifteen days, according to the season.

By drawing up the earth over the potato in sloping ridges, the plant is deprived of its due supply of moisture by rains, for when they fall the water is cast into the ditches. Further, in regard to the idea that, by thus earthing up, the number of tubers is increased, the effect is quite the reverse; for experience proves that a potato, placed an inch only under the surface of the earth, will produce more tubers than one planted at the depth of a foot.

Brown bronze dip, for coating hat hooks and similar small hardware articles, is made of iron scales, 1 lb.; arsenic, 1 oz.; muriatic acid, 1 lb.; zinc, solid, 10 ozs. The zinc should be kept in only when the bath is used. The castings must be perfectly free from sand and grease.

A good test for gold or silver is a piece of lunar caustic, fixed with a pointed stick of wood. Slightly wet the metal to be tested, and rub it gently with the caustic. If gold or silver, the mark will be faint; but if an inferior metal, it will be quite black.

Cider may be purified by using glass, about 1 oz. of the latter to the gallon. Dissolve in warm water, stir gently into the cider, let it settle, and draw off the liquor.

The solvent power of glycerin upon several substances commonly used in medicine and the arts is as follows: 1 part of sulphur requires 2,000 parts of glycerin; iodine, 100 parts; red iodide of mercury, 340 parts; corrosive sublimate, 14 parts; sulphate of quinine, 48 parts; tannin, 6 parts; veratria, 96 parts; atropia, 50 parts; hydrochlorate of morphia, 19 parts; tartar emetic, 50 parts; iodide of sulphur, 60 parts; iodide of potassium, 3 parts; sulphide of potassium, 10 parts.

Some weeds can be killed and prevented from growing in garden paths by watering the ground with a weak solution of carbolic acid, 1 part pure crystallized acid to 2,000 parts water. Sprinkle from a watering pot.

A screen or blower of wire gauze, from 36 to 40 wires to the inch, placed in front of range or stove fires, will prevent, it is said, smoke coming into the room when the chimney fails to draw well.

To prevent condensation in a steam pipe laid under ground, place it inside another larger pipe, filling the intervening spaces with pulverized charcoal. The outside pipe should be watertight.

Tar water may be employed for dyeing silk or wool ashen gray. The stuff is first mordanted with weak perchloride of iron, by soaking in the solution some hours. It is then drained and passed through the bath of tar water. The oxyphenate of iron, which is thus precipitated on the fabric, gives a very solid color.

A cement, impermeable by air and steam, and especially well adapted to use for steam or gas pipes, is made of powdered graphite 6 parts, slaked lime 3 parts, sulphate of lime 8 parts, and boiled oil 7 parts, well kneaded.

Cider may be preserved sweet for years, by putting it up in airtight cans, after the manner of preserving fruit. The liquor should be first settled and racked off from the dregs, but fermentation should not be allowed to commence before canning.

The mordants used for dyeing with sumac are either tin, acetate of iron, or sulphate of zinc. The first gives yellow, the second gray or black, according to strength, and the third greenish yellow.

When boilers are ordinarily fed with hard water, it is worth while to save the drippings of the exhaust pipe, the condensation of the safety valve blow-off, and that from the cylinder, and use the water thus obtained to fill the boiler after blowing off. The result will be surprising in effect in loosening scale.

The evaporative efficiency of American anthracite and American bituminous coals is in the proportion of 8.9 to 9.9.

Glossed shirt bosoms: Take two ounces of fine white gum arabic powder, put it in a pitcher and pour on a pint or more of water, and then, having covered it, let it stand all night. In the morning, pour it carefully from the dregs into a clean bottle, cork, and keep it for use. A teaspoonful of gum water stirred in a pint of starch, made in the usual way, will give to lawns, white or printed, a look of newness, when nothing else can restore them, after they have been washed.

A cheap fertilizer consists of sulphate of ammonia, 60 lbs.; nitrate of soda, 40 lbs.; ground bone, 250 lbs.; plaster, 250 lbs.; salt, 4 bushels; wood ashes, 3 bushels; stable manure, 20 bushels. Apply the above amount to six acres. Labor in preparing included, it costs about \$15. It is said to give as good results as most of the commercial fertilizers costing \$50 per ton.

To make a handy paint, break an egg into a dish and beat slightly. Use the white only, if for white paint; then stir in coloring matter to suit. Red lead makes a good red paint. To thin it, use a little skimmed milk. Eggs that are a little too old to eat will do for this very well.

Magnetism of Iron Filings.

"De Haldat published, during 1836, in *Memoires de l'Academie de Stanislas*, that he had put iron filings into a brass tube (closed by two screw plates), which he magnetized by the ordinary process, and that he succeeded in obtaining two contrary poles. The polarity slowly decreased when varying quantities of river sand were mixed with the filings, while in every case it was very weak, and disappeared when the metal grains were displaced in position by shaking the tube. I repeated this experiment by firmly ramming down the iron filings into the tube, by means of a small hydraulic press. I found that when the filings begin to aggregate the polarity considerably augments, and continues to increase with pressure. I now lay before your Academy some tubes, 3.2 to 4 inches long and 1.2 inches in diameter, which attract at least as powerfully as those made from broken pieces of good steel of the same dimensions. As the iron filings which I used were of unknown origin, I had some prepared under my own eyes, from good soft iron, perfectly reduced, and without appreciable coercive force: the results were not lessened. Thus, then, a metal which has no coercive force when it is entire acquires it in as considerable a degree as that of steel when it has been reduced and compressed by pressure. Is it not to this fragmentary character that we must attribute the observed polarity? and is it not, also, this same cause which explains the coercive force of steel? One cannot explain the distribution in a magnet without considering it as composed of rows of very small magnetic elements of opposite poles, reacting between themselves at a distance; and it is proved that the quantities of separate magnetism in each of them increase, by this reaction, from the extremity to the middle line. Until now it seemed admissible that these elements are the molecules themselves; but the preceding experiment appears to show they are formed of either compacted iron fragments or small agglomerated crystals, as in steel. When, before pressing the filings, materials which render the mass more homogeneous are put with them, the same polarity can no longer be given to them as before the mixture. For example, if we make a paste of chloride of iron and filings, and press it, we obtain, after several days, a subchloride of iron of continued appearance, which may be filed and polished like pure iron, but which can scarcely be magnetized. Iron reduced by hydrogen and oxygen from scales behaves like iron filings; but magnetic or diamagnetic bodies mixed with the filings notably change its faculty of becoming magnetized. It is probable that, in very powerfully ramming home the powders, the coercive force would be found to increase to a maximum, and that it will afterwards decrease when the compactness of the fragments will have given a sufficient continuity to the mass."—J. Jamin, in *Comptes Rendus*.

