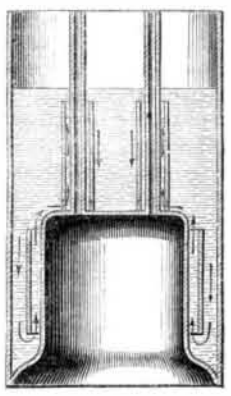
Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Design for a Vertical Boiler.

MESSRS. EDITORS:—I beg permission to draw the attention of the readers of your valuable paper to an improvement in vertical boilers, which I designed several years ago, and which I believe will be of some interest to others engaged in boiler construction.

The annexed sketch represents the idea, only two of the vertical tubes being shown, and these out of proportion to the size of the boiler, in order to show the construction. The figure represents an ordinary fire-tube vertical boiler, with the following additions: each of the small tubes, of which there need be less in this than ordinary boilers, is surrounded by another tube, which terminates below the water line. These outer tubes are open at their upper end, and fastened in such a way to the top crown-plate of the firebox as to leave space for the water to enter below. The action is at once understood by everyone familiar with the subject. The water in the annular space being hotter than the outside of it, rises in the way shown by the arrows, and the colder water from the outside takes its place. In such a way a constant circulation is kept up in this boiler, which is actually the vital question of every good boiler construction.



Considering the firebox as a tube of large dimensions, the same system is followed out here; and it is here of much importance, as the circulation of water and consequent disengagement of steam prevents the burning of these plates. The only place in which the water is comparatively at rest is in the lowest part of the firebox, where the solid matter will be deposited, to be removed through the manholes.

I believe that this construction has some merit, and as I do not intend to take out a patent for it, anybody who thinks fit is at liberty to use it; but I would like to hear the opinion of others about it. A. BERNSTEIN.

Chicago, Ill.

Solar Spots.

MESSRS. EDITORS:—I addressed a communication to you a few days since upon the subject of solar spots; it was my intention at the commencement of that communication to give what I thought to be some of the proofs of the theory I offered in explanation of these spots; but fearing the article on the subject would be too long, I then deferred giving these proofs. I desire now to offer a few proofs of the above theory, which will, at least, seem as plausible as the theory itself.

First, to go back to the year 1777, nearly one hundred years ago, and note the appearance and progress of the spots on the sun's surface, and the various terrestrial phenomena attending the prevalence and absence of them, as observed from that time to the present. We find that during the greatest prevalence of these spots, a corresponding disturbance of the electrical condition of the earth was observed and made manifest in the magnetic needle by its variations, and also by the increase or decrease in frequency and magnitude of the auroral display, corresponding exactly to the increase or decrease of the solar spots. The variation of the needle and the unusual auroral exhibitions are both owing to a disturbed condition of the earth's electricity. Some of the auroral displays during the past summer have been unusually large and attractive. If the accounts are true, the magnetic needle is more sensibly disturbed than in other years. The spots on the sun are also larger than heretofore, and, consequently, the season of 1869 has been a season of lower temperature than usual—sensibly so. The electrical condition of the earth is more sensibly disturbed than in other years; the disturbance will probably be more marked next year than this.

These phenomena are owing to thermo-electrical causes; the larger the masses of solid matter on the surface of the sun become, the more the radiation of heat is diminished; and as electricity accompanies heat, a smaller supply of electricity is derived from the sun, which may materially affect the electrical condition of the earth. The earth must be regarded as a thermo-electric pile of large dimensions, but small intensity, and receiving a large supply of its electricity from the heat of the sun. Astronomers tell us that these solar spots are of large dimensions, at least in the aggregate 30,000 miles broad by 50,000 miles long, consequently must cover an area sufficiently large to very materially affect the radiation of heat from the sun to the earth.

Regarding the earth as an immense thermo-electric pile, it must be admitted that it cannot be otherwise than very sensitive to heat and cold, and, on parting with its heat, will therefore part with a corresponding amount of electricity, and in the present case, probably enough to account for the electrical disturbances on the earth. These unusual phenomena attending the electrical arrangement of the earth at the present time are owing to a reduced supply of heat and electricity from the sun. This supply owes its diminution to the increase of solid, condensed, or opaque matter on the surface of the sun consequent on its cooling. This solid matter obstructs the radiation of heat from the sun.

