the upper half; also, the displaced air would have a tendency upwards, where it could make room for itself much quicker than downwards, as firing under water parallel with the surface, the bullet will come out of the water into the lighter air. J. WHITEFORD.

Junction City, Kan.

Law of Attraction.

MESSRS. EDITORS:—In a recent number of the SCIENTIFIC AMERICAN appeared two brief, but interesting articles in re lation to the phenomenon of rapidly revolving bodies overcoming the force of gravitation. The first was a communication from R. H., setting forth the reasons why rail-cars can be easily thrown, or even blown by heavy gales from the track when the locomotive is running at a high rate of speed.

The second was a paragraph from the London *Globe*, in which it was asserted that a cannon-shot after leaving the muzzle of a rifled gun, sensibly rises above a horizontal line. In both the above named instances the revolving bodies have been raised, or thrown above the horizontal line by reason of a temporary suspension of the earth's attraction upon the *atoms* of those revolving bodies. A solution of this singular problem may be easily obtained by carefully observing the movements of that curious toy known as the gyroscope, or "Philosopher's Puzzle." Some years ago, mainly for my own amusement, I set to work in order to discover if possible how it was that a rapidly revolving wheel of iron could, by mere momentum, completely set at defiance the law of gravitation. My experiments were extremely simple and can be readily repeated by any one; but simple as they were, they were ample enough to satisfy my mind at least, that *magnetic attraction* is the true cause of gravitation and that the rapid reversion of the polarized atoms of bodies temporarily dis turbs, or in other words, cuts off the earth's magnetic current thus producing such phenomena as we have seen in the car-wheel, rifled cannon-shot, and revolving gyroscope.

Now for the experiment. I started out with the assumption that the earth is a constant magnet, and that all bodies are attracted towards its surface by reason of magnetic polarity; that the only power which can overcome the earth's magnetic force, is motion; that revolving or gyratory motion as seen in the bearings of fly wheels, in whirlwinds, and even in the little gyroscope, is the most effective in bidding defiance to the force of gravitation. By moving a magnet near either of the poles of a common pocket compass, the needle can be made to oscillate according to the movement until, by increasing the motion, it can be induced to revolve rapidly on its axis and will so continue to gyrate independent of the attracting point until its momentum it exhausted when it will again obey the magnetic influence. In this it is quite apparent that the rapid reversion of the polar, or positive and negative points of the needle, for the time being completely disturbs or cuts off the attracting current of the magnet and that the motion must proceed until friction has reduced the momentum below the attractive power of the magnet. It must be borne in mind that the magnet is a *constant* force, while momentum, by reason of friction and other resistance, is constantly decreasing and must ultimately obey the superior power of attraction.

The same is true of the whirling rifle-shot, and revolving gyroscope. Each for the time has its rapid rotary motion, reversing the polarity of its particles and overcoming the attraction of the earth. But the earth is a powerful and constant magnet and ultimately asserts its control over the disturbing object.

In my experiments with the gyroscope, I found that the wheel could be made to revolve at any angle to the pedestal upon which the staff rested, but that, at ordinary velocity, it revolved better when the staff was placed horizontally. I further noticed, however, that when very great velocity was imparted to the wheel (it weighed one pound avoirdupois) it would immediately rise above the horizontal line, and so continue to rise gradually until it would attain a vertical position and fall upon the pedestal.

I think this may tend to explain the phenomenon of the rapidly revolving rifle shot rising in the air the moment it leaves the muzzle of the gun. W. F. STEWART.

San Jose, Cal.

Latent Heat of Metals.

MESSRS. EDITORS:—In an article copied from "Pynchon's Chemical Forces," under the above title, in the SCIENTIFIC AMERICAN of December 18, the old theory of latent heat is still adhered to, as explaining the phenomenon of the rise in temperature which takes place when a mass of metal or other matter is subjected to condensation, or to the lowering of temperature when subject to liquefaction or evaporation.

