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IMPROVED FEED WATER HEATER AND PURIFIER.

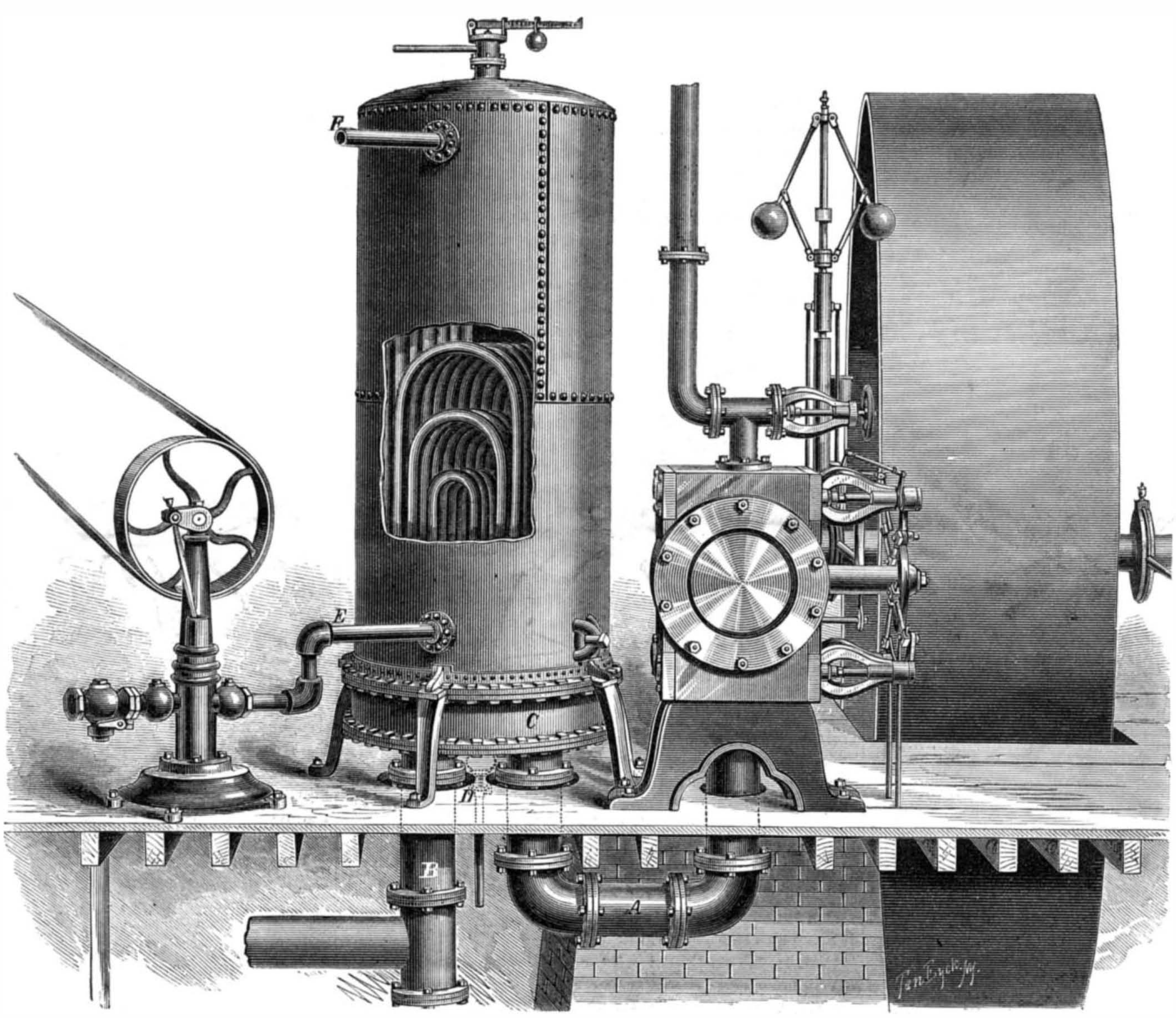
To the use of impure feed water, there is little doubt but that a large proportion of the constantly recurring boiler explosions may be attributed. The history of those catastrophes which have happened on the steamboats plying upon Western rivers shows that the majority have taken place when the streams 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 genera tor, 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 eduction 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 incrusted 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, patronized 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 Russi an 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. Paralysed 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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NEW YORK, SATURDAY, AUGUST 28, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

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 untilled and tenantless through the failure of genial showers; and large areas, as in the lower half of the Punjaub 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 Punjaub—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, unskilfully 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 Punjaub 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 Godavery. 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 massy 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 Punjaub, 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 Umritser, 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 Cauvery canals are reputed to pay 23½ per cent on their cost, the Godavery 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 accomplish 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 fail 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 worldly wise 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 Methusaleh 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 toil 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 metal 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, multiplicator, 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.

