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IMPROVED MACHINE FOR UNLOADING GRAIN.

The apparatus illustrated in the annexed engraving is designed for use in connection with grain elevators or warehouses, and its object is to afford a speedy means of removing the grain from the cars in which the staple is transported. The device is claimed to effect a saving of from three to four fifths of the labor incident to unloading. The large scoop or shovel shown in the hands of the workmen in the car is provided near it lower edge with hooks, to which is attached the rope leading from the machine. The rope passes between the sheaves of a fair leader, A, the arms of which are hinged to a beam on the floor of the warehouse, so that, when the apparatus is not in use, the portion, A, may be placed in a vertical position or turned back out of the way. When the car comes alongside, the fair leader is turned down horizontally, as shown in the illustration.

B is a drum to which are connected the barrels on which wind the cord, C, and chain, D, and also the tappet disk, E, the whole being loose on the shaft to which power is applied by means of the belt pulley. To the right of the drum is a clutch, F, feathered to and revolving with the shaft. G is a pivoted bell crank lever, one arm of which embraces the clutch, F, while to the other arm the chain, D, and a rope, H, are secured; the latter passes over a pulley and down through the floor, and carries a weight. The cord, C, is also similarly arranged. As represented in the illustration, the operator is drawing back the shovel, the clutch, F, is now disengaged, the drum, B, revolves freely on the shaft so as to pay out the rope thereon, and the cord, C, is thus wound around its barrel; the chain, D, by the same motion is unwound, while the tappets on the disk, E, striking from below against the pallet, I, on the latch, J, lift the former as each tappet passes. When the workman has drawn the shovel back to any desired distance, he pushes the edge of the shovel into the grain and slightly slacks the drag rope; this allows the drum immediately to be rotated in the opposite direction by the action of the weight on the cord, C. The result is that, as the tappets on the disk, E, strike the pallet, I, from above, the latter no longer yields, but is carried down, thereby lifting the pivoted latch, J, and freeing the end of the lever, G; at the same time the chain, D, being unwound from its barrel, allows the weight attached to rope, H, to pull the end of the lever, G, outward, thus, as is evident, throwing the clutch, F, into gear with the drum, B. The drum now rotated by the belt wheel winds up its rope, and, in so doing, drags the scoop, guided by the workman, toward the edge of the car, and thus hauls a large quantity of grain out through the door. Meanwhile the chain, D, is being wound up, and its length is so adjusted that, when the shovel has reached the door of the car, the tightening of the chain pulls the end of the lever, G, inward, thus throwing the clutch out of gear; at the same time the latch, J, falls over the lever, as before, holding it in place, when the parts are once more in the position noted in the beginning of the description, and the same operation is repeated.

The main drum makes, we are informed, about fifty-five revolutions and winds up one hundred and forty-five feet of rope per minute, so that the unloading is accomplished very rapidly and with no other labor than that of the single hand guiding the scoop.

In large grain houses several machines may be employed upon one line shaft extending past a number of elevators, and, where necessary, the apparatus may be arranged overhead. Single machines, like the one illustrated, may be used, or double machines, enabling two workmen to operate in one car at the same time, as circumstances may require.

The device is in use in many of the largest elevators of the West, and, judging from the many commendatory testimonials submitted by the inventor, is a valuable labor-saving invention.

It was originally patented by Mr. E. M. Clark, in 1864, and has since had combined with it improvements patented by Mr. John Beattie, July 6, 1869.

MACHINE FOR UNLOADING GRAIN.

For further particulars, address Mr. T. L. Clark, Newark, Licking county, Ohio.

Electrical Gas Lighting.

One mode of lighting numerous gas jets is by the electric spark, which is the sudden passage of an electric current through an aeriform body, producing heat, light, and sound. The electricity that produces a spark is of very high tension —that is, it moves with much greater velocity than the ordinary current from a galvanic battery, and hence possesses peculiar powers. This high tension electricity is generated chiefly by friction and by "induction," or the influence from a passing current in an adjacent conductor. It has little quantity, but great penetrating power, and might be compared to a bullet shot from a rifle, if a galvanic current were likened to a large stone thrown by hand. In igniting coal gas by this means, the sparks leap between the points of two wires that are brought together, but do not touch, at the orifice of the burner. The heat of the spark is sufficient to cause the ignition of the gas when this is combined with the air, but if the spark points be entirely immersed in the pure gas, unmixed with atmospheric air, no inflammation will ensue when the spark passes, because pure coal gas is not an explosive compound, and a lighted candle introduced into an inverted jar full of such gas, is as effectually extinguished as if dipped into water. When the gas is mingled with a certain proportion of atmospheric air, or oxygen, it is readily and powerfully explosive.

The Late Sir Charles Fox.

During the forty-five years of his professional life, Sir Charles Fox was engaged upon works of magnitude in all parts of the world. As a manufacturer and contractor his works include the bridge over the Medway at Rochester; three bridges over the Thames at Barnes, Richmond, and Staines; the Shannon swing bridge; a bridge over the Saone at Lyons, and the Great Western Railway bridges. In roofs he executed those at the Paddington station, at the Waterloo station, and at the New street station, Birmingham, and slip roofs for several of the royal dockyards. In railways we find him engaged upon the Cork and Bandon, the Thames and Medway, the Portadown and Dungannon, the East Kent, the Lyons and Geneva (eastern section), the Macon and Geneva (eastern section), the Wiesbaden and the Zealand (Denmark) lines. He also constructed the Berlin water works, in conjunction with others. During his practice under the firm of Sir Charles Fox & Sons, he was engineer to the Queensland railways, the Cape Town railways, the Wynberg railway (Cape of Good Hope), the Toronto narrow gage railway, Canada, and, in conjunction with Mr. Berkley, to the Indian Tramway Company. In addition to these Sir Charles Fox & Sons were engineers to the comprehensive scheme of high level lines at Battersea for the London and Brighton, the London, Chatham, and Dover and the London and Southwestern railways, with the approach to the Victoria Station, Pimlico, including the widening of the Victoria railway bridge over the Thames. His two elder sons, Mr. Charles Douglas and Mr. Francis Fox, continue to carry on the firm of Sir Charles Fox & Sons, civil and consulting engineers, London. In personal character, Sir Charles was of a most urbane and generous disposition, and to few were these qualities better known, and by none were they better appreciated, than by those—now to be found in all parts of the world—who have been at one time or other in his employ. Sir Charles was highly esteemed by a large circle of friends, by whom the sad news of his decease, which took place on the 14th of last June, was received with no ordinary sentiment of regret.—*Engineering.*

A CORRESPONDENT, Mr. E. P. S., writes from Pskow, Russia, to inform our readers that the Mennonites, who are coming to this country in such large numbers, are not leaving home on account of any religious intolerance, but merely to avoid compulsory military service, from which they were exempt till the emancipation of the serfs abolished the inequality.

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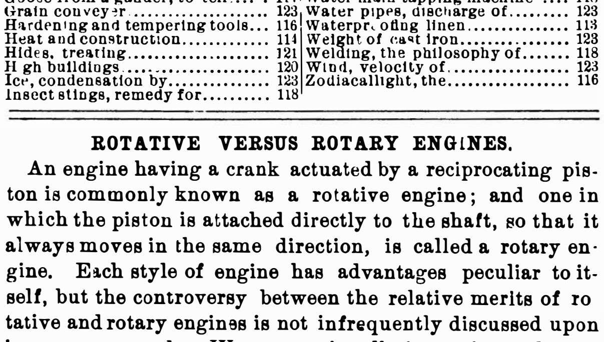
Contents:

(Illustrated articles are marked with an asterisk.)

ROTATIVE VERSUS ROTARY ENGINES.

An engine having a crank actuated by a reciprocating piston is commonly known as a rotative engine; and one in which the piston is attached directly to the shaft, so that it always moves in the same direction, is called a rotary engine. Each style of engine has advantages peculiar to itself, but the controversy between the relative merits of rotative and rotary engines is not infrequently discussed upon improper grounds. We are continually in receipt of letters of the same general tenor as the one which lies before us at present, in which the writer asks: "What percentage of power is claimed to be lost in a steam engine by the piston movement, and what is the probable percentage which would be gained by rotary motion?" Our readers are doubtless ignorant of the frequency with which these queries are sent to us. Our object, in this article, is to give a general answer on this subject. We have no idea of opening our columns to discussion on the supposed loss of power in the crank, any more than to arguments of perpetual motion or methods of squaring the circle. But there are numerous points of interest in the theory of the crank, and thorough explanations are only to be found in works which are inaccessible to many of our readers. Hence it may be well to devote a little space to the consideration of these points; and first we will endeavor to state with all fairness the argument of those who contend that there is a loss of power in the use of the crank as applied to the steam engine with the reciprocating piston.



Let the circle, B G H, represent the path described by the center of the crank pin, in one revolution of the engine; let C B be the direction of the crank, and A B, the direction of the connecting rod, at some given point of the stroke. The pressure on the piston is transmitted through the connecting rod to the crank pin at B, and may be represented in quantity and direction by the line, B D. But the only part of this force which can produce motion in the crank is that which acts tangentially to the circle at B, or perpendicularly to the crank, B C. This can be represented graphically by resolving the force, B D, into its components perpendicular and parallel to B C, by the principle of the parallelogram of forces; and this being done, it appears that B E, less than B D, represents the part of the force on the piston that tends to move the crank, while the component, B F, acting in the direction of the crank, is apparently lost, as it has no effect in causing motion. Suppose, for instance, that the angle, B A I, between the connecting rod and the guides, is 30°, and that the pressure on the piston is 100 pounds. Then the force tending to move the crank is found (by multiplying the pressure on the piston by the cosine of 30°) to be only 86·6 pounds. At other points of the stroke, the effective pressure on the crank pin will be much less, being reduced to nothing when the direction of the connecting rod passes through the point, C, or when the crank is on the center; and the only point in which the effective pressure on the crank pin is equal to the pressure on the piston is that for which the connecting rod is perpendicular to the crank. Taking the mean of the effective pressures on the crank for successive points, it will be found that, if the mean pressure on the piston during a stroke is 100 pounds, the mean effective pressure on the crank pin will be 63 66 pounds. Hence, say those who insist that there is a loss of power in the crank, we have a loss of 36·34 per cent in a rotative engine, as compared with a rotary engine of the same dimensions. This, we believe, is a fair statement of the argument usually advanced by opponents of the crank, and as far as the facts are concerned they are correct; it is only the conclusion to which we demur. We will now present our argument, based on these same facts. An examination of the connecting rod, of an engine in motion, will show that the two ends pass over different spaces in a given time. If, for instance, in one stroke, the end of the connecting rod that is attached to the crosshead moves through one foot, the end which is attached to the crank pin, and makes half a revolution in the same time, passes through 1·5708 feet. Now power is something more than mere force or pressure; it is force acting through space. Suppose that an engine is placed with its crank on the center, and steam is admitted: no motion will be produced, and consequently there will be no power developed, and no expenditure of steam. But let the piston make a stroke: the power exerted is equal to the force or pressure acting on the piston multiplied by the space passed through, or it will be 100 foot pounds, assuming the data of the preceding instance. During the same time, the crank pin has passed through a space of 1·5708 feet, and the force or pressure exerted has been 63·66 pounds, so that the power exerted during this time, or the product of 1 5708 multiplied by 63 66 pounds, is 100 foot pounds. Hence there is no loss of power in the use of the crank, in theory, all the power exerted on the piston being imparted to the crank. The reader who has pursued this discussion attentively will probably be able to detect the fallacy in the argument of the opponents of the crank. It consists in confounding power and pressure, forgetting that a small force exerted over a great distance in a given time may develope as much power as a large force exerted over a small distance in the same time.

In practice, it is to be expected that the friction of the working parts will absorb some of the power exerted by the piston. Mr. Scott Russell, in his "Treatise on the Steam Engine," gives, as the result of some careful experiments on rotative engines, that the work done amounted to 90 per cent of the power exerted by the pistons. It may be added that this book contains an excellent discussion of the theory of the crank, as well as a careful comparison of the relative merits of rotative and rotary engines.

Another stumbling block in the way of many is the fact that the motion of the piston is continually stopped at the end of a stroke, preparatory to the commencement of a stroke in the opposite direction. But it should be remembered that while one end of the connecting rod is subject to this reciprocating motion, the other end has a rotary motion, always in the same direction. Now it will be found by observation that all single rotative engines are provided with heavy parts, such as fly wheel, disk cranks, and counterweights, which also have a rotary motion when the piston is in action. These heavy parts acquire energy during the stroke to continue the motion past the centers, where the pressure on the piston produces no effective pressure on the crank pin; and it would be easy to show, did space permit, that, by proper attention to the proportion and arrangement of these heavy parts, all trouble arising from what are known as dead points can be overcome. Indeed, most of our readers must have noticed that this trouble is only imaginary, and does not exist in practice in the case of a well designed rotative engine.

Our readers must not conclude from the foregoing remarks that we intend to induce inventors to give up designing rotary engines; we only wish to place the matter in its true light. If a practical rotary engine can be produced, one that can compete successfully with our best rotative engines in regard to economy and durability, the advantages of lightness, compactness, and capability of high piston speed are so important as to render its success almost certain. We only wish to dissent from the opinion that, other things being equal, the rotary engine is better than the rotative because the latter applies the power by means of a crank, thereby occasioning a loss, since this is not a fact.

THE FABRICATION OF ANTIQUES.

Apparently the most thriving branch of manufacture in the East is the production of pretended relics of the past, gems, coins, statues, ornaments, arms, written documents, everything that archæologists can desire being turned out in quantity to meet the liveliest demand, and so skillfully done that the expertest judges find it difficult to detect the fraud. One of the most successful manufactories in Constantinople is devoted entirely to the fabrication of coins of the time of Constantine and his mother, to be palmed off on collectors and tourists by confederate dealers who profess to obtain them from workmen engaged in pulling down old houses. A Greek monk in Athens drives a busy trade in spurious Greek coins, their composition regulated by such profound numismatic knowledge that much learning and great technical experience are required to distinguish them from genuine antiques. Equal adroitness is displayed in getting rid of his productions, which are never offered for sale in Athens, though it is known that they are sent by special emissaries to Constantinople and others of the larger capitals of Europe. The most successful agents, however, are herdsmen and shepherds of the provinces, who find a ready market among tourists and scientific explorers.

Spurious Mahommedan coins and gems are manufactured throughout the East, particularly in Persia, with surprising skill and boldness. A coppersmith in Shiraz is said to be able to supply anything of the sort—genuine, of course—that the traveling connoisseur may desire, as much as forty ducats having been paid him for a silver coin made in his own manufactory to represent one struck for the Khalif Ali. Bagdad sends forth gems on which Sassanian busts and Pehlevi inscriptions are reproduced with masterly skill; their only drawback is the fact that the characters, though admirably done, never admit of being reduced to legible words, much less to sense. The Byzantine coins made at Constantinople have the same failing. Dr. Mordtmann, who exposes these nefarious practices at great length in communications to a German paper, asserts—as evidence of the grave dimensions of the evil and the skill with which even experts are defrauded—that the great part of a large collection recently purchased in the East by no less a connoisseur than the Count de Gobineau, and described by him in the *Revue Archæologique*, consists of modern and spurious stones and medals. One of the stones bears an inscription of two words in Pehlevi characters, in which modern Persian, modern Greek, and Mohammedan elements are blended to form a pretended antique! Others of the stones and tablets are flagrantly evident copies of well known rock carvings in Asia Minor.

Special warning is given against a spurious gem fabricated by Persians and now offered for sale in Constantinople for the modest sum of 2,000 francs. The fraud is betrayed by the inscription, which, though handsomely cut, is only a bit of artistic patchwork. The recent swindling of the Berlin Academy by a Greek forger, and the reported purchase of a lot of well made Bagdad "antiquities" by the British Museum for $10,000, are proof enough that the warning is not uncalled for.

METEOROLOGICAL AND MEDICAL STATISTICS.

A Boston scientist has observed that a diminution of atmospheric pressure, indicated by a low state of the mercurial column of the barometer, not only increases largely the gases set free by putrefactive fermentation, but even causes such gases to be evolved in localities otherwise considered healthy, often manifesting their presence by a nauseating odor in the best portions of cities like New York or Boston. This discovery may be unexpected by some persons; but it is not by others, who are aware that a similar effect of diminished atmospheric pressure is experienced in mines. Evolutions of explosive or suffocating gases are always more common when the barometer is low; while the evolution is stopped, and even the gases filling some galleries in the mines will disappear, when the mercury in the barometer ascends. The increased atmospheric pressure which causes the rise in the mercurial column prevents the expansion of the gases in the subterranean caves and crevices, and may in some localities, favorably situated for the effect, press the gas from the mining gallery or shaft back again into the recesses whence it was evolved by diminished pressure. All this explains the reason why explosions in mines seldom or never take place when the barometer is high, but usually when it is low; whence some mining masters always recommend special care in regard to the use of safety lamps, etc., when the mercury is descending; and at very low states of the barometer, they even stop the working in certain galleries of dangerous mines altogether.

We see then how dangers may increase from changes in natural conditions. A change in atmospheric pressure, which here is the inducing cause, is not an isolated illustration of this class. Local changes in gravitation, for instance, will also result in the production of unusual phenomena: such local changes are constantly being brought about by the moon, as seen in the ocean tide wave. When at new moon, the combined attraction of both sun and moon, acting in the same direction, diminishes the regular terrestrial gravitation in a certain locality; and when to this diminished gravitation, a diminished atmospheric pressure adds its influence, the terrestrial crust is more easily ruptured, and volcanic gases escape, especially in localities where its weight is scarcely sufficient to resist the upward pressure of the liquid or gaseous material confined under the solid shell which constitutes the terrestrial envelope. It has indeed been observed, in volcanic countries, that eruptions and earthquakes more commonly occur at new moon, and they are especially most common when, at the same time, the barometer—that is, the atmospheric pressure—is low.

That diseases like yellow fever, typhoid fever, fever and ague, consumption, etc., are more common in certain defined regions, and that some of these are confined within given belts of low, moist countries, and that they are comparatively unknown in certain dry, elevated plateaus, situated at from 5 000 to 10,000 feet above the surface of the ocean, proves that emanations produced by excess of moisture are powerful helps for the engendering of miasma; while a change of wind has often had the most striking effect in arresting the virulence of an epidemic.

KITE TAILS AND TELEGRAPH WIRES.

To keep the telegraph lines free from entangling alliances in a city like New York is no easy task, and the chief of sinners in this respect is the small boy's kite tail. As though presuming on the service to telegraphy rendered by one of their class in the hands of Franklin, these playthings —of future Franklins, let us hope—are incessantly taking liberties with the wires, breaking thereby their own continuity, and endangering the continuity of the messages the wires are intended to convey. To assist the kite tails in this mischievous work, naughty boys tie stones to strings and strips of cloth, and then sling them so that they wind round the wires, and suspend the stones—a perpetual menace to passers underneath. In this way the wires in many neighborhoods are made to resemble the limbs of an African prayer tree, with its burden of rags, tags, and strings hung on by pious wayfarers.

The effect is not ornamental, nor does it add to the efficiency of the wires, especially on rainy days. At almost any moment on the side streets you may see the telegraph men climbing the poles to remove the strings, or reaching for the nuisances with long rods like stout fishpoles, which they twist among the strings until they are firmly attached, then by main strength strip them from the wires, sometimes at imminent risk of the integrity of the wires and their attachments. We never see the operation without wondering at its clumsiness. Why not burn the strings? It would be an easy matter to attach a light to the end of a slender bamboo pole, so that the flame could be slid along under the wire, charring any string or rag it might encounter, thus dislodging the snarls that are so hard to remove by force. The light could be hung, if need be, so as not to touch the wire or in any way interfere with the transmission of messages. A simple hook, or a grooved wheel at the top of the pole, would enable the apparatus to run along the wire so that it would be no trouble to guide it.

INFLUENCE OF THE EARTH'S FIGURE ON GEOLOGIC CHANGES.

The slow oscillation of portions of the earth's surface, now above, now below, the mean level of the sea, has long been recognized as an occasion of geologic changes, with their attendant alterations of climate and consequent successions of living forms. The cause of such oscillations has never been satisfactorily explained. The latest hypothesis comes from the Canadian geologist, H. Y. Hind, who shrewdly suggests that it may be due to the wavelike movement of the equatorial bulge which gives the earth the figure of a squeezed orange.

The reader may not be familiar with the fact—which has been established but a short time, comparatively—that the equatorial circumference of the earth is not a circle, but an ellipse, the diameter which pierces the earth from long. 14° 23′ E. to 194° 23′ E. of Greenwich being a little more than two miles longer than the diameter at right angles thereto. This gives on each side of the earth an equatorial ridge fully a mile high, which may have been much greater in earlier geologic epochs, when the crust of the earth was in a more plastic condition.

It is scarcely possible that this element of the earth's figure should form an exception to the universal rule of change, and be immovable. In case it does move, its influence would be felt on the elevation and depression of land, especially near the equator; on the simultaneous elevation and depression on opposite sides of the earth; on ocean currents, consequently on climate, etc.; on the thickening and thinning of formations to the east and west; on the flow of rivers, hence on river and lake terraces, beaches, etc. The geology of North America tallies singularly well with the effects of such a cause. The successive risings and sinkings of the continent appear to have always taken place very gradually and with a progressive motion from west to east and from east to west, as though produced by a vast equatorial undulation, moving, with extreme slowness, eastward at one epoch, westward at another.

The latest evidences of this great earth wave are seen in the stupendous escarpments which rear their wall-like fronts above the Ontario, Red River, and Saskatchewan plains, and in the symmetrical terraces and lake beaches so largely developed throughout the northern part of the continent. Mr. Hind looks to it, also, to account, in part at least, for the changes which diverted the water of the Great Lakes to the eastward, sending their drainage into the Gulf of St. Lawrence, instead of the Gulf of Mexico whither it originally flowed, leaving their ancient outlets southward to be filled with drift from 200 to 600 feet in depth.

Should corresponding effects be observed on the southern slope of the "bulge," and also on the opposite side of the earth during the same geologic periods, it is possible that geologists may find in the movements of this (now hypothetical) undulation the measure of time which they have been so long in want of.

OUR SIX LEGGED RIVALS.

It is a remarkable circumstance that those creatures which mimic man most nearly in mental and social development should be not his nearest allies among the vertebrates, but members of an entirely different order. It is something more than remarkable that they should stand to their order —the articulata—precisely in the same relation that man bears to the order with which he is classed.

Though surpassed in every detail of physical accomplishment by his subordinates, man nevertheless excels them all in intellectual power and capacity for self-improvement. Similarly our six legged rivals, though the least of the articulates, are first in grade of development, surpassing the next below them—the bees and the wasps—as man surpasses the lower mammalia. This in itself is not surprising; but it does surprise one to see them excelling the higher vertebrates also, and pressing hard upon man's prerogative.