In the light of advanced science as laid down by such men as Prof. Tyndall and others, the whole theory of latent heat has been greatly modified; for while all bodies contain a certain amount of latent heat, it by no means follows that because a body rises in temperature upon being subjected to any mechanical force, the heat developed was previously stored up in the mass as "latent."

To say, therefore, that the quantity of heat which is given out by a metal when it is compressed is simply making apparent that which was before "latent," is an absurdity. Fortunately for us the researches of science at the present day have cleared up, to a great extent, the mystery which enveloped the study of the forces of nature and the universe, and the former theory of latent heat has been displaced by that of the undulatory or vibratory conditions of matter. It is now universally accepted that light and heat are but "modes of motion," or, rather, that the particles of "ether" which pervades all bodies and all space are in a state of oscillation, the oscillations being of different degrees of velocity and length, one condition resulting in that which, to our senses, is perceived as "light," another manifesting itself to us as "heat," with various intermediate degrees. Some of greater and some of less velocity, light itself being divisible into the prismatic colors, actinic and caloric rays, each particular class of rays resulting from a greater or less number and length of vibrations per second.

Therefore, in the phenomenon of the flash of light which is emitted by a bullet when striking a target, instead of its being an emanation of that heat which was before "latent" in the bullet or target, the true explanation would be, that the force exerted by the combustion of the powder against the ball is suddenly changed at the moment of contact with the target, from that of the *mass*, in a given direction, to that of moving the *particles* of the mass among themselves; or, in other words, the velocity of the mass has been changed to the velocity of the atoms composing the mass, and this velocity of the atoms is propagated and communicated to the ether and particles of the atmosphere, which motion gives us the sensation which we call "heat." Should the vibratory action thus generated be sufficiently energetic, not only heat but light will be evolved; and should the ball be projected with a motion equal to that imparted to a meteor before it enters our atmosphere, not only would heat and light be evolved at the moment of contact, but the particles of the ball would be set in such violent oscillation that the atoms would be torn asunder and dissipated in vapor.

All this is entirely consistent with the theory of the "conservation of force"—that nothing is lost, either in "motion" or force; so in the experiment of the Dahlgren guns, which was referred to in the article in question, instead of the heat being previously stored up in the iron projectile and made sensible by compression, it is simply the change in the mode of motion of the ball against the iron wall of the monitor.

So in the matter of friction, the heat which is given out by a rope rapidly running out over the side of a vessel, is really a leakage, as it were, of the force with which the rope is being dragged from its position, and this leakage is caught up by the particles of wood in contact with the rope, and they are set to vibrating. If the force or velocity—for velocity is power—be great enough, the side of the boat will speedily burst into flame.

The passage of a meteor through our atmosphere is another illustration of the same phenomena, the meteoric mass, moving with immense velocity, impinges upon the particles of the atmosphere, and it is at once retarded in its flight; but the original force is not lost, it only takes on another form, and the atoms of the meteor are set in motion with such violence that they burst into flames of dazzling brilliancy, and in many cases the whole mass is dissipated into thin vapor.

But it is needless to multiply examples, all the foregoing are but exhibitions of one and the same force under different degrees or conditions of vibratory action, and easily demonstrable according to the now accepted theories as laid down by scientists of the present age. J. P.

Cincinnati, Ohio.

Setting and Filing Mill Saws.

MESSRS. EDITORS:—In your valuable paper of December 11th, I see a communication from J. R. P., of Alabama, in regard to filing and setting mill saws, which conflicts with my views, based on twelve years' experience.

I file all splitting saws straight across, holding the file at right angles with the saw, on the under and upper side of the tooth; because, in the first place, if you file the teeth on an angle or bevel, it is very difficult to get them all alike, and if you do not, one tooth draws off more and works against the other, the saw runs harder, and is also more liable to knock the set out of the teeth. And, again, I contend that it takes more power to run a saw, filed in that way, because if a tooth is filed on an angle it has a longer cutting edge than when filed straight across. When filing square across, the file is held constantly in one position, and after a little practice it is easier to see when it is at right angles with the saw.