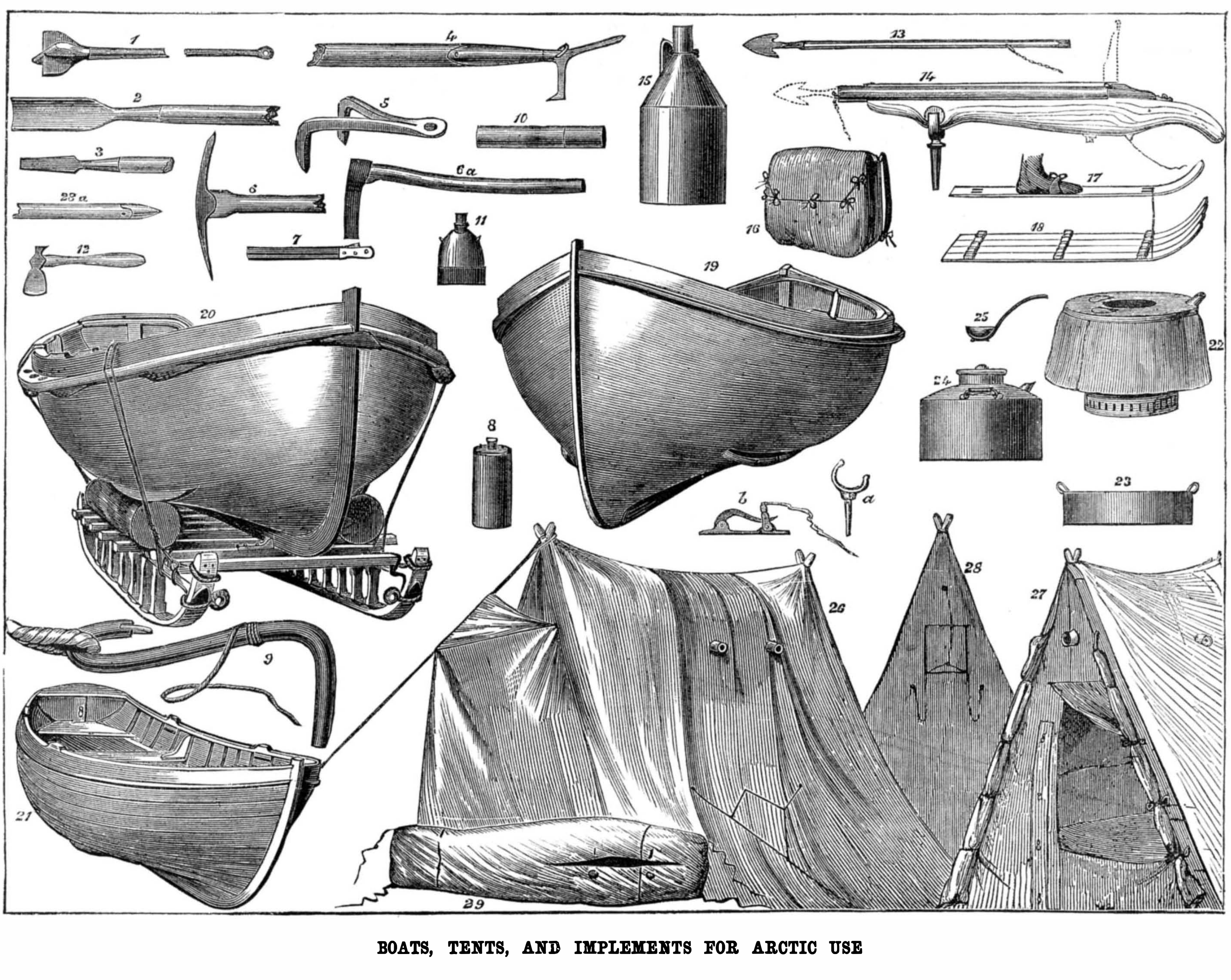
THE BRITISH ARCTIC EXPEDITION.

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.

CAPTAIN G. S. NARES.

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



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 traveling 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 sleigh 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 sleigh are shown (1, 2, 3) a gage, chisel, and hooks for cutting through the ice.