Accustomed to find brain power associated with and measurably related to brain bulk, it is simply astounding to discover a few microscopic specks of nerve pulp—the ant's cerebral ganglia—harboring a degree of intelligence such as the infinitely more bulky brain of man alone gives evidence of.

We have printed a good deal of late in regard to the manners and customs of these interesting creatures, and think the facts will warrant the position we have taken.

The question is not one of difference between undeveloped reason and a high order of instinct, but of difference between instinct and instinct, reason and reason. In the first, which we are too apt to consider an attribute peculiar to the lower forms of life, the ant might possibly be accounted our superior. But ants also reason, profit by experience, make a judicious use of new means for the accomplishing of new ends or the overcoming of new obstacles, and in many ways exhibit a degree of quickwittedness and intelligence which we may look long for among many tribes of man.

The completeness and complexity of the social organization of ant communities, the magnitude and variety of the works which they plan and execute, the perfection of their military and industrial discipline, the evident scope and flexibility of their language, their sympathetic regard for each other in times of distress or danger, their forethought and calculation, have been celebrated by every observer of insects from Solomon to Belt; and the more they are studied the more do their various civilizations and the motives which animate the members surprise and delight us.

Now we see them roaming about as independent warriors or hunters—formic Ishmaelites or Indians—fierce, vindictive, self-reliant, and marvelously fertile in tricks and traps for the securing of their prey. Again they appear in organized armies, nomadic swarms without settled habitation, like the Tartar hordes of Gengis Khan, marching from conquest to conquest, sweeping all before them. Others are pastoral in their habits and more or less permanent in their habitations. In temperate regions they rear and maintain, on suitable plants, herds of honey yielding aphides and beetles, which they tend with assiduous care, transporting them from pasture to pasture, and defending them from their enemies and the elements as zealously as the shepherd does his sheep; in the tropics the same kind offices are performed for domesticated scale insects and leafhoppers, in return for the honey-like secretions they emit. Some constitute themselves standing armies for the defence of plants which yield them subsistance directly or by affording pasturage for their cattle. Others are a scourge to plant life, gathering leaves by wholesale to make hot beds for the cultivation of fungi in underground chambers.

The harvesting ant—which provideth her meat in the summer and gathereth her food in the harvest—has been proverbial for thrifty wisdom, certainly since Solomon commended her ways to the sluggard: how much longer, we have no means of telling. Had the wise man enlarged upon the way some of her kind have learned to secure plenty without labor by the enslaving of others—the raiding ants of our correspondent in Arkansas are probably given to the practice—his advice would doubtless have been more highly appreciated by lazy humanity, too many of whom have hit upon the same expedient without the help of revelation.

But wiser than the common harvesting ants are the agricultural ants of Western Texas—the only Simon Pure and original Grangers—who have solved the transportation problem, by bringing not the grain but the grain fields to market. They have learned—possibly through the gradual desiccation of that now almost desert region—that chance productions are but a precarious support in a climate like theirs, so they surround their communities with fields of rice grass, which they protect by killing all rival growths, and in due season harvest their crops, doing all by well timed and concerted labor. Could there be a happier illustration of that ideal state of organized industry and mutual helpfulness, which philosophers have dreamed of and enthusiasts labored for since Plato planned his Republic? As in Sir Thomas Moore's Utopia (reading ant for man), every ant has a right to everything; and they do know that, if care is taken to keep the public stores full, no private ant can want anything; for among them there is no unequal distribution, so that no ant is poor or in any necessity; and though no ant has anything, yet they are all rich.

We have seen how all the common attributes of mankind are mimicked by these six legged rivals of ours, to a degree unapproached by any other class of animals. But man, we are told, has a faculty higher than thrift, higher than fellow feeling, higher even than reason. It is the faculty of reverence, the basis of religion, whether manifested in the fetichism of the Fantee or the faith of the Christian. This the theologians are wont to declare is shared by no other terrestrial creature. But here comes the French observer M. Lespés, with a story which disturbs our sole remaining ground for pride of peculiarity, raising the suspicion that ants too may have a religion!

In the nests of certain ants, and nowhere else, there is found a species of blind beetles which appear to be entirely dependent on their voluntary guardians for food and shelter, yet make no material return for the kindly services they enjoy. To complicate the matter, some of the communities of this species of ants are found to be destitute of beetles, which they greedily devour the moment the beetles are exposed to them. On the contrary when the beetles are placed near the nests of the communities which possess them, they are straightway fed and cared for most tenderly, and defended as resolutely as the ants defend their own young. Clearly the strongest of natural instincts, appetite, is somehow restrained in the case of these little keepers of asylums for the blind. What is the restraining influence?

Similar conduct on the part of a tribe of men would be unhesitatingly attributed to a rude sort of religious feeling; and Sir John Lubbock wonders whether something of the kind may not actuate these ants, whether they do not regard their helpless though relatively gigantic wards with a feeling akin to reverence. Is it possible that they have arrived at a stage of development parallel with that of the beetle-worshipping Egyptians?

In our pride of bulk, we despise the ants for their littleness. But suppose they were as big as horses, proportionately strong for their size, as thoroughly organized and as intelligent as they now are, where would we be?

SMALL ENGINES AND BOILERS.

A cursory examination of the correspondents' column of the SCIENTIFIC AMERICAN will show that many of our readers are building model engines and boilers. We endeavor, as questions in regard to their proper construction arise from time to time, to give useful hints; but in the limited space devoted to the answers, we have not been able to treat the subject as fully as seemed desirable. We have, however, taken note of the various points arising in connection with this subject, and it is our intention, at an early day, to give some general directions and rules for the proportions of small engines and boilers. Many of our readers can render us valuable aid in preparing a complete article on the subject, and we feel confident that they will be glad to help us, when the way is pointed out.

We desire to receive accounts of the performance of small engines and boilers, embracing the following data:

Description and dimensions of boilers, manner of setting, and means adopted for heating the water. Size and description of engine, pressure of steam, number of revolution, and work performed. Amount of water evaporated by the boiler per hour, expressed in cubic inches or cubic feet, also temperature of the feed. We hope that those of our readers who have small engines will take note of our request, and let us hear from them as soon as possible.

SCIENTIFIC AND PRACTICAL INFORMATION.

EFFECTS OF TORPEDOES.

Experiments are now being conducted at Cherbourg, France, in order to determine the effects of submarine torpedoes. An apparatus charged with 3,300 lbs. powder was sunk to a depth of 50 feet. On explosion a column of water 500 feet in hight was thrown into the air, and a hulk anchored at a distance of 18 feet from the spot was broken completely in two. The earth at the bottom was torn up, making a hole 40 feet in diameter and about 5 feet deep.

NEW GLAZING FOR POTTERY.

A kind of lead glazing is used upon common pottery, the employment of which often causes cases of lead poisoning among the workmen. M. Constantin, of Brest, France, has recently devised a substitute which is said to be much superior and to possess the hardness and inalterability of glass. He uses silicate of soda, pulverized quartz, chalk, and a small proportion of borax. This glazing may be colored green by copper and brown or violet by manganese. It is already coming into use in many of the largest French potteries.

WATERPROOFING LINEN.

Professor Kuhr gives the following directions for this purpose: Pass the linen first through a bath of one part of sulphate of alumina in ten parts of water, then through a soap bath, of which the soap is prepared by boiling one part of light colored rosin and one of crystallized carbonate of soda with ten parts of water until the rosin is dissolved. The rosin soap thus formed is to be separated by the addition of one third of common salt. In the soap bath the rosin soap is dissolved, together with one part of soda soap, by boiling it in 30 parts of water. From this bath pass the articles fixally through water, then dry, and calender. Made-up articles may be brushed with the solutions in succession and be rinsed in the rain. Wooden vessels may be employed.

A COMPOUND ENGINE ROCK DRILL.

M. Jules Garnier, according to the *Revue Industrielle*, has lately devised a modification of the compound engine which he employs with great success in connection with rock drills. In M. Garnier's engine, the two cylinders are placed end to end and the two pistons are attached to the same rod. Two slide valves are so arranged that one serves to admit live steam to the small cylinder, while the other distributes the steam directly from the latter to the large cylinder. By this means the steam does not become condensed in passages or reservoirs between the two cylinders, and hence power is economized.

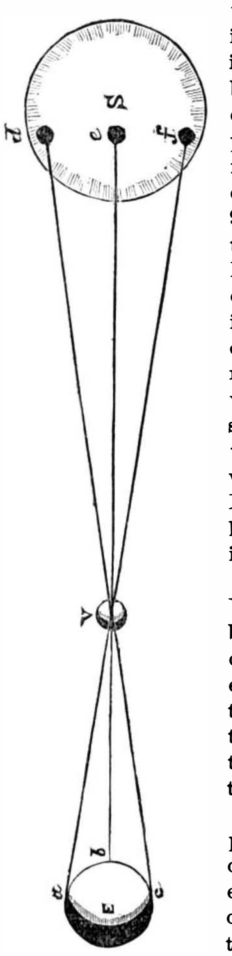
The inventor adapts this arrangement to drills which operate by compressed air. Ordinarily air at full force is used to drive the drill into the rock, and a second supply is needed to lift the tool back, the latter operation, of course, not requiring so much power as the down stroke. M. Garnier uses the air directly from the compressor to give his powerful stroke, and then exhausts it into a larger cylinder and uses it over again to lift the drill back. The single piston rod is retained working through the partition between the two cylinders. Further details of the machine, which will convey an accurate idea of its construction, will be looked for with interest.

THE TRANSIT OF VENUS.

On the 9th of December, 1874, the planet Venus will pass between the earth and the sun, and will appear as a round black spot traveling across the sun's face. This phenomenon is what is meant by the transit of Venus, and it is expected that by its careful observation data will be obtained by which, generally speaking, we shall be able to measure the distances of the heavenly bodies, their weight, and their dimensions.

As matters now stand, our knowledge of the celestial world in the above respect is not exact, although a scale of measurement has been approximately constructed. The last observed transit of Venus, which took place in 1769, gave us data on which our ideas of celestial distances are now based. But errors have been discovered in the observations, owing, perhaps, to the primitive instruments used. For example, the sun's distance, then estimated at about 92,000,000 miles, is now believed to be at least 500,000 miles too great. Naturally, the finding of such serious errors has caused great anxiety in the scientific world to make the coming observations perfectly accurate, and hence the transit will be watched with the greatest care by some two hundred observers, stationed in seventy different places where it will be visible: that is, in Northern India, Australia, New Zealand, Mauritius, Japan, etc., but not in the United States.

Fig. 1.

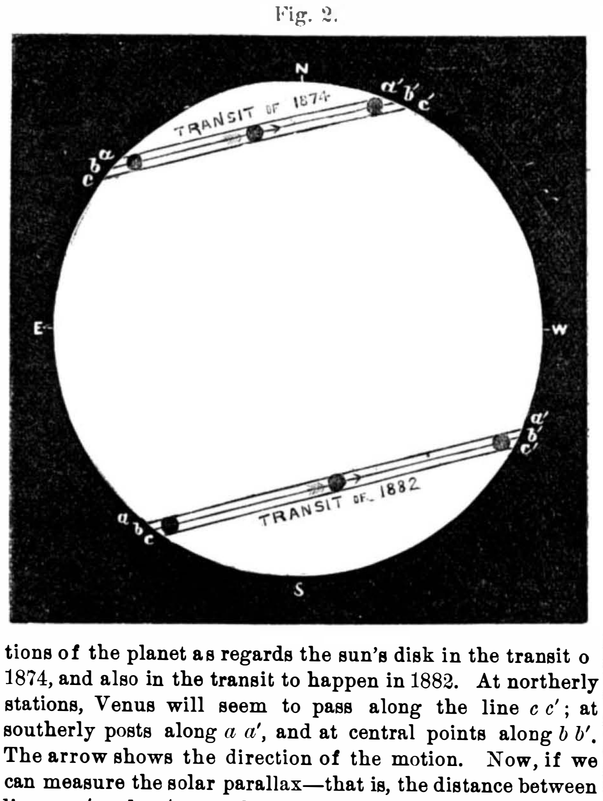


Now by means of the transit of Venus, it is expected that we shall be able accurately to measure the distance between the sun and our earth; and with this gage once established, it will be a very easy matter to apply it to the spaces between the orbits of all the other bodies of the solar system.

The most direct and valuable practical result of the determination of the sun's distance is that which enables us to tell the exact attraction of the sun for the moon, and hence to predict the motions of our satellite. Our lunar tables, by the aid of which we can determine longitude, will then be rendered, instead of approximately, absolutely correct. The result will be that the moon will become not only our nocturnal luminary, but a reliable clock, from which the astronomer or navigator can read the time with certain accuracy.

When Venus crosses the sun's face, the observers on opposite sides of the earth will see the planet on different points of the sun's disk. This will be clear from Fig. 1, where S is the sun, E the earth. If three observers, stationed at *a*, *b*, and *c* on the earth, note the transit at the same time, to the first the planet will appear to be at *f*, to the second at *e*, and to the third at *d*. In our second figure are shown the positions of the planet as regards the sun's disk in the transit o 1874, and also in the transit to happen in 1882. At northerly stations, Venus will seem to pass along the line *c c'*; at southerly posts along *a a'*, and at central points along *b b'*. The arrow shows the direction of the motion. Now, if we can measure the solar parallax—that is, the distance between lines *a a'* and *c c'*—we shall know the angle subtended by any known distance on the earth's surface at the distance of the sun, and hence be given the necessary means for the trigonometrical solution of the triangles, and the determination of the sun's distance.

Fig. 2.



To find this distance, various ways will be used. Observers stationed in both northern and southern hemispheres will measure the lines *a a'* and *c c'*. This gives the length of two chords of a circle, from which it will not be difficult to find the distance between them. This is called Halley's method. Then another way is for two observers, widely separated, to note the exact time when the planet enters and leaves the sun's disk. The difference in the hour and minute recorded will show what effect the separation of the observers has on the apparent position of the planet. This is the principle of Delisle's plan. Besides this, the sun will be photographed, and the positions of the black spot as seen from different places can be afterwards compared. A new instrument, called the heliometer, will also be used to measure directly the distance of the black spot from the edge of the bright circle of the sun.

It is generally admitted that the United States has shouldered the most difficult share of the work, not only in appropriating the largest sum, but in accepting the most difficult stations. Of the latter our astronomers take eight—three in the northern hemisphere and five in the southern. The former are at Wladewostock, Yokohama, and in Northern China, the latter at New Zealand, Tasmania, and Chatham Island on the east, and Macdonald Island and the Crozets on the west. Our expeditions rely chiefly on Halley's and the photographic methods, but Delisle's and the direct plans will also doubtless be availed of. The whole transit will be visible at all the stations. We have already noted the departure of the Swatara, and of the various parties to their distant posts.

All the English expeditions, excepting one, which goes to Alexandria, in Northern India, in October, are already *en route*. They are stationed at Oahu and at Rodenck's and Falkland Islands.

The Germans send four parties to Falkland, McDonnell's, and Kerguelen Islands, in the southern hemisphere. France sends five expeditions—two to Northern China, one to Japan, one to Campbell Island, and one to St. Paul's Island. Russia has twenty-five stations in Siberia. Besides these national preparations, a number of private observations will be taken by parties under Lord Lindsay at Mauritius, and at the observatories of Madras, Capetown, etc.

Heat and its Relation to Construction.

The present extensive use of iron in building operations necessitates the careful consideration by architects of the molecular changes which that metal undergoes, owing to changes of temperature, and the consequent effect of the same upon the structure. It is well known that a powerful conflagration, occurring in an iron edifice, warps and twists the walls and facings to such an extent as to necessitate their prompt destruction; while a like casualty, taking place even in a brick building in which iron beams and girders are employed, is often apt to expand the metal so greatly that walls are dragged out of place and thrown down. Cases have also occurred in which, owing to careless construction, summer heat and winter frosts have caused serious deterioration in iron fronts and have necessitated alterations and the application of strengthening devices, involving considerable trouble and expenditure.

The *Building News* of recent date contains a carefully prepared article on heat and its relation to construction, which embodies several useful hints and suggestions.

It is somewhat surprising, says our contemporary, that architects and engineers so frequently neglect this expansibility of metal in girders, ribs, columns, etc., and provide no means for their free movement. Sometimes, it is true, the bearings of long girders in bridges are made of sufficient depth to allow for this increase of length; but even in these cases the mere weight of iron and superincumbent loads upon the points of support render the intended result nugatory, the weight of the iron girder alone often creating so much friction on the bearing surfaces as to overcome the rigidity of the supporting piers or walls, or the cohesion of mortar at certain points. This immovability of the ends of iron girders and joists is often increased by their being clenched or fixed by the weight of wall above, which often improperly is allowed to bear upon the top flanges.

To obviate this, some engineers have contrived movable bearings, more or less effective. One simple method we would suggest. Let each template be of cast iron of sufficient substance and bearing surface, and let it be placed upon an under template of stone or metal, the surfaces being either left smooth simply or brought into contact by a friction roller, of small diameter and of the length of the bearing surface. By this means free dilatation could take place, provided, of course, the ends of girders are left a free space of sufficient distance. No weight should be allowed to rest upon the ends of these beams, but in all cases the bearings should be free all round, and may be made as cast iron sockets, built into the wall, or standing out independently.

The linear expansion a bar of iron undergoes when heated from the freezing to the boiling point, or from 32° to 212° Fah., is about one 812th of its length; at higher temperatures, the elongation becomes more rapid. Thus the progressive dilatation of wrought iron, as determined by Daniell's pyrometer, allowing one million parts at 62°, is as follows:

At 212°.	At 662°.	At fusing point.
1,000,984	1,004,483	1,018,378

Cast iron is rather less.

It may be mentioned here, that the expansions of volume and surface are calculated by taking the linear expansion as the unit, following a geometrical law; thus the superficial expansion is twice the linear, and the cubic expansion three times the linear.

These figures show how sensible a change takes place when iron undergoes an ordinary variation of temperature; and it may be said that in all ordinary cases of building this change is quite sufficient to cause serious disruptions of parts. Thus a bar or beam of even 10 feet long and subject to an ordinary change of temperature, say from 32° to 180°, will elongate more than ⅛ of an inch—a sufficient modicum to cause fracture in stonework, to snap the thread of a screw, or to endanger a bridge floor or roof truss. When we think of lengths ten and even a hundred times this dimension, the danger of uncompensated expansion or contraction is increased a thousand fold. In ordinary cases, the margin of safety is really dependent upon the amount of flexibility or elasticity of the parts of a building connected with iron, or to imperfection of joints; yet we should not rest satisfied with such presumptive security.

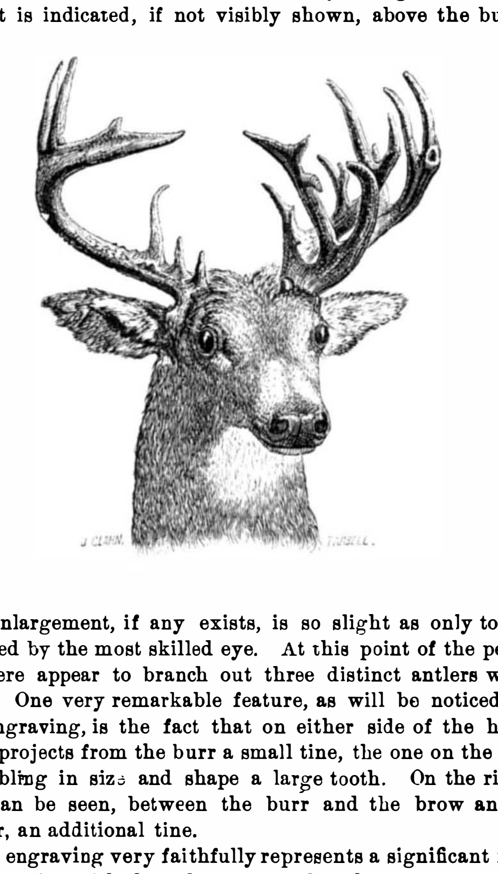
It would appear that the most promising mode of using iron is in combining it with concrete, brickwork, and other materials; but it appears to us such a combination would be still more advantageous if the iron were completely imbedded or encased in such materials.

It appears that there are some substances particularly bad conductors of heat; such are brick earth, composed of a variety of bodies, and porous: porcelain, asbestos, pumicestone, charcoal, sand, etc. These substances are, in fact, such bad conductors that a red hot iron ball may be held some time in the hand if it be first coated with one of them. Such materials offer themselves as coverings for iron girders, columns, etc., and we do not see why compound materials of a porous kind, as animal charcoal and plaster, should not be applied to such iron work *in situ* by first filleting the girder or column, or surrounding it with a perforated plating of thin earthenware or metal on which to lay the coating, which could be run as molded work or finished ornamentally. A lining or casing of such materials, molded to the form of the iron to be protected, could also easily be prepared in cast blocks, rebated or grooved together, the external facing being molded to any section.

Animal charcoal should be one of the ingredients in the compound used, as it is one of the worst known conductors. Fire clay lumps could be well treated in this manner, or plastering—which materials have been suggested lately by recent English experiments which proved that iron protected with fire clay can withstand a fierce heat and yet remain uninjured in its elasticity, while the brick arching and concrete backing can resist any amount of heat likely to occur. We think, if an air space were left between such casing and the iron, it would provide a still more effectual barrier, though a few perforations would be required in the casing to allow the heated and expanded air to escape. If, also, brick earth mixed with charcoal were used, a still more effectual non-conducting casing would be obtained, and the iron would be comparatively preserved at a moderate temperature. By thus encasing a good conductor of heat in a bad one, the evils of expansion and contraction are avoided, or considerably lessened, and we are thus left the advantage of using in our construction a material which may aptly be called a "good servant but a bad master."

A FOUR-ANTLERED DEER'S HEAD.

The *American Sportsman* publishes a description of a remarkable specimen of the deer (*cervus Virginianus*), the head of which carries four antlers, three on one side and one on the other. The editor of our contemporary gave the head a critical examination, and found that the antlers are located in their natural positions, having a total number of twenty-one tines—eight on one side and thirteen on the other. To the casual observer, no deformity at the base of either is perceptible, although a minute examination and strict measurement would reveal a slight variation in diameter at the extreme base. If there is any enlargement, however, it is indicated, if not visibly shown, above the burr.