I swedge the teeth, of course, so they need but very little set; and to get that, I spring the tooth near the plate of the saw to get all the strength of the tooth, and set it to a gage on each side. When I start my saw it always points straight ahead, the tooth being swedged makes it wider at the point, and the saw always runs perfectly free, and if it dodges in striking a hard knot, the corners being sharp on the opposite side, it will work its way into line immediately instead of crowding further off.

In running saws in this way, I have less trouble, and make more and better lumber than those that file their saws flaring. S. P. WILLIAMS.

Rutland, Vt.

Two Driving Wheels vs. One for Harvesters.

MESSRS. EDITORS:—It is neither practically nor philosophically true that two driving wheels for harvesters are better than one, as the following facts will show: Two driving wheels on one axle must turn independently of each other, and the wheel that turns fastest must of necessity do all the driving. Consequently, when the machine moves on ever so small a curve, the outside wheel turns fastest, and not only does all the driving but must make a heavy side draft as the draft pole is then all on one side of the center of draft, so the wheel that runs over a stone or knoll, while the other runs on a level, turns faster and does all the driving, which, on rough or uneven ground, causes the side draft to be continually changing from one side to the other. Any one can satisfy himself of this by looking at the front end of the draft pole. He will see it knock first one way and then the other, as I have described. These are by no means all the difficulties; for while the driving is changing from one wheel to the other, the knives must stop until the lost motion caused by the room for play in the cogs, bearings, and boxes, is all taken up, and this, when they become much worn, will frequently be so much that the knives will not cut at all in tough lodged grass. It is like stopping and starting in the grass without backing the machine.

These are important objections which farmers and manufacturers should well understand, as they apply to all two driving wheel machines; but none of them applies to one driving wheel machines. It is only when two driving wheel machines are drawn in a straight line on smooth ground that both wheels drive at the same time, and this is the very time when they are least needed. The driving wheel of one-wheel machines is made a little heavier, with more face and more corks, so as to drive strong enough on any ground. I know many farmers are very much prejudiced in favor of two-wheel machines, as they call them, but I presume it is not because both wheels are drivers, but simply because they run on two wheels, in opposition to the old one-wheel machines with a rigid finger bar dragging on the ground.

All harvesting machines, when cutting grass, should run on three wheels, two besides the driver, and the axis of these should be in a line, or nearly so, with each other, so as to run and back easily, and to turn about without the necessity of lifting up the finger-bar, or tearing up the sod or turf, and also to prevent the finger-bar from dragging on the ground. If the draft pole be placed in the center of draft alike on both machines, the side draft will be far less in the one driving wheel machine than in the two. It will run easier for the team, turn about with less trouble for the driver, and do its work as well when cutting grass, all other things being equal. It is also far better in almost every respect as a combined machine or as a reaper. S. HULL.

Poughkeepsie, N. Y.

Curious Phenomena.

MESSRS. EDITORS:—Let me lay before you really curious phenomena witnessed in this vicinity on the morning of Nov. 25, and ask you, or some of your able contributors, to give us an explanation.

Mr. Hamilton, who owns the grist mill here, found his gate fast in the morning and sent for me to see what could be the matter. We soon got the gate open and the mill running. He not long after sent me word that he could not shut the gate, and in one hour his mill stopped entirely under a full gate. The rack filled up with ice. He cleared this out again and again, and it as often filled up again. The ice accumulated on the rack and slides of the flume a foot or more thick. It appeared to accumulate on the gate, right in the current, under nine feet head. It filled the wheel all full and stopped it with power enough on it to drive two run of stones. There is a hole through the dam, the lower end at least seven feet under water, five feet by one and one half feet, with a timber running through the center, made to enable us to finish repairs. This filled up. The water ceased running over the dam and very perceptibly fell off till the ice disappeared, when it immediately rose again to its usual hight. This ice was a porous substance fibrous in formation; such as we see thrown up by the side of the road in the fall. In the hand it felt like crust snow. At about noon it all disappeared at once and the mill started at full speed. During this time the water seemed to have no power of motion. It changed to ice in a manner contrary to all the laws of ice formation. All up and down the sides of the channel, in the current the most as in the hole in the dam, on the rack, on the gate, and in the wheel.

