BOARDMAN'S COMBINED TOOL.

This tool, of which our engraving is a good representation, comprises a screw wrench, a pipe wrench, a hammer, a nail claw, a screw-driver, and a bit handle, or socket wrench.

The bit handle is the entire tool, the square socket or opening being made in the end of the handle, in which the shanks of bits may be inserted.

The screw driver is formed on the end of the screw bar, attached to the outer jaw of the wrench, and is taken out from the hollow of the handle when required for use.

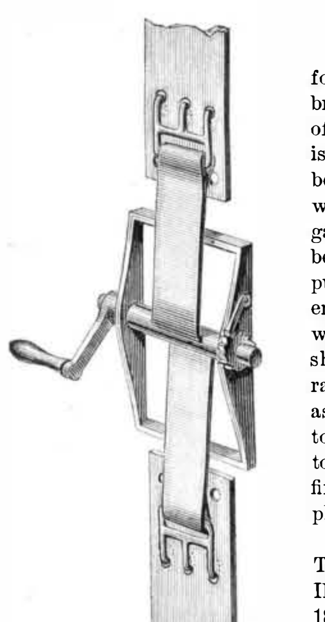
The use of the other parts of the tool will be apparent from the engraving.

The tool is very compact, and has this advantage over the ordinary screw wrench, that its leverage increases as it is opened to receive nuts of larger size.

This invention is protected by two patents, dated respectively, May 30, 1865, and July 10, 1866.

For further information address B. Boardman & Co., Norwich, Conn.

BELT TIGHTENER.



This instrument will be found of great service in bringing together the ends of belts, the weight of which is so great that they cannot be held together by the hand while lacing. A strap engages with holes made in the belt, at the back of the holes punched for lacing, the tightening strap being provided with claws or hooks, as shown. A winch axle and ratchet, adjusted in a frame as shown, are then employed to pull the ends of the belt together and hold them firmly till the lacing is completed.

This is the invention of T. G. Stansberry, of Medora, Ill. Patented in September, 1867.

Some Things I don't want in the Building Trades.

I don't want my house put in repair, or rather out of repair, by a master who employs "Jacks of all Trades."

I don't want my foreman to tell me too much at one time about the faults of the workmen under him, as I may forget asking him about himself.

I don't want a builder or carpenter to give a coat of paint to any joinery work he may be doing for me, until I have examined first the material and workmanship.

I don't want any jobbing carpenter or joiner, whom I may employ, to bring a lump of putty in his tool basket. I prefer leave the use of putty to the painters.

I don't want jobbing plumbers to spend three days upon the roof, soldering up a crack in the gutter, and, when done, leaving fresher cracks behind them. The practice is something akin to "cut and come again."

I don't want a contractor to undertake a job at a price that he knows wfll not pay, and then throw the fault of his bankruptcy on "that blackguard building."

I don't want any more hodmen to be carrying up the weight of themselves in their hod, as well as their bricks; I would much prefer seeing the poor human machines tempering the mortar or wheeling the barrow, while the donkey engine, the hydraulic lift, or the old gray horse, worked the pulley.

I don't want house doors to be made badly, hung badly, or composed of green and unseasoned timber.

I don't want houses built first and designed afterwards, or, rather, wedged into shape, and braced into form.

I don't want to be compelled to pay any workman a fair day's wages for a half day's work.

I don't want an employer to act towards his workmen as if he thought their sinews and thews were of iron, instead of flesh and blood.

I don't want any kind of old rubbish of brick and stone to be bundled into walls and partitions, and then plastered over "hurry-skurry." Trade infamy, like murder, will out," sooner or later.

I don't want men to wear flesh and bone, and waste sweat and blood, in forms of labor to which machinery can be applied, and by which valuable human life and labor can be better and more profitably utilized.

Correspondence.