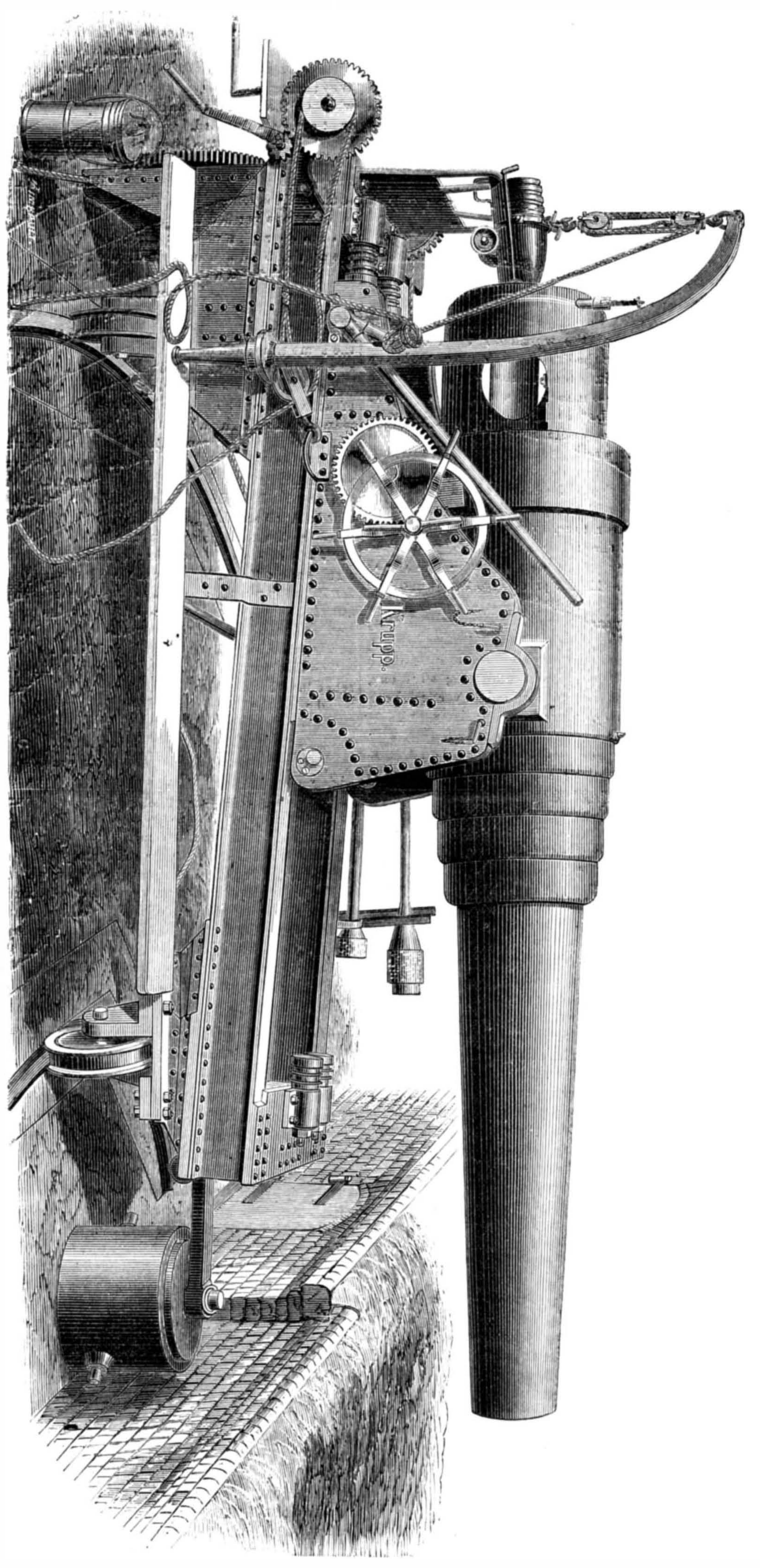
The enlargement, if any exists, is so slight as only to be detected by the most skilled eye. At this point of the pedicel there appear to branch out three distinct antlers with tines. One very remarkable feature, as will be noticed in the engraving, is the fact that on either side of the head there projects from the burr a small tine, the one on the left resembling in size and shape a large tooth. On the right side can be seen, between the burr and the brow antler proper, an additional tine.

The engraving very faithfully represents a significant fact in connection with these horns, namely: the extreme points of the brow antlers curve naturally toward each other, while in other species they are quite erect.

TO AVOID explosions with hydrogen generators, adapt a safety jet made of disks of wire gauze placed in the delivery tube between plugs of cotton wool.

MODERN GERMAN ARTILLERY.

Our engraving represents a 10 inch 22 tun cast steel gun, manufactured by Krupp, the celebrated founder of Essen, Prussia, and now in use in the German artillery service for coast defence. The arm is made of two layers of rings or hoops over the barrel, and fires a shell of 423 pounds, with a charge of 66 pounds of powder, at 1,200 yards, through an 8 inch armor plate. The illustration shows the gun mounted in a sea fort, and resting on a thick bed of concrete so as to fire over an earth breastwork 40 feet thick, the muzzle of the piece being 7 feet above the platform. A tramway, not shown in the engraving, runs behind the guns upon the terreplain, upon which trucks loaded with projectiles, after being hoisted up from the casemate below the gun platforms by means of a hydraulic lift, carry the required ammunition to the battery. The trucks are so high that the projectiles can be rolled from them direct upon the platform, where two davits with tackles receive them and lift them up to the breech. In the engraving a shell is shown just entering. The arrangements are said to be so perfect that six men are sufficient to fight a 10 inch gun, and for a long time can fire once every 1½ minutes, or about 40 rounds per hour.



THE KRUPP 10 INCH CANNON.

NEW GEOLOGICAL DISCOVERY.

During the recent voyage of the Challenger, a discovery has been made, the significance of which must strike every one who gives the matter even a passing thought; but to those who possess a knowledge of chemistry or geology this discovery is of peculiar interest.

In sailing from Teneriffe, off the west coast of Africa, to St. Thomas, one of the outlying West Indian islands, the soundings indicated that the bottom of the Atlantic rose into a ridge about 300 miles west of Teneriffe, and that from that, where the depth was 1,500 fathoms, it sloped gently down until, at 750 miles west of Teneriffe, it had sunk to a depth of 2,950 fathoms. From this point to within 300 miles of Sombrero, the depth was pretty constant, and for 1,800 miles the explorers seem to have been sailing over what geologists term a plain of marine denudation.

A remarkable relationship was found to subsist between the depth and the character of the dredgings. When worked on the 1,500 fathom ridge, the dredge brought up *globigerina* ooze, multitudes of minute shells, and fragments of coral, the whole, with the exception of a few silicious sponges, being composed mainly of carbonate of lime. As the depth increased, the proportion of these shells regularly diminished, until in the deep water they had altogether disappeared, and the dredgings then consisted of a fine, red mud which did not effervesce with acid. This red colored deposit of the silicates of peroxide of iron and alumina was met with everywhere all over this vast submarine plain; everywhere it had the same unmistakable appearance; it could not, therefore, be the fine sediment brought down by rivers and carried out to sea, slowly settling in deep water, for then it must have differed in different localities; the absence of currents, too, as well as the great extent of the deposit, precluded this view of the origin. Another remarkable feature of this area was the absence of those pelagic shells which are littered in such numbers over all other parts of the bed of the Atlantic.

How, then, was this gradual disappearance of shell to be accounted for? Why was it that on this red mud area the shells of those animals that frequent surface waters were not found, since, when these creatures die, their shells must inevitably fall to the bottom? Whence came this enormous accumulation of impalpable clay?

Air dissolved by water is richer in oxygen and carbonic acid than the air of the atmosphere. The ratio of the carbonic acid to the total amount of dissolved gases is greater in water taken from a depth than in surface water.

If, to the depth of 3,000 fathoms, the amount of carbonic acid keeps on increasing, relatively to the other dissolved gases, in a ratio at all comparable with that indicated by the foregoing analyses, it is easy to see that the water at this depth, under such enormous pressure, must be capable of dissolving a large quantity of those solid substances which, like carbonate of lime, are soluble in water containing carbonic acid. It is clear, too, on account of both the pressure and the amount of carbonic acid being less, that water near the surface must possess a much feebler solvent power than water at a great depth. This being the case, we should expect to find more lime-secreting organisms in the shallower than in the deeper parts of the ocean; now, as has been seen, this is exactly what was found by the explorers in the Challenger.

Under these circumstances, Professor Thomson concludes that this vast deposit of fine red clay is neither more nor less than the insoluble portion of myriads of shells, the residue, in fact, of a chalk formation now dissolved.

It appears then that, just as the higher regions of the Alps or the Andes are buried beneath a pall of eternal snow, so the higher regions of the sea bed are covered by a layer of grayish white ooze, prolific in organisms whose vacated shells will one day form chalk; and just as at the edge of the snow sheet the glacier melts away into a liquid, ocean-seeking stream, so, where the chalky covering of the sea bottom descends into submarine valleys, it descends into ocean, leaving behind it the red mud, like a terminal or bottom moraine.

Suppose, now, that a geologist should come across an ancient ocean bed, undisturbed by volcanic eruptions and undefaced by denudation: he would expect to find, on the higher levels, chalk or limestone of some sort, and, as he descended into the lower plains, that the rocks would gradually lose their calcareous character, passing from chalk to argillaceous limestone, from that to a calciferous slate, and finally into slate containing no lime whatever.

There is every reason to believe that the fine red clay accumulation is but incipient slate rock.

If, then, the great bulk of these rocks be removed from the category of mechanically formed, into that of chemically formed, or of organic, rocks, it will appear that geologists have been in the habit of underestimating the importance of organic processes as geological agents. We will no longer be able to affirm with confidence, of a single grain of the commonest materials found on the earth's surface, that it has not at one time or other been associated with the manifestation of those mysterious forces which we call living. Our globe therefore resolves itself into a great charnel house or mausoleum. Man has been called a plagiarism from oxen and sheep; but his house, whether it be of mud or of marble, is equally a plagiarism from the deserted dwellings of the invertebrata.

The tendency of modern geology has been to break down the well marked divisions into which the older geologists were wont to parcel out past time. The old notion, which in some measure still clings to the terms Devonian, carboniferous, cretaceous, etc., was that of a distinct period in the history of the earth. Each of these epochs was conceived to have begun and closed before the succeeding era began. In this way the world was believed to have passed through so many stages, in each of which only rocks belonging to that particular formation were deposited anywhere on the earth's surface. Thus, all the rocks of the gneiss were thought to have been formed before the lowest of the Cambrian began to be laid down; similarly with the succeeding silurian and Devonian systems. Now, however, these terms are used without reference to time, and we think of systems, widely separated according to the old method, being formed simultaneously. The chalk age was formerly supposed to have come to an end at a period long prior to man's appearance on the earth, but the researches of Carpenter, Thomson, Huxley, and others have established the "continuity of the chalk," and shown that a fauna, very similar to, if not identical with, that of the chalk, inhabits the Atlantic at the present day. The discovery of this red clay seems to point to the continuity of those ages when slate rocks were supposed to have attained a maximum, that is,of the Cambrian and silurian formations.

Chalk deposits and coral reefs are, by a process of metamorphosis, converted into crystalline limestone, and by the action of sea water even into dolomite. Granite and other so called primitive rocks have been shown to be in many cases only metamorphosed sedimentary strata, so that we are unable to say in what particular line the recurring cycles of geological operations began; nor, on this account, can we assert, except in the case of species which have become extinct, that the fauna of any preceding differed from that of the present age.

When this red clay comes to be slate, the only traces of life it can exhibit will be derived from silica-secreting organisms of a low type, like those doubtful appearances in older slate rocks which have been described as fossils. It is therefore altogether unwarrantable to regard this low type as the sole, or even prevailing, form of life during the time when these rocks were formed; nevertheless, there have not been wanting supporters of this view.

For aught, then, that geology can say, while the oldest rocks of Britain were being laid down in 3,000 fathoms of water, far away silurian man may have been cultivating vines on the fertile slopes that flanked the volcanoes of the period.—*A. S. Wilson.*

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

It has been with no inconsiderable degree of interest that I have read Mr. Joshua Rose's several papers, published in your recent issues, treating on machinists' tools and their treatment in forging and tempering for specific purposes. He prefaces his remarks on tool hardening, in his fourth paper (in your issue of July 11), with the remark: "The degree to which a tool may be hardened is dependent in a great measure on its shape;" and he states what particular shapes or forms of tool require special treatment, in forging and tempering, to render them of maximum utility. With very great clearness, he sets forth the practice of lowering the degrees of hardness by watching the hue assumed by the polished surface of the tool that had been immersed in water at a "moderate red" after it had been reheated, or allowing that part of the tool that had not been immersed to impart its heat to the part that had been immersed to "draw the temper," or obtain the required degree of hardness or tenacity: while in other specific cases, he states that tools require to be "as hard as fire and water can make them." His several papers have evinced considerable practical knowledge, and he evidently writes his experience with great perspicacity.

I would not now have obtruded upon you had I not noticed, in your issue antedated August 1, a communication from Mr. John T. Hawkins, in which he makes an extract from one of a series of lectures he had delivered to the engineer class at the Annapolis Naval Academy, in 1868. "It is safe," he had stated in this lecture, "to say that a cutting tool cannot be too hard for any purpose whatever, so long as the edge will not crumble or break up. "Mr. Rose, in his paper, says: "It is undoubtedly advantageous to make the tool as hard as it can be made, so long as it will bear the strain of the cut," and enumerates the several steels (with the makers' names) capable of such treatment. Mr. Rose, treating his subject in quite a masterly manner, states that tools for particular kinds of work require to be "as hard as fire and water can make them," while the temper of others, for other special service, should be "lowered in temper" (hardness) "to a light straw color, which leaves them stronger than they would be if hardened right out," that is, changing the condition of the tool by sudden immersion and allowing the tool to remain in the fluid until cold or of a temperature equal to that of the fluid, for he also states (and correctly) that the "chill should be taken off the water." Mr. Rose is evidently giving the result of his experience, for the benefit of those who have not had the varied experience he evinces in his papers on tools and their treatment under the elements of fire and water. His language is plain; he makes the object of his investigation speak, as it were, in its own language.

Steel or iron, immersed in water at a "moderate red" or white heat, hardens. In this Mr. Rose and Mr. Hawkins are agreed; but Mr. Hawkins states that Mr. Rose makes his "greatest oversight" in the final operation of drawing the temper, and adds that to "give simply a certain color to a tool is the least of what is required to be known or observed." By whatever chemical action or cause the various hues appear, that guide the operative in tempering tools, it is doubtless a natural law or sequence, and, as such, is subject to conditions. The different hues will appear, faster or slower, which alike are subject to conditions of degrees of temperature at which they commence to evolve, rapidly at high, and gradually at low, temperatures, to produce what Mr. Hawkins calls "films of oxide."

I have failed to see where Mr. Rose has made his greatest oversight. Mr. Rose states: "While he who has been accustomed to the use of tools properly forged and hardened right out, upon entering another shop where the tools are overheated in forging and underhardened to compensate for it, finding he cannot," etc. Mr. Hawkins says: "If a tool be dipped at the lowest temperature at which it will harden at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn at all."

Here the gentlemen in question evidently mean the same thing, namely, that low temperatures are best for tempering tools. Each seems to regard the color evolved during the process of tempering tools as important. Still while Mr. Rose speaks of positive colors, Mr. Hawkins treats of conditions. Mr. Rose treats things as they are and as they appear to every observer, and advises the easiest means to the end. Mr. Hawkins writes of films of oxide and conditions necessary to produce them, as if they were negative or absent. Mr. Rose, on the contrary, mentions them as ever present and attendant upon the operative for him to avail himself of.

Many tool dressers there are who regard the hues evolved in the process of drawing the temper as the steel maker or iron maker does those evolved or emitted by the spectroscope, while watching to shut off the blast at the proper instant of time; and it seems that the hues evolved in tempering tools is so regarded by Mr. Rose. The hues will appear sooner in a thin piece of metal having the same temperature as that of a thick one; but these differ in hardness or tenacity if immersed at the same instant of time. A thin piece of metal will harden more thoroughly than a thick one and will differ in degrees of hardness. I hope that you may deem my criticism worthy of a place in your paper.

Trenton, N. Y. JUAN PATTISON, C. E.

Steam Cars.

To the Editor of the Scientific American:

Some months ago I referred to a short line of three feet gage railway which was then being put in operation between Worcester and Shrewsbury; and since that time I have watched with much interest the working of the steam cars which have been running on the line. On account of the heavy grades, one hundred and sixty feet to the mile, it has been a pretty severe trial for these machines, and they have stood the test remarkably well; but I think that a slight modification in their construction would render them far more durable and efficient. It was demonstrated practically and in a most thorough manner, seventy years ago, that the steam engine was applicable to the hardest kind of locomotive work. Where Oliver Evans propelled his mud scow, weighing sixteen or eighteen tuns, over the sand, from his shops along the bank of the Schuylkill, a distance of some two miles, by the power of its own engine—which was about five horse—it was sufficient proof that the thing was quite feasible.

During these seventy years since that exploit of Evans, the thing has been verified in every possible way; locomotives have been constructed in every conceivable form: with boilers vertical, horizontal, and both combined; with one, two, three, and four cylinders; with cylinders vertical, horizontal, and slanting, with cylinders placed inside as well as outside of the boiler, with cylinders of unequal size, with cranks between and outside of the drivers, etc. And the result of all this long and costly experience is our present locomotive, an ideal at once of simplicity, symmetry, beauty, and efficiency; and it certainly seems that a model which is the outgrowth of such an ordeal, and which has proved so so eminently satisfactory and efficient for the whole of the immense railroad work of the world, ought to be more of a guide for those who are engaged in making steam cars and traction engines for whatever purpo e of locomotion.

The great efficiency of our present locomotive is doubtless chiefly due to its boiler. It seems to be the only plan which possesses so perfectly all of the qualities needed for locomotive work. It is simple, compact, accessible for repairs, has vast generating power; all of its parts exposed to intense heat are deeply covered with water, and, of course, it may be constructed of any desired strength. Its center of gravity is low, and this part is an important item in the construction of all locomotive engines.

I believe that if makers of steam cars or traction engines of any kind would adopt precisely this type of boiler for the foundation of their machines, and then make and correct their running gear in as thorough and symmetrical a manner as is the practice of our best locomotive builders, we should see far better results in this line of engineering. The common upright boiler, though an excellent boiler for certain uses, is unsuitable for first class locomotives. If made short, the tops of the tubes are too much affected by the intense heat required to maintain the 120 or 150 lbs. to the square inch, which is necessary to do the work; if made long, the center of gravity is too high; if made with an annular steam chamber above the top of the tubes of sufficient capacity, this also brings the center of gravity too high, and also renders the top of the tubes unhandy for repairs. In either case the boiler lacks generating power.

I have much confidence, as a matter of economy, in the idea of making the cylinders of locomotives of unequal capacity, say in the proportion of three or four to one, the small cylinder exhausting into the large one through a superheater, but so arranged that direct steam may be used in both cylinders whenever an exigency requires. Our present locomotives might be easily arranged in this way without affecting their style at all. In passenger and express work especially, considerable economy would doubtless result from this change. F. G. WOODWARD.

The Zodiacal Light.

To the Editor of the Scientific American:

The erroneous assertions made by one of your correspondents (page 371 of the number for June 13), in regard to the zodiacal light, ought not to remain uncorrected. He says: "The zodiacal light is not on two sides of the sun, neither is it all around the sun; but, on the contrary, it is ever on one side of the sun only, his hinder side, if you will," etc. This error proceeds from the fact that he judges only from its appearance in our latitude, where we see this phenomenon distinctly only in April and May after sundown, and in October and November before sunrise. If this were the case over the whole earth, his assertion might have some foundation; but as in the southern hemisphere it is not visible at the periods stated, but only distinctly seen in April and May before sunrise, and in October and November after sunset (exactly at the very times that it is invisible in our northern hemisphere), the assertion that it is only at one side of the sun falls to the ground.

Between the tropics this phenomenon shows itself the whole year round, every morning and evening, with great splendor. Humboldt states, in his "Cosmos," that in the highlands of South America he watched it morning and evening, and observed that it sometimes varied in brilliancy, and often equaled in luminosity the brightest spots of the Milky Way; sometimes it was weaker, but it was always there, whether the observer was on land, or on the mountain tops, or at sea, on shipboard.

Some account of the latest observations between the tropics were furnished by Chaplain Jones, of the United States Navy, who observed it in the years 1856–57 from the elevated equatorial region in which the city of Quito is situated. His observations verified the fact that the light is entirely confined to the region of the zodiac; that it was very strong in the central band and broadly diffused at the sides, where it it gradually faded away; however, a boundary line between the stronger and weaker portions was quite distinct.

He not only saw the light every night, but at midnight at both sides of the horizon, in the east and in the west at the same time; and during favorably clear nights, it extended as a broad, luminous arch over the zenith, entirely from one horizon to the other, having a pale white luster, and a breadth of about 30°.

In high northern and southern latitudes it is never visible, as the ecliptic is too much inclined to the horizon: in the temperate zone, it is only visible in those periods of the year in which the zodiac is as nearly perpendicular to the horizon as possible. In the northern hemisphere, this is the case in April and May, at evening, and in October and November, at morning; and in the southern hemisphere, the cases are reversed. At other seasons, our atmosphere obstructs the diffused light from reaching our eyes, as it is too far from the zenith, and this is the sole reason that we do not see it always, as is the case between the tropics. In December, however, it may be faintly observed, both morning and evening, even in the latitude of New Jersey.

The discovery of Professor Wright that it is caused by the reflection of solar light from solid meteoric material, combined with the above observations, proves that this zone of meteors extends beyond the earth's orbit, and that the earth moves among them. It is certain that they revolve around the sun, so as to counterbalance solar gravitation, and it is highly probable that, in regard to their orbits and velocity, they are subject to Kepler's laws. In the course of ages, their mutual gravitation causes some of them to combine, and so their number must diminish; while also, from time to time, the earth, Mars, Venus, and Mercury appropriate others of them. In regard to our earth, at least, we know that the fall of meteorites is not a very uncommon occurrence. It is probable that our whole planetary system has been made up in this way, and that the different belts of meteors, the zodiacal light, the asteroids, etc, constitute what there is now left of the material from which sun and planets were primitively formed by the action of universal gravitation.

New York city. P. H. VANDER WEYDE.

The Business Outlook.