Such are the facts. The phenomena are new to the old mill owners here. We would like an explanation.

Week s Mills, Me. REV. W. H. LITTLEFIELD.

[For the Scientific American.]

ARTIFICIAL LIGHT FROM THE PINEWOOD CHIP TO THE GAS CHANDELIER.

BY I. CANTINI.

Ere long we shall not be able to imagine to ourselves a city or town without gas light, or a country farm house without its petroleum oil lamp. The present generation is swimming in a sea of light. But these acquisitions are of recent date, and the remembrance of smoking lamps, dripping candles, candle snuffers, etc., is still fresh in our memory.

Dark and gloomy centuries lay between the pinewood light and the gas chandelier. Chips of pine wood afforded the first lights, but as soon as the combustibility of animal fat was discovered, the idea of filling it into a vase and putting a wick to it, almost suggested itself. This crackling, flickering light was transmitted from father to son, until the introduction of oil, which soon threw animal fat into oblivion.

Orientalists and antiquarians agree that the Assyrians, the Egyptians, the Jews, the Greeks, and the Romans, all used the oil lamp. Most wonderful designs for these utensils, made of stone, iron, and brass, have been discovered in the Pyramids, in the old temples of India, and among the ruins of Jewish cities. Of the lamps used among the Greeks and Romans, the excavations at Pompeii have furnished a rich assortment. Gold, silver, marble, precious stones—nothing was considered too costly an ornament for this necessary household article. Most of these lamps were works of art of the first order, and even the more common kind used by the lower class of inhabitants, made of *terra cotta*, are tasteful in form and artistic in execution. Even our modern industry has not been able to excel their workmanship. Yet these ancient lamps were not as practical as they were beautiful. A common lantern of our day affords a better light than the elaborately wrought vessels of ancient Rome and Egypt.

The art of refining oil was unknown to the ancients. As an especial luxury they mixed their oils with the essence of roses and with sandal-wood, which, however they disguised the bad odor of the oil, only diminished the strength of the light. The historians mention that Lucullus, and others, spent large sums for these perfumed oils, and yet the illumination of our most modest of shops and stores is of course far superior to that of the most magnificent of the palaces of ancient Rome. The gold and silver lamps were hung on fine worked chains from marble pillars, but the flame was small, and, besides smoking excessively, it flickered or went out entirely in a slight current of air.

From Rome the oil lamp passed into France, Germany, and England, where the pinewood chips, and wicks soaked in fat, were still in use. The inhabitants of Denmark, Scandinavia, and Scotland, when in want of pine wood, caught some fat bird, or other greasy animal, and set fire to it, and patiently endured the smell emitted from the burning carcass until it was burned to ashes.

The Roman lamp underwent but little change until the discovery of the tallow candle. The spare illumination explains in some measure the sober habits of our ancestors. They arose with the break of day, and retired when the present generation begins to get ready to go to places of amusement. The "curfew bell," derived from the French word *couvre-feu*, was not without its signification. Under William the Conqueror, every light had to be extinguished at eight o'clock, and no one was much incommoded by this law, for the people were generally too poor to pay for an extra quantity of oil.

The first step to introduce the tallow candle, was taken in the twelfth century, when the tallow torches came into use; during the following century the tallow candle was brought before the public, much in the same form and shape which it bears at the present day, only they used a flaxen wick, cotton being unknown at that age. These candles were, however, considered a great luxury, and used only by persons of high rank. Some fifty years later the wax candles were manufactured for the courts and royal palaces. When they were first used in churches their cost was enormous. A wax candle offered on the altar to the praise of God was considered a royal gift.

The price was still high up to the sixteenth century. The anecdote related of Oliver Cromwell, who one day found two wax candles burning upon his wife's toilet table and extinguished one, shows that even among the rich illumination formed an important item in the household budget.