Concrete for Walks, etc.

John Turner, in the *London Agricultural Gazette*, gives his experience in making and using asphalt as follows: "I have done a great deal successfully in walks and some kinds of floors such as the floor of a pig house, but have never attempted it for heavy traffic. It is neither difficult nor expensive. Of course a great deal depends upon the cost of material; the labor is trifling. I have used screenings of gravel (I don't like it clean, but mixed with sand); I have used sand alone (when I could not get anything better), blacksmiths' ashes, and ashes from my engine. The last I did was for our churchyard walks; for those I got the screenings of Leicestershire granite, which made a splendid path, but of course more expensive—the granite cost \$2.50 per ton. It is quite an unnecessary expense and trouble to boil the tar. Get your material dry, mix it with tar, turn it over twice, and let it lie a couple of days, then turn it again, and mix a little lime with it, about a tenth, let it lie another day, and then on a fine sunny day lay it on. rake it even, and roll well as soon as it will roll, in an hour or two's time; if the roll does not work well (it ought to if the stuff is not mixed with two much tar), scatter a little dry sand over it. Every summer I brush my walks over with cold tar, and give a good sprinkling of sand, and they are as good now as when first put down, fifteen years since. Any laborer can do it, only take care, before laying it down, it is of proper consistence. When ready it ought not to show the least tar, but should be a dull dead black, and, when moved with a shovel, ought to be lively, exactly like a mass of mites in a cheese. The stuff will keep a long time in a heap if covered up or otherwise kept dry."

Boiler Explosion.

Mr. R. Nickerson, of Harlem, Ga., informs us that a boiler at Sawdust, Ga., exploded on August 7. It was in a sawmill, and the building was torn to pieces. Parts of the boiler were thrown to a distance of several hundred yards. One man was blown to pieces, and two seriously injured. Mr. Nickerson states that the pressure gage showed 45 lbs.; but the gage was defective, as the practice (indulged in by the person in charge) of hanging car couplings on to the safety valve did not appear to form any increased pressure in the boiler.

Recent American and Foreign Patents.

Improved Stone Crusher.

Joshua Comly, Philadelphia, Pa.—This stone crusher has one stationary and one vibrating jaw. There is a toggle-bar contrivance in combination with the crank shaft and the rod connecting it with the movable bar in a manner calculated to apply very great force; also another device for giving vertical or endwise motion to the movable jaw, to be used or not, as may be found desirable.

Improved Wire Barb Pinchers.

John Dobbs and Benjamin F. Booth, Victor, Iowa.—This invention consists in the pinchers made with curved and notched jaws, and provided with projections upon the inner sides of said jaws, to adapt it for use in applying barbs to fence wires. In using the pinchers, an ordinary wire staple is placed in the space between its open jaws, with its arms resting in the notches in the inner edges of the faces of said jaws. The jaws of the pinchers and the arms of the staple are then placed around the wire of the fence, and the pinchers are closed. This forces the arms of the staple past each other until they rest upon stops and project in opposite directions, and the formation of the barb is completed.

Improved Combination Cotton Press.

John F. Taylor, Charleston, S. C.—The object of this invention is to produce a press of great power, especially adapted to compressing cotton bales to the smallest possible dimensions for shipment, and that with the greatest possible speed, and with the least possible consumption of fuel. It consists in the particular construction of a toggle lever press operated by steam, in combination with a hydraulic press, the steam in the cylinder that operates the water piston being used a second time in a cylinder which operates the toggle lever through the instrumentality of an equalizing part in the side valve of the first steam cylinder.

Self-Discharging and Re-Setting Lumber Car.

James L. Ridgely, Jr., Harrisonville, Md.—This invention relates to cars or trucks whose wheels run upon a track to transfer lumber out of the way, after it has been sawn, to a convenient place for piling it up; and it consists in the combination of a truck running upon a suitable track of a load-receiving frame, having cross bars that form the bearing of the load, and pivoted on a median axis to said truck, whereby the lumber may be dumped by its own weight.

Improved Candlestick.

John B. Gribble, Grass Valley, Cal.—The core or shuttle has a screw thread cut on it. On the movable part of a tube, threads of a screw are made, which fit the pitch of the screw on the shuttle. The candlestick rests upon the upper end of the shuttle, and the latter is made fast in the stationary part of the tube. By this arrangement, the movable portion of the tube is adjusted to the candle, and the end of the shuttle prevents the tallow from running down.

Improved Self-Acting Blowpipe.

John Martin Hancock, Lansing, Iowa.—This is a self-acting blow pipe for hard and soft soldering, by which the flame would be fully and instantly controlled, and the power of the same regulated without interrupting the working of the blowpipe. The invention consists of a pipe attached sidewise and projecting to some distance from the alcohol vessel, which is exposed to the heat of a small flame, being about the same distance from the main flame of the lamp as the bottom of the alcohol vessel is from the outermost end of the blowpipe.

Improved Buffer for Steam Rock Drills.

Joseph C. Githens, New York city.—As the piston in its upper movement strikes the upper head, it forces the said head upward against the packing, and the blow is finally sustained by long bolts, which draw against the lower head. As the piston, in its downward movement, strikes against the lower head, the said head moves downward a little, and, through the long bolts, draws a plate down upon the packing, relieving the head from the force of the blow. By this construction, a single buffer at one end of the cylinder relieves the head from the force of the blows at both ends of the cylinder.

Improved Wagon Rack.

Joseph Bolt, Warsaw, Ill.—The object of this invention is to so improve the wagon rack heretofore patented to the same inventor, under date of February 10, 1874, that the loading, conveying, and unloading of corn may be accomplished by one person in an easy, quick, and secure manner. The invention consists of separate tilting frames, which are arranged on the supporting rack frame to swing to opposite sides, and carried back and retained with the load by cords with hooks and pulley blocks passing over pulleys to winding-up rollers, and ratchets operated by a hook lever. The rack frame is braced in rigid position by inclined bars extending from seat blocks at opposite sides through lateral guide pieces of the rack to the ground.