In a time of drouth, it is safe to predict rain, because we know that in the economy of Nature there is an inevitable law of reaction; and in a period of business depression, we known that it cannot always last, because the elements exist which are certain to bring about renewed activity. These elements are manifest and visible all around us. The great staple products of grain and cotton, to say nothing of other crops which promise an abundant yield, will in a few weeks add untold millions to the wealth of the nation. There is midsummer stagnation now, and dullness prevails in all departments of trade and manufacture; but is it rational to suppose that the crops now maturing are to be gathered in to rot in warehouses, that exchanges and consumption will cease, the reduced stocks of general merchandize remain unreplenished, and the accumulation of unemployed capital wait in vain for profitable investment, and all because a few railroads have been built on speculation, and have come to grief for the lack of capital and earnings to meet their obligations? We admit there is a present want of confidence in railroad securities which ties up capital and keeps it in abeyance; but it is a significant sign that, notwithstanding the Wisconsin imbroglio and the record of embarrassment and bankruptcy of the past eight months, choice securities are more in demand and command better prices than before the panic. The movement of the crops which must soon begin will give employment to capital and also to the roads; confidence will gradually be restored, the machinery of trade set in motion, and the activity thus inaugurated will be legitimate and lasting. The crippled roads will gradually get upon a better basis; and with the natural development and increase of traffic, there is no reason to doubt that existing lines will be improved, and new ones constructed wherever they are really required. If this is a rose colored view of the situation, not justified by present appearances and indications, then the history of previous revulsions in trade and business is no criterion by which to judge, and any speculation in regard to the future is of no avail.—*National Car Builder*

Concrete as a Building Material.

In a paper lately read before the British Association of Gas Managers, by Mr. J. Douglas, of Portsea, upon the subject of making gas tanks of concrete, he presents the following information: "At the London Exhibition of 1851 it was found that a beam of pure Portland cement 14 inches long and 4 inches square, fixed at one end, bore 1,580 lbs. at the other, which is about half the strength of Riga fir. The reduction in strength by mixture with sand was the subject of experiment this year by Mr. Lamb, of Newcastle on Tyne, who found the following remarkable results.

	Pure. lbs.	1 cement and 1 sand. lbs.	1 cement and 2 sand. lbs.	1 cement and 4 sand. lbs.
7 days	830	550	375	77
112 days	1,065	859	580	224
Inciease per cent	36	55	60	200

The inference he draws from these figures is that, seeing that pure cement at 7 days is ten times the strength of mortar containing one cement and four sand, and at 112 days is only five times the strength, there is good reason to believe the process continues till there is very close approximation. In corroboration of this, Mr. Colson, of the Portsmouth Dockyard Extension Works, who has tested within the last few years about 80,000 tuns of cement, has furnished me with the following figures respecting the relative strength of pure cement and one cement to two sand

	Pure cement. lbs.	Increase per cent.	1 cement and 2 sand. lbs.	Increase. per cent.
6 months	1,200	....	246	....
12 months	1,400	16·6	404	64·2
3 years	1,600	33·3	1,174	377·2

These are extraordinary results, no doubt, but they are the average of many tests, and most of us will be able to appreciate them when we remember with what difficulty a piece of brick and cement mortar in the above proportions can be broken; frequently the brick gives way before the cement joint. I have at this moment a slab of concrete, 10 feet by 8 feet 6 inches and 12 inches deep, in all 85 square feet, bearing 6 cwt. to the square foot without any appreciable strain. On the other hand, the resistance of Portland cement concrete to compression is greater than that of any of our best building materials. At nine months old, the comparison stands thus, upon a block showing 40 inches of surface:

Portland stone	47 tuns.
Fire brick	50 "
York landing	96 "
Portland cement	120 "

Experiments were made by Mr. B. P. Smith, the well known engineer, for Mr. Hawkshaw, prior to determining the foundation of the Spithead forts; so that, whether for resistance to crushing weight or to tensile strain, Portland cement concrete is stronger than any other ordinary materials.

Chemical and Galvanic Action upon Teeth.

Dr. S. B. Palmer, of Syracuse, N. Y., publishes in *Johnston's Dental Miscellany* an interesting paper on chemical and galvanic action upon the teeth and the material used for their preservation. The author appears to have conducted extended original investigations into this curious and important subject, the results of which will be found below, condensed from the article above mentioned. He considers that chemical action and the electric current stand in the same relation to each other as do electricity and magnetism—inseparable. This brings us to consider the action of the force upon the teeth. We adopt the theory that chemical action, which results in the disorganization of the teeth, is stimulated generally by acids. An investigation of the constituents of tooth bone and its surroundings warrants such conclusions, and numerous recorded experiments attest the same. Calcium, magnesium, and sodium are ingredients of dentine; the saliva in which teeth are bathed is usually alkaline; the calculi which become attached to the teeth are also of the same nature, having no chemical action upon the bone or dentine. Having decided that these agents are acids, how do they find their way to the mouth?

Chemically speaking, the oral cavity is an electro-chemical cell and laboratory, in which Nature employs certain forces, that act by laws as inflexible as Nature herself. Mechanical force for crushing and pulverizing is furnished in mastication; heat and moisture are not wanting to facilitate fermentation.

Saliva contains chloride of sodium and soda; galvanic currents decompose this compound, the chlorine unites with the hydrogen derived from the water of the saliva, and hydrochloric acid is the result. We have sent the current from two cells of Daniell's battery through litmus paper wet with saliva, and been able to write, in acid, characters with the copper wire forming one pole of the battery. Hydrochloric acid is the result of decomposition of saliva by the current. The singular combinations of nitrogen and oxygen as satisfactorily explain the manner in which nitric acid finds its way to the teeth. Abundant material is furnished in the lodgment of meat fiber, rich with nitrogen, also in other articles of food that are permitted to decompose between the teeth.

The galvanometer teaches that the filling and tooth in which it is inserted, or an approximate tooth, are sufficient for two elements, the saliva of food forming the third; or, by union, a more complex current may be established. We take gold foil as a unit, or negative element for our experiments; with it and tin, we make a test and pronounce tin positive to gold, or, in chemical language, it is an *electrolyte*, a substance that is oxydized, or, if a compound, that is decomposed. We find tooth bone, also an electrolyte, or positive; the gold will remain a negative. Between the tooth and the gold, the action of the needle will be slight; between the tin and gold, very great. The tenth part of a grain of each will deflect the needle fifteen or twenty degrees. Tooth bone and tin foil are both below the gold, and both positive to gold, therefore electrically nearer to each other than either is to gold. The trial of tin and the teeth shows but a slight difference, the tin occupying the place of gold, still throwing the action and consumption on the side of the tooth.

Substitute alkali for acid, and the current is reversed; the bone now occupies the negative, and the tin the element oxydized. There is less galvanic action between tin foil and tooth bone, than between gold and tooth bone. In other words, a loose porous tin filling would be better in a tooth than a gold one in the same condition. If the saliva be alkaline, the tin might be blackened and wasted away, while this action would throw the tooth into the electro-negative condition to be preserved. In an acid saliva the tin would be oxidized upon the surface, and by that means form an insoluble compound to greatly lessen further action.

Gold, being so far superior to tooth bone, throws the latter into positive relations with itself, be it in a poorly applied plug, or in approximation to another tooth, or in a clasp for the support of an artificial denture. In the latter case we need not look for base solder to prompt the action. The only remedies to correct the evils that arise from this source are cleanliness and perfect filling. A gold filling so imperfect as to show discolor will in time enlarge the cavity.

A tooth containing an amalgam plug has in it the elements of a minute yet intense battery, capable of decomposing not only the plug, but the tooth around it; this is in accordance with a law of chemical affinity. The moisture in the tooth bone is sufficient to communicate the current which exists in the plug, to the tooth, and thus enlarge the cavity, or diminish the plug, or both.

The galvanometer shows that the intensity of a current between two elements in a battery increases as the metals approach each other, inversely as the square of the distance from one to four. In the amalgam, the elements are in the nearest possible relations. The smallest possible particle of gold and tin or amalgam, even the dust that may be taken from separating files used for those metals, shows decided action, by turning the needle. On separating the elements a short distance, no action is perceived. Thus minute surfaces, excited in close proximity, equal larger ones at a distance. Again, a current, if very feeble, continued for a long time, is equivalent to an intense one for a short period.

In view of the above statement, the importance of thorough amalgamation of the compound, and cleanliness of the mouth, cannot be ignored. Amalgam should be resorted to, as the physician resorts to other mercurials, to arrest a violent and threatening disease. A tooth, that would be speedily lost without it, is a proper tooth to be preserved by it.

Iron Dams.

The Elmira *Gazette* urges a new departure in the method of constructing dams. It says:

Masonry is but a little better than earthwork when opposed by rushing water. What is needed, it seems to us, is material which will not crumble or break up when attacked by rushing water. A dam might be constructed with a frame work of iron, held by subterranean guys anchored beyond the reach of the water. The foundation could be planted in a rock bed, or, in the absence of rock, against a system of piling, so as to be absolutely immovable. Thus strength would be attained. By planking the iron frame and covering the latter with earth or cement, tightness would be secured. This system would achieve one end, at least. In case of a break in the dam, no disaster could follow to the region below, because only a small portion would give way and the water would escape comparatively slowly. The anchor could be so disposed as to render complete giving-way impossible, or at least improbable. The matter of cost, and the process of rendering the iron durable as against rust, are matters for engineers and iron makers to consider. We believe that, for dams as well as bridges, iron is destined to come into use.

[We have no doubt, as the *Gazette* suggests, that dams of almost absolute security could be made of iron. The only difficulty is the expense. The interest on the outlay would in many cases pay or nearly pay for the fuel required to produce an amount of steam power equal to the water power furnished by the iron dam.—EDS.]

How to Tell a Goose from a Gander.

In sorting out a flock of geese for home breeding or to make sales, it is often difficult to distinguish the males from the females. A correspondent of the *Farmers' Home Journal*, Ky., thus delineates the difference:

"The goose has always a feminine appearance and the gander the opposite. Her head is smaller and her beak shorter; knot on forehead smaller and not so pointed; her neck shorter and more delicate; the black streak on back of neck not so high; colored ring around head not so bright; her neck comes out of her body more abruptly (this is occasioned by her having a larger breast than the gander), giving a square appearance to the body. The voice of the gander is keener and louder; coloring about head more brilliant; eyes keener and always on the lookout. With such marks plain to view, any practical gooseman can readily distinguish one from the other."

THE British steamer Tagus is now taking on board, at the Jersey City wharf, opposite New York, ten large locomotives, built at the Grant locomotive works, Paterson, N. J. They are for a Russian railway and are to be delivered at Taganrog, on the Sea of Azof. They are said to be splendid examples of American mechanism

New Theory Comets.

The following novel theory of comets is proposed by a correspondent of *Iron*: "Comets are supposed to consist of thin vapors of gases, held together by the mutual attraction of their particles. Like all bodies so circumstanced, they necessarily assume the spherical form; and therefore the common notion, that they consist of a comparatively small and bright nucleus and an immensely long and illuminated tail, evidently derived from their appearance in the heavens, cannot for a moment be entertained. That their spherical form, as shown by the reflected light of the sun, would scarcely be discernible at the distance of our earth, even though the comet were as dense as the densest cloud of our atmosphere, would not be surprising; but if their attenuation, as described by Sir John Herschel, be considered, all wonder ceases. Sir John Herschel says 'that the most unsubstantial clouds, which float in the highest regions of our atmosphere and seem at sunset to be drenched in light and to glow throughout their whole depth as if in actual ignition, without any shadow or dark side, must be looked upon as dense and massive bodies compared with the filmy and all but spiritual texture of a comet.' Owing to this extreme tenuity of matter, the rays of the sun's light, as reflected by it, are absolutely invisible to the inhabitants of the earth; but the other rays, penetrating into the center of the comet, are refracted by this powerful lens of twenty millions of leagues diameter into the focus which forms the nucleus of the comet, where there is, perhaps, a greater concentration of rays of light than anywhere else, not in the body of the sun. Hence this large body of concentrated light, streaming in a narrow path through the remaining half of the comet, in a direction opposite to the sun, forms that splendid appendage called the tail.

It seems scarcely necessary to point out that this mode of viewing a comet accounts for the circumstance of the tail being always in opposition to the sun, whether in advancing or receding. Also for the wonderful celerity shown by the tail in turning round the sun when the comet is in perihelion, and for the rapidity with which the comet darts out its tail after the perihelion passage. It explains, also, on the principle of the aberration of light, the bend which the tail of some comets have towards the region they have left, also the absence of a solid nucleus, and the non-obscuration of the stars by the body of the comet. If the conjecture be correct that the nucleus of a comet is near its center, and that the comet extends in every direction round the nucleus to as great a distance, at least, as the length of the tail, then it follows that at this present moment the sun is feasting on our comet, and that when it emerges from his embraces, a few days hence, it will have suffered some diminution of size."

Coating Cast Iron with Copper.

The Society of Forges and Founderies of Val d'Osne has recently opened in Paris an exposition of their curious products, consisting of objects of art in cast iron, some of considerable volume, which are covered with copper by the Gaudoin process. This operation admits of the deposition of copper upon cast iron without necessitating any previous coating of the latter. The difficulty of accomplishing this has been the scouring of the iron, the baths of chemicals hitherto used being incapable of thoroughly cleaning the metal. M. Gaudoin has found that very acid solutions are necessary to remove the oxides of iron which escape the scouring; but at the same time the acids do not attack the subjacent metal. Such a solution acts continually on the points upon which the copper is not deposited, and ends by dissolving the oxides and allowing the deposition to take place. A large number of organic acids have been found suitable for the purpose. The oxalates of copper combined with the quadri-oxalates of soda are said to give excellent results. An electric current is employed to secure the fixing of a thick layer of copper.

Moles.

W. S. N. says: "On page 50 of your current volume, you have an item about moles; and I would like to give you my experience with them this spring. I planted some sweet corn in the garden very early; and after waiting longer than the proper time for it to come up, I examined it to see what the cause was, and found that a mole had taken every grain in four rows of corn, across a garden three fourths of a square acre, not only once, but two more plantings after the first. On the rear end of my farm, in a piece of "new ground," they finished half of an eight acre field. I would like to know what Monsieur Flourens would say to that? The negroes in this section always plant several hills of caster oil beans in their gardens to keep the moles out."

Powdering Camphor.

G. T. Eberts, in the *Pharmacist*, says that the methods and suggestions for powdering camphor and retaining this refractory body in its powdered state, have not alone been numerous but curious.

Glycerin is the simplest and most efficient substance to keep camphor in a finely divided state. Take camphor 5 ounces, alcohol 5 fl. drachms, glycerin 1 fl. drachm. Mix the glycerin with the alcohol and triturate it with the camphor until reduced to a fine powder.

FRENCH RAILWAY CARS.—Some of the double deck cars which are quite common upon French roads, exhibit a most extraordinarily small proportion of dead weight. One on exhibition at Vienna, with a capacity of 90 persons, weighed only 11 75 tuns. Freight cars weighing but 10,000 lbs. carry 20,000 or even as much as 30,000 pounds.

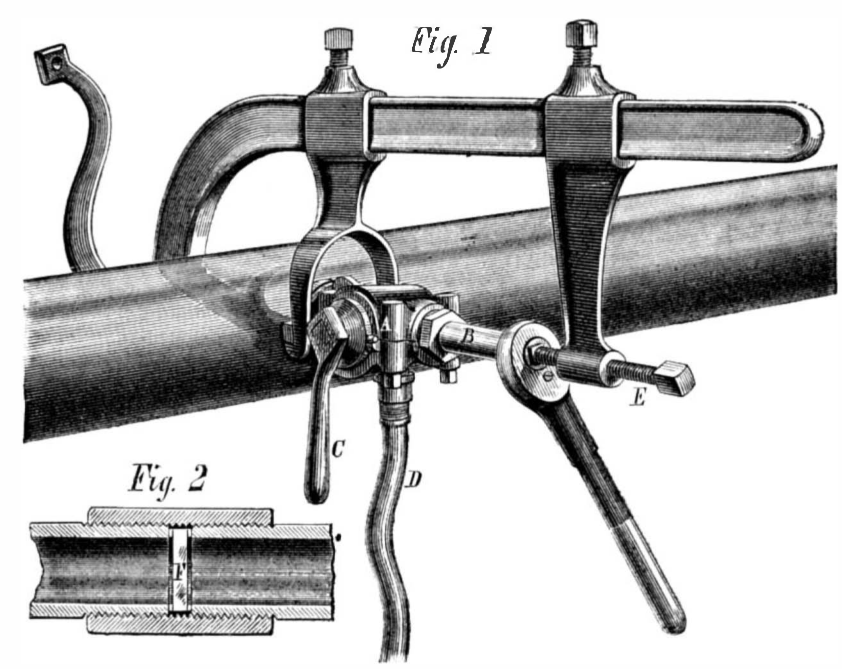
YOUNG'S WATER MAIN TAPPING MACHINE.

This invention, an engraving and description of which we presented in the SCIENTIFIC AMERICAN of June 7, 1873, has recently been the subject of several improvements. These mainly consist in the material used in the construction, the main bar being made of cast steel, and all other portions of steel or brass, thus avoiding any difficulty from springing while in operation. The two parts of the drill case, A, are clamped by bolts and receive the drill, B. At the end nearest the pipe is a detachable washer, in a socket having a concave face to be clamped against a packing gasket in order to make a watertight joint. Instead of making this packing in two parts as formerly, it is now formed solid and a round stop cock employed, over which the packing is pulled when the machine is removed. The handle at C communicates with a cock within, to close the aperture when the drill is removed, said cock having a notch to allow of the passage of the tool. After the hole is drilled and the point of the implement drawn back beyond the cock, the latter is turned so as to close the orifice. The connecting pipe is then substituted for the drill, the cock turned back, and the connection made. The hose at D serves to conduct away chips blown out. The drill is operated by the ratchet lever shown and fed by the screw, E.

The apparatus as improved may be adapted to 1, $\frac{3}{4}$, $\frac{1}{2}$, and $\frac{3}{8}$ inch pipe, by substituting different drills.

This inventor has also patented, through the Scientific American Patent Agency, April 1, 1873, an extra improvement on his device, by which a disk of glass, F, Fig. 2, is substituted for the stop cock usually employed and left buried in the earth, thereby decreasing the expense and simplifying the process. For the purpose of keeping the water back while the connection is being made, the service pipe is constructed in sections coupled together by a union and having between their ends the glass plate. As soon as the work is done, one of the sections is screwed up tightly, thus crushing the glass and permitting the water to flow. The pieces are, of course, quickly washed out.

Further particulars regarding these devices may be obtained by addressing Mr. William Young, Easton, Pa.



YOUNG'S WATER MAIN TAPPING MACHINE.

IMPROVED DUMPING WAGON.

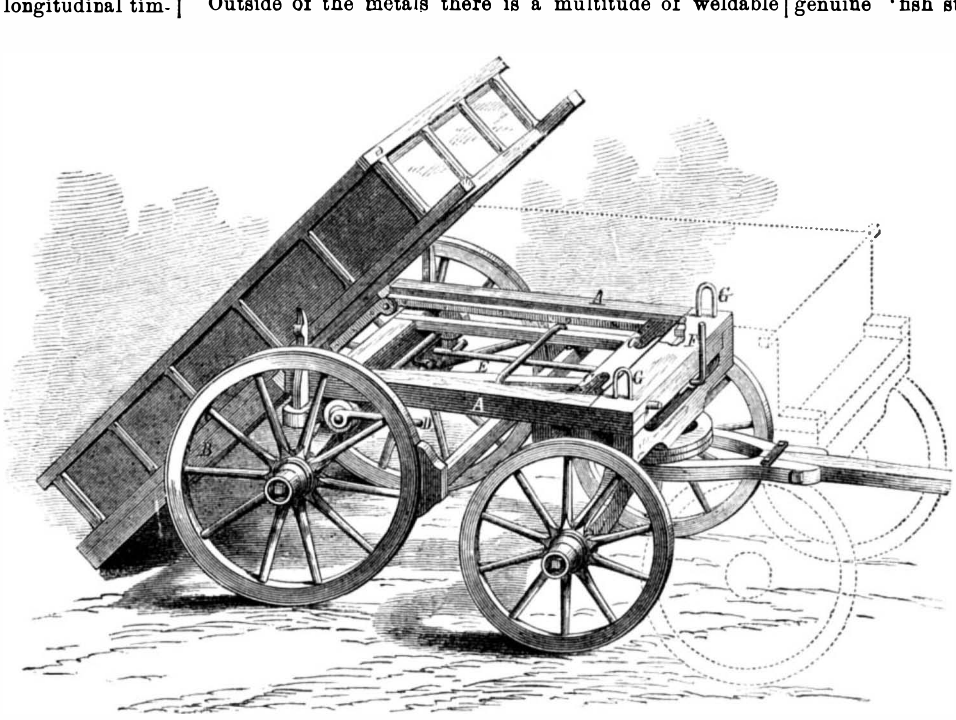
The action of the dumping wagon represented in the annexed illustration is in one sense automatic, inasmuch as, in order to dump the load, it is merely necessary to back the vehicle up to the place of deposit. The construction is such that, when the wagon is thus situated, the rear axle and wheels remain stationary while the front axle and wheels are moved toward them, causing the wagon body to slide over the rear axle and finally to tilt rearward. The reverse operation—that is, simply starting the draft animal ahead—pulls the wagon body back into its place.

The mechanism and its mode of operation are as follows: Under each side of the wagon box are two longitudinal timbers, each of which is made in two parts hinged in the center. The front ends, A, of these timbers are connected by the foot board and are secured to the upper part of the fifth wheel, while the rear portions, B, are permanently fastened to the wagon body. On the sides of the rear hounds are pivoted slides, C, which fit over and move on guides attached to the inner sides of the parts, A, of the bed timbers. Just forward of the rear axle, and suitably connected thereto, is a shaft, on either end of which are adjusted rollers in eccentric journals. To the latter are attached handles, D, by pressing down which the rollers are thrown in action, lifting the wagon body clear of the axle.

Supposing the wagon to be first in the position of the dotted lines in the engraving, it is evident that, the rollers being turned into action and the front axle and frame being pushed to the rear, the wagon body will slide over the rollers until the hinge of the long timbers under the bed is reached. The weight of the load will then bear the rear end, left unsupported downward, and the contents of the wagon will necessarily be discharged. The vehicle is represented in our illustration while in this position.

It will readily be understood, without further explanation, how the application of draft to the pole or shafts of the wagon speedily pulls the front axle forward and causes the body to fall back in its former position. A longitudinal bar, E, having a horizontal projection, and which passes through a keeper in the rear hounds, is then turned by means of the handle, F. The projection, assuming an upright position, just forward of the cross piece of the rear hounds, prevents the same from moving forward and locks the parts in place. The rear levers, D, are also turned up, thus allowing the body to rest directly upon the axle. The forward end of the box is also secured by pins passing through staples, G, which enter slots in the body timbers. The rear wheels are provided with suitable brakes, and the general construction of the vehicle is of strong and durable description. We are informed that the invention is now in use in Louisville, and has proved both efficient and useful.

Patented August 19, 1873. For further particulars regarding sale of rights, etc., address the patentee, Mr. Daniel D. Smith, 376 West Jefferson street, Louisville, Ky.



SMITH'S IMPROVED DUMPING WAGON.

The Philosophy of Welding.