The eighteenth century brought an essential change in this necessary household article, caused by the discovery of rape oil; olive oil had till then been used in Italy and France, and whale oil in the North; but rape oil was much cheaper, and thus afforded an opportunity to the poorer class to enjoy the the comfort of an oil lamp.

In the year 1783, the first great reform in the construction of oil lamps was devised. A Swiss, named Argand, who had been adopted by an Englishman in London, was the inventor of the cylinder-formed wick, which moved like a tube between two metallic pipes. This mechanism allowed an even current of air to feed the flame, the smoking of which was obviated by the addition of a glass cylinder, which latter not only prevented smoke, but also diminished the disagreeable smell of oil, and more than all, caused an increase in the strength of the light.

This new invention soon came into general use. The Gerard Brothers improved it greatly by placing the oil receptacle below instead of above the flame, which gave to the lamp a much more graceful form. They also introduced the milk-glass shades to break the glaring light. The next improvement appeared in the "Carcel" lamps; the "moderators" soon followed, which latter is still in use in many places where oil is burned.

With the improvement of lamps refining of oil also under went an essential change. In 1790, vitriol was used in purifying oils, an invention which was made almost simultaneously in France and England. With every year the number of substances from which oil could be obtained was increased by new discoveries; but all these inventions were left far behind after the discovery of petroleum wells in America in 1845.

But tallow and wax, and even the most refined oils, are far surpassed by the gas light. The first attempts to burn gas were made by an Englishman named Murdoch, who distilled gas from coals and with it illuminated his house. In 1804, Mr. Murdoch introduced it into a factory at Manchester. A few years later the first gas company was organized in London, where it has been in use ever since. The fast progressing civilization of America did not tarry long in adopting this new invention, and the improvements in the art of illumination, which in America are almost a daily occurrence, prove that this western hemisphere will never have to pass through such an ordeal of darkness as that which for centuries has been allotted to the eastern world.

In the days of Shakespeare the theaters were illuminated by tallow candles, and the actors had to come forward between the acts and themselves perform the work of snuffing the candles. This always occasioned a great deal of merriment among the audience, who, having a moment before been moved to tears by their tragical speeches, were made to witness such a menial performance. To such Hamlet's and Othello's, our sperm candles and petroleum lights, not to speak of the gas, would doubtless have appeared as a gift from Heaven.

Some fifty years have passed since gas was first introduced and already dangerous rivals threaten to take its place. The electric and calcium lights, and various kinds of gas have been tried with very considerable success. Nobody believes, however, that the art of illumination has arrived at its climax of perfection. Undoubtedly the time will yet come when our city streets, bridges, and tunnels, will be lighted in a style scarcely inferior to daylight, a *desideratum* which might even now be attained were our officials as anxious to serve the public as to fill their pockets.

[For the Scientific American.]

THE CALABASH TREE.

BY JOHN RAMSAY GORDON.

The calabash tree is of the *genus* known to botanists as *Crescentia*. It grows in the tropical countries of South America, and also in the West Indies, in which parts it flourishes profusely. This tree attains a hight of thirty feet and arrives at a moderate age. The trunk and branches of it are very tough and ligneous, and the bark is very irregularly distributed on them, being found thicker in some parts than in others. As the branches are, in comparison with the trunk, disproportionately thick, they thus have a clumsy appearance, which is increased by their being studded with irregular protuberances throughout their entire length. They have a tendency to bend in the opposite direction to that from which the wind blows. Thus in the West Indies, where the prevalent wind is from the east, the branches of this plant are mostly curved towards the west. The leaves are of an oblanceolate form and of a dark green color. They do not grow in clusters like most others, but proceed separately from the branches, and even from the trunk, at almost regular distances on them. The flowers are of a pink shade streaked with lines of a bownish tinge. After the decay of these, nuts appear on the same stalk. The nuts are ellipsoidal in shape and are of a woody consistency. They extend in size from that of a walnut to that of a large pumpkin.