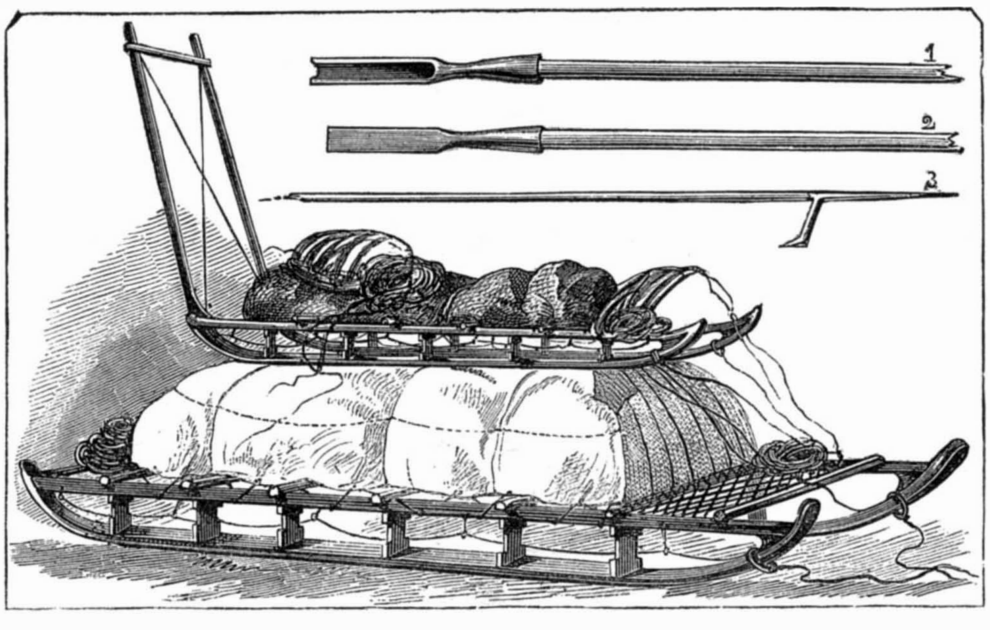


Fig. 3.—ARCTIC SLEIGH.

Fig. 4 shows (1) the substantial sleigh 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 sleigh, intended for use when the wind is favorable; and the rigging is clearly shown. If these sleighs 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

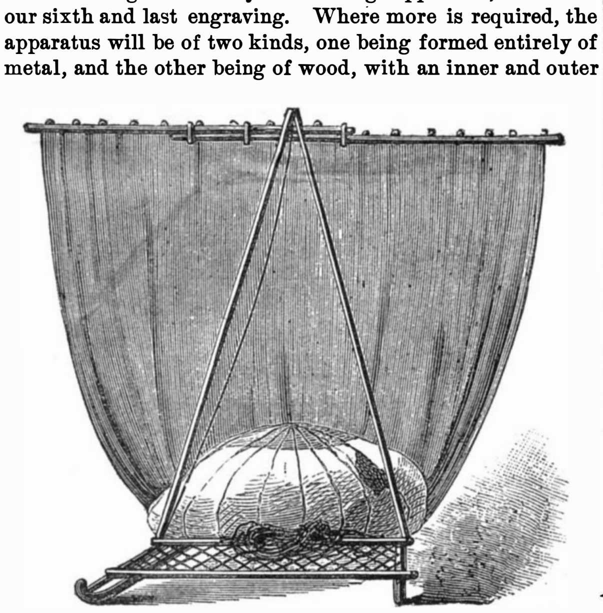


Fig. 5.—SAILING SLEIGH.

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 o illuminating purposes. To enrich it, a small jet of crude 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.

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 Phœnixville, 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 Phœnixville 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 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, 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, preparations 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.

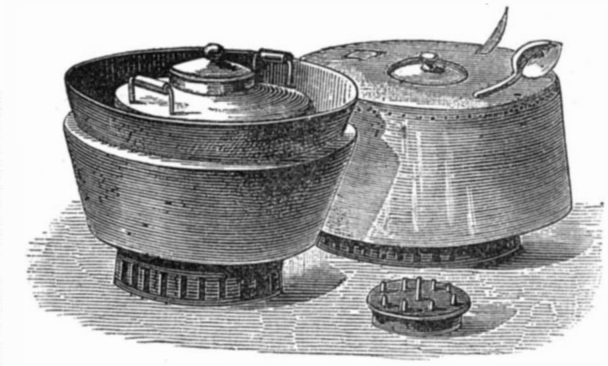


Fig. 6.—COOKING UTENSILS.

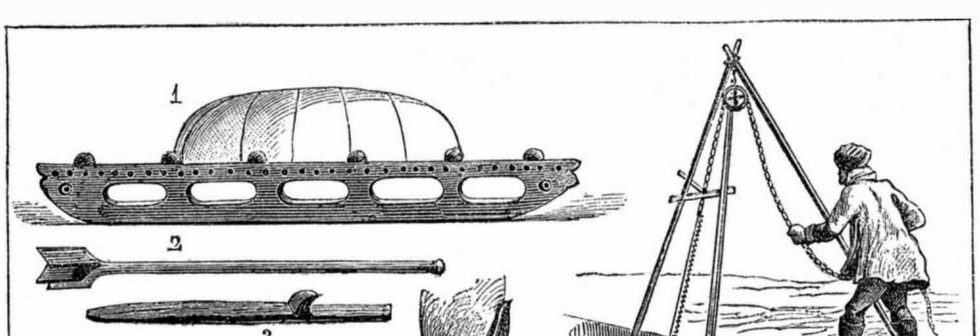


Fig. 4.—ARCTIC TOOLS, ETC.

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 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 azymotic, 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 unirritating 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 opinion 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-resistent 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 stains 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 develope 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 nebulæ 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 irreconcileable.

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-invigorator 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. G. PROSPER ZALESKI.

New York city.

AUGERS.

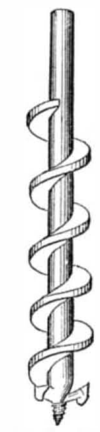
Continuing our series of extracts from Mr. E. H. Knight's "Mechanical Dictionary,"* we give below a number of illustrations, together with descriptions of various forms of boring tools. Augers are made in numerous forms, including hollow augers, annular augers, taper augers, augers with secondary borers,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

Fig. 1.