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

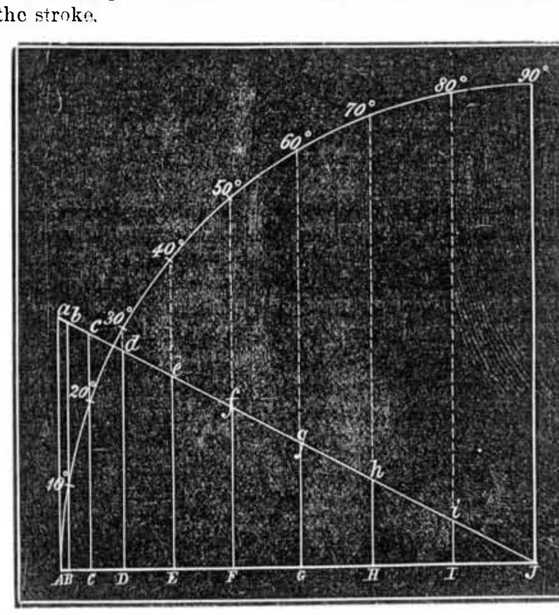
Action of the Reciprocating Parts of Steam Engines.

MESSRS. EDITORS:—I have hesitated about the propriety of replying to the criticisms of your correspondent, J. E. Hendricks, upon my paper, on the action of the reciprocating parts of steam engines. It is not to be expected that a truth so opposed to commonly received notions—the reception of which requires so much to be unlearned—should at once receive the assent of every one. Some odd fancies on the subject are likely to be ventilated first.

But your correspondent touches the root of the matter, and perhaps the fact questioned by him should be more clearly placed beyond dispute.

I will dismiss the introductory part of his letter, merely observing that his "logical inference" is quite gratuitous and unwarranted. He says himself that its absurdity is obvious, in which I quite agree with him.

The real question is this: What is the figure representing the acceleration of the motion of a piston, controlled by a crank which revolves with a uniform velocity? I stated it to be a right-angled triangle, and indicated, as I supposed, clearly enough, a simple method by which this could be shown. Your correspondent claims that the calculation, according to my own rule, gives a figure of a totally different form, and one that shows the acceleration, as well as the motion, to be reduced to zero at the commencement of the stroke. Let us see. Let the straight line, *AJ*, in the following figure, represent half the stroke of the piston, and let the distances, *AB*, *AC*, etc., on this line, represent the versed sines of 10°, 20°, etc., up to 90°, or the motion of the piston while the crank is moving through these arcs. At the points *A*, *B*, *C*, etc., erect the perpendiculars, *Aa*, *Bb*, *Cc*, etc., and let the length of each of these ordinates represent the acceleration imparted in a given time at that point of the stroke. Then will *AJ* be to *Aa* as *IJ* is *Ii*, as *HJ* is *Hh*, etc., showing that the straight line, *aJ*, connects the extremities of all the ordinates, and that the triangle, *AJa*, represents the acceleration of the motion of the piston, from the commencement to the middle of the stroke.



The following table will enable any one to make the calculations proving the truth of the above proposition:

Degrees.	Versed sine.		Motion for 10°		Acceleration during 1°	
0°		·0000000			*Aa*....	·0003046
10°	*AB*....	·0151922	*AB*....	·0151922	*Bb*....	·0003001
20°	*AC*....	·0603074	*BC*....	·0451152	*Cc*....	·0002862
30°	*AD*....	·1339746	*CD*....	·0736672	*Dd*....	·0002638
40°	*AE*....	·2339556	*DE*....	·0999810	*Ee*....	·0002332
50°	*AF*....	·3572124	*EF*....	·1232568	*Ff*....	·0001958
60°	*AG*....	·5000000	*FG*....	·1427876	*Gg*....	·0001523
70°	*AH*....	·6579799	*GH*....	·1579799	*Hh*....	·0001041
80°	*AI*....	·8263518	*HI*....	·1683719	*Ii*....	·0000529
90°	*AJ*....	1·0000000	*IJ*....	·1736482	*Jj*....	·0000000

The method of obtaining the decimals representing the acceleration for 1°, at any point, was fully explained in the paper, and compared with the similar method of showing the uniform acceleration of a body acted on by a constant force. The ordinary tables in the hand-books, going only to five places of decimals, are of no use for these computations.