Improved Harrow.

Isaac W. Hutchin, Clinton, Ill.—Each of the two triangular sections of the harrow is composed of converging bars connected by transverse straps. The teeth are in suitable manner fastened in the bars. The two sections are hinged together so that their inner bars are parallel. The hinges are raised above the surface of the sections, and their connecting pivot is thereby brought high enough from the ground to clear corn of ten or twelve inches in height. Each section has a projecting handle, and the two handles are united by a chain, which can be shortened so as to slightly raise the outer sides of the sections. This will cause the harrow to cut more in the center when harrowing corn stalks. By slackening the chain, the sections will be brought flat upon the ground.

Improved Vehicle Spring.

Christen Nielsen, South Brooklyn, N. Y.—The rear springs are attached to the rear axle, and their forward ends are pivoted to brackets attached to the wagon body. To the rear ends of the springs are pivoted links, the upper ends of which are pivoted to bracket. The shackles allow the springs to expand as they are brought under the pressure of the load. The couplings are kept parallel with each other to keep the springs from being twisted by brace bars. The forward springs are connected with the forward axle, and the forward ends are pivoted to brackets attached to the platform. The rear ends are connected by a bar, the middle part of which is bent upward, and has a hole to receive a bolt, which also passes through the bent down middle part of a bar pivoted to the ends of the bars of the platform and to the ends of bars which are pivoted to the springs.

Improved Device for Destroying Bugs upon Plants.

Robert M. Clark, Nisbet, Pa.—In using the device, Paris green or other suitable poison is put into a vessel suspended from the shoulders of the operator, either by taking off the cover or by pouring it in through a funnel in the same. A suitable quantity of water is then poured into the vessel through the funnel, in which may be placed a filter in case the water be so dirty that it would clog the perforated nozzle, which is attached to a faucet by a flexible tube. The poison and water are mixed by operating a perforated dasher, and are kept mixed by occasionally operating said dasher. The faucet enables the escape of the poison to be prevented when charging the vessel and when carrying it from place to place. The mixture is directed upon the plants from the nozzle.

Improved Apparatus for Destroying the Cutting Ant.

Ferdinand A. Fenner and John H. Power, Mission Valley, Tex.—In using this apparatus, the main cell of the ants' nest is found by means of an iron probe of suitable length, and a hole about eight inches in diameter is sunk to such a depth that its lower end may be a little below the lowest cell. The perforated and covered iron cylinder is then lowered into it, the collar of said cylinder resting upon the surface of the ground and closing the mouth of said hole. A fire is then built in the cylinder, and a blast of air is forced into it by a bellows connected with the end of a pipe which enters the side of the cylinder near the bottom pipe. When the fire is fully kindled, six or eight pounds of sulphur are poured into the cylinder, and the cover is put on. The bellows is then worked for from thirty to forty-five minutes, which forces the fumes of the sulphur through all the cells and passages of the ant nest and kills all the ants of the colony.

Improved Cotton, Corn, and Pea Planter.

Dwight W. Bristol and John F. B. Searcy, Pleasant Hill, Miss.—A drum, having twelve salient and as many re-entrant angles, revolves in bearings attached to the side bars of the frame. Within the drum is secured a smaller drum, in the middle part of which is secured a wheel, from which six radial tubes lead out through the faces of the drums. In the wheel, at the inner ends of tubes, are formed recesses, into which the seed passes through holes in the side plates attached to the sides of the said wheel and forming a part thereof. Upon the opposite sides of the wheel are placed circular plates, in which are holes corresponding in position with the holes in the side plates of the wheel, so that, by turning the disks, the size of the holes leading into the recesses in the wheel may be adjusted to allow more or less seed to enter the said recesses and pass out through the tubes.

Improved Vehicle Hub.

Joseph H. Lindsay, Freehold (Woodside P. O.), Pa.—The inner part of the hub has a ring flange to project over the collar of the axle arm, to serve as a mud band. Upon the outer side of the ring flange part are formed wedge-shaped projections, the spaces between which are dovetailed in form, so as to prevent the spokes, the inner ends of which are fitted into said spaces, from being drawn out. Upon the outer parts of the projections are formed segments of a ring flange, which enter a ring groove in the outer part of the hub, and thus strengthen the connection between the part of the hub. In the body of the hub is formed a chamber to receive the oil, from which chamber a hole leads into the bore. The hole is surrounded with a recessed projection, in which is placed a ball to act as a valve to prevent the oil from flowing through the hole when the wheel happens to stop with the oil chamber upward. From the oil chamber a hole leads out through the hub, through which the oil is poured into said chamber.

Improved Earth Auger.

Oscar Rust, Macon City, Mo.—The body of the auger is made elliptical in its cross section, and in two parts, the plane of division passing through the longer axis of the ellipse. To the lower end of each part is secured a jaw. The jaws project downward and forward, and are slightly concave, and their lower ends pass each other. To the forward ends of the jaws are secured the bits, the edges of which are made oval, and have their corners rounded off. The outer ends of the bits are curved upward, and project outward a little beyond the walls of the pods, so as to cut a bore a little larger than the bucket, so that the said bucket can be readily raised and lowered through said bore. Braces are attached to the turned up outer ends of the bits. The parts are further secured together near their lower ends by hasps.

Improved Trace Carrier.

William H. Townsend, Goodland, Ind.—This is a frame adapted for attachment of harness straps, having rigid trace-supporting arms extending inward from its rear corners in a plane parallel to the side bars, and spring arms pivoted to a transverse bridge piece and coinciding with the arms. The trace-connecting straps are in this manner quickly applied and taken off.

Improved Wind Power.

Austin Lowe, Salina, Kan.—The invention relates to a portable wind power, which is designed for propelling wheeled carriages used for transporting loads and for furnishing a prime motor for operating thrashing machines, churns, plows, and other agricultural machines. The principal feature of the invention consists in the provision or relative arrangement to each other of a pair of wind wheels, which are of such a construction that both are brought into action simultaneously, and caused to revolve in reverse directions for transmitting motion to a vertical or main shaft, which is connected with the machinery to be operated.

Improved Plow Attachment.