L'Hommedieu's Auger.

Fig. 2.

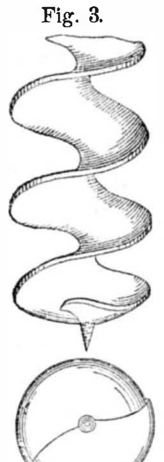


Shetter's American Auger.

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.

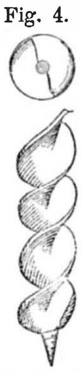
Kasson's auger (Fig. 4) permits the formation o cutting lips at any point on the length of the spiral, by cutting off the twist at any point in a plane vertical, or nearly so, to the axis of the auger, and then sharpening its edges. The front surfaces of the twist are concave, and the rear convex.

Fig. 3.



Cook's Auger.

Fig. 4.

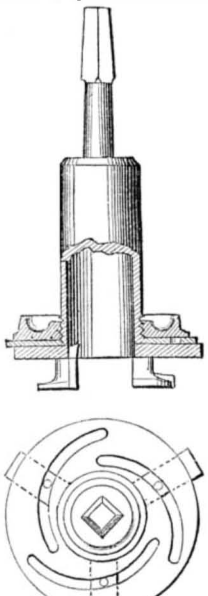


Kasson's Auger.

Fig. 5.

Slotting Auger.

Fig. 6.

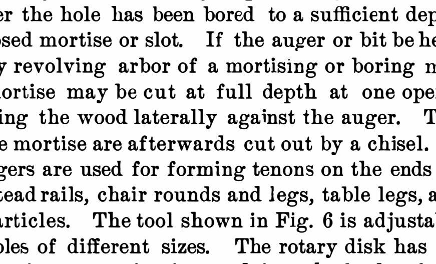


Hollow Auger.

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.



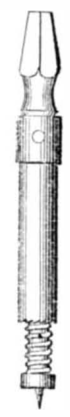
Hollow Auger.

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 reduced 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.

Fig. 8.

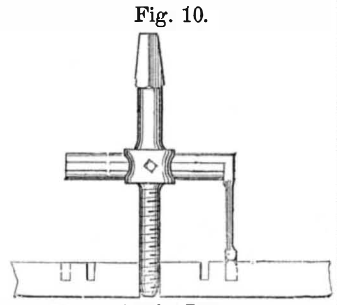


Annular Auger.

Fig. 9.

Annular Auger.

Fig. 10.

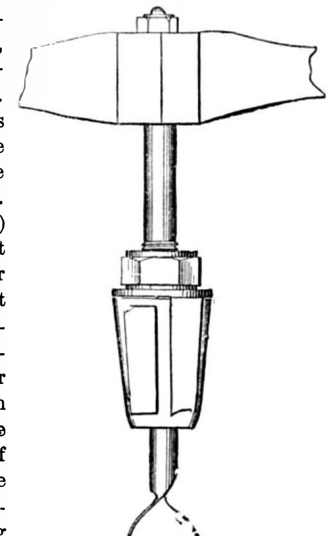


Annular Borer.

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.

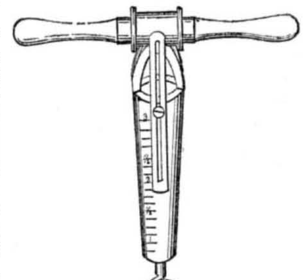
Taper augers (Fig. 11) are used for reaming out bungholes, making butter prints, etc. The center bit bores a hole, and is succeeded by the taper reamer, which has a throat for the chips, cut through from the edge of the bit on one side to the opposite side of the stock. The bunghole reamer (Fig. 12) 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 handle is fastened. On one side is an adjustable gage and an index to determine the size of the bore.

Fig. 11.



Kirby's Taper Auger.

Fig. 12.



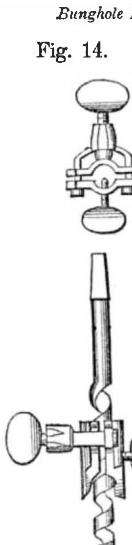
Bunghole Reamer.

Fig. 13.

Crocker's Taper Auger.

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, countersinkers, or expansive cutters.

Fig. 14.



Counter-Borer.

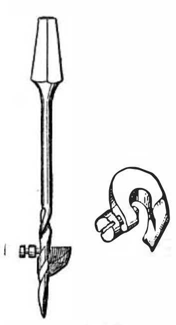
In Fig. 14 the reamer or secondary borer is formed in two pieces, and is clamped to the auger shank at the required distance from the end of the tool, and at the same time is adjustable to ream out a hole of the required diameter. The clamp is shown separately in the upper portion of the figure.

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.