In order to find a true analogy to welding, we need go no further than the vulgar "sticking together" of two pieces of cobbler's wax, pitch, putty, or clay. These are in a viscous or semi-fluid condition, and they cohere by an action similar to the transfusion or intermingling and uniting of two liquids. Iron and platinum pass through a viscous or pasty stage on their way from the solid to the liquid states, and the temperature at which this pasty condition occurs is the welding heat. Other metals are not weldable, because they pass too suddenly from the solid to the liquid condition. Ice, although it fuses slowly, in consequence of the great amount of heat rendered latent in the act of fusion, passes at once from the state of a brittle crystalline solid to that of a perfect liquid. It passes through no intermediate pasty stage, and therefore is not weldable, or does not cohere like iron, etc., at a temperature below its fusing point.

It is usual to cite only iron and platinum, or iron, platinum, and gold as weldable substances, but this, I think, is not correct. Lead should be included as a weldable metal. The two halves of a newly cut leaden bullet may be made to reunite by pressure, even when quite cold. This is obviously due to the softness or viscosity of this metal.

Outside of the metals there is a multitude of weldable substances. I may take glass as a typical example of these. Its weldability depends upon the viscosity it assumes at a bright red heat, and the glass maker largely uses this property. When he attaches the handle to a claret jug, or joins the stem of a wine glass to its cup, he performs a true welding process.

The chief practical difficulty in welding iron arises from the fact that at the welding heat it is liable to oxidation, and the oxide of iron is not viscous like the metallic iron. To remedy this oxidation the workman uses sand, which combines with the oxide and forms a fusible silicate. If he is a good workman he does not depend upon the solidification of this film of silicate, as the adhesion thus obtained would be merely a soldering with brittle glass, and such work would readily separate when subject to vibratory violence. He therefore beats or squeezes the surface together with sufficient force to drive out from between them all the liquid silicate, and thus he secures a true annealing or actual union of pure metallic surfaces.

Cast iron or steel containing more than two per cent of carbon cannot be welded. Why? I think I may venture to reply to this oft repeated question by stating that the compound of iron with so much carbon is much more fusible than pure iron, or than steel with less carbon, and that it runs more suddenly or directly from the solid state into that of a liquid, and hence presents no workable range of weldable viscosity.—*W. Mattieu Williams, in Iron.*

Fishing by Means of Explosives.

At a recent meeting of the California Academy of Sciences, Mr. A. W. Chase, of the U. S. Coast Survey, read a short paper on the capture of fish by the explosion of cartridges by means of fuses under water, which he has practiced with much success. He says: "I have found that the ordinary waterproof fuse will burn about one foot to every twenty-five seconds, and by experiment that a cartridge will explode in from four to six fathoms with from three to four inches of fuse. I have, however, made no exact experiment on the subject. The shock of the explosion is most severely felt downwards, as the resistance is greater; and the different varieties of sea fish found near the rocky shores of the islands as a rule being found on or near the bottom, it is desirable to explode your cartridge about midway between the surface of the water and the rocks beneath, as you thus reach both the deep lying fish and those, like mackerel and smelt, which swim between."

The *modus operandi* adopted by Mr. Chase was to take a small skiff and row out to the kelp beds surrounding the island. "Here, in six or eight fathoms of water, the bottom is distinctly visible. When an unusually large school of fish would swim by, I would quietly light the fuse and drop the cartridge into the water gently. If the water was, say, eight fathoms deep, I would graduate the fuse for explosion at four. The cartridge would slowly sink—generally in a spiral—and a few bubbles of air or smoke arise to the surface. When the fire reached the fulminate of mercury, there would be a sudden white flash, then a quick, sharp detonation, the blow striking the bottom of the skiff as if some one had struck it with a hammer. Then, in a space of time varying from eight to ten minutes, every fish within a radius of forty or fifty yards would slowly come to the surface. Those within the immediate vicinity of the explosion, of course, were killed by bursting the bladder and injury to the large intestines, and had to be speared up from the bottom. Those, however, at a greater distance would be simply stunned, and could be taken in with a net. Care had to be taken to avoid touching those only slightly stunned until the net was fairly around them, as the slightest blow would arouse them from their torpor.

I am now about to relate what will, perhaps, be called a genuine 'fish story'; but as I have, in addition to my own, the testimony of my men to the fact, I give it as it occurred:

I had brought up by an explosion a number of yellow bass fish, weighing about four pounds each. These are delicious in chowder, and so instead of putting them in alcohol I had them cleansed, which was done by scaling, removing the intestines, and cutting off the fins and tail. The head, however, still remained joined to the back bone. These fish, from the time they had been taken from the water up to the time of cleaning, remained apparently lifeless. Nor did the removal of the intestines arouse them. They were then taken up to the old barracks, where I was temporarily camped, and hung upon nails driven in the clapboards. Some little time after they had been thus disposed of, one of the men came in and asked me to go out to look at the fish. I did so, and found every individual bass slapping around in as lively a manner as if he had been freshly caught and hung up. They had, in fact, recovered from the explosion, and proceeded to die in the common fashion. I took one down and broke the backbone where it joined the head. Its struggles ceased instantly, thus showing that the vital force had been arrested in the nerve centers and brain at the time of explosion, and, when the effect had passed away, that the fish had resumed a galvanic life. It was probably about half an hour from the time of explosion when this occurrence took place. I have not been able since, however, to secure the same result, although I must state that the only time since then that I have tried the experiment was on the Oregon coast, where I brought up a school of salmon, all of which were pickled for Agassiz. These fish were, howver, too close to the explosion, as they were killed outright."

REMEDY FOR INSECT STINGS.—M. Dauverne says that 30 or 40 grains of quicklime dissolved in water is a thorough remedy for the stings of insects, and far superior to ammonia or any other alkali.

THE WESTERN LOCUST PLAGUE.

We supplement the description recently given of the locusts, which are producing such widespread destruction to the Western crops, with an engraving representing the insects devastating a grain field. An estimate of the damage done to the harvests of Iowa and Minnesota during the present year places the value of the vegetation destroyed for the former State at $2,000.000, and for the latter at $3,000,000. It is also said that about 4,000 people in both States will require help to the total extent of some $800,000.

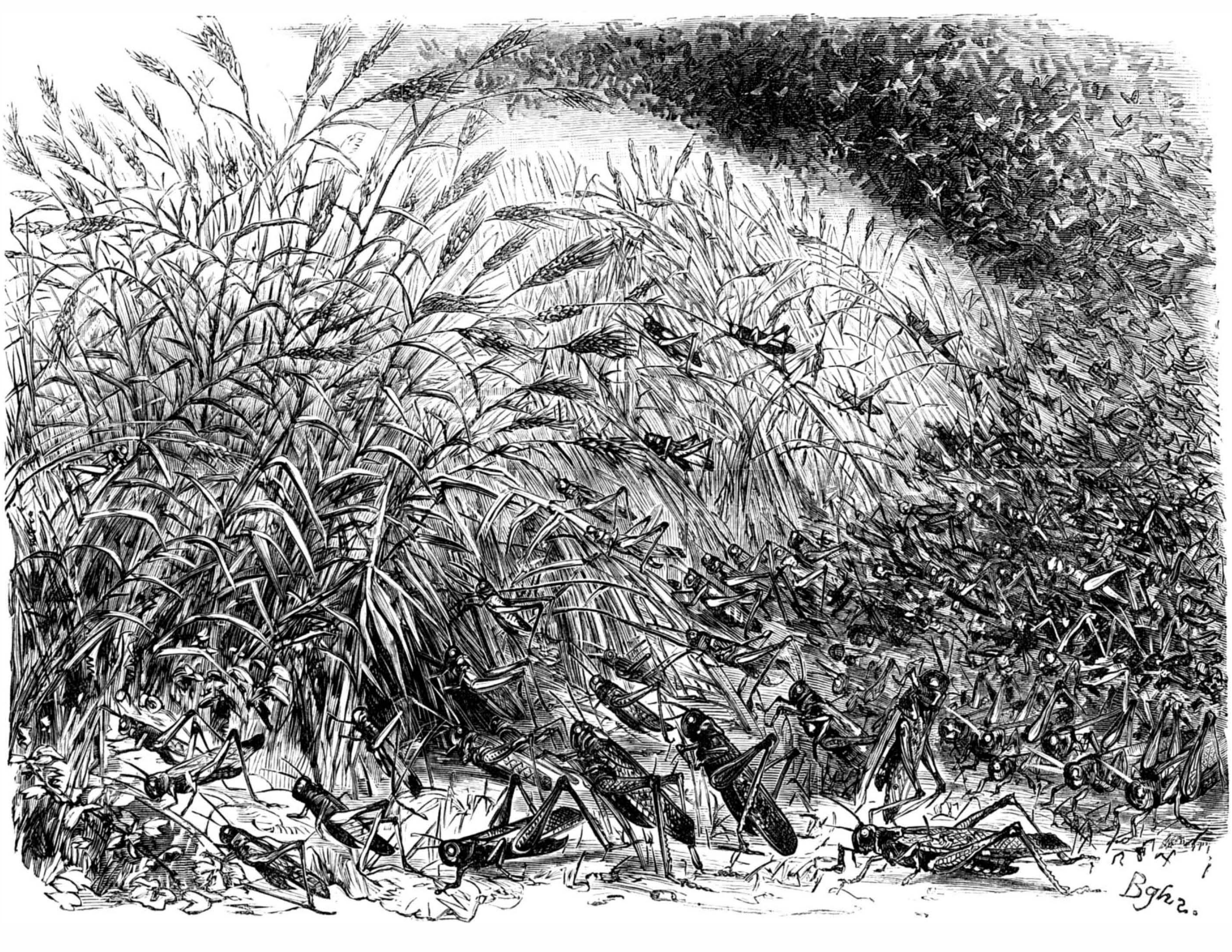
The present belief is that the locusts originate in the great prairies, and, when fully developed and able to use their wings, become carried off by the wind. Their instinct compels them to alight upon the first fields of young crop encountered, which they speedily strip of every leaf. If they remain long enough to deposit eggs, the following year will see the plague resumed with even greater severity. Professor Humiston, of Worthington, Minn., who has studied the habits of the insects with care, describes the process of egg laying as follows:

The tail of the female locust consists of a hard, bony, cone-shaped substance, capable of being thrust into the ground from one half an inch to an inch in depth. Just above this on the body of the insect, and attached to it, is the egg cell. The grasshopper is able to push its conical-shaped tail down into the ground, and to leave it there with the cell containing the eggs. The warm sun in the spring causes the eggs to hatch, and the field is covered with millions of young grasshoppers, not as large as a kernel of wheat, just when the tender shoots of grain begin to show themselves above the ground.

A correspondent of *The Tribune*, writing from Minnesota, states that many farmers knew last fall that their land was full of these locusts' eggs, and anticipated that, unless they could be destroyed, the crops would be greatly injured again this year. Professor Humiston and others conceived the idea of plowing deep and thus covering the eggs with a layer of earth so thick as to postpone, at least, the time of hatching. Much of the land in which these eggs were deposited was the prairie which had just been broken, this being only the second year that a crop has been raised there. Some of the farmers "back set" the land in the fall—that is, turned the sod back again and covered it with a thin layer of earth. In one of Professor Humiston's wheat fields, a part has been treated in this way, while part has been sown among the locusts' eggs. The contrast is wonderful. The part that had been "back set" will yield at least four times as much wheat to the acre as the other. The young locusts that hatched on the field appeared later and in much smaller numbers. In fact, had the matured locusts let it alone, it would have yielded more than an average crop of wheat. The theory is that turning the eggs well under prevents many of them from hatching, and delays those that do hatch so long that the crop has a chance to get a good start.

The locusts generally begin to fly each day between 10 A. M. and noon, and alight about 4 P. M. If they alight in a wheat or oat field, they are generally so thick that there are from three to ten locusts on every stalk of grain. In the cornfields they actually cover the corn that is three or four feet high, and in many cases bend it down to the ground with their weight. Neither flax, potatoes, garden vegetables, nor any other crops escape.

One of the most effectual means recently employed for saving the grain of Minnesota farmers was to "rope" the fields—that is, to hitch each end of a rope 200 feet long to a horse and drag it over the grain. This disturbed the "hoppers" and brushed many of them off the heads of the grain upon the ground, where they would remain until the swarm got ready to fly, and doing little damage. Others would return to their work of destruction, but would be allowed to remain but a few minutes before they were again disturbed. This "roping" was continued until the locusts became disgusted and flew away. Some farmers found smoking very effectual. When the locusts were flying, they placed damp prairie grass on the windward side of their fields and set fire to it. The locusts either did not alight, or, if they did, did not stay long. But this was not always successful. One farmer who tried it states that at first he thought the "hoppers" about to leave; he went away for a fresh load of grass, and when he came back he "found the rascals roosting on the fence and warming their feet by his fires." After that, the hotter he made the fires and the denser the smoke, the better they seemed to like it.



LOCUSTS DESTROYING A GRAIN FIELD.

China Making in Dresden.

The fashionable mania now existing in Europe, and especially in England, which is also extending to these shores, is for old and curious china, and for odd and rare specimens prices are given which are ridiculously enormous. At an auction sale recently, a professional china dealer paid $50,000 for a single pair of vases, after a very sharp competition, and several instances have happened where sums of nearly equal magnitude have been lavished by the wealthy in gratifying this peculiar taste. The old Dresden china is extremely valuable, more from its quaintness and richness of design than for the method of its manufacture. The latter at one time was kept a profound secret, but, like many other trade secrets, this one eventually leaked out, so that the true material came to be produced in many German towns. In a report by Mr. E. Locke, an expert deputed by the English Society for the Promotion of Scientific Industry, we find the following description of how the china is now made at the Dresden Royal Works:

The material of the porcelain body is found near Meissen, and it is washed on the works. It has the appearance of being of a loose, sandy nature. The fine particles are floated away, and carried with the water along a series of spouts till deposited in tanks of slate, after which the water is gradually drawn off. The thick slip is then put in bags about two feet long and eighteen inches wide, which are laid on their sides upon wooden hurdles plaited with wickerwood. Several layers of hurdles and bags are put upon each other, a flat board is placed on the top, and a screw is brought to bear gradually, till all the water is squeezed out. The clay is then ready for tempering. The plates and round dishes are made upon the thrower's wheel, and are then blocked upon a mold on the wheel, the foot upon it being worked with a roll. When it has left the mold, it has to be hardened and the back turned on a wheel, to give the finished outline to the foot. The bottoms of all the plates and dishes are raised up about a quarter of an inch, to allow for the dropping in the firing of them. Another man does the finishing of the edges of the plates and dishes, for there is a clear waste upon the plate of half an inch, level with the edge, and that has to be cut away with a knife. The figure makers have their labors divided. The figures are all made very thick, and the bodies of some of the figures are all pressed solid; and to get the molds close they are put under a screw press. The parts of the figures are then taken to the finishers, who have to go over all the surface with their tools, and every fold and embossment is retouched; it is a great waste of labor. The molds are all very dull, and the lines of fine drapery hardly be seen.

The plaster of Paris used for the molds seemed very hard, with a gray look, and heavy in its gravity. The cottles used by the mold maker were of a very rude description, and those for the square molds were made of plaster bats fastened at the corners with twisted wire; the plaster seemed to take a good finish.

The figures are burned the first time, laid upon their backs, with short props dipped into ground quartz. The kiln is divided into two parts by a low dome about six feet high, with a hole, in the center, of two feet. The clay is placed in the bottom part and the gloss above, and all the saggers are luted. The ware fired in the bottom part of the kiln is hardly out of clay, and has done scarcely any contraction; it is as porous as an earthen piece in the biscuit state. It is afterwards dipped; and the glaze being in a very thin state, the dipper gets it on the piece very equal and thin. They do not use a wash for the bottoms of the saggers, but a thick bat of sagger clay, with a deal of sand in it, and it seems to answer the purpose well.

From this it will be seen that the piece of ware has to do almost all its contraction in the second burning with the glaze upon it, and with no support at all. Mr. Locke was told the contraction was one sixth; but, from what he saw, he thought it about one eighth. The glaze is composed of felspar from Norway, good clear quartz, and a limestone, of a bluish gray color before it is calcined. The clay with which they make the saggers is found in the neighborhood of Meissen; it is not a fire clay, but more after the nature of a ball clay. They use the ground grog and a sand mixed with it. Coal is obtained from Bohemia; it is of a very dull looking black, and the cost must be considerable from the distance it has to come.

The Henderson Brake.

This improvement has lately been subjected to a practical trial with much success, on the West Chester and Philadelphia Railway, the train consisting of engine, tender, and five cars. On a level, speed 35 miles per hour, the stop was made in a distance of 180 yards in 19½ seconds; boiler pressure, 120 lbs. Trials on grades were made with equally favorable results, all showing that the brake has no superior. Its construction and operation are as follows: Between the wheels of each truck there is placed a cylindrical vessel of cast iron, whose ends are formed of two dish-shaped flexible diaphragms of india rubber, secured to the drum, and making an airtight joint at the periphery by flanges bolting thereto. Two rams working in opposite directions are fitted against and into the hollow part of the diaphragms; their outer ends are attached by rectangular flanges and bolts to the brake beams carrying the brake shoes. The several castings are simply bolted together, with the diaphragms, as they come from the foundery, without recourse to the usually expensive mechanical fittings.

When pressure comes between the diaphragms, it simply forces them apart, projecting the rams, which act immediately on the brake beams, applying the brakes; and when the pressure is relieved, the atmosphere reacts on the area of the rams and forces them back, assisted by the tendency of the diaphragms themselves to recover their normal condition.

The peculiar construction of this device, it will be seen, possesses all the requirements of a cylinder and working piston, as well as recoil springs. All piston packing and stuffing boxes are dispensed with, and no lubrication is required; the interior is sealed from dust, all complications of levers and rods and attendant lost motion is done away with, and its operation is free from all connection with the usual hand brake gear, which remains as efficient as it was before.

The power is derived directly from the boiler of the locomotive; we have therefore at our command the same power to stop the train which is used to impel it forward. The device employed to transmit this power, to the pressure boxes just described, consists of a hydraulic press, operated by a double acting steam cylinder, the valve of which is worked by the hand of the engineer. There is a piston in each; steam actuates the one to force the water from the other, thus creating hydraulic pressure on the pressure boxes, and to withdraw the same to release the brakes. An air cushion is provided above the press piston to prevent striking the heads when coming back light. The press receives water from a tank, which may be the engine tank or a special tank provided for the purpose, through a pipe furnished with a check valve opening towards the press cylinder, in such manner that the fluid cannot return to the tank; the supply is arranged to feed automatically; any excess or leakage past the press piston is at once returned to the tank. For low temperatures, a mixture of equal parts of glycerin and water is used in lieu of water, which is safe to 30° Fah. below zero. Iron pipes are used under the cars with flexible hose between them, furnished with hydraulic couplings, which it is obvious must be tight both with and without internal pressure, a peculiarity possessed by this coupling alone.

Vaporizing Metals by Electricity.

The following simple results, communicated to *Nature* by G. H. Hopkins, obtained by frictional electricity may be of interest, perhaps too of use in the investigation of certain minerals and the action of intense heat upon them.

The description of a characteristic experiment is all that will be necessary to explain the process and to show how similar results may be obtained from other substances. A very fine thread of sheet platinum, of about an inch in length, is placed between two microscope slides of glass, and two pieces of thin sheet copper with rounded ends are placed in contact with the extremities of the platinum, the copper being any of convenient length and breadth, so as to extend beyond the glass slides, but not to be as broad; a charge of electricity from about eight square feet of Leyden jar is passed through the metals; the effect of the heat from the charge is to vaporize the platinum, which is instantly condensed in a transparent layer upon the cold glass. The layer can be investigated by a microscope, and employed in various ways to determine the character of the metal and its effect upon reflected or transmitted light.

Copper, tinfoil, tinfoil amalgamated with mercury, gold and silver, can be used in a similar manner, but they produce layers very dissimilar in appearance. To act upon finely ground substances, such as vermilion, sulphate of antimony, sulphur, etc., a line of the powder must be made and the charge be passed through in the same way as through the platinum.

Part of the vapor escapes from between the slides, but this can be easily condensed upon each of two pieces of glass placed in such a way as to intercept the vapor as it passes from between the two slides; it is then condensed in a long but narrow line. The manner in which the glass is affected by the heat, and the concussion produced by the expansion of the vapor, are worthy of notice.

Considerable difficulty will be found in vaporizing copper, doubtless from its being such an excellent conductor. Some of the powdered substances appear to require a small spark to be passed through them before they allow a larger charge to pass, as if the particles needed polarization.

Patented Car Improvements.

There were one or two points in the proceedings of the Car Builders' Association, at its late meeting, in which a peculiar sensitiveness was developed about discussing the merits of patented devices. The impression seemed to prevail with many of the members that such devices were not only inadmissible as legitimate topics for discussion, but that committees, in making their reports, must not indorse or recommend any such devices for adoption, no matter what might be their actual merits. This, in our judgment, is a mistake which can not be too soon corrected; nor do we think that, in order to do so, any alteration of the constitution of the Association is necessary. That instrument, as it is now, merely forbids the admission of patentees or their agents to advocate their claims at any of the meetings of the society, but does not prevent the members from freely expressing their views in the regular course of discussion upon any invention or device, whether patented or not. To suppress all discussion which respect to patents would seriously hamper the Association in the exercise of its proper functions, and so far destroy its usefulness. It must necessarily be progressive or disband.

It is not the business of the Association to make or unmake the fortunes of inventors or patentees, or to discriminate between rival claims, except on the score of actual merit, and as the interests of railroads may be affected thereby. If the Miller platform or the Westinghouse brake is a good device now, let it be indorsed and approved; but as soon as either is surpassed by something better, let it be condemned. There is no evading this obvious duty. The Association has got to recognize patented inventions and pronounce upon their respective merits, so far at least as they apply to railway cars, or to be exposed to comment and criticism, such as may be found in the SCIENTIFIC AMERICAN of July 18.—*National Car Builder.*

The Fireless Locomotive System.

A correspondent, Mr. Michael Flurscheim, mechanical engineer, of Gaggenau, Germany, asks: "Could not the principle of the fireless locomotive be applied to coaches, cabs, and private vehicles? By calculation, I find that a tank of 1½ feet diameter and ¾ foot length, jacketed by a non-conductor of heat, would be sufficient to propel an ordinary vehicle, containing two persons, on a Macadam or wooden pavement, at a speed equaling that attained by ordinary cabs. It seems to me that, in cities like London, Paris, New York, Boston, and even in smaller towns, large charging boilers could be kept at each cab stand or in each street, where, at a minute's notice, a charge of hot water could be obtained at a moderate expense, which would propel the vehicle, say, 7 miles, and then another charge of hot water could be obtained. Horses could thus be entirely done away with; and traveling would be cheaper, more convenient, and less dangerous. A man who now keeps a horse and carriage could, at less expense, purchase a little buggy provided with a fireless engine, and keep it at the boiler stand in his street. If he wants to drive, he sends his boy or man to the stand; in one minute the boiler is charged, and the cab at his door. He need not be afraid of keeping his horses waiting at his door, as no weather will injure his steam animal. If this system were generally adopted, the municipalities would probably be forced to lay narrow gage tracks along each street, connecting with the cross streets by easy curves; and tracks for longer distances all over the country would follow, connecting with the city roads and provided with boiler stations. We could then easily come to town from our country places, or travel all over the country, in our own vehicles, at very little inconvenience, needing no one to look after or feed the horses."