Almerin P. Allen, Denmark, Iowa.—The invention consists in combining with an ordinary plow a machine adapted for acting on the soil which has been turned by the plow, in such manner as to reduce, level, or pulverize the same, or plant it with seed, the side draft of the machine being opposed to the tendency of the plow to crowd in the opposite direction (laterally) against the vertical land-side portion of the furrow, so that the power which would be otherwise uselessly expended or absorbed, in excessive friction between the landside of the plow and the contiguous wall of the furrow, will be all, or nearly all, neutralized and utilized in completing the operation of preparing the soil for reception of seed. The invention also includes a peculiar combination or arrangement of seed hopper, harrow, and roller, to form a plow attachment of light draft and great efficiency.

Improved Vise.

George W. Millner, Charlottetown, P. E. I.—This invention relates to certain improvements in vises especially adapted to holding bolts or pipes; and it consists in a screw bolt having a T-shaped head and a handle nut, in combination with the extended handles of a pair of pipe tongs, constructed respectively with an oblong hole and an open slot.

Improved Animal Poke.

Samuel N. Gustin, Mexico, N. Y.—This invention relates to certain improvements in animal pokes, which, as usually constructed, have a yoke pivoted at the lower ends to a tongue, upon the rear end of which is a breast block provided with points, the whole being attached to the necks of unruly animals to prevent them from jumping fences, and to keep them within bounds generally. It consists in the improved construction of the pivot plate that attaches the yoke to the crosshead, the said plate being made with a tapering eye to facilitate the connecting of the said devices. It also consists in the means of attaching the crosshead to the tongue.

Improved Bottle Stopper.

George E. Reed, Brooklyn, N. Y.—The lower part of the stopper is provided with a shallow ring groove to receive a rubber band, which comes in contact with the mouth of the bottle. Around the upper part of the stopper is a metal band, in the upper edge of the opposite parts of which are inclines, the shoulders of which serve as handles for turning the said band. At the lower ends of the inclines are slots to receive a loop, to allow the stopper to be removed from the mouth of the bottle. Its ends are secured to the opposite sides of the bottle's neck by a wire band passed around the said neck. The stopper is fastened, when pressed into the mouth of the bottle, by turning the band, so that the inclines may press against the bend of the loop.

Improved Seed Cotton Cleaner.

Manassah C. Cheek, Mansfield, Tenn.—This invention consists of a secondary spiked fan cylinder and open concaves formed of wire rods, in combination with the ordinary spiked fan cylinder to counteract the air blast from the first cylinder, and direct it down through the open concaves, and also to detach the cotton from said cylinder and pass it along to the discharge opening through the case, thus cleaning and delivering the cotton better than the ordinary cleaners will. It also consists of a suction fan in the dust chamber below the spiked fan cylinders, to increase the draft through the dust chamber.

Improved Chair.

Henry Reupke, Chicago, Ill., assignor to himself and Frederick W. Krause, of same place.—The seat rails pass through the uprights of the chair back by a tenon, and are fastened therein by keys. The lower ends of these uprights are tied into the rear legs, thus bracing the back securely. Stretchers pass through the legs (front and rear) by means of tenons, are secured by keys, and are connected together by a center bar. The front and rear legs are slotted at their upper ends, and gains are cut in the seat rails, so that the rails and legs fit together, and are flush on each side. The back of the chair is filled in by an upright bar and a cross bar. The head piece is let into slots in the upper ends of the side pieces, and is fastened by screws, while tenons on the cross bar pass through the side pieces and are secured by keys. This chair may be taken to pieces by removing the keys and screws, so that it may be packed in a small space for storage or transportation.

Improved Die for Forming the Eyes for Tools.

John R. Thomas, Hamilton, Ohio.—This is an improved adjustable punch and die for forming the eyes of agricultural and other tools, such as a hoe, axe, adze, etc., so that the diameters and shapes of the eyes may be varied without the necessity of having a corresponding number and variety of dies and punches for the purpose. The stock of the punch is slitted transversely, and the divided parts may be expanded or spread more or less by means of a tapering pin. A tapering nut screws on the stock or body of the punch, and constitutes the punch proper. The punch is employed with a die, the size of aperture of which is adjustable.

Improved Machine for Rolling Nail Plates.

Hiram Woods, Newcastle, Pa., assignor to himself and William F. Merriman, of same place.—A movable table fetches the plate from the roughing rolls, and presents it to a self-feeding roll, above the upper roll, to be carried over the roller's side and on to an inclined feeding table. Besides taking the plate from the movable table without the aid of the hooker-up, the roll delivers the plate without the aid of the hand.

Improved Washing Machine.

John W. McQuillin and John A. Knepper, Delta, Ohio.—By suitable construction, as either end of a lever is pressed downward, a presser connected with that end is forced down upon the clothes, forcing the water out of them, which water escapes downward through a grate, upward through the presser, and laterally through the other part of the clothes, which are relieved from pressure by the upward movement of a second presser, and so on. One of the pressers always moves downward as the other moves upward, thus washing the clothes in a short time.

Improved Straw Cutter.

Leopold Schellinger, Mishawaka, Ind.—The invention is an improvement in the class of straw cutters in which the rollers for feeding the straw and the bar for clamping the same while being cut are operated from the shaft of the hand wheel, to which the knives are attached. By suitable construction a saddle, at each revolution of the eccentric, will be drawn upon the substance in the feed box and then raised. The fly wheel and the eccentric wheel are so arranged that the saddle will be drawn down as the knife begins to cut, and will be raised as the cut is completed. By other devices the rapidity of the feed may be regulated as may be required. The feed rollers revolve toward each other to feed the substance forward, and the upper roller moves up and down to adjust itself to the thickness of the substance without being thrown out of gear. The feed mechanism is so arranged as to stand still when the saddle is pressed down, and to operate when the said saddle is raised.

Improved Apparatus for Measuring Liquids, etc.

Emile E. P. Clausolles, Barcelona, Spain.—This apparatus consists of bellows, formed of annular disks, which are in communication with the ingress and egress passages formed in the foundation plate of a box. The bellows are united by the arms of a compound lever, which vibrates in a spherical recess in a fixed stand, and the lower end of the axis of this compound lever communicates a rotary motion to a circular valve, which opens and closes the ingress and egress ports. The upper end of the axis gives motion to the index dials or to a rotary shaft for transmitting power or to pumps. The bellows are made to contain a certain fixed quantity of liquid, and the pressure on the liquid to be measured causes the said bellows to expand and collapse alternately.