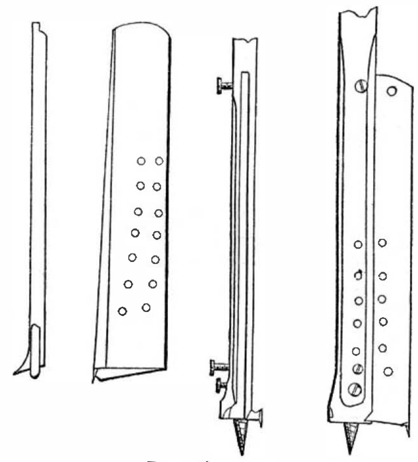
The shanks and turned cutting edges of the expanding bits in Fig. 17 pass through a mortise in the head of the tool, and are secured to their adjustment by a key. Their radial adjustment adapts them to bore holes of varying sizes

Fig- 15



Countersink.

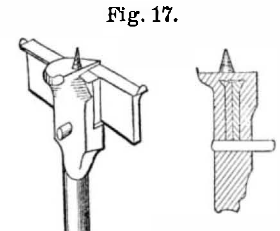
Fig. 16.



Expanding Auger.

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 22¼ 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.

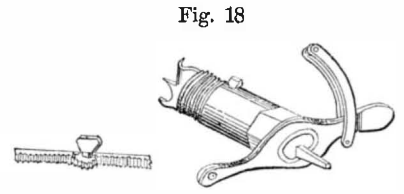
Fig. 17.



Expansible Auger.

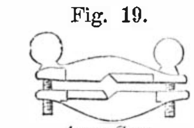
Fig. 18 is a faucet with an attached auger, by which the necessary hole is made in the head of the cask. Fig. 19 represents a device to be attached to the shank of an auger to limit the penetration. The example has a pair of bars, secured by temper screws to the spiral shank, so as to form a gage of depth.

Fig. 18



Auger-Faucet.

Fig. 19.

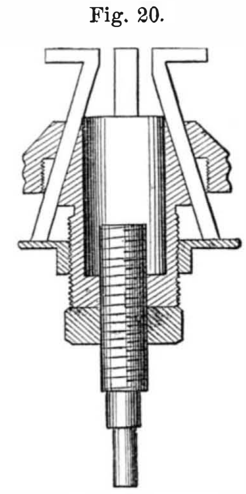


Auger-Gage.

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.

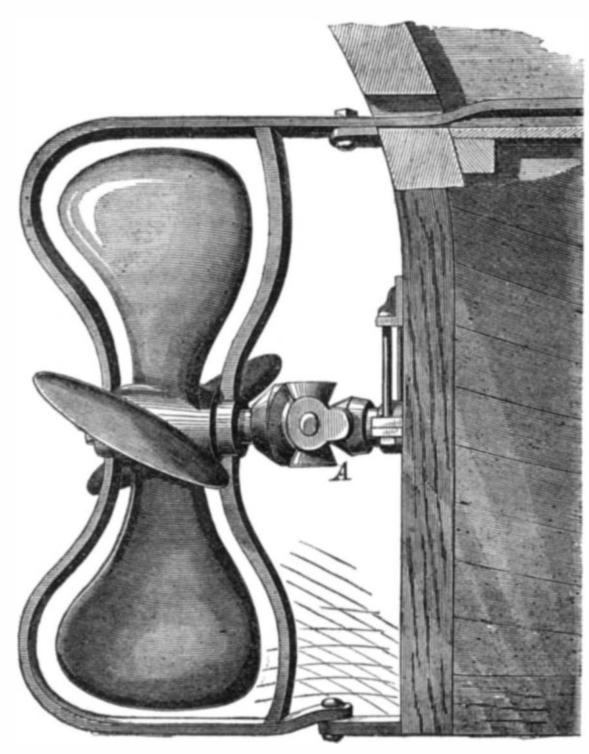
For further particulars address Mr. W. O. Spayth, Tiffin, Ohio.

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 tuns each, and travel about three miles an hour, with full boats carrying a cargo of 150 tuns 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.