I would suggest a practical experiment. Let any one having an engine running at a good speed, loosen the crank pin brasses a little, so that, at starting, it will thump heavily. Let the engine be lightly loaded, so that only a small portion of the boiler pressure will need to be admitted to the cylinder. As its speed increases, the thump will die away; and, if at its full speed, the pressure of the steam admitted is not so great as to overcome the centrifugal strain of the reciprocating parts on the crank, as it passes the centers, the engine will revolve in silence. Any one can ascertain, by the rule given in the note to the paper, just what pressure can be admitted without causing a thump, or this can be found by a little experimenting. I am running an engine which does not thump with loose crank pin brasses, under eighty pounds pressure, admitted sharply on the centers.

CHARLES T. PORTER.

Answer to Practical Problem.

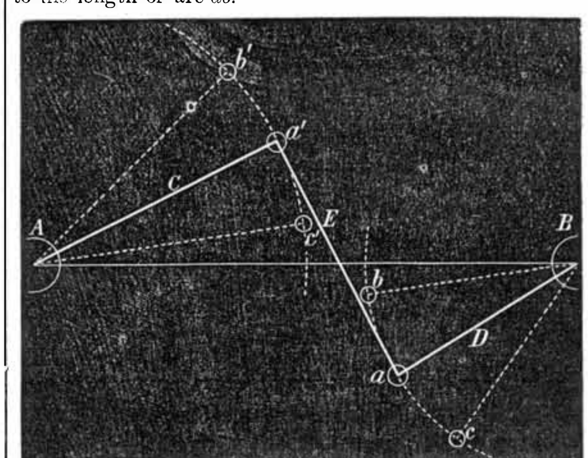
MESSRS. EDITORS;—I submit the following solution of "Practical Problem" on page 147:

Given AB, arm, C, arm, D, chord of half angle of oscillation of arm, D, and angles of arms, with line AB.

To find angles, BA*c'*, AB*b*, and length of link, E.

1. As the length of arm, D, is to the chord of arc, *ab*, divided by 2, so is the radius to the sine angle oscillation of arm, D, divided by 4.

2. 360° is to the whole circumference as the angle *b*B*a* is to the length of arc *ab*.



3. Now arc *ab* is equal to arc *a'c'*.

4. The whole circumference is to 360° as the length of arc *a'c'* is to the angle oscillation of C divided by 2.

5. Half angle oscillation, C, taken from angle BA*a'* is equal to angle BA*c'*.

6. Half angle oscillation, D, taken from angle AB*a* is equal to angle AB*b*.

7. The diagonal of the rectangle formed by the (sum of the sines of the angles of the arms with AB) into (AB—sum of cosines of same) will be the length of link, E.

G. R. NASH, Civil Engineer.

North Adams, Mass.

[We have received other solutions of this problem, but as this covers the ground in a very simple manner, we think it will be sufficient. Those forwarding the solutions not published will accept our thanks and assurances that it is not because they lack merit that they are declined.—EDS.

Reciprocating Parts of Steam Engines.

MESSRS. EDITORS:—In one of the late numbers of your journal, you publish a paper, read by Mr. Porter before some learned society in New York, on something about the possibility or practicability of running a steam engine at a high rate of speed, and claiming to give a scientific explanation of the why and wherefore. Now, scientifically, I know nothing about a steam engine; practically, I know how to stop and start one. Therefore, you will understand that what I say is not as coming from one who claims to be wise above what is written, but as simply being a statement of the case, as it appears to one who wants to learn, and takes this way to draw out the truth. A scientific theory, invested with all its sines, coefficients, and other paraphernalia, is a very pretty thing to look at, no doubt, for those who understand it, and, when properly applied, is invaluable; but when, as in this case, a practical question is to be decided, by the aid of a scientific demonstration, it will not do to throw aside the main elements of the problem, or any, in fact, of the minor points, no matter how trivial they may appear.