Sensitized Paper.

At a recent meeting of the Photographic Section of the American Institute, in this city, Mr. H. J. Newton, President, made some observations on this subject. He said: The preparation of a sensitized albumen paper as a commercial article has not been successful. It has been either too expensive to meet the popular demand, or deficient in keeping quality. There are several ways by which paper can be prepared so that it will keep indefinitely; but as a rule, it is exceedingly difficult, if not impossible, to make a print on such paper that would not ruin the reputation of any photographer, especially after it is a week old. Some time since, in experimenting in this direction, I found that, by floating the albumen paper back down for one or two minutes on a solution of hydrochloric acid—one ounce of acid to forty ounces of water—and drying, it would render it capable of keeping perfectly for ten or twelve days after sensitizing. Not only this, but the prints made on paper thus prepared were remarkably fine, and also those made after ten days' keeping were equal to those printed immediately after sensitizing. Paper so prepared should not be fumed until required for use. After the paper has been removed from the acid solution and dried, it would be well to pack it away under a light pressure, placing the albumen surfaces together, so that when required for use it will be in proper condition to put upon the sensitizing bath. As it is a great convenience for photographers to be able to keep paper for several days after sensitizing without its deteriorating, I would suggest that some of our many manufacturers of albumen paper prepare some of it in this way, as I am sure that photographers would willingly pay the extra expense. In the toning of these prints, I used a little tartrate of antimony, and it worked very well. In the first place, the prints turned red—a very deep, rich color—and toned up from that. I have not experimented enough to give a reliable formula, but I would suggest half an ounce of tartrate of antimony, which is commercially known as tartar emetic, dissolved in sixteen ounces of water; for each grain of gold use half a dozen drops of that solution, and increase it until you get the desired effect.

The Railway Rolling Stock of the United States.

The return of railway rolling stock, as given in *Poor's Manual* for 1874—5, on the roads of the United States and Canada are as follows:—

Passenger cars of all classes	29,90
Baggage, mail, and express cars	4,157
Box, merchandize, and house cars	87,009
Platform, gondola, and flat cars	52,198
Stock cars	14,222
Coal cars (number of wheels not stated)	66,887
Four wheel cars (mostly coal)	37,892
Caboose cars	1,549
Oil cars	3,154
Ore cars	2,102
Lumber cars	193
Freight cars not classified	94,694
Total	373,959
Locomotive engines	14,939

Deducting from these aggregates 774 engines and 13,980 cars of all classes, as returned by the Canada roads, leaves for the roads in the United States a total of 14,165 engines and 359,979 cars, exclusive of what are denominated service cars, and exclusive of narrow gage cars.

Simple Dyspepsia Remedies.

Dyspepsia arises from a great variety of causes, and different persons are relieved by different remedies, according to the nature of the disease and condition of the stomach. We know of a lady who has derived great benefit from drinking a tumbler of sweet milk—the richer and fresher the better—whenever a burning sensation is experienced in the stomach. An elderly gentleman of our acquaintance, who was afflicted for many years with great distress after eating, has effected a cure by mixing a tablespoonful of wheat bran in half a tumbler of water, and drinking it half an hour after his meals. It is necessary to stir quickly and drink immediately, or the bran will adhere to the glass and become pasty. Coffee and tobacco are probably the worst substances persons troubled with dyspepsia are in the habit of using, and should be avoided. Regular eating of nourishing plain food, and the use of some simple remedies like the above, will effect in most cases quicker cures than medicine.

High Buildings.

A visitor to our office recently, coming to New York for the first time in several years, mentioned the prevalent mania for lofty buildings as one of the most noticeable, to a stranger, of the changes which have taken place in our city architecture. It is curious to remark that the tallest of these high edifices are situated within the radius of a few blocks of the SCIENTIFIC AMERICAN office, and our out-of-town friends, in visiting the latter, may spend an interesting hour in making the round of these very imposing structures. Their hights are as follows: Trinity church, 284 feet; Union Telegraph building, 226 feet; Brooklyn bridge tower, 223 feet; *Tribune* building, 221 feet; shot tower, near Beekman street, 220 feet; St. Paul's church, 203 feet; post office dome, 195 feet; Equitable Life Insurance building, when two stories, soon to be added, are finished, 175 feet.

A Natural Curiosity.

Massachusetts papers report that a portion of Winchendon, Mass., covered with grass, cranberry vines, whortleberry bushes, and over four hundred trees, recently floated off into Monomonock lake, between Rindge, N. H., and Winchendon, Mass. The newly formed island was first seen near the town of Rindge on May 30. The following day it again floated off about two miles down the lake, but on June 3 returned to its first place of anchorage.

The island covers six acres, and is in a lake covering an area of 2,500 acres. It was probably started from its natural site by the lake being unusually high and a strong southerly wind prevailing. But it has also been suggested that it left Massachusetts for a summer vacation in New Hampshire, to escape the effects of protracted legislation, and that after all it may only have originated in a Yankee trick for attracting summer tourists to the lake.

New Property of Metallic Rhodium.

MM. H. Saint Clair Deville and Debray state that rhodium, precipitated from its solutions by formic acid or alcohol, decomposes the formic acid with a disengagement of heat, and reduces it to its elements, hydrogen and carbonic acid. This action continues almost indefinitely.

When the action of the rhodium on the formic acid becomes weak, it is merely necessary to wash and dry the metal in contact with air in order that the phenomenon be repeated with its primitive intensity, disengaging equal volumes of carbonic acid and hydrogen.

Agricultural Life in Missouri.

What can be pleasanter, says an exchange, than the life of a Missouri farmer? At daylight he gets up and examines the holes around his corn hills for cut worms, then he smashes coddling moth larvæ with a hoe handle until breakfast. The forenoon is devoted to watering the potato bugs with a solution of Paris green, and after dinner all hands turn out to pour boiling water on the chintz bugs in the corn and wheat fields. In the evening a favorite occupation is smudging peach trees to discourage the curculio; and after a brief season of family devotion at the shrine of the night-flying coleoptera, all the folks retire and sleep soundly till Aurora reddens the east and the grasshoppers tinkle against the panes and summon them to the labors of another day.

New French River Steamboat.

A large steamboat has recently been constructed at Seyne, France, after the plans of M. Dupuy de Lome, for the navigation of the river Rhone. She is 496·8 feet in length, and has 37·1 feet beam. With her coal on board she draws but 17·5 inches of water, and can receive 126 tuns of load per 3·9 inches of immersion. At a draft of 50 inches she carries a load of 900 tuns. The vessel has four boilers and two inclined compound engines, which drive two large helicoidal wheels placed in the stern, each of which has twelve wings. Each wheel moves independently of the other, so as to be used for steering. The craft has been tried once, but without good results, through some mistake in the construction of the machinery. It was found that a high speed threatened to shake her to pieces. This, however, it is said, will be shortly remedied.

American Telegraphy.

The efficiency of the service of the Western Union Telegraph Company is well illustrated by a statement which we copy from Mr. William Abbott's *Monthly Circular* for July 1. This statement, which alludes to the perfect organization of the Anglo American Telegraph Company, says that messages are exchanged between London and California in the same space of time occupied for similar service between London and Paris, the distances respectively being about 5,500 and 250 miles. As the Western Union Company perform over two thirds of the entire service between London and California, the exhibit is a remarkable evidence of the efficiency of that company, and, considering the respectable source whence it comes, the appreciation is all the more valuable.—*Journal of the Telegraph.*

Spiritual Phenomena.

At a private party, given at his London house during the past month, Sir Charles Wheatstone exhibited some curious electrical experiments for the amusement of his friends, which would seem to throw some light on certain so called "spiritualistic manifestations." In a dark room, by a stamp of his foot, Sir Charles produced a brilliant crown of electric light in mid air, while musical instruments seemed to be played by invisible hands, whereas the sounds really came from an adjoining room, in which the player sat, and were made to appear to be produced by the instruments before the spectators by an ingenious contrivance. A contest between Science and the "spirits" in their own chosen feats would be almost as memorable as the celebrated competition between Moses and the magicians.—*Liverpool Post.*

An Interesting Discovery.

Some workmen, while engaged in laying water pipes in Cividale, Italy, recently encountered a large flat stone. On raising this, a bed of mason work was revealed, in which was placed a stone sarcophagus covered with a marble lid. Within the receptacle were the remains of a human skeleton, some portions of which were yet perfect. Beside the body lay a sword, lance, helmet, spears, a gold clasp and ring, a piece of very beautiful gold tissue, and a flask of water, which was still remarkably clean. The removal of clay from the bottom of the grave brought out the letters GISVL—from which archæologists have decided that the remains are those of Gisulf, Duke of the Lombard Marches of Friuli, who fell in battle in 611, while repelling an invasion of the Avars.

THE NEW COMET.—Professor Parkhurst says that the new comet may be found, by the aid of a small telescope, 7° south of γ *Ursæ Minoris*, the upper pointer of the Little Bear. Between 9 and 10 P. M., it will be almost directly to the left of that star. The distance of our new visitor is estimated at about 100,000,000 miles. In about a week it will be found midway between the γ and Thuban.

TOOTHACHE CURED BY ELECTRICITY.—Dr. Bouchard, of Paris, says that toothache may be almost instantly arrested by a constant battery current from ten cells. The positive pole is placed against the jaw, on a level with the painful tooth, and the negative pole to the antero-lateral region, on the same side of the neck.

THE Earl of Caithness, of whose novel form of ship's compass we recently gave an illustration, has produced another invention in the shape of a machine for cleaning and brushing railway carriages. The device, we understand, is an excellent one, and has been adopted by the London and Northwestern Railway Company.

SUCCESS, says Josh Billings, does not consist in never making blunders, but in never making the same one a second time.

THE immersion of hides for hours in a two per cent solution of carbolic acid, and then simply drying them, has been recently substituted for the tedious and expensive process of salting them for transportation from South America and Australia, and with most satisfactory results. Bones have been similarly treated for transportation.

HOW SHALL I INTRODUCE MY INVENTION?

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

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Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From July 7 to July 20, 1874, inclusive.

AMMONIA FROM GAS.—B. Silliman, New Haven, Conn.
ARTIFICIAL STONE.—J. O Friel, Brooklyn, N. Y.
BOILER TUBE SCRAPER.—J. Collicott, Boston, Mass.
CAR AXLE.—G. W. Mitt'more, Janesville, Wis., *et al.*
CHEMICAL TELEGRAPH, ETC.—T. M. Foote *et al*, New York city.
COAL CUTTING MACHINE, ETC.—H. F. Brown, Indianapolis, Ind., *et al.*
COD LIVER OIL.—J. G. Hava, New Orleans, La.
CONSTRUCTING PIERS, ETC.—C. E. Hill, New York city.
DAMPING PAPER.—R. M. Hoe, New York city.
FERTILIZER.—R. A. Chesebrough, New York city.
HORSE SHOE.—G. Dunning *et al.*, Waukegan, Ill.
LIGHTING GAS.—E. E. Bean, Boston, Mass.
MAKING BOOTS, ETC.—D. Mills, Brooklyn, N. Y., *et al.*
MAKING BOOTS, ETC.—H. G. Thompson, Milford, Conn.
MAKING GAS.—W. Elmer, New York city.
MAKING ICE, ETC.—J. M. G. Beath, San Francisco, Cal.
MATCH IGNITION SURFACE.—L. O. P. Meyer, Newtown, Conn.
PUNCHING TICKETS, ETC.—J. H. Small, Buffalo, N. Y.
REGENERATOR FURNACE.—M. Foster, Alleghany, Pa.
RENDERING FATS, ETC.—H. S. Firman, New York city.
SAW AND HANDLE.—H. Disston, Philadelphia, Pa.
SCREW-CUTTING MACHINE.—C. Sellers, Philadelphia, Pa.
SIGNAL LANTERN.—Universal Signal Light Company, New York city.
SPINDLE AND BOLSTER.—F. J. Rabbeth, Pawtucket, R. I.
STEAM BOILER.—G. G. Lobdell, Wilmington, Del.
STEAM ENGINE AND GENERATOR.—E. A. L. Roberts, Titusville, Pa.
STITCHING AND STRETCHING CLOTH.—A. S. Dismore, Boston, Mass.
TUCKER FOR SEWING MACHINE.—J. Barrett, Buffalo, N. Y.

NEW BOOKS AND PUBLICATIONS.

THE POEMS OF VIRGIL. Volume I., containing the Ten Bucolics and the First Six Books of the Æneid. Price $1.75. Boston, Mass.: Ginn Brothers.

A handsome reprint of classics of worldwide fame, edited with care by Messrs. Allen and Greenough, with notes of great value to the student and translator.

MINING INDUSTRY OF THE STATES AND TERRITORIES OF THE ROCKY MOUNTAINS, including Descriptions of Quartz, Placer, and Hydraulic Mining, Amalgamation, Concentration, Smelting, etc. By Rossiter W. Raymond, Ph. Dr., United States Commissioner of Mining Statistics, etc. Illustrated with Engravings and Maps, and a Colored Geological Map of the United States. 8vo., 540 pp. Price $4.50. New York: J. B. Ford & Co., 27 Park Place.

There is little need to inform our readers of Professor Raymond's extended knowledge of the topography and resources of the mineral districts of the West. Probably no one has so thoroughly explored these regions, pregnant with the future prosperity of the whole continent, as Professor Raymond, and certainly no one can speak more authoritatively on the subjects of mining and metallurgy. The great experience and information of the author have been admirably elaborated in the volume before us, and we welcome it as a valuable addition to our list of technical and statistical works. It is excellently illustrated, the maps being especially commendable for accuracy and clearness.

STATISTICAL ATLAS OF THE UNITED STATES. Part III.—VITAL STATISTICS. New York: Julius Bien, 16 & 18 Park Place.

The third part of this magnificent publication is ready in advance of the others, and consists of charts of the proportional prevalence of various classes of disease and bodily infirmities, as well as of nationality of the people and other valuable statistics. The whole work is to consist of fifty maps, with explanatory text, the expenditure for which has been authorized by Congress; and from the initial section sent us, we are able to assert that no more elaborate or valuable compilation has ever been organized, printed and published. We are indebted to the Secretary of the Interior for the copy of this work.

WILEY'S AMERICAN IRON TRADE MANUAL of the Leading Iron Industries of the United States, with Descriptions of the Iron Ore Regions, Furnaces, Rolling Mills, Bessemer Steel Works, Car, Locomotive, Steam Engine, and Bridge Works, Iron Ship Yards, Stove Founderies, etc. Compiled and Edited by Thomas Dunlap. Price $7.50. New York: John Wiley & Son, 15 Astor Place.

The promise held out in this very comprehensive title is amply fulfilled in the book, wherein Mr. Dunlap has, with great labor, care, and perspicacity, given an elaborate account of every establishment in the country which makes or uses iron in its trade. It is a complete directory of our most important industry; and the descriptions of the various mines, works, and factories are graphically written, giving the most detailed particulars of every branch of the subject. As a book of reference, it is indispensable; and it is also a very interesting and instructive work for the general reader.

THE LABORATORY is the name of a new monthly journal of the progress of chemistry, pharmacy, medicine, etc. Price 50 cents per annum. Boston, Mass.: W. W. Bartlet & Co.

Recent American and Foreign Patents.

Improved Bottom Plate for Range Chimney.

Hamilton C. Garwood, Jersey City, N. J.—This is a bottom plate for range chimneys having a conical or pyramidal elevation in the middle portion, with an opening and valve at the top, and above the top a pipe or flue for carrying off the odors, smoke, etc., from the range when cooking, and for ventilating the room.

Improved Burglar Alarm.

James H. Whitelegge, New York city.—This invention relates to the construction of safety bolts for burglar alarms; and consists mainly of a spring bolt so constructed and arranged in relation to a hole in the lock bolt that when the lock is acted upon by a key or other instrument from either side it stops the movement of the lock and rings a bell.

Improved Joint Connection for Top Chords of Iron Bridges and Improved Girders and Columns.

Walter G. Coolidge and Edward Hemberle, Chicago, Ill.—The first invention consists of a peculiarly constructed joint piece for wrought iron top chords in bridges having what are known as pin connections, the joint piece being made either of cast iron or wrought iron. This connection is adapted for the construction of the top chords entirely of wrought iron without necessitating any riveting at the place of connection; it further has the advantage of enabling the connection of ties and posts with the pin, being made independent of the top chords, and the chord sections being put on afterward, which expedites and cheapens the labor of the erection of the structure. The same inventors have devised a new form for iron bars for columns, consisting of a plate with ribbed edges. Into the trough of the said plate other plates are fitted to form thickening plates at the ends of the columns. Rolled ⌶ beams or plate girders are attached to said plates connecting two together. A plain plate, straight or tapered, may be employed between two ⌶ beams. Pins pass through the ends of the columns. The advantages are superior strength for a given amount of metal, simplicity and cheapness of construction, and accessibility of all exposed parts for inspection and painting.

Improved Boiler Washing Machine.

Reuben Wood, Grand Ledge, Mich.—This is an improved washing machine so constructed that the steam and hot suds may be poured upon the clothes while they are in agitation and constantly changing their places, and may flow off, carrying the dirt with it, and may leave the dirt in the bottom of the boiler, so that it will not again be carried up and deposited upon the clothes. By suitable construction, as a cylinder is revolved, the clothes will be carried up by the wings and flanges nearly to the top of the cylinder, when they will give way in the middle of the mass, and fall back into the bottom of the cylinder, so that they will be all the time changing their position, and all the time will have streams of steam and hot water discharged upon them, so that they will be washed clean in a very short time. The water, as it flows back into the space beneath the false bottom, carries with it the dirt taken from the clothes, and leaves it there, so that very little of said dirt will again be thrown upon the clothes.

Improved Steam Boiler.

Carlos A. Clark, Bloomfield, Iowa.—This is a boiler constructed with two steam domes connected with each other by tubes, and with horizontal steam-generating tubes by vertical tubes. The steam may be used from the upper tube or from either of the domes, as may be found most convenient. With this boiler, fuel may be utilized to a great extent. No large body of water is to be heated, and danger of explosion is less than with ordinary boilers.

Improved Horse Blinder.

John W. Kennedy, Central Village, Conn., assignor to himself and William H. Kennedy, Oberlin, O.—This invention consists of a blinder made independent of bridle or halter, and applicable to prevent horses from jumping over fences and thereby escaping from a pasture. It passes under the eyes, stopping all vision from side views as well as front, and as the horse approaches a fence, not seeing it or the ground on the opposite side, he fears to and will not leap the fence.

Improved Curtain Fixture.

Levi Bradbury, Bennington, Vt.—The brackets are made of wire with one or more convolutions to form springs, and with prongs, so that they may be driven into the wood, and fastened without screws or nails. These spring brackets are made to press against the ends of the roller with any required amount of friction to hold the curtain in any desired position.

Improved Hay Elevator.

Uel H. Shockley, Ringville, Kan.—In this hay elevator a carriage is arranged to travel horizontally and carry a bundle of hay suspended by the cord, by which movement is imparted to the carriage. The improvement relates to the construction and arrangement of parts, whereby, when the carriage has reached the place of deposit for the hay, the suspending rope may be swung laterally to free it from hinged doors or clamps, and allow the load or bundle to descend.

Improved Feed Water Heater.

Richard Garstang, St. Louis, Mo.—This invention consists of a feed water heater composed of two cast metal oval heads, with short cylinder attachments, connected to an intermediate cylinder containing tubes fitting into tubesheets in the cast metal cylinders. This forms a heater of three compartments, in one of which is a filter, and in another of which the feed water is supplied in direct contact with the waste steam, after which it is forced by a pump through the other compartments, also through the tubes surrounded by the exhaust steam, and also through the filter into the boiler all in a way calculated to be very efficient in heating the water.

Improved Hog Ringing and Marking Instruments.

Philip Listemann, Collinsville, Ill.—This invention consists of pinchers so constructed that a semicircular ring blank for the hog's nose is formed, and the ring blank inserted. The partly finished ring blank is placed in the grooves of the jaws, and, in this position, it is slipped on the upper cartilage of the hog's nose, the jaws are compressed, and the ring blank is inserted. The blade for marking a hog shuts into one of the levers.

Improved Machine for Making Hollow Cylinders of Paper.

Marble D. Keeney, Rockton, Ill.—This invention consists of a forming roller, which is keyed to the free end of a shaft driven by suitable power, and constructed of two semicircular sections. These are pivoted by their diametrical arms and fulcrumed at some distance from one joint of the sections, while the other joint is acted upon by a pivoted wedge piece, so as to hold the edge of the continuous paper firmly in the clamping joint by spreading the other joint, and form then the box or barrel on the roller

Improved Journal Bearing.

De Witt C. Clough, Auburn, N. Y.—This invention consists in a journal box, cast with longitudinal side grooves or channels, extending between shoulders near the face parts for producing a firm binding of the Babbitt metal lining cast therein.

Improved Hay and Cotton Press.

Hiram Lupher and Dexter S. Munger, Tullahoma, Texas.—This invention relates to novel means for operating the follower of a hay or cotton press, the object being to give a maximum purchase in applying the muscular strength of men, and to enable the greatest weight to be compressed into the smallest bulk. This not only produces greater convenience in the manipulation of the bale, but diminishes the freight chargeable thereon by railroads and steamers.

Improved Cooking Apparatus.

Mary A. Scott, Patoka, Ind.—This invention consists of a metal case containing a steam boiler, ovens, and steaming chambers, adapted to be placed on a stove or range, to generate the steam for heating the cooking chambers. It is designed to distribute the heat better, and thus utilize it to a greater extent than is done in the common stoves and ranges.

Improved Corn and Bean Planter.

George B. Smith, Coburg, Can.—The object of this invention is to plant corn, beans, etc., in rows of any width, and to fertilize and cover the same in one operation. It consists in an upper frame containing the fertilizer and grain boxes and mechanism actuating the same, and a lower or supplemental frame containing openers, spouts, coverers and rollers attached to the upper frame by links, and elevated by means of an elbow lever. A cylinder in the grain boxes having cavities upon its periphery is actuated by a squared shaft; and as it revolves inside a jacket of sheet metal, an arm attached to its end alternately opens a feed slide admitting the grain which fills the cavities in said cylinder; and the said cavities, when inverted from the revolution of the cylinder, discharge their contents through the spouts below. The mechanism in the fertilizer boxes is similar to that of the grain boxes, except that the hopper is provided with a stirrer, and the cylinder has no jacket. Both grain and fertilizer boxes are laterally adjustable upon the squared shafts, as are also the bars of the supplemental frame supporting the opener, spouts, coverers, etc.