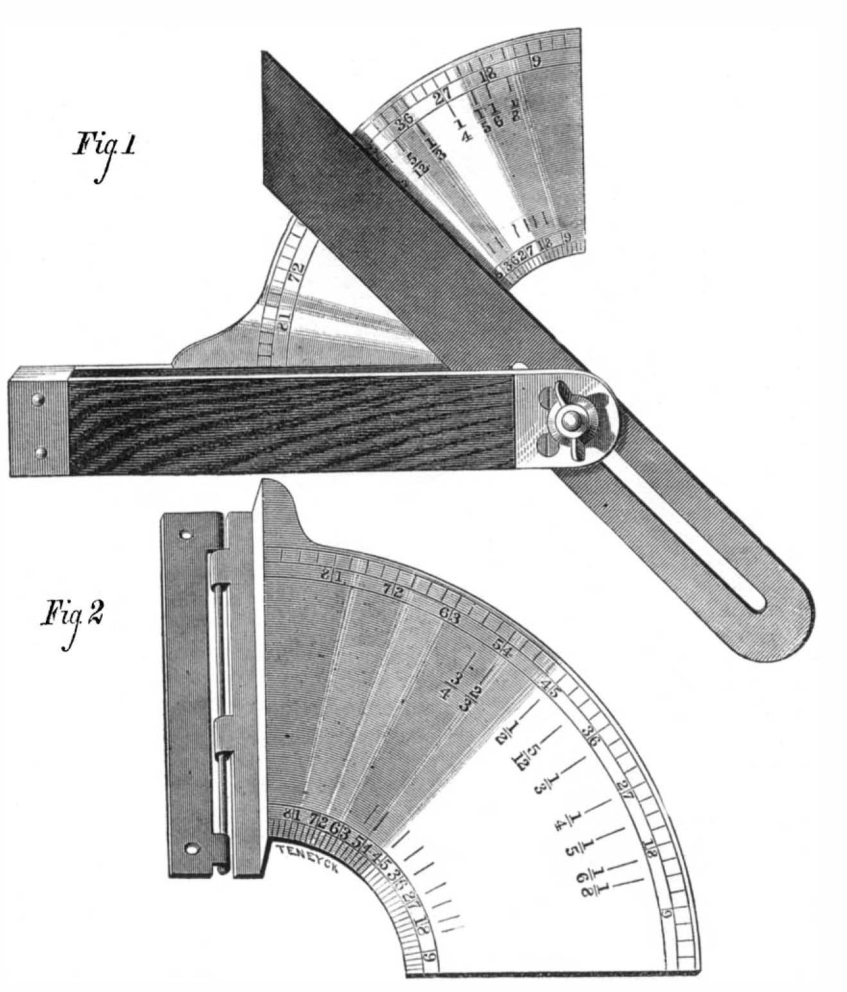
The axis of the propeller is hung in bearings in a stout metal frame, which is pivoted to the sternpost of the vessel or to outriggers on the same, and is so connected with the tiller as to be readily swung to the right or the left thereby. The propeller shaft projects out through the stern post, and 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 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.

Fig 1

Fig 2

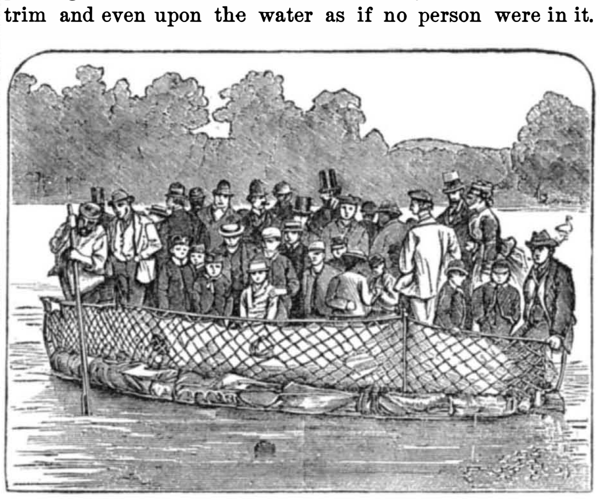


SPAYTH'S RAFTER SCALE AND BEVEL GAGE.

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 Enameled Iron Ceiling.

A ceiling made of thin plates of iron, and enameled, 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 enameled. The whole gives an impression of perfect cleanliness, and every part might be washed down by a fire engine weekly, if necessary.

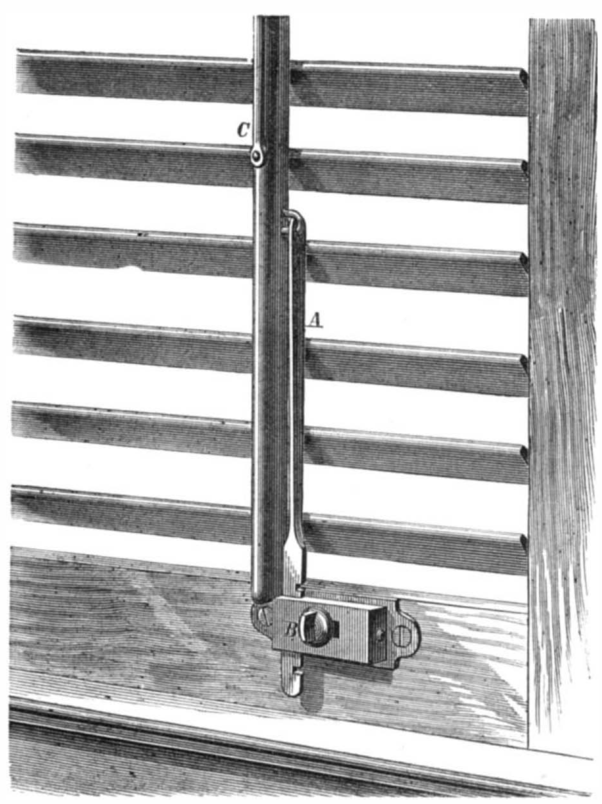
The manufacturing part of this ceiling was done at Birmingham by the Enameled Iron Company, the whole enameled plates being sent from Birmingham, and painted with charming and vigorous arabesques by the artist, Mr. James Gamble. The work is highly effective and the experiment successful. In cases where 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 tuns 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.