Improved Gas Regulator.

Joseph Adams, Washington, D. C.—This invention relates to certain improvements upon the gas regulator for which letters patent were granted to the inventor May 5, 1874; and it consists in the construction of the valve, which is of a funnel shape and provided with an outer covering of flexible material secured by a nut and funnel-shaped clamp upon the inner and lower side of the valve. It also consists in the particular construction and arrangement of the hollow valve stem with the flexible diaphragm and the balloon.

Improved Heating and Ventilating Register.

John B. Oldershaw, Baltimore, Md.—This invention relates to that class of heating and ventilating registers that are inserted in the chimney jamb when the chimney flue is employed for conducting the hot air. It consists in an extensible flue stopper, adapted to be inserted in the chimney flues of different sizes, to deflect the current through the register, and in the particular construction of the register frame having openings for giving access to the flue, either above or below the flue stopper plate, for cleaning off soot and examining and adjusting the stovepipe connections.

Improved Horseshoe.

Joseph H. Dorgan, Plattsburg, N. Y.—A strap is made in three parts. A piece laps on the central part on each side, and is fastened thereto by bolts. A series of holes is made through the central part, which allows the pieces to be adjusted, so as to make the strap fit hoofs of different sizes. A bolt passes up through the shoe, and through a hole in the front part of the strap. The ends of the flexible plate or band may be expanded or contracted to accurately fit hoofs of different widths, while the lap pieces may be adjusted according to the length of the hoofs.

Improved Water Elevator.

Jesse Chandler, Barry, Ill.—This invention relates to endless chain and bucket elevators. The buckets have a block on the under side to throw up the bottom, when passing over the one upper wheel, high enough to discharge readily. The second top wheel is placed a little lower than the first, also to tilt the buckets so as to empty readily. The flanges of the wheels are also employed to utilize those of the wheel, to conduct the water first emptying from the buckets over sufficiently to run into the trough.

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Notes & Queries

A. K. will find a recipe for water glass on p. 225, vol. 23.—A. F. will find directions for making a sundial on p. 409, vol. 29.—F. J. C. will find directions for making colored glass on p. 390, vol. 30.—J. N. will find a recipe for blackboard composition on p. 91, vol. 31.—J. N. can utilize the tin of tinned plate scraps by the process described on p. 319, vol. 31.

(1) J. H. asks: How can I make pure chloride of gold and nitrate of silver from United States gold coin? A. Dissolve the coin in a limited quantity of a warm (not hot) mixture consisting of one part nitric and three parts hydrochloric acid. When solution is complete, filter from the white residue of chloride of silver; dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (8 parts to 1 of gold); collect the precipitated gold, which is now free from copper; redissolve in aqua regia as at first, and evaporate to dryness on a water bath. Place the filter paper containing the chloride of silver, along with a quantity of borax, in a small Hessian crucible, and heat strongly until the silver is separated and rests as a small button on the bottom of the crucible; remove from the fire, cover, and allow to cool. Then separate the silver from the borax by means of boiling water; dissolve in nitric acid, and evaporate to dryness on a water bath.

What chemicals will act as a bleaching agent when exposed to sunlight? A. Moisture, chlorine gas, chloride of lime, etc.

(2) M. H. K. asks: What is the green substance that gathers on the outside of a porous earthenware drinking vessel? Does it come from the water inside, or from the atmosphere? It washes off readily, and resembles the green slime of stagnant waters. A. It is probably due to the quantity of organic matter dissolved in the water, which, on evaporating, leaves it behind in the form you mention. Test a little of the clear water by coloring it slightly with permanganate of potash; if, after standing for some time, the color disappears, the water is unfit for drinking purposes.

(3) S. D. G. says: I have a steam whistle which sounds well at 100 lbs. steam. If I now raise steam to 1,000 lbs. what effect will it have on the whistle? Can it be heard so much farther, or will it fail to sound at all? A. It is problematical whether the expansion of the metal would not altogether alter both the tone and effectiveness of the whistle.

(4) W. M. J. says: The boiler of a thrashing machine engine recently exploded at Lexington, Md. On examination it was found that the safety valve was stuck fast in the guide, it being a light globe valve with a stem about 3 1/2 inches long, like a common globe valve stem, with thread left off, being a close fit. I am under the impression that the hand had gone once clear around and up to the 65 lbs., as the sheets do not show any signs of having been over heated. A. The safety valve stem being fast totally impaired the efficiency of the boiler, and it is possible that the needle of the pressure gauge (if the construction of the gauge would permit) had made more than an entire revolution. The pressure in such case is an unknown quantity; hence the explosion.

(5) J. C. asks: Is it possible to plane a piece of hardened steel? A. It is impracticable, and would be, if it could be done, disadvantageous.

(6) C. W. M. asks: 1. If I make an engine of brass, it will turn blue when heated. Will the color change if I plate it with nickel? A. No. 2. How large a copper boiler should I have for an engine 14x3 inches, and how thick should the shell be? A. Size of boiler about 8 inches diameter and 15 inches long; shell 1/2 inch thick for moderate pressure. 3. Should it be brazed or riveted? A. It should be brazed and riveted. 4. Will ports 1/4x3/4 inches be large enough for a 14x3 inch cylinder? A. You will find a rule for size of ports in No. 16, etc., of Practical Mechanism.

(7) W. E. S. says: A friend of mine asserts that, in a common bucket pump the only water lifted by the bucket is that which is above the bucket. Is he right? A. Yes.

(8) A. D. T. says: In my daily experience in the use of twist drills, I have remarked one improvement which a manufacturer might make. It is this: Flatten three sides of the shank; this will do away with all slipping. Also put a good center in the shank. All this can be done at very little expense and cannot fail to give great satisfaction.

faction. A. Twist drills 1/4 inch and over in diameter usually have a taper shank, and a feather on the end which effectually holds them. Those below that size, and those having parallel shanks, may be held sufficiently firm in an ordinary chuck. It would be difficult to make triangular holed chucks run true.

(9) A. C. T. says: I have seen an article in relation to a certain alloy of metals, which when melted was of the required degree of heat for tempering edge tools. What is it? A. We know of no special alloy for that purpose. Common lead is sometimes used, the work being greased before immersion.