Mr. Porter's labors were strictly of a scientific nature. He starts out with the proposition that what he is about to explain is very simple, and very likely it is; but, for one, I can't see it, and I want more light. He says that it takes a certain number of pounds to overcome the inertia of the reciprocating parts of a certain weight, to give it a certain speed. What is inertia? He says, "we will not take into account the friction of parts." Now, my understanding of this point is, that friction is practically one of the main elements in the problem. How can we hope to obtain a correct solution when he rubs out one of the terms of the equation? What is friction doing all the time, while he is theoretically having his reciprocating parts storing up power and then giving it out again, just at the right time, and in the right quantity?

What an immense amount of iron has been wasted by being cast into fly wheels, when a fraction of the amount, if only put into cross heads, would render fly wheels unnecessary!

Mr. Porter stops short in his discussion. He should have added a table giving the proportionate length of stroke, weight of parts, and number of revolutions required to produce the effect of an engine running at a high speed, without the least fraction of inequality in the strain on the crank, and then the sun would have fairly risen in the "dawn of a new era for the steam engine." But, as it is so very simple we can all figure it out for ourselves.

In the diagram Mr. Porter gives, to illustrate the travel of the piston, he wets his finger and draws it over another term in the equation (a method of elimination not taught by Hutton, Davies, and other mathematicians). It is a quick way, but is it correct? He says, "the distance traveled by the piston is the versed sine of an angle formed by a line from the center of the crank pin, in any part of its stroke to the center of the circle described by the crank pin, leaving out of the calculation the angularvibration of the connecting rod " What he means by the "angular vibration," I do not know. He is wrong in the statement. If he will think of it he will see it. If he meant to say that the piston's travel was measured by the versed sine of the angle formed by the connecting rod and the line of horizontal centers, he is wrong again, yet nearer the truth than before, just as the proportion between the length of the connecting rod and the half diameter of the circle described by the crank pin. This can quickly be seen by supposing the connecting rod to be detached, and allowed to fall down on the center line, at any part of the stroke. If he understood this (as no doubt he did), he should not ignore the facts.

What I am aiming at is this. When a man attempts to demonstrate a thing mathematically, he must take into his calculation everything essentially connected with the problem, just exactly as it is, and not as he would have it; otherwise, he cannot, by any possibility, attain a correct result. When he claims, as now, the practicability of running engines at a high speed, I think he is claiming too much. Build an engine of proper materials, make it strong, and fit everything as it should be, balance crank and fly wheel to a nicety, keep everything snugly in its place, and the terrors of a quick stroke vanish.

S. W. H.

Test for White Lead.

Messrs. Editors:—I have read, with much interest, Dr. Chandler's colorimetric test of the purity of white lead, as published in the Scientific American sometime ago. I enclose another test, which, though not new, is of value to all using white lead on account of its simplicity and effectiveness. It has been in use here for nearly two years, and has been found reliable. Having never seen it in print, I have tried to put it in as simple words as possible.

Felix McArdle, Analytical Chemist.

St. Louis, Mo.

Take a piece of firm, close grained charcoal, and, near one end of it, scoop out a cavity about half an inch in diameter and a quarter of an inch in depth. Place in the cavity a sample, of the lead to be tested, about the size of a small pea, and apply to it continuously the blue or hottest part of the flame of the blow pipe; if the sample be strictly pure, it will in a very short time, say in two minutes, be reduced to metallic lead, leaving no residue; but if it be adulterated to the extent of ten per cent. only, with oxide of zinc, sulphate of baryta, whiting or any other carbonate of lime, (which substances are now the only adulterations used), or if it be composed entirely of these materials, as is sometimes the case with cheap lead, it cannot be reduced, but will remain on the charcoal an infusible mass.

Dry white lead, (carbonate of lead) is composed of metallic lead, oxygen and carbonic acid, and, when ground with linseed oil, forms the white lead of commerce. When it is subjected to the above treatment, the oil is first burned off, and then at a certain degree of heat, the oxygen and carbonic acid are set free, leaving only the metallic lead from which it was manufactured. If, however, there be present in the sample any of the above mentioned adulterations, they cannot of course be reduced to metallic lead, and cannot be reduced, by any heat of the blow pipe flame, to their own metallic bases; and being intimately incorporated and ground with the carbonate of lead, they prevent it from being reduced.