These nuts contain a pulpy kernel, in which there is an innumerable quantity of small flat seeds. When they are young they are perfectly green, but as they become older they assume a darker hue; and, although when unripe they can be penetrated by a penknife, yet they can only be divided by means of a saw, or some other forcible alternative, when they have attained maturity, as they are then of the woody consistency before mentioned; and, indeed, they are so hard, that the instrument employed in cutting them is very often blunted during the process.

In the West Indies, the natives convert the nut of the calabash tree into household utensils of many kinds. Of them they make drinking cups, sugar pots, baskets, divers ornaments, and dippers for water, and such are procured from the small nuts; of the large ones they make bath tubs for their infants and wash tubs for their clothes. The manner of preparing these nuts employed by them is as follows: They obtain a saw and cut out the shape of the article they require; then they extract the pulpy kernel, which they generally reject, and with a knife they scrape the inside of the nuts until they have cleared it of moisture; next, they scrape the wood of the interior with a piece of bottle-glass and polish it with sand paper. After this process has been completed they place them in boiling water, which they assert prevents them from becoming black within. If the exterior of the nut be required to be scraped, it is done before the hot water is applied.

Some of the aforenamed articles are painted with a variety of colors, but such consist only of the ornamental kind. Those that are intended for drinking purposes are not colored. The drinking vessels are formed by sawing off one end of the nut or by dividing it longitudinally, and, in the latter case, two vessels are obtained from one nut. The sugar pots are formed by sawing off the end of the nut and employing the piece which is cut off as a cover to the vessel, and it is attached to it by means of a bit of string. These articles they call their "Gobis" or "Govis." The dippers are formed by taking away a portion of the end of the nut, and inserting a wooden rod in a small hole in the side of the nut, to serve as a handle.

Some of these articles of household furniture are very tastily manipulated to captivate the eye. In the absence of a saw the negroes employ a piece of string and a stone to divide these nuts, and this is effected by tying the string round them and tapping gently with the stone on it till it enters; it is a tedious process but is often successful.

The kernel of the calabash is boiled into sirup by the natives, and it is asserted that this sirup is very beneficial to consumptive invalids, as it has a soothing quality. Occasionally the pulp is given to goats who are exceedingly fond of it and eat it with avidity.

The calabash tree is the haunt of iguanas, snakes, lizards, and all kinds of reptiles, which exist on the flowers, of which they are very fond.

On the subject of the foregoing article, the calabash tree, the works of the celebrated French writer, Pierre L'Abbat, are very interesting, and I think are worthy of perusal.

About Water Supply-Pipes.

A correspondent in the *Herald of Health* makes the following inquiries, and to which the editor sensibly answers:

"What can I use as a water supply-pipe? Is gutta-percha the best? How is galvanized iron? Is there not mischief in it, or in the zinc used to whiten it? Pure block tin is not to be had, for they will mix lead with it when the pipe is drawn, in order to make it more ductile. Is rain water, running through lead goose-necks from a roof, with sheet lead round the chimney (as is usually the case), preferable to well water as a drink?"

It yet remains for some one to achieve fame and fortune and confer an incalculable amount of good upon the race, by inventing water supply-pipes which shall possess the following requisites: 1. Entire freedom from corrosion by any and all kinds of natural waters. 2. Exemption from the action of air and moisture and a moderate degree of heat. 3. Flexibility, strength, and ease of joining. 4. Cheapness. The nearest approach to this standard, at present, is the tin-lined pipe. The objections to the tin-lined pipes are: 1. Where joints are made, the tin and lead come in contact with the water, and then, owing to galvanic action, the corrosion of the lead is more rapid than if tin was not present. 2. The tin lining is liable to cracks and flaws, which allow the water to come in contact with the lead, with the same result as at the joints. 3. There are some waters that rapidly corrode the tin itself, when it is not in contact with lead or other metal. If, as this correspondent states, lead is mixed with the block tin to make it more ductile, this is still another and more serious objection. Gutta-percha will not withstand the action of air and moisture, and is consequently useless. Iron rusts, and if galvanized, the water dissolves the zinc coating. [Pure water oxidizes, but does not dissolve the oxide of zinc. The expression, water dissolves zinc coating is calculated to mislead. Galvanized iron pipes may be used with safety under proper circumstances, and when the water is free from free acids, alkalies, chlorine, etc.—EDS. SCIEN. AMERICAN.] The answer to the last question depends upon circumstances. If the well water is pure and soft, then it is preferable. If it is hard, choose the rain water, and filter it. If we adopt the rule not to use water which has stood or been long in contact with metal, we shall escape with slight injury.