(10) L. H. R. asks: 1. I have two shafts situated 24 inches from center. I have an endless belt 66 inches long. How can I find the diameter of two pulleys, both to be the same size, on which this belt will fit tight? A. Subtract twice the distance between the centers of the shafts from the length of the belt, and divide the remainder by 3.1416; the quotient will be the required diameter of each pulley. 2. Under similar circumstances, the size of one pulley being given, how can I ascertain the correct diameter of the second? A. To twice the distance between the centers of the shafts, add half the circumference of the given pulley, and subtract their sum from the length of the belt; the remainder, multiplied by 2 and divided by 3.1416, will give the diameter of the second pulley.

(11) G. D.—It is likely that the law of your State, forbidding the sale of goods manufactured under your patent without a seller's license, may be enforced; but by a number of judicial decisions, you are at liberty to travel in any State or Territory and sell rights to manufacture under your patent, and no State legislation can legally stop you.

(12) H. M. says: We are putting up a horizontal engine. Please give us your method of getting out the template, and the lines and right angle line for back box, distance, etc. A. The cylinder and crosshead guides are set true horizontally, and parallel with the bed frame. The crank shaft is set by running a line, true with the bore of the cylinder, the full length of the bed, and setting the crank shaft at a right angle to it, keeping all parts level with a spirit level.

(13) A. M. B. asks: What kind of steel shall I use for making a gun barrel? A. Forge it from a square bar of soft machine steel of not too fine a quality.

(14) J. N. P. asks: What is the rule for calculating the strength of boilers, steam pipes, etc.? A. "For calculating the strength of a singly riveted steam boiler, multiply the internal diameter of the boiler in inches by the pressure of steam in lbs. per square inch, and divide the product by 8000. The quotient is the proper thickness of the boiler plate in inches."—Bourne.

(15) A. H. D. says: We turn our axle nuts in soda and quinine, and put them away without cleaning or oiling, and they rust. Is there a way to keep them from rusting without much expense or labor? A. Coat them with boiled oil and white lead, mixed to a thick paint.

(16) C. P. asks: 1. Is the temperature in the hot air space of furnaces, used for heating purposes, enough to make steam? Yes, generally. 2. My house is heated by steam, but not satisfactorily, and I thought of putting in a furnace with a boiler inclosed in the air chamber, believing that I should get the heat of the furnace for the lower floors, and make steam enough for the upper stories. Would it work? A. This plan will answer if properly constructed.

(17) J. G. asks: 1. Could I have a brass cylinder, 2x4 inches, made, that would be equal to one half horse power? Yes. 2. Would it be a high pressure engine? A. Yes. 3. Could a small boat be fixed so that the wheel can be propelled with one cylinder? A. Yes.

(18) W. S. S. says: If I place two cylinders, 10x30 inches, side by side, and connect them with a pipe, stop cocks, etc., and attach to the pipe a small engine, cylinder 2x2 inches, and if I fill cylinder No. 1 with compressed air, 200 lbs. to the square inch, and cylinder No. 2 is empty, and if the air from No. 1 is liberated through pipe and engine to No. 2, and I keep the pressure to a minimum of 200 lbs. per square inch until all the air is forced into No. 2: What power will I obtain, and how long will it take to empty No. 1 into No. 2, and so on, alternately? A. Your power will depend upon the point of cut-off and the speed of the engine, and would gradually decrease, as the air entering cylinder No. 2 would create a constantly increasing back pressure upon the engine which would prevent cylinder No. 1 from ever becoming empty. The time necessary to bring the engine to a standstill in consequence of the above back pressure of course depends upon the size of cylinder No. 1.

(19) C. E. K. Jr. asks: For vulcanizing rubber plates I have a small boiler, 4x3 1/2 inches, which I heat up to 320°. I fill it about 3/4 full of water, and then put in the flask, which makes the boiler about half full. Is all the water converted into steam at a temperature of 320°? If not, what temperature would it take to convert it into steam, and what amount of pressure should I have? A. Only a small portion of the water is converted into steam, and it would not be practicable, with an ordinary apparatus, to evaporate it all in the closed space.

(20) J. T. says: I send you a piece of scale from a boiler. What is in the water to make such scale, and what will take it off? A. A good feed water heater will probably be efficacious in preventing further deposit; and it is probable that annate of soda will loosen what is already formed.

(21) T. McG. asks: What welding mixture used on vises to weld the faces on the jaws? A. For welding steel to iron, borax will do.

(22) F. M. asks: Please tell me of a remedy for cold feet. A. A fast walk of 2 1/2 miles, morning and evening, is in most cases a sure cure.

(23) H. L. S. says: 1. I have an engine 14x3 inches, with a fly wheel 10 inches in diameter. Would it be large enough to run a skiff 10 feet long and 2 feet wide, with a pressure of 40 or 50 lbs. of steam? A. It would be better to use a steam pressure of 100 or 125 lbs. per square inch. 2. What size of boiler would it take? A. Make a boiler with from 20 to 25 square feet of effective heating surface. 3. Could a boiler be made to give that amount of power, using gasoline as fuel? A. Unless you have had experience in the use of gasoline as fuel, it would be better to depend upon coal or charcoal.

(24) H. M. N. asks: Which will be the most economical way of feeding a boiler, by a steam pump driven by an engine, or by an injector? A. The pump driven by the engine will be the most economical in general, but not the most convenient or desirable in all respects.

(25) W. J. N. says: I have a small boiler 8 inches in diameter and 2 feet long, and propose to enlarge it by having a double shell of 1/2 inch, making a water space of 2 inches between the skins. The shell is to be 3 feet high, with an outside diameter of 16 inches, and an inside diameter of 12 inches. Inside of this, I intend to suspend my old boiler, connecting the walls and steam spaces by 1/2 inch pipes. I will make the lower part of the shell act as a firebox, fitting a door at one side and putting in four cross tubes through the furnace one inch in diameter. Is this a practicable plan? A. If you make the connections so as to secure good circulation, there is no reason why the arrangement will not prove satisfactory.

(26) J. W. S. asks: How can I melt German silver? It runs well enough; but when we roll it it is full of scales. A. Do not add the zinc until the copper and nickel are fused together, and put in a little borax with the zinc.