It is well, after blowing upon the sample, say for half a minute, by which time the oil will be burned off, to loosen the sample from the charcoal, with a knife blade or spatula, in order that the flame may pass under as well as over and against it. With proper care the lead will run into one button, instead of scattering over the charcoal, and this is the reason why the cavity above mentioned is necessary. A common star candle or a lard oil lamp furnishes the best flame for use of the blow pipe; a coal oil lamp should not be used.

By the above test, after a little practice, so small an adulteration as one or two per cent. can be detected; it is, however, only a test of the purity or impurity of a lead, and if found adulterated, the degree or percentage of adulteration cannot be well ascertained by it.

Jewellers usually have all the necessary apparatus for making the test, and any one of them can readily make it by observing the above directions, and from them can be obtained a blow pipe at small cost.

If you have no open package of the lead to be tested, a sample can most easily be obtained by boring into the side or top of a keg with a gimlet, and with it taking out the required quantity; care should be used to free it entirely from the borings or particles of wood, and it should not be larger than the size mentioned; a larger quantity can be reduced, but of course more time will be required, and the experiment cannot be so neatly performed.

How to Build a Chimney.

Messrs. Editors:—I am satisfied that a great many fires originatethroughpoorlyconstructed chimneys; and, although not a bricklayer by trade, I would offer a few hints how to construct a fire-proof chimney. Let the bed be laid of brick and mortar, iron, or stone; then the workman should take a brick in his left hand, and with the trowel, draw the mortar upon the end of the brick, from the under side, and not from the outside edge, as is usual. Then, by pressing the brick against the next one, the whole space between the two bricks will be filled with mortar; and so he should point up the inside as perfectly as the outside as he proceeds.

By drawing the mortar on the edge of the brick, the space between the ends will not always be entirely filled, and will make (where the inside pointing is not attended to) a leaky and unsafe chimney, which, if not kept clear of soot, will, in burning out, stand a good chance of setting the building on fire. The best thing that I know of, to put the fire out in a burning chimney is salt; but the matter of first importance, after having a chimney properly constructed, is to keep it clean.

Austin B. Culver.

Westfield, N. Y.

Crystallized Honey.

Messrs. Editors:—Please allow me to say to the querist who, through your columns, asks what to do with crystalline honey, that if he will "doctor" it with almost any artificial honey of the day, it will not become like lard in cold weather, which change is a natural proof that it is pure. For almost any purpose, pure honey is preferable to that which has been adulterated, but purity is a minor consideration with many.

Next we shall hear of some fastidious customer who objects to pure lard, because it looks white when cold. To such we would recommend lard oil as a great improvement, especially for cooking purposes.

A. M. B.

Louisville, Ky.

[For the Scientific American.]

RAMBLES FOR RELICS.

NUMBER II.

At a depth of fifteen feet, we were about to suspend our labors, supposing from the nature and uniformly dark color of the earth, that we had reached thesurface of the alluvium, when a sign of the inevitable wood and bark layer was seen in a crevice. An excavation, five or six feet, into the wall, revealed the skeleton of a man laid at length, having an extra coverlid of wooden material. Eighteen large oblong beads, an ax of polished green stone, eleven arrow points, and five implements of bone (to be described) were deposited on the left side; and a few small beads, an ornamental shell pin, two small hatchets, and a sharp-pointed flint knife or lance, eight inches long, having a neck or projection at the base, suitable for a handle, or for insertion in a shaft, on the right side. The earth behind the skull being removed, three enormous conch shells presented their open mouths. One of my assistants started back as if the ghost of the departed had come to claim the treasure preserved, in accordance with superstitious notions, for its journey to the "happy lands." The alarm seemed to be a warning, for at the moment the embankment, overloaded on one side, caved in, nearly burying three workmen, myself, and a spectator. Our tools being at the bottom of the heap, and the wall on the other side, shaken by the falling earth, giving tokens of a change of base, our prospects of a ready deliverance were not very hopeful. The bystanders, however, went to work with their hands, and we were soon relieved, not without casualty, the spectator having the worst of it. Struggling to extricate himself, instead of abiding his time, he dragged one leg out of the pile shorter than the other.