Another fact which may properly be considered as proof of the "Spot Theory" in question, is the glacial epoch, known to have existed on the earth; evidences that the earth once experienced a greater degree of cold than now, are abundant. There must have been several such epochs on the earth—in fact, a number corresponding to the number of planets whose orbits range within that of the earth, or nearer the sun. All these epochs may not have been properly "glacial," but periods of lower temperature corresponding to the accumulation of solid matter on the surface of the sun necessary to form successively all the planets whose paths are nearer the sun than that of the earth.

The increase of the spots on the sun of late indicate that another "glacial epoch" may not be an impossibility some future day.

I do not claim that this theory offered in explanation of solar spots is the correct one—so of the proofs; but I have been induced to offer them because I believe them to be new; and should this hypothesis fail to be established by further research, it may be of some value in provoking deeper investigations in the matter, but should it be of no practical value whatever, and wholly untenable, I shall be quite ready to abandon it.

C. A. HOPPIN.

Loss of Life in Coupling Cars.

MESSRS. EDITORS:—A few days ago an old and faithful engineer was killed at Goldsboro, N. C., while coupling cars. A wife and children were thus suddenly deprived of a husband and father, their sole support.

It is safe to say that a man is killed or injured every day in the year on an average upon the railroads in the United States while coupling cars. Among the list of patents published in your paper for several years past may be seen a number for coupling cars without the necessity of endangering life and limb by going between the cars. Why are not some of them in general use? Will none answer the purpose? If not, then let the public make it known through the press that they require such an invention, and American ingenuity will be sure to meet the demand. Have the class of men who work on railroads no friends to champion their cause, or is it "only a private" killed? The law provides for the safety of passengers and crew on the sea, but sadly neglects them on the railroads.

I was for years a passenger train conductor on one of the trunk lines between New York and Chicago, and have seen so many good men killed by useless man-traps that I feel it a duty to write to you in the hope that I may induce you to call attention to this subject.

G. T. NUTTER.

Newbern, N. C.

Singular Ice Formation.

MESSRS. EDITORS:—I inclose a photograph of a remarkable ice formation to you, which, perhaps, will be of interest to you and many others.

On the nights of December 10th and 11th, when we had a temperature of 10° below zero in Springfield, Mass., a gentleman, Mr. Lester F. Sikes, of West Springfield, placed, as usual, a pail of water in his kitchen to be used in the morning. At 7 A. M., Dec. 11. this pail of water was found frozen over about one inch in thickness, and in the center of the ice surface was left standing a perfect prismatic column 5 inches high, 1¼ inch in diameter, with a flat top.

The white part marked *a b* on the photograph was the perfect image of a fountain jet. The pail was brought to me on Saturday; I cut the ice surface out and had it photographed because I thought it was a phenomenon worth preserving.

If any scientific man would undertake to explain how this remarkable formation took place, I am satisfied he would receive the thanks of many interested in nature and her doings.

EDWARD WIEBE, Pres. Humboldt Institute.

Springfield, Mass.

Cause of Typhoid Fever.

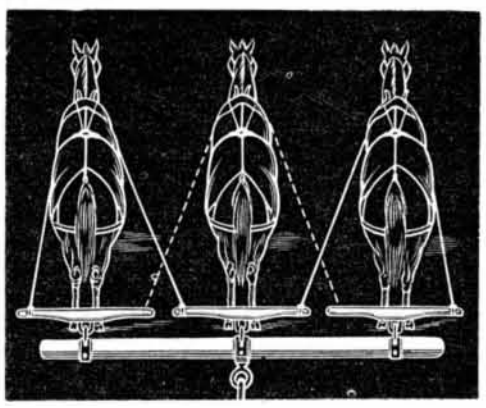
MESSRS. EDITORS:—In your number of Nov. 27th, 1869, I have seen an article on the necessity of cleaning the sewers in order to avoid typhoid fever. There is something to add to your article. Dr. Hepp, druggist of the hospital and Medical Faculty of Strasbourg (France) found last year that typhoid fever is appearing as an epidemic in that city with the rain, or rather by the disappearance of the rain, and his observations of about twenty years taught him the following facts: There is a subterranean water layer, communicating with the rivers and fountains, at a pretty short distance under the soil, that increases with the rains, and when these are ceasing decreases in the same way, leaving organic substances in a state of decomposition which communicates a certain degree of impurity to the drinking waters. Epidemic typhoid fever always made its appearance in Strasbourg and in the surrounding places, when such was the case. A. VEITH, M. D.,