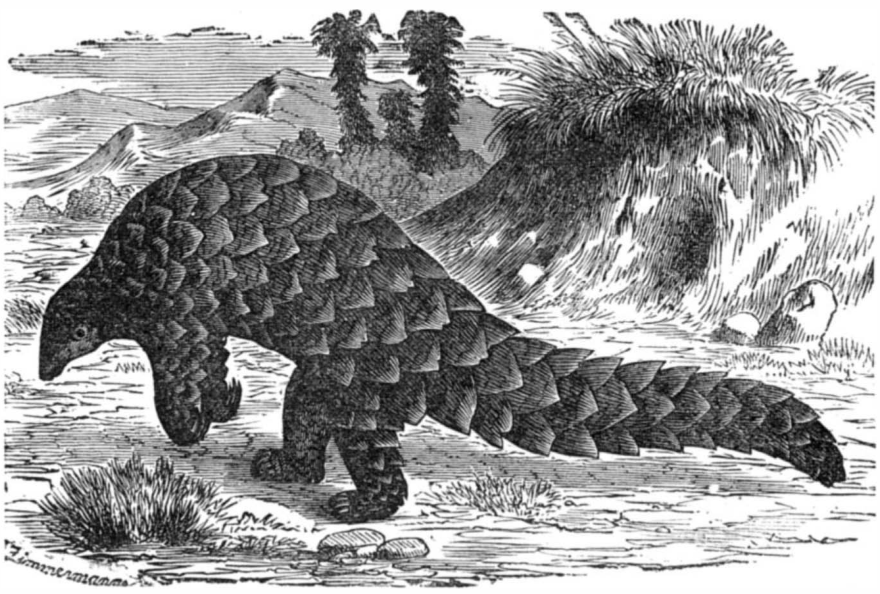
THE ANT-EATER FAMILY.

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 (*myromecophaga jubata*); it is about four feet long, and has a bushy tail of two and a half feet more, and its hight 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.



THE SCALY ANT-EATER.

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 Deutscher 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 3½ 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.

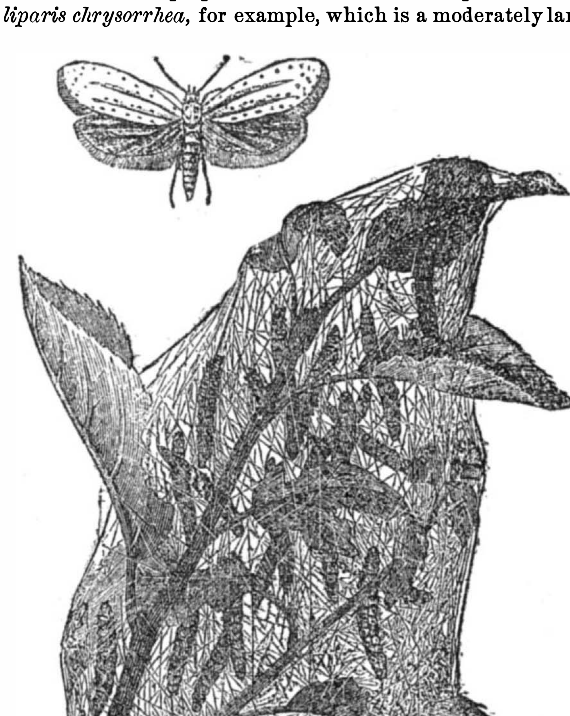
6. Alloys of lead and platinum: (*a*) With 10 per cent platinum. The decomposition is slow and incomplete, and ends at 536° Fah. (*b*) With 2 per cent of platinum. The decomposition is sudden and complete, between 500° and 536° Fah.

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 *yponomeuta*. 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 *yponomeuta* 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 larvæ 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 larvæ 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 silicium, 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 thresher 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.

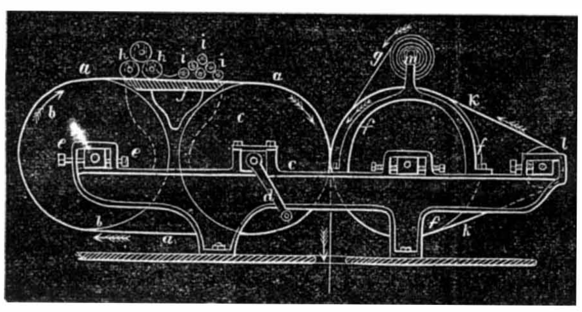
Printing Photographs by Machinery.

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 gelatined 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 *resumé* 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 tuns, 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-tun 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 tuns 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 develope 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 *et al.*

[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 a ratchet or notched hub, so arranged that the former will engage with the latter at any point or hight 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 hight 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 state of the art before 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 "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 o 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 any desired hight, 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 revolving rapidly the width of the ratchet notch will pass under 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 under a slow movement of the roller. Under a quick revolution of the roller the pawl toe will not be unsupported by the periphery of the ratchet for a space of time 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 with the cord which had been employed to operate the pawl and disengage it from the ratchet notch, and so 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 latter 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 is 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 hight 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.* Tripp *et al.*, in the circuit court for the southern district of New York: "There is no 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. Maynadier, 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 named a combination of rubber with some other substance to increase the erasive 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 BARKER MANUFACTURING COMPANY *vs.* ABRAHAM BUSSING.