Improved Rolled Metallic Bars.

Reuben P. Colton, Gananoque, Can.—This invention is a new manufacture consisting of iron rods or bars from three fourths to half an inch in cross section, rolled from piles or fagots, and provided with edged projecting ribs parallel to the planes of piling.

Improved Car Axle Lubricator.

John W. Bollman and John G. Ernst, Baltimore, Md.—This invention elates to a novel and economical mode of applying lubricants to car axles, nd consists in using a spring, one or both of whose ends clasp a side or ides of the journal; while, on the inner side of each of these ends is attached the end of a wick which is saturated with and has part of its length resting in the lubricant.

Improved Bedstead.

Stephen P. Leake, London, Can.—This invention relates to the construction of cribs, cots, cradles, and bedsteads, so that they may be made cheaply, durable, and without the use of metallic fastenings, such as screws, catches, or hooks: and so that the labor, machinery, and expense of letting the fastenings into the frame, and fitting them thereto, may be entirely avoided.

Improved Thrashing Machine Attachment.

Asa Low, Shell Rock, Iowa.—This invention consists in causing the grain to pass from the thrasher cylinder to an upwardly moving endless straw carrier made of leather belts or wooden slats, and then to reach the rattle rake while the grain that drops from the straw falls upon the bottom of said rake, and is carried back where the apron deposits. The grain that is blown over the ordinary thrashing machine riddle passes directly to the riddle of the inventor's attachment; while that carried away in the straw is first dropped through the ventilators, and then returned with the straw carrier on the lower floor of the stacker to the same destination.

Improved Stump Extractor.

Randolph P. Cory, Consecon, Can.—This invention relates to and consists in mechanical means for extracting stumps and roots of trees from their native soil, in lifting heavy bodies, and in transplanting them with convenience, dispatch, and facility.

Improved Apparatus for Hoisting and Tiering Cotton.

James B. Wendel, Memphis, Tenn.—This invention relates to means whereby cotton bales may be raised and transferred to any given position so as to form a succession of tiers or piled bales in a building.

Improved Stove Grate.

M. Augustus Withers, Pottstown, Pa.—This invention relates to stove grates, and consists in novel means whereby the clinkers may be detached and removed from one part of the grate without the necessity of tipping, disarranging, or emptying the whole grate.

Improved Horse Detacher.

Thomas E. West, Nicholasville, Ky.—In this device the traces are released from pivoted levers by pulling a strap and allowing the levers to turn into a position at right angles to the whiffletree, to which they are pivoted.

Improved Railroad Car Stove.

John H. Mahrenholz, New York city.—Railroad car stoves are usually so constructed that, when the car upsets or the stove is displaced by a violent collision or other cause, the car is frequently set on fire, and the roasting of the helpless passengers is added to the other horrors of a railroad accident. The present inventor arranges a closed top firepot and drop flue in a cylinder having an openwork top, so as to present a large area of heating surface, and to allow the air free access to the pot and flue on all sides, and free escape through the top of the cylinder. He also arranges a water reservoir and steam generator beneath the floor of the car. The stove is firmly attached to the floor of the car, and cannot be readily displaced. It may be turned over or bottom side up without discharging any fire into the car, and is, therefore, safe in cases of accident.

Improved Balanced Slide Valve.

John T. Hill, Warren, Pa.—Slide valves for steam engines, as usually constructed, are subjected to the full pressure of the steam, and consequently wear and cut on their faces, and frequently become useless. The object of the present invention is to so construct a valve that it will not be subjected to this down pressure; and it consists in a valve having an elastic top plate or follower confined between flange plates on the sides and ends of the valves. The valve having this plate thus arranged is placed on the face of the cylinder within the steam chest, and the steam chest cover put on, which forces down the plate against the pressure of the springs. The reaction of the springs and the action of the steam on the lip forces the plate upward with a constant pressure.

Improved Table for Vessels.

Captain Edward P. S. Andrews, Havilah, Cal.—This is an improved table for use on vessels, constructed with sectional top leaves, swinging in suitable supporting standards by means of weights connected to them by pivoted lever rods for the purpose of retaining a level position of the top during the rolling motion of the vessel.

Improved Bluing Package for Laundry.

Alexander M. Van Lier, New York city, assignor to himself and Frederick R. Gillespie, same place.—This invention relates to the manner of putting up bluing used for laundry purposes, and consists in a perforated glass casing in which the bluing bag is enclosed.

Improved Steam Boiler.

Philip T. Brownell, Elmira, N. Y.—This boiler has a flue leading to its smoke discharge pipe, connected with a sliding fire box, to take off the products of combustion when said firebox is withdrawn. The sliding fire box is provided with a lip arranged to close the flue when the firebox has been pushed under the boiler. The firebox is also combined with a plate hinged to the boiler base, covering the top of the firebox when said box is drawn out, and swinging up out of the way at other times.

Improved Game Apparatus.

Henry L. Crist, Middletown, Pa.—In playing this game the object is to throw rings into the coils of a spring, so as to be suspended. The spring is vertically fastened to a suitable standard. It is also a part of the game to throw the rings over pins on the table beneath. The suspended ring counts a certain number, and the other ings encircling the pins are given ess values.

Improved Vapor Burner.

Frederick A. Sawyer, Houston, Texas, assignor to himself and Addison H. Baldwin, same place.—The oil is carried through a wick tube to the reservoir. The burners are simple perforated tubes, radiating from the center, but in communication with an annular generating chamber which forms the base of the reservoir. The flow of oil to the chamber is regulated by means of a valve. The burner tubes are closed at their outer ends and are provided with pans to catch the drip. The liquid consumed may be any of the light hydrocarbons, as gasoline, naphtha, etc., and is carried up to the reservoir by capillary attraction, and is converted into vapor as it enters the burners by the high temperature caused by the flames.

Improved Adjustable Window Reflector.

Charles Christensen and Charles Olsen, New York city.—This invention has for its object to furnish reflectors for windows, so constructed that they can be readily adjusted to give an inmate of the room a view of the street in both directions without being seen. It consists in a simple arrangement of gearing so constructed that, by turning the knob, the reflectors may be extended at any desired angle, as the observer may desire.

Improved Fruit Dryer.

Judson Allen, Everett, Mo.—The hot air enters into spaces at opposite sides of the drawers. These spaces are separated from the space under the lower drawer by plates. They are also separated from the spaces between the drawers, except the upper one, by valves, and they are enclosed below the upper drawer by curved deflecting plates. The drawers are arranged with a passage, alternately on opposite ends, and have slots or perforations in the bottom, to allow some heat to pass up between them. The heat is supplied to the drawers mostly from passages by the valves, which are graduated so that each one will take its due measure, the upper one entirely cutting off the space when necessary. The heat escaping beyond the upper valve is all turned in under the upper drawer, or the next to the upper one. The dampers are connected to levers outside of the case by links which are so adjusted as to graduate the valves to the air currents.

Improved Finger Ring.

James Annin, Le Roy, N. Y.—This invention consists of a spring filling piece, to spring into the ring inside of the finger after it is put on, to fill up the slack space and make the ring fit the finger closer above the joint, and secure it against being lost. The filling piece is provided with points, to spring into sockets in the ring to hold it in place; or it may have clips to overlap the edges of the ring.

Improved Ditching Machine.

Thomas F. Cocke, St. Louis, Mo.—On the right hand side of a plow is arranged a wheel the rim of which is a long endless belt of plates jointed together and running up over a sprocket wheel on an elevated frame, and carrying buckets which, in passing under the wheel, go alongside of the moldboard of the plow, so as to receive the earth turned over by it, and carry it up and discharge it into a spout, to be thrown upon the bank at the side.

Improved Wind Wheel Toy.

William Gorton, New York city.—This is a toy wind wheel consisting in a wheel and staff, the former being provided with a sleeve box and pin journal, and the shaft with one or more ferrules. The wings may be placed at any desired angle, so that when the wheel is moved rapidly through the air it will revolve.

Improved Link Block for Locomotives.

William A. Alexander, Mobile, Ala.—This link block is not constructed of one solid piece, as ordinarily the case, but composed of two longitudinal parts, whose adjoining sides are produced under suitable inclination for the introduction and close fitting of a wedge piece; the latter is adjusted from time to time, and forces the block parts closely on the link, producing equal wearing over the whole surface of the same.

Improved Washing Machine.

William E. Banzett, Brooklyn, Pa.—This invention relates to that class of machines that combine in one apparatus a washer and wringer. It consists of a receptacle for the water having a concave false bottom, made of ridged or grooved slats, over which vibrates one or more rubbers attached to the ends of a pair of levers containing a wringer. Said wringer oscillates with the rubbers when the same are in operation, and when not in use is folded out of the way in the receptacle. Said receptacle is provided with a double hinged lid, which, in connection with a pair of hinged leaves upon the sides of the washer supported by brackets, forms an ironing board when the wringer is folded within the machine.

Improved Wheel for Vehicles.

Milledge B. Wever, Johnston's Depot, Edgefield county, S. C.—This invention relates to methods of adjusting the spokes of vehicle wheels to the fellies, and is a new and improved method of doing the same by means of oval-shaped thimbles terminating in screw-threaded stems. Said thimbles are attached to the ends of the spokes, and the screw-threaded stem provided with a nut. The projecting end of the stem passes into a socket or cavity in the felly, and the nut forms a shoulder by turning which the length of the spoke is increased and the connection correspondingly tightened, the oval shape of the thimble preventing the same from turning upon the spoke.

Improved Hay and Cotton Press.

Fielding L. Kirtley, Cleburne, Texas.—This invention relates to that class of machines known as hay and cotton presses. It consists in a strong, substantial box, for the purpose of holding the material to be pressed, provided with doors opening on all sides of the portion of the box into which the bale is compressed. Said box is mounted on rollers upon a frame work, one set of which are contained within a pair of keepers which allow the box to turn upon the frame and assume a vertical position when the same is to be filled. Securely attached to the box are metallic straps provided with links, one set of which engage with a ratchet toothed bar above and below, and the other set, with a rack, on each side of the apparatus. Said rack is contained within a frame work mounted upon rollers and moving upon a level with and upon the same supporting frame as the box. In the same frame with the rack is a shaft, bearing pinions which engage with the racks, said shaft being driven through cog wheels by a second shaft which is actuated by a spring-seated lever that engages with a ratchet wheel made fast to said shaft. As those levers are operated, the movable frame is advanced, and a follower block attached to the same is forced into the box, there compressing the material contained therein into a bale.

Improved Car Wheel.

Isaac Dripps, Philadelphia, Pa.—The wheel is formed of wood and metal, the object being to render it light, elastic, and yet strong and durable.

Improved Jigger for Separating Ores.

William H. Plumb, Mauch Chunk, Pa.—This invention consists, mainly, in the arrangement of an ore-receiving receptacle with inclined perforated bottom and central tubular extension, which is vibrated rapidly by suitable mechanism in connection with a central perforated disk. The latter is inclined in opposite direction to the bottom of the receiving receptacle, and provided with vertical downward extending guide lugs, and a mechanism for adjusting the relative position of the perforated parts. The central bottom extension of the receiving receptacle is guided in its motion by a sleeve, while the upper part of the same is guided in a surrounding perforated cylinder, with similarly reciprocating but considerably slower motion. This slides up and down in the upper wall of the main casing, and discharges intermittently the lighter part of the ores when its perforated inclined rim rises above the upper rim of the casing, conducting the lighter parts off to a chute of suitable inclination, extending around the main casing. The ore or coal is fed through a suitable hopper to the center of the receiver, and kept continually submerged in the water in the tank, and acted upon by the currents of the same. A piston valve serves, in connection with the bottom extension of the receiver round the conical base of the main casing or tank, for the regulation of the flow of water from the extension to the interior part of the tank where the heavier particles are discharged. An inclined casing connects with the bottom of the tank and incloses the ore elevator for carrying up the heavy particles and discharging them above the water level of the tank.

Improved Washing Machine.

John S. Headen, Freeman, Mo.—This invention consists in combining, with the beater or press board frame, a cover, in such a manner that the same is free to reciprocate with the beater frame for preventing spattering of the water, the cover being also detachably applied, so as to enable the clothes to be readily inserted and removed.

Improved Candle Holder.

William Ulrich, Newark, N. J., assignor to himself and F. Haupt, same place.—This invention relates to a candle holder for use on Christmas trees. Spring legs are soldered to the under side of the socket base, and bent in such a manner that they pass sidewise of each other and give to the curved parts, immediately below the point of intercrossing, a spring action, so that this part not only fits to the branch of the Christmas tree, but also adheres firmly to the point to which it has been applied. The lower parts of the legs are spread out in inverted V shape, and are detachably connected by a piece of wire to which a weight is hung.

Improved Sewing Machine.

William W. Abbott, Philadelphia, Pa.—The first part of this invention consists of a guard attachment on the bulged take-up plate used in connection with the rotary looper of a machine in which a commercial spool is used for the under thread, to prevent the said looper from hooking into the old loop. The second part consists of an improved arrangement of devices for actuating the loop spreader; and the third part consists of an improved arrangement of devices for operating the under thread spool carrier.

Improved Farm Gate.

George Hoskins, Gilead, Mo.—This invention consists of a gate which slides by its double end piece along T-shaped pieces hinged to the main post, and is retained thereon by pins passing through perforations of the end pieces. A lever, pivoted near the middle part of the gate, raises the gate by its pivoted upright rod near the fore end of the lever, while the rear end of the same locks into notches of the gates for the adjusting of the supporting pins. The adjustment of the gate for the passage of small stock above the snow or other purposes is easily accomplished.

Improved Pill Machine.

Pierre Cauhape, New York city.—This invention consists of a couple of sets of pointed hooks in a jointed stock, which opens and closes the hooks for griping and releasing pills, in combination with a table and a holding bar, for holding the pills so as to be taken by the hooks for dipping them in the gelatin coating bath; also, a socket clamp for taking the pills from the hooks after the first dipping; and also a spring clamp for taking the pills from the socket clamp and dipping them a second time in the coating bath. A special advantage of this apparatus is that the pills may be dipped each time exactly to the center, so that the two coats will meet and join thereat without overlapping, and thus make the pills uniform.

Improved Horse Shoeing Harness.

John Clarridge, Mount Sterling, Ohio.—This invention consists of a strong harness with ropes from the breech band to posts near the head of the horse; also, straps from the breast strap to the post at the rear; also, straps for fastening the breech and breast straps to the floor, for preventing the horse from going forward or backward and rearing or kicking. It also consists of a strong saddle, having a windlass on it for raising the foot to be shod by a rope, said windlass being adjustable along the top of the saddle and capable of turning as required for hitching to the different feet; and it also consists of a strong bar on each side of the saddle, for the support of an adjustable hook, with straps attached, with suitable ring and buckle for lifting and holding the feet while being shod; also, for holding the guide pulley (which is adjustable), over which the rope passes from the windlass to the foot to be lifted.

Improved Gate for Railway Crossings.

Elmer Ridge, Philadelphia, Pa., assignor to himself, Amos H. Taylor, and Isaac C. Shallcross, of same place.—This is an improved gate for railroad crossings, consisting of balanced folding gates placed parallel to the track into recesses of the ground, and hung to side standards, combined with connecting lever rod and lateral crank shaft with lever handle, so as to be rapidly and easily thrown into position on the approach of a train for preventing the passage of vehicles or persons over the track, and instantly folded out of the way after the train has passed.

Improved Hot Air Furnace.

Edwin H. Camp, Jackson, Mich.—The fire box extends horizontally, and is made diamond-shaped in cross section, a little larger one way than the other, and arranged with its greatest diameter in its vertical axis. Flanges in the horizontal axis separate the parts below from the part above, so that the cold air, which is first admitted to the lower part, will all be caused to pass through the fire chamber by tubes into the upper part of the heating chamber. The upper set of the horizontal tubes of the radiator in the space above the furnace is supported directly over the top of the furnace by two short flues, discharging the smoke and hot air from the furnace into it. The other tubes are suspended over the sides of the furnace by middle and end flues. Disks are placed on a rod, which extends along the interior of the upper horizontal tube and projects out at the front for a handle for working the disks which constitute a damper for controlling the escaping smoke, hot air, etc.

Improved Vehicle Spring Brace.

Andrew J. McRay, Alma, Wis.—The rear end of a brace is connected with the rear axle, and its forward end is connected with the forward bolster. A rod passes up through a hole in the reach, through a hole in the brace, and its upper end is firmly secured to the body of the vehicle. The rod has a head formed upon its lower end to prevent it from being drawn up through the reach. By this construction, the rod and the brace will prevent the body of the vehicle from being thrown forward when the wheels enter a hole, and will also prevent the springs from jumping up, so that the springs will be prevented from being injured or broken by these causes.

Improved Drawing Board.

Charles Poore, of Lexington, Ill.—This is an improved drawing board, on which the paper can be placed quickly and neatly without the use of mucilage or glue, and without producing stiff glued edges or ridges, and thereby an inaccurate working of the T square. The board is provided with grooves running parallel to and at a suitable distance from the edges of the same. The inner sides of the grooves are slightly inclined, and the fastening strips, of the width of the grooves, are pressed down over the edges of the paper, to bind the same to the board.

Improved Tile Machine.

Ira P. Merwin, Syracuse, N. Y.—This invention relates to that class of machine in which the pipe is mounted on a vertical core in a vertical case supported on a base plate, so that the core can be removed from the molded pipe, and the latter removed in the mold case to dry, and consists of a core standard or core base for the support of the core, detachably connected to the latter by a bayonet fastening, to allow of connecting and disconnecting them readily; also, a novel mode of fastening the core standard in the machine.

Improved Sink Trap.

Henry Miller, Johnston, R. I., assignor to himself, George Miller, and Alfred B. Irons, same place.—The nozzle of the cesspool extends down so as to afford a considerable fall of water, and discharges into the cup of the trap. Thence the water escapes over the edge in such manner that small articles, falling down the nozzle when the strainer is raised, will not be carried out of the cup and down the pipe. Lugs are cast on the stench trap, with a bolt cast in for attaching the trap by lugs on it to be screwed up by the nuts. This trap is adapted for the use of revolving scrapers for cleaning it out, if required, in case the strainer be screwed down, the scrapers being fixed on arms under the strainer connected to the pivot of a turning knob at the top of the strainer, in the center.

Improved Paint Compound.

George W. Pond, Brooklyn, N.Y., assignor to Mary E. Pond, same place.—This invention is a paint which readily dries and hardens under water either salt or fresh, effectually resists the attack of the *teredo spiralis* and is consequently very valuable as a paint for all marine vessels. It made from coal tar by combining with the latter nitric acid, rosin, and sulphuric acid.

Business and Personal.

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

Answers to Correspondents

H. B. will find a recipe for modeling wax on p. 58, vol. 24.—A. J. L. can remove stains of ink and fruit by the recipes on p. 171, vol. 30.—C. A. B. will find that the construction of paper boats is fully described on p. 165, vol. 27.—J. D. G. will find details of the manufacture of tin plates on p. 377, vol. 29.—E. L. will find directions for canning green corn on p. 107, vol. 31.—W. R. H. will find a description of an æolian harp on p. 330, vol. 26.—I. I. N. will find directions for making paper fire and waterproof on p. 129, vol. 28.—F. A. M. can japan small tin articles by the process described on p. 132, vol. 24.—J. E. can join pieces of rubber by using the cement described on p. 203, vol. 30.—B. W. B. can keep cider sweet by following the directions on p. 10, vol. 28.—F. C. R. can enamel leather by the process given on p. 122, vol. 27.—P. O. F. and W. R. T. do not send their addresses.

O. P. B. asks: What mode of procedure is necessary to prevent paint from blistering and cracking? I have three doors, all facing the east, which blister exceedingly, from the size of a pea to that of a Mexican half dollar. I have had them painted twice in the last year, each time with the same results, blistering, scaling, and cracking. They are pine of the best quality. Would boiling the oil have any effect? Or would hot oil, first applied, help the case? Is the use of shellac any advantage? A. The cause of the blistering is most probably a too rapid execution of the work. After the first coat of paint is put on, time should be allowed for it to shrink into the wood and get hard upon the surface before the next coat is applied; and the same for each coat, when there are more than two. Use spirits of turpentine to thin the paint, and not benzine.

F. A. H. says: 1. You deny that a solid body, projected vertically, returns to the earth with the same force as was used in projecting, by reason of the resistance of atmosphere, whereas the atmosphere has just as much resistance one way as the other. A. If you have any idea that our statement was incorrect, you can easily settle the matter by an experiment. Get a friend to throw a ball into the air, as far as he can, and you catch it as it returns. Then stand off two or three feet from him, and ask him to throw the ball to you, with all his force, and again catch it; you will thus be able to determine whether the force at starting and returning are the same. We do not think that we have given any rule for the horse power of steam boilers. If you have any information on the subject that you would like to impart, we shall be glad to hear from you.

W. E. D. says: I am building a conveyer to convey feed and grain and wish to turn an angle with a universal joint. The angle is of 110°: can the conveyor be made to work? A. It would be better to make the conveyor in two parts.

J. J. T. asks: Which will discharge the most water, two 6 inch pipes or one 12 inch pipe? A. All other things being equal, the discharges of water from pipes are as the areas of their cross sections. A 12 inch pipe has an area of 113·0976, and a 6 inch pipe, of 28·2744. Therefore a 12 inch pipe has double the capacity of two 6 inch pipes.

J. E. asks: What will restore the color to a black coat which has been stained by perspiration? A. Try ammonia.

L. E. A. says: In your issue of July 29, wax is recommended for softening violin tones. In what part of the bridge should the wax be placed, and what wax is the best to use? A. Use a hard white wax, and place it on the edge of the bridge where the strings are strained.

B. M. & Co. say: In casting an iron roller around a cast steel mandrel, the cast iron always bubbles up and forms, after cooling, a honeycomb. We have tried borax, and warmed the mandrel; but we had no better result. What will prevent it? A. Dry the molds and cast the rollers upright, suspending the steel shaft if necessary, and cast the roller rather long er than is necessary. By this means your casting will be sound: and cutting off the top end of the roller, to bring it to its proper length, will take away the few air holes that are liable to remain there.

J. A. B. asks: A freemasons' lodge has a hall in a brick building, using the second story. The lower story is used for store and dwelling; and in building, the usual method of deafening was used, namely, a floor midway in the joists, and then an inch or so of plaster, and then the floor laid down as usual. But this fails to deaden the sound, in fact it seems to make it more hollow sounding, and the noise comes below too much. Our proposition is to lay strips one inch thick on the floor, say 1 foot apart, and then fill that even with mortar, and lay another floor tight on that; will you please inform us about it? Would several thicknesses of sheathing paper, tacked down under the carpet, help it? A. The deafening was probably put in with a loamy mortar, which is too often the case, and has since shrank from the wood and cracked, and perhaps turned to dust. If it were possible to take up the floor and put in a fresh layer of good lime mortar, it would help it. If not, two thicknesses of building paper laid under the carpet would improve it.