(27) J. B. R. says: Your paper of August 14 contained an article referring to paper suitable for copying purposes. I enclose a sample of an okra paper, originated by me a few years ago. Until I saw the article referred to above I had never tested my new paper for copying purposes. I think I have reason to be satisfied with the result. You will see that the copying is as distinct as if done with the best Japanese tissue paper; and this has been accomplished with paper that was manufactured for ordinary newspaper printing. The strength of this paper is such as to adapt it for copying important documents, legal papers, etc., while there is no doubt that the paper may be made still heavier (if desired) and yet answer for making distinct copies. Another purpose for which this paper would be well adapted would be in the manufacture of vegetable parchment. A. The paper you send is a fine specimen of exceeding toughness, and is, we think, the strongest unsized paper we have ever seen. It is an admirable copying paper, and would answer well for the purpose you suggest.

(28) F. C. W. asks: What is the best metal for an expansion tube for hot water? A. Copper.

(29) M. R. says: 1. I send a sample of stuff found in a reservoir for condensed steam from an engine. We run steam through 650 feet of pipe (the last 100 feet of which is perpendicular) to a steam pump, the cylinder of which is 8x10. I have found the same material in every spare space between the engine and the pump, making it necessary to clean it out every six months. There has not been any grease in the pipe. I should like to know what it is. A. It resembles the material produced by the action of impure grease on the piston. Examine the piston of your engine and see whether or not it is changed in places into a charcoal-like substance, that can be readily cut with a knife. 2. I have had a discussion about the distance that water can be raised with a siphon. One claims it could be raised any distance, provided the discharge end was low enough, while I claimed that it could not be raised more than 34 feet. Which is right? A. You are.

(30) M. W. asks: Will you explain in your answers to correspondents how a locomotive will run around a curve, the outside rail of the track on the curve being longer than the inside rail, and the wheels, of the same size, being keyed on the axle at both ends? A. Under the circumstances, the wheels would slide on one of the tracks.

(31) W. P. asks: 1. Is there more pressure on the top side of a boiler than on the lower side, or is there the same pressure upon every square inch in the boiler? A. There is a little more at the bottom. 2. What is the rule for calculating the horse power of an engine? A. See p. 33, vol. 33.

(32) R. M. says: We want some black paint for smoke stacks that are heated nearly red hot. Is there such a paint? A. We know of nothing that will stand such a temperature.

(33) R. F. H. says: I have a coarse half round file, 6 inches long, which has been in use for some time. It has become quite strongly magnetized, with the south pole at the tip and the north pole at the tang. Is not this unusual? A. Such an example as you notice is interesting, and not at all usual. Perhaps some of our readers may have observed similar instances.

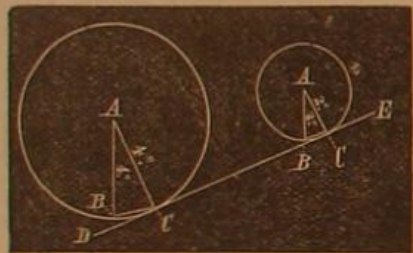
(34) G. W. I. asks: 1. What practical gain would result from the use of a feathering wheel instead of the ordinary paddle wheel, in the propulsion of steamboats? A. Increase of speed or diminution of power required. 2. Does the float or paddle exert the most force as it enters the water or as it leaves it? A. There is very little difference.

(35) J. W. W. asks: Will paraffin in nitric and sulphuric acids act the same as nitro-glycerin? A. Paraffin is not suitable for this purpose.

(36) W. A. says, in reply to W. H. P., who asked how a solution of ammonio-sulphate of copper may be rendered colorless and still retain all the copper in solution: Add potassic cyanide. The composition of the solution is altered, but the copper is all there. It may appear dark brown when fresh, but this is due to a little iron in the copper sulphate, and will subside on standing.

(37) M. W. W. says, in answer to the question: Shall we attach a horse to his load at a high point or low? If the load is light and is to be propelled at considerable speed, it perhaps makes but little difference. Possibly it might be advantageous to put it level with the point of draft, as (see your reply to K. C. & Co., No. 40, July 10, 1875) would seem to be your opinion. But if the load is heavy, and the horse will have to exert himself to propel it, it will be, as experience has demonstrated fully, not only advantageous, but frequently absolutely necessary to make the attachment so low that he may have to exert some lifting as well as propelling force; and the rationale of this is that the animal has not weight enough to keep him from pushing his feet backwards instead of pulling his load forward, and he requires to be supplied with it from some other source. I have seen a horse pull a load with a man on his back that he was unable to move without; and any person who has not tried it will be surprised to see how light a load will stall a team when the attachment is such that it is required to exert some downward pulling force. This consideration is also implicated seriously in the practical operation of tractive engines, and their efficiency would be greatly increased by any device by which the engine could be given the benefit of a portion of the load to hold it to the ground or track, preventing slipping and carrying unnecessary weight.

(38) M. W. W. says, in reply to several inquiries in regard to the draft of high and low wheeled vehicles: A high wheel will be more easily drawn over any small obstruction in the road (such as a stone or stick), or out of a rut, or through mud; but whether this is the case on an ascending grade is a question not easily determined. It has been asserted that a man will draw a heavier load up a given incline on a small wheeled truck than on a large wheeled one, and the theory for it is that a perpendicular line drawn from the center of the axle falls nearer to the point of contact between the wheel and floor; this is equivalent to the short end of a lever, the distance from the axle to the point of contact being the long end. At first this might seem plausible, but an examination of the accompanying engraving will show



that the long ends of the levers, A C, are lengthened or shortened in the same proportion as the short ends, B C, and therefore no advantage is gained by that means. We must, therefore, look for some other explanation, and perhaps the readers of the SCIENTIFIC AMERICAN can clear up the difficulty.

(39) E. D. R. says: If E. B. W. would mix a strong infusion of quassa with his ink, he would have no more trouble with flies eating his inked lines.

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

E. G. A.—No. 1 is magnetic oxide of iron. No. 2 is probably an alloy of tin and lead; but the sample is too small for a decisive report. No. 3 is a variety of bituminous coal containing considerable percentage of ash.—J. M. B. Jr.—It is a poor variety of porcelain clay.—M. S.—It is a poor pig iron, containing an unusual amount of earthy material.—C. G.—It is quartz, inclosing particles of iron pyrites. It is of no value as an ore.—R. L.—It consists of felspar and calcite, inclosing mica and a few crystals of garnet.—S. G. R.—It is refined tin. It never occurs native as you found it, and was undoubtedly left there by some person.—J. H. T.—It is a formation of variegated clay upon shale. It has been hardened by exposure.—W. B. H.—No. 1 consists principally of antimony. No. 2 is galena. No. 3 is impure galena. No. 4 is a fine conglomerate.—D. W. W.—To determine the value of an ore, it is necessary to have a quantitative analysis made.