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

This was a suit under letters patent granted to C. N. Gilbert and J. F. Barker, August 3, 1869, for an "improved apparatus for carbureting 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 degree for an accounting of gains, profits, and damages against the manufacturer of the infringing machines, 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. KURSHEEDT *vs.* ROBERT WERNER.

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

[The case came upon motion for preliminary injunction.]

BLATCHFORD, J.:

The letters patent sued on herein are reissue No. 3,000, 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 fluting 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 puffing. The portions of the rollers from between which the crinkled part of the finished fabric issues are plain, and so are the portions from between which the flattened parts of the finished fabric issue, while the portions of the rollers from between which the fluted parts of the finished fabric issue are grooved, so as to make grooves and flutes on each roller—a groove alternating with a flute, and the flute on one roller taking into the groove on the other. Each part of each roller is 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* Maudelbaum (8 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 detent 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 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 in King's machine, in all features that are essential to King's invention, as described and claimed, and the result in the finished fabric is the same. 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. H. Betts*, for complainant.
A. V. Briesen, 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 Neamann, 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. Schemerhorn, 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. Bodenhamer, 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 gasfitter'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 board 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 stright 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 Bilharz, 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 griping 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.

Business and Personal.

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

Notes & Queries

L. K. Y. will find directions for lacquering brass on p. 283, vol. 31. The Minotti battery is described on p. 26, vol. 32.—H. M. will find a full description of artesian well boring tools on p. 54, vol. 33.—A. F. 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. 163, 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 æolian 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. 395, vol. 32.—W. B. will find directions for making Pharoah's serpents on p. 315, vol. 32.—R. R. W. will find a full description of the Carré ice 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 23·5°. 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 ½ 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 unacquainted 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 guncotton 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) ½ drachm, olive oil (lukewarm) ¼ 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 ocher. 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 mixture 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 housewas 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. 386, 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 gasolin; 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, 1799, and in the United States to Richard French and J. T. Hawkins, May 17, 1803.

(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 lighting 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 ozs. 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 1½ 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 ¾, 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 gage 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 4½ horse power. 2. How much power is required to drive a 20 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 ⅜ and the heads $\frac{3}{16}$ inch, if of steel, or the shell $\frac{3}{16}$ and the heads $\frac{5}{10}$ 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 2½ 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 gage, 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 $\frac{3}{16}$ and the heads $\frac{5}{16}$ 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 telescopic 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 felting.

(44) L. K. Y. asks: How can I make gutta percha 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 (hydrocarburets) of organic origin. Chancourtois observes that the formation from a hydrocarburetted 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 carburetted 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 580° Fah., as otherwise a partial decomposition of the glycerin will take place. The distillate is next concentrated, and brought to the consistence 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 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 *anguillula 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.—Box 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 *phytocoris 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 nquiries 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.

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 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

FOR WHICH
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DESIGNS PATENTED.

8,495.—STEAM PUMP, ETC.—D. A. Burr, Philadelphia, Pa.
8,496.—GLASS VESSEL.—E. Finney, Philadelphia, Pa.
8,497.—CIGAR BOX.—F. Haehnel *et al.*, New Orleans, La.
8,498.—TOY BANK.—J. Hall, Watertown, Mass.
8,499 to 8,523.—CARPETS.—O. Heinigke, 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 8,534.—OIL CLOTH.—C. T. Meyer, Bergen, N. J.
8,535 to 8,545.—CARPETS.—E. S. Ney, Dracut, Mass.
8,546 to 8,549.—CARPETS.—J. H. Smith, Enfield, Conn.
8,550 to 8,553.—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
On issuing each original Patent	$20
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On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
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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. Fensem, Toronto, Ont. Hydraulic elevator. July 24, 1875.
5,026.—S. T. Waggoner, Mattson, 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. Peat 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. Rigby, Montreal, P. Q. Gas from petroleum. July 31, 1875.

Advertisements.

THE SCIENTIFIC AMERICAN

Circulation larger than that of all the weekly and monthly publications devoted to Science, Manufactures, Mechanics, Inventions, and Engineering combined, published on this Continent; therefore its value as an advertising medium cannot be over-estimated.

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JAMES W. HARRIS, Secretary.

NEW YORK STATE FAIR.

ELMIRA, SEPT. 27 TO OCT. 1, 1875.

RAILROAD TRANSPORTATION.

The Managers of the following Railways have, thus far, given consent to transport property for exhibition, free both ways, upon the usual conditions:

Erie Railway; Delaware, Lackawanna & Western; Albany & Susquehanna; Rensselaer & Saratoga; Northern Central; Southern Central; Greenwich & Johnsonville; Rome, Watertown & Ogdensburgh; Utica, Ithaca & Elmira; Troy & Boston; Ogdensburgh & Lake Champlain; Adirondack: Fonda, Johnstown & Gloversville.

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ENTRIES CLOSE AUGUST 28,

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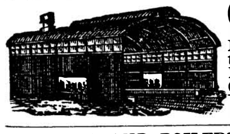

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