The Hartford Steam Boiler Inspection and Insurance Company.

This company makes the following report of its inspections for the month of November:

During the month 510 visits of inspection have been made; 909 boilers examined, 822 externally and 144 internally; 57 have been tested by hydrostatic pressure. The number of defects in all discovered are 294, of which 57 are regarded as dangerous. These defects in detail are as follows: Furnaces out of shape, 20—4 dangerous; fractures in all, 19—6 dangerous; burned plates, 35—4 dangerous.

Mr. Fairbairn finds that the strength of iron plates diminishes one fourth at a red heat, and it is not difficult to understand that, at a very high heat, no reliance whatever could be placed upon iron when subjected to a strain; and although portions of the crown sheet from exploded boilers do not always indicate that they have been subjected to an injurious temperature, still this is true in some instances, and must be reckoned among the causes which operate to weaken steam boilers, and they are consequently in a condition inviting explosion.

Blistered plates, 51—2 dangerous; cases of incrustation and scale, 59—5 dangerous. Of cases of sediment and deposit several have been found, generally the result of exhausting into the heater. This difficulty has been especially true in certain cases where manufactured oils were used for lubricating the engine cylinders, and where there was considerable carbonate of lime in the water used in the boiler. Either use pure oils for lubricating or else run the exhaust somewhere besides into the well or tank from which the boilers are filled.

Cases of external corrosion, 52—7 dangerous; cases of internal grooving, 4; water gages out of order, 23—10 dangerous; blow-out apparatus out of order, 8—1 dangerous; safety valves overloaded, 15—4 dangerous; steam gages out of order, 15—3 dangerous; boilers without gages, 3; cases of deficiency of water, 6—1 dangerous; cases of insufficient or broken stays, 4—2 dangerous. One inspector reports that in one case nearly all the braces were broken from one boiler head, and another reports that in a boiler 5 feet in diameter, under heavy pressure, nearly all the braces in both ends were either broken or very loose. This difficulty may be set down as another cause of boiler explosions.

Force, and What It Is.

Professor Youmans, in a recent lecture delivered in Steinway Hall, in this city, om the "Dynamics of Life," stated some interesting facts. The lecturer pointed out the nature of force, showing that it was indestructible, although capable of change. Thus the force acting on the very center of the sun was never lost. It went forth in the form of light and heat; it raised up the plant; the plant was food for the ox; the ox was changed into muscle and nerve, which gave men power to strike the blow; the blow produced heat: so force was convertible. Force is never lost. By an easy transition, he passed to the storing up of force. He gave some remarkable instances of this storing, which is mechanical and molecular. Thus, one pound of coal has sufficient power in it to raise one pound of matter two thousand miles high. Then referring to a pail of water changed first into ice, then dissolved into water, which in turn was changed into steam, and subsequently separated into oxygen and hydrogen, he remarked that the force requisite to make these eight parts of oxygen and one of hydrogen into water was equal to the fall of one tun down a hight of five miles, the change of steam into water was represented by a fall of one tun 2,900 feet, of water into ice by a fall of one tun 433 feet. A knowledge of this fact caused Tyndall to observe that the force which a child carried in an apronful of snow was sufficient to hurl back an avalanche precipitated down a mountain side.

PRIZE ENGRAVING.—The first large batch of engravings was mailed or expressed to all parties entitled to them, on the 29th ult., the postage and expressage being in every case prepaid. We have now a sufficient number printed and put up in pasteboard covers to meet each day's demand, and orders will hereafter be filled on the day of their receipt.