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 inquiries analogous to the following are sent: "Who sells nitro-glycerin? Who makes canvas tents? Who buys corundum in lump? Who sells aluminum in sheet and wire?" 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

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DESIGNS PATENTED.

5,563.—HEATING STOVE.—W. C. Davis, Cincinnati, Ohio.	
5,564 to 5,566.—CARPETS.—A. Heald, Philadelphia, Pa.	
5,567.—HEATER.—P. Hollings, Jr., Brooklyn, N. Y.	
5,568.—RANGES.—W. Whitman, Bangor, Me.	
5,569.—CLOCK CASE DOORS.—L. E. Jerome, New Haven, Conn.	
5,570.—CAN HANDLES.—H. Miller, New York city.	
5,571.—FORK HANDLES.—L. R. S. White, Waterbury, Conn.	

SCHEDULE OF PATENT FEES.

On each caveat.....	\$1.
On each Trade mark.....	\$2.
On filing each application for a Patent (17 years).....	\$15.
On issuing each original Patent.....	\$20.
On appeal to Ex. in. in Chief.....	\$10.
On appeal to Commissioner of Patents.....	\$20.
On application for Extension of Patents.....	\$36.
On filing a Disclaimer.....	\$10.
On an application for Design (3 1/2 years).....	\$10.
On application for Design (7 years).....	\$15.
On application for Design (14 years).....	\$30.

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
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5,076.—H. E. Casgrain, Quebec. Illuminating gas machine. August 19, 1875.	
5,077.—E. V. Wingard, Pittsburgh, Pa., U. S. Burning bricks. August 24, 1875.	
5,078.—J. Hewitt, Hamilton City, Pa., U. S. Ore crusher and stone breaker. August 24, 1875.	
5,079.—A. Nye, Jr., Boston, Mass., U. S. Telescopic feed bag. August 24, 1875.	
5,080.—J. Steger, New York city, U. S. Air brake. August 24, 1875.	
5,081.—E. H. Gratiot, Plattsville, Wis., U. S. Wheat steamer. August 24, 1875.	
5,082.—G. R. Moore, Westford, Mass., U. S. Scull propeller. August 24, 1875.	
5,083.—G. Isles, Montreal, P. Q. Differential compass. August 24, 1875.	
5,084.—T. Saunders <i>et al.</i> , Toronto, Ont. Burglar and fire proof safe. August 24, 1875.	
5,085.—D. M. Kelley, Athelston, P. Q. Bolt and rivet trimmer. August 24, 1875.	
5,086.—C. G. Force, Jr., Cleveland, Ohio, U. S. Device for excavations for sewers, etc. August 24, 1875.	
5,087.—W. Lightfoot <i>et al.</i> , Toronto, Ont. Lawn sprinkler. August 24, 1875.	
5,088.—T. H. Marsh, Toronto, Ont. Clamp. August 24, 1875.	
5,089.—E. A. Calahan, Brooklyn, N. Y., U. S. Signal and alarm telegraph. August 24, 1875.	
5,090.—W. Johnston, Shelby, N. Y., U. S. Door hanger. August 24, 1875.	
5,091.—J. Gerhardt <i>et al.</i> , Montreal, P. Q. Portable re-sawing gang saw. August 24, 1875.	
5,092.—P. M. Thompson, Derby, Vt., U. S. Pipe wrench. August 24, 1875.	
5,093.—J. Klink, Keswick, Ont. Meat-preserving process. August 24, 1875.	
5,094.—J. J. Curran <i>et al.</i> , Chicago., Ill., U. S. Lumber dryer. August 24, 1875.	
5,095.—P. C. St. Marie, Montreal, P. Q. Screw windlass for vessels. August 26, 1875.	
5,096.—J. J. Stewart, Sargentville, Me., U. S. Pegging jack. August 26, 1875.	
5,097.—F. Van Doren, Adrian, Miss., U. S. Corn planter. August 26, 1875.	
5,098.—H. Sprague, Churchville, N. Y., U. S. Wagon. August 26, 1875.	
5,099.—D. P. Sharp, Ithaca, N. Y., U. S. Horse rake. August 26, 1875.	
5,100.—J. and F. A. Bailey, Farmington, Mass., U. S. Fruit picker. August 26, 1875.	
5,101.—J. Clay <i>et al.</i> , Montreal, P. Q. Fire lighter. August 26, 1875.	
5,102.—J. B. Fayette, Oawego, N. Y., U. S. Lifting jack. August 26, 1875.	
5,103.—M. and W. Fitzgibbons, Galt, Ont. Washing machine. August 26, 1875.	
5,104.—J. Benson, South Boston, Mass., U. S. Vapor burner. August 26, 1875.	
5,105.—J. C. Moore <i>et al.</i> , Philadelphia, Pa., U. S. Cans for shipping oils, etc. August 28, 1875.	
5,106.—N. Silverthorn, Toronto, Ont. Hog-cleaning machine. August 26, 1875.	
5,107.—W. R. Anderson, Cleveland, Ohio, U. S. Boiler fuel cleaner. August 26, 1875.	
5,108.—S. Ballerchey, Elderslie, Ont. Adjustable plow beel. August 26, 1875.	
5,109.—S. Mitchell, Lima, N. Y., U. S. Carriage hub. August 26, 1875.	
5,110.—J. T. Burns, Springfield, Ont. Root cutter. August 26, 1875.	
5,111.—R. Sadler, Owen Sound, Ont. Elevator and snow shovel. August 26, 1875.	
5,112.—J. W. Grover, Westminster, Eng. Spring washer. August 26, 1875.	
5,113.—J. H. Hussey, Baltimore, Md., U. S. Protective toe shoe. August 26, 1885.	
5,114.—D. McPherson, Caledonia, N. Y., U. S. Binder. August 26, 1875.	

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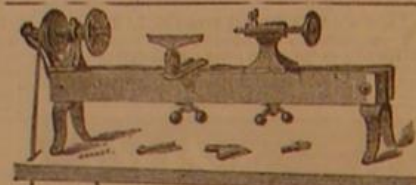
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