R. M. says: 1. I have a boiler about 16 inches in length and 8 in diameter. What would be the best size for a cylinder for such a boiler? A. You should use a cylinder of 1 inch diameter and 2 inches stroke. 2. What could I best make it of? A. Either of iron, brass, or white metal. 3. What should be the power to the pressure per square inch? A. It will equal the pressure on pistons in pounds, multiplied by space passed over in feet per minute, and divided by 33,000.

What power is required to run an ordinary sewing machine? A. About one thirtieth of a horse power, on an average.

W. S. P. says: I have hit upon a crank which gives two strokes of the pitman to one revolution of the crank shaft. I made a model and showed it to several machinists, and they all said that they had never seen or heard of anything like it. Do you know if such an invention was ever made? A. A device for the purpose is quite old.

M. & H. ask: Will leather last longer than rubber, if continually under sweet water, and bent forward and back under a little strain? How long will each last? Is there any other flexible stuff more durable for the same purpose? A. Rubber will generally be the more durable of the two. We cannot answer your other questions without knowing more details.

A. S. asks: Having to renew the firebox to my hot air engine, having a cast iron bottom with flange on the same and sides of heavy sheet iron, I find it impossible to draw the sheet iron to the bottom tight, although the rivets are only ⅛ inch apart. Can you tell me of a cement that will close them and withstand the heat, the bottom being often of a white heat? The leaks are small. I have tried pulverized firebrick 2 parts, with 1 part plaster of Paris, also litharge and glycerin. The former is the best, but flakes under the intense heat. A. A well made rust joint may answer.

R. G. T. says: I have a spindle of three inches diameter, and I want to bore a ring out, driving fit. What additional allowance am I to make to get that ring to go on, and what is the specified rule to take in practical work of that kind? A. Set your outside callipers to just perceptibly touch the shaft, and your inside callipers on a pointed wire gage to barely touch the points of the callipers, and to barely touch the hole in the collar. Why do you not try the spindle in the collar while the latter is in the lathe? If the collar is to be a permanent fixture, why not warm it and then shrink it on? There is no rule as to the allowance on callipers for a driving fit; it is too fine an operation to allow of any practical rule. An expert workman can rely upon his judgment; others try and re-try the fit.

B. H. S. says: I am running an engine of the following dimensions: 20x26 inches cylinder, 125 revolutions per minute, 100 horse power, 7½ inch crank shaft, and 11,000 lbs. fly wheel of 12 feet diameter. There is an opening in steam pipe from steam dome to engine of 5 inches diameter, and cast iron steam pipe 18 feet in all, with 3 elbows. I have 3 boilers, 24 feet long and 43 inches diameter, with two 16 inch flues in each. A steam drum runs across the 3 boilers at ½ the distance from the back end of boilers. The dimensions of steam drum are 18 inches diameter, 14 feet length, and there are three 4 inch openings in connection. At certain times, just after firing up, we have a severe rushing and hissing sound, just as if steam were passing very rapidly from one boiler to the other; this lasts for 3 or 4 seconds and is then followed by a heavy thumping and rumbling noise and a quick sudden jarring of the boilers. All of this probably lasts for 6 seconds, and at low stages of water and high pressures of steam; and the needle on the steam gage shakes and trembles, and the water leaves either the middle boiler or one of the side boilers. Can you tell me what is the trouble? I think the openings in the mud drum connections are too large, and the water passes from one boiler to the other from uneven firing. A. The trouble seems to be caused by excess of pressure on one boiler, due to uneven firing. We have frequently pointed out, on former occasions, the trouble and danger likely to result from this arrangement of feed pipe. Each boiler should be fixed so that it can be supplied with water independently of all the rest, and so that water cannot be forced from one boiler into the other.

G. & W. say: Sixty days since we put up a boiler of 44 inches diameter and 20 feet long, with nine 6 inch return flues, to run a 12 x 30 engine twenty feet distant, and connected thereto by a steam pipe of 2½ inches diameter, with a furnace 18 inches deep and bridge wall carried within four inches of boiler and circular in shape, with side walls 3 inches from boiler. The side walls are carried up to make fire linings high, and there is a combustion chamber, at rear of bridge wall, 16 inches deep, divided by two walls equal distances apart, and carried up like the bridge wall; but it fired hard and ate up too much fuel. We changed it several times with no improvement, and now have the bridge wall 5 feet 2 inches below the boiler. We took down the division walls of combustion chamber and filled it up to within from 9 to 12 inches of boiler; but it is not as good as at first, firing much harder and not keeping steam so easily. We use shavings from yellow pine for fuel. We sometimes run three planers, besides a carpenter's shop. We require 100 lbs. steam to run everything well, but cannot keep it up now by any kind of firing. Our chimney is 30 inches diameter and 40 feet high. We shall await your advice before changing again. A. It may be that your furnace is not large enough, that your grate bars are of the wrong kind or improperly set, that there is a large leak of steam in the engine, that the boiler is not large enough for the work, etc. Matters of this kind are best settled by a good engineer, after an inspection.

J. D. asks: 1. Of what horse power should an engine be to run a boat 25 feet long and 4 feet wide, built with a flat bottom (like the boats on the Mississippi river) with a depth of 18 inches, with a 12 inch guard on each side? A. From 6 to 8. 2. What amount of tunnage could such a boat carry? A. From 3 to 4, including the weight of the boat. 3. Would a propeller or stern wheel be the most efficient? A. Stern wheel, probably. 4. Which would be the cheapest? A. There would not be much difference in cost between the two.

A. M. S. asks: What will be the pressure on 128 square feet when the wind blows against it at the rate of 40 miles per hour, 20 miles per hour, and 10 miles per hour?

A. Velocity of wind, in miles per hour.	Pressure against a perpendicular surface, in lbs. per square foot.
10	0·492
20	1·968
40	7·873

2. Would the pressure be the same if the air was still, and the plane moved against it at the same rate? A. Yes.

1. What is the cost of aluminum? A. About the same as that of silver. 2. Can it be procured in this country? A. Yes.

N. B. S. asks: Where was the first railroad on which the first locomotive engine was used, for conveying passengers or freight, in this country? What was the date thereof? A. The late Joseph Harrison, Jr., states that the first locomotive run in America was the "Lion," built at Stourbridge, England, and used on the Delaware and Hudson railway in 1829.

A. & W. B. C. asks: How can we soften a broken circular saw, so that we can easily cut it up to use the steel for other purposes? A. Make the steel red hot, and leave in a heap of dry sawdust till cold.

G. D. asks: Suppose a man were stationed at every degree, or only four minutes of time apart around the globe, and a man should start from New York, say at noon on Monday and keep pace with the sun, which station would first inform him that it was Tuesday noon? A. At 180° from the meridian from which time is reckoned. All vessels keeping Greenwich time change the date one day either backward or forward, according as they are moving east or west, in pasting the place where the longitude is 180°.

At what place opposite the sun on the earth should an observation be taken to be in a straight line through the center of the sun and the earth at the moment of perihelion, in order to establish a point in the heavens at the moment the earth is nearest the sun? A. The time of the earth's perihelion passage is given in astronomical almanacs in Greenwich time, and an observer who wishes to be on the line between the centers of the sun and of the earth at that time must place himself on the meridian of longitude there indicated.

M. H. R. says: I have a large brick building, built of common brick, which I am now having painted and pencilled. Would you advise me to mix any liquid glass with the last coat of flat brick red, or to put on a coat of liquid glass, after the painting and pencilling is done? If the liquid or soluble glass makes a permanent covering, I think it would be a valuable addition to put on a last coat of it, as otherwise in a few years the oil dries in and the red will rub off unless a coating of oil is applied. Perhaps it might be well to wait a year or two before applying the glass. A. We do not think the use of soluble glass would improve the paint; it is used mostly for inside work. If your building is a new one, it would be better to let it stand as long as possible without painting, to enable the walls to dry.

P. D.—The problem of a boring bar being out of true, boring a true or oval bore is capable of three explanations: If by "being out of true with the lathe shears" is meant that the bar is out of true as if in consequence of being bent in its length, it will bore a true hole, providing, as stated, that the carriage feeds up to the cutter. If the term "out of true with the lathe shears" means that a line drawn between the centers of the lathe will not be parallel, both horizontally and perpendicularly, with the shears of the lathe, still the bore will be true if the boring bar runs true and the cutter head feeds along the bar; if, however, in this latter case, the cylinder feeds to the cut, the bore of the cylinder will be oval. Boring bars with immovable heads are not, however, under any circumstances good tools to use, because their length must necessarily be twice that of the length of the cylinder; hence they are not so rigid, and are therefore more liable to jar and spring than bars having traveling heads, which need be only long enough to allow the head to pass through the cylinder.

E. L. E. and others: A child is in the second year of his age when he has completed the first, and so on. So that a man is in the twenty-sixth year of his age when he has completed twenty-five years, the twenty-sixth year commencing on the twenty-fifth anniversary of his birthday.

W. P. G. asks: Where can I get a copy of the American *Astronomical Ephemeris*? A. At the Hydrographic office, Washington, D. C.

J. H. G. asks: What objections are there to the use of raw gas tar with clean bar sand, thrown on as applied, for a coating on an English roofing felt? Would such a coating last, say, two or three years? Gas tar is sold here for eleven cents per gallon. Will it last long enough to pay for the putting it on? A. Gas tar is used as a paint or varnish on wooden fences, and all wood exposed to the weather, and is found to be beneficial as a preservative; especially is it used to advantage on the bottom of fence posts in the ground, to prevent decay. It will no doubt preserve the felt, and we do not know of any objection to its use. But they charge you too much for it; two cents per gallon is enough.

G. W. S. asks: Is there any device for taking steam out of a boiler by a tube and conveying it under the grates of the fireplace, to keep the fire down when the engine is stopped? A. We do not know of anything of the kind.

C. asks: How can I blue gun work? A. Having a quantity of charcoal ashes on an iron plate or in a box, place over the fire and heat slowly. Put the articles to be blued in the ashes; and as they heat up, take out occasionally to observe the color. When the color is a blue, do not take them out, but leave them until they have become white again, when they should be taken out and allowed to cool. By returning the articles and re-heating, you will have the second blue; the first will rub off easily, but the second will wear a long time.

H. D. A. asks: What is the correct weight of cast iron balls of 5⅝ inches diameter, made of hard iron, such as is used for car wheels? A. Average weight, about 21¼ lbs.

Z. asks: How many lbs. of steam of 160° Fah. can one lb. of ice condense, leaving its water deposit at 30°? A. About 0·182 lb., if there is no loss by radiation and conduction. A line in our Business and Personal column will doubtless obtain an answer to your other questions.

H. H. H. asks: 1. Can an engine be made to cut off at any desired point with a cut off valve working on top of an ordinary slide valve, by lengthening or shortening the cut-off valve rod? A. Yes. 2. If so, what is the relative position of eccentric? A. The cut-off eccentric should be set so that the cut-off valve has motion coincident with that of the piston.

W. C. asks: Will you please tell me the usual proportion between the high and low pressure cylinders in a compound engine? A. The low pressure cylinder is made from 2½ to 4 times as large as the high pressure.

Is it difficult to determine the horse power of a locomotive? A. It would be necessary to attach a dynamometer to the locomotive, or to take indicator diagrams from the cylinders.

Is the *Science Record* printed every year, and can I get back numbers? A. Yes.

J. B. says: I have seen it stated that, for accurate shooting, a muzzle loader beats a breech loader. Is this the case? A. A good breech-loading rifle is better than a muzzle loader.

C. M. A. says: 1. In a late number of your paper you advise a correspondent, who wants to build a sail boat sixteen feet long, to build a center board boat six or seven feet beam, and cat-rigged. What is a cat rig? A. Single sail with boom and sprit mast. Would you have the boat clinker-built or caulk-seamed? A. Caulk-seamed. 3. How far from the bows should the widest place be? A. From 8½ to 10 feet.

E. S. G. asks: In setting the valves on a locomotive engine in which the throw of her eccentrics had been changed from 5 to 5¼ inches, I could not get her valves square. I first set her at full stroke; and when hooked up she was out very badly. I laid it to the links, but do not think the fault was in them altogether. I next set her hooked up to 13¾ inches, and found that at full stroke, on the forward center, giving her no lead and putting her on the back center, she was blind ⅛ of an inch. This was with the reverse lever in the forward motion, with the engine cold. The valves have 1⅛ outside lap and ⅛ inside lap. When she went out, she was square at full stroke. I told the foreman that the expansion had divided that ⅛ inch blind, and made her blind 1/16 inch on each end. Was I right, and what is the reason we can get her square only at one notch? Would the link lifters affect it any? They are very short. A. It is generally impossible to get equal action of the valve at each end, on account of the angularity of the connecting rod, etc. A valve which is right when cold is frequently very much out of adjustment when steam is turned on. A trial with the indicator is the surest test, and in general the only one that can be relied upon to ensure accuracy.

B. W. says, in reply to W. H. M. L., as to accelerating the making of good butter in warm weather: When milk is reduced to between 50° and 60° Fah., immediately after coming from the cow, the cream will rise in four hours. If the temperature is kept at 51° without variation or agitation, all the cream will come to the surface in one hour. One of the secrets of making good butter is to remove the cream before lactic acid commences to form. Hence the reason why farmers who have milkhouses situated over cool springs invariably make the best butter. A few years ago, business necessitated my remaining in the South for about two years; and feeling the want of good, fresh butter, I arranged a block tin worm in a wash tub, with funnel in upper part, the lower end protruding through the side of the tub near the bottom. I filled the tub with ice water, and as the milk came in pails from the cows, poured the milk through the worm, regulating the flow and temperature by pouring it in. I could run it off at 51°, and kept it so for one hour by setting the pan in ice water, when the cream was removed and churned, making the "Simon Pure." "Orange county" milk will keep one day longer without souring by the same process.

W. H. W. says: In your issue of July 25, F. E. T. says: "Piles driven in salt water on the Southern coast are very soon destroyed by worms. They might be protected by metal sheathing, but that is too expensive. Is there any method known, both cheap and effective, of securing wood against the attacks of these worms?" You add: "We shall be glad to receive replies to the above for publication:" Thorough coating with amorphous black lead paint will effectually deter the worms; they will no more attack the carbon of that paint than they would charcoal; only by an abrasion which shall lay bare the wood, is there any danger from the worm. The paint should be carefully made, wholly with raw linseed oil. Let each coat be well worked on, and perfectly dry before a succeeding coat be put on; polish each coat gently with sand paper. Three or four coats of good paint, properly put on, will prevent any attack by the worms. This paint becomes exceedingly hard, and adheres with singular tenacity.

B. says, replying to the query of H. D. M.: "How can I clean petroleum barrels, fitting them to hold cider?" Steam the barrels by means of a pipe from a boiler introduced at the bung hole until all the glue and dirt comes away, then wash once or twice with scalding vinegar. The outside is of course to be cleaned with a brush and soap and water. Petroleum barrels cleansed in this manner, and with wooden hoops and the usual plastered ends, are extensively used in Europe for shipping the finest salad oils which come to our tables.

C. B. L. says, in reply to J. A. J., who asked how to kill house flies: Fill a tumbler about half full of soapy water; cut a piece of pasteboard somewhat larger than the top of the glass; cut a hole in the middle about the size of a cent: then smear one side of the pasteboard with molasses or other sweet stuff, and turn it so that the molasses will be on the lower side, nearest the water. Be careful not to get any of the molasses on the outside of the pasteboard; and put it in the place frequented by the flies. In trying to get the molasses, they will tumble off and be drowned. You will soon have a tumbler full of flies.

B. C. asks: How can I melt steel scraps in a crucible, and have it retain the nature of steel? My experiments thus far, when the steel was melted and poured into a sand mold, have produced castings of a very poor kind of rotten white iron.—J. E. asks: How is the phosphorus light (which the Navy Department have adopted) made?—D. C. G. asks: Why is it that some of the human teeth (most frequently the cuspids) have corrugations or rings around them, similar to corrugations around the horns of cattle?—C. B. F. asks: Will some one give me full instructions for making a racing boat?

COMMUNICATIONS RECEIVED.

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

On Feathered Arrow Heads. By C. J. H.
On a Mechanics' Political Organization. By V. T.
On Davies' "Arithmetic." By L. H. S.
On an Improved Furnace. By B. T. S.
On a Mosquito Net. By L. E.
On Lightning Rods. By B. W.
On Ice Machines. By J. W. H.
On Aerial Navigation. By D. and by J. H. D.

Also enquiries and answers from the following:

A. O. L.—C. M.—G. W. R.—H. H. F.—P. & E.—W. R. T.—J. H. S.

HINTS TO CORRESPONDENTS.

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

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

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

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

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AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

30.450.—RUBBER CAR SPRING.—T. F. Allen. Oct. 7.
30,451.—CLOTHES SQUEEZER.—F. Arnold. Oct. 7.
30,458.—CAR WHEEL.—G. S. Bosworth. Oct. 7.
30,517.—CAR SEAT AND COUCH.—E. Burke. Oct. 7.

EXTENSIONS GRANTED.

29,228.—MOWING MACHINE.—A. B. Allen.
29,229.—SCHOOL GLOBE.—J. R. Agnew.
29,23 .—FILE CUTTING MACHINE.—E. Bernot.
29,238.—GRIDIRON.—J. S. Brooks *et al.*
29,261.—LOWERING BOATS.—W. Flowers *et al.*
29,300.—STOVE GRATE.—D. H. Nation.
29,319.—FLOUR CHEST.—I. R. Shank.
29,333.—WATER WHEEL.—J. W. Truax.
29,335.—GRAIN SEPARATOR.—A. J. Vandegrift.
29,338.—CABLE SURGE RELIEVER.—J. Bingham

DISCLAIMERS.

29,300.—STOVE GRATE.—D. H. Nation.
29,333.—WATER WHEEL.—J. W. Truax.

DESIGNS PATENTED.

7,564.—NUBIA.—H. Boot, Philadelphia, Pa.
7,565 to 7,567.—CARPETS.—J. H. Bromley, Philadelphia, Pa.
7,568.—BOXES.—J. Comly, Philadelphia, Pa.
7,569 to 7,571.—CARPETS.—H. F. Goetze, Boston, Mass.
7,572 to 7,574.—STAIR PLATES.—W. T. Mersereau, Orange, N. J.
7,575 and 7,576.—CHANDELIERS.—F. R. Seidensticker, W Meriden, Conn.
7,577.—CHECKER MEN.—C. Spooner, Bridgeport, Conn.
7,578.—TWINE HOLDER.—E. J. Steele, New Britain, Ct.
7,579.—BRACKET.—A. Wunder *et al*, New Haven, Conn.
7,580 to 7,584.—CARPETS.—J. M. Christie, Kidderminster, England.
7.585.—SPOON HANDLE, ETC.—J. Polhamus, N. Y. city.
7,586 to 7,588.—CARPETS.—C. A. Righter, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,883.—CARPET SWEEPER.—Haley & Co., Boston, Mass.
1,884.—DYE STUFF.—W. H. Place, Providence, R. I.
1,885.—POWDER.—J. W. Willard, San Francisco, Cal.
1,886.—SOAP.—C. E. Willetts, Chicago, Ill.
1,887.—WINES, ETC.—A. D. Findlay, Brooklyn, N. Y.
1,888.—KID GLOVES.—F. Hegle, New York city.
1,889.—ELECTRIC APPARATUS.—S. Kidder, New York city.
1,890.—OLIVE OIL.—H. K. Thurber & Co., New York city.
1,891.—PACKED FRUITS, ETC.—South Jersey Packing Co., Cedarville, N. J.
1,892.—SPICES, ETC.—Warren & Bidwell, Toledo, O.
1,893.—SPECTACLES, ETC.—T. A. Willson & Co., Reading, Pa.
1,894.—IRON AND STEEL.—W. Barrows & Co., Tipton, Eng.
1,895.—KID GLOVES.—F. Hegle, New York city.
1,896.—CURE FOR CORNS.—Lawrence & Co., London, Eng.
1,897.—BITTERS.—Sloat & Powell, Peekskill, N. Y.
1,898.—FILES AND STEEL.—W. Spencer & Co., Masbrough, England.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

JULY 21 TO 25, 1874.

3,690.—W. E. Wright, Rome, Oneida county, N. Y., U. S. Improvements in evaporating moisture from drying peat, brick, lumber, fruit, vegetables, and other substances, called "Wright's Drying Arrangement." July 21, 1874.

3,691.—G. Doane and B. L. Harris, Grosse Isle, Wayne county, Mich. Improvements on hinges, called "Doane's Improved Hinge." July 21, 1874.

3,692.—C. E. Seal, Winchester, Frederick county, Va., U. S. Improvements on cut-off and regulating cocks, called "Seal's Gas Cut-off and Regulator." July 21, 1874.

3,693.—I. K. Macaulay, Kingston, Frontenac county, Ont., assignee of C. H. Williams, Matteawan, Duchess county, N. Y., U. S. Improvements on brick machines, called "The Star Brick Machine." July 25 1874.

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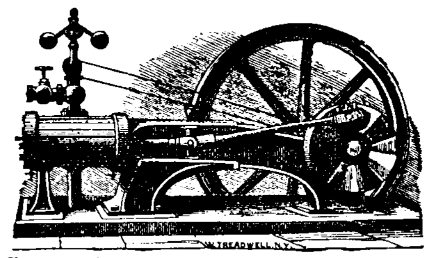

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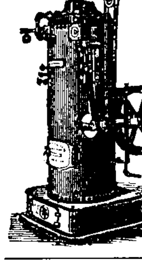

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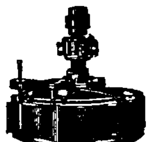

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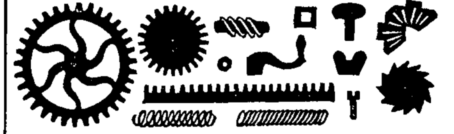

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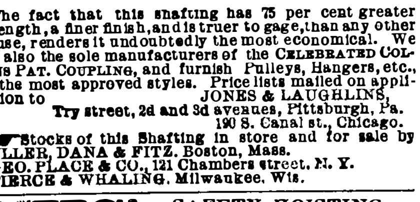

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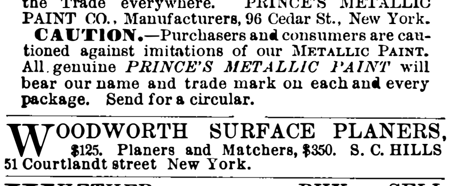

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