of the University of Strasbourg, France.

Natchez, Miss.

How to Hitch Three Horses to One Plow.

MESSRS. EDITORS:—I notice in a recent number a communication from a St. Louis correspondent, in regard to hitching three horses to one plow. I will inform your readers how to do it. The sketch I send you explains itself. Instead of a double-tree I use a triple-tree, having three single trees attached, as shown.



The "lead horse" is in the middle, to which are attached "jockle-sticks" connecting the leader with the other horses to guide them; that is, if the driver wishes to use what teamsters call a single line. This method equalizes the draft perfectly. ARTHUR CUNNINGHAM.

Cincinnati, Ohio.

Effect of Steam Pipes on Wood Placed in Contact With Them.

MESSRS. EDITORS:—I send you a piece of common pine wood. Upon examination you will see the effects of steam heating pipes (for *two* winters) when brought into close connection with wood. We could send other specimens, showing a still greater "charring."

Whether or not steam pipes are dangerous is not for the writer to say, although he has taken the precaution of enlarging all openings for the passage of such conductors of heat. Thanks to you for agitating the question.

Pittsburgh, Pa. SUBSCRIBER.

[The wood mentioned varies in color from the natural tint of the wood through gradations from brown to black, although the black portions are very thin and lie wholly on the surface. The browned portions penetrate to some depth and the wood is so far charred that portions of it are easily crushed into powder by the fingers. An experiment shows it to be most easily ignited. In fact, it is nearly as combustible as tinder. On the whole, we are inclining to the belief that pipes carrying high steam cannot be placed in contact with wood without a risk. Our correspondent omits to state what pressure of steam is carried in the pipes which produced this effect. This is an important point, as it is desirable to ascertain at what temperatures these effects are produced.—EDS.

Who Get The Patent Office Reports?

MESSRS. EDITORS:—The 25th number, last volume, of the SCIENTIFIC AMERICAN failed to come to hand, the first failure in the present year; will you please send me one? I would as soon do without a new coat as my SCIENTIFIC. Can you tell me why so many of the Patent Office reports are sent to men who do not care anything for them, and so few to inventors, the very men who need them?

My lock is finished, and no man has been able to open it with the key in his hand. I have just sold the New England States for my patent heel cutter for twenty thousand dollars. My motto is "Never despair." J. H. BEAN.

Marietta, Ohio.

[The reason why so many get the Patent Office reports who do not value them, and that so many inventors, and persons who would prize and be benefited by having them, cannot obtain them, is that a proper distribution is not made by Congress. The members vote themselves too large a number for distribution among their constituents, and not half enough for the use of the Patent Office. The Commissioner should have the distribution of the bulk of each year's issue, that every patentee and applicant for a patent might be supplied from the Patent Office. Inventors are the persons most interested in these reports; it is their money that is appropriated for the payment of them, and they should be first served with them. The Commissioner has the names and addresses of many thousands of persons who would be glad of his annual report, and he has the facilities for the proper distribution of all that are published.

We hope Congress, in their next appropriation, will largely increase the number for the Patent Office, if the members are somewhat curtailed in the distribution. We are glad to know your good success in disposing of your patent. We like your motto.—EDS.

Curious Phenomenon in Artillery Firing.

MESSRS. EDITORS:—In your Dec. 11th issue of the SCIENTIFIC AMERICAN, under head of "Curious Phenomenon in Artillery Firing," I would say that the resistance of the atmosphere on the lower half of the projectile was greater

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 relation 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 disturbs, 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.