The occurrence of marine shells in a burial depository, especially of the varieties pyrula and oliva, four or five hundred miles from the Gulf and that portion of the Southern coast where the mollusks exist, bears upon the question of migration and tribal intercourse, and the commercial value of these articles. Obtained from a distance and regarded as precious commodities, they were used in exchange, for the material of ornaments, and for choice utensils Only two or three of these shells have been found in a perfect condition, but defective ones are frequent, with fragments, "cuttings," and various trinkets made out of them—such as ornamental pins, needles, crosses, buttons, amulets, engraved plates, and beads. From one of the specimens recovered from the mound sepulchre, the spire and columella had been removed, leaving a hollow utensil. It would have been suitable for a water vessel, but for a hole in the bottom, which had furnished a button-shaped ornament, or piece of money, which was found with the relic, and exactly corresponded to the orifice. The twirled end of the shell, however, had been improved for a handle by shallow cavities, one on the inside slanting from the middle longitudinal line, and one crossing that line at right angles on the convex side, so as to be fitted to the thumb and fore finger of the left hand, suggesting a use of the implement as a shield, or a mask held before the face. Adair speaks of large shells in use by the Indians of his time (1735), suspended about the neck for shields, and regarded as badges of priestly dignity.

A trench was dug on the east side of the mound, nearly corresponding in dimensions to the one on the west side, making the length of the whole excavation, including the central cavity, thirty-two feet.

In the last opening, eight skeletons were exhumed; the mode of burial was the same throughout. The only article of value recovered was a curiously wrought pipe of stone, having a "figure head" representing the human face, which I have put down in a list of "articles stolen," and which the thief can describe better than the writer. After filling up all the gaps, and levelling the surface to suit the taste of the proprietor, we closed our labors on the mound in the Bent.

Of the skulls collected, it is sufficient to say that they belong to the "short heads," the length and breadth having a comparative medium proportion, a common form of cranium in the mounds of Tennessee.

Of stone implements I specify an ax of serpentine, ten inches long, two thick, and four broad, having plain sides and a straight edge ground down on both of the flat faces; hatchets ("tomahawks") of green stone flint, and diorite, from five to eight inches long, with rounded faces and sides, contracted to an edge at one end, and to a flat heel at the other; a wedge of black slate, seven inches long and half an inch thick, of a square finish on the faces and sides and at the heel, which was diminished two inches, as compared with the length of the edge; hatchets with a serrated edge at each end, plane on both sides, convex on one face and flat on the other.

With one skeleton was deposited a "set of tools," eight in number, of the species of rock before mentioned, varying in length from two to eight inches. Their peculiarity consists in a variety of shapes—no two being precisely alike—and in their fitness to various uses, such as carving, hacking, paring, and grooving. The smallest of them, having a square finish, was held by the thumb and two fingers, and is suitable for cutting lines and figures in wood and shells. Specimens of this art were furnished from the mound. The largest number might serve for hatchets, chisels, and gouges. One had been ground in the form of a cylinder five inches long and an inch thick, and then cut an inch on two sides to an edge, and worked into a handle with a round head, from the center of the elliptical faces. It might be used for chipping wood and stone. One answered the purpose of a cold chisel; another was somewhat similar, but had a hollow face reduced to a curved edge for grooving. These polished instruments, wrought with much care, seemed intended for use by the hand rather than for insertion in a handle or socket, or attachment to a shaft by means of a strap or withe. Only one was perforated. The drilling through granite, quartz, and diorite, without the use of metal, was a severe labor, even for savage patience. A long knife of silex, with a wrought handle, lance heads, leaf shaped, of the same material, of beautiful workmanship, arrow points of fine finish, furnished, with others before mentioned, an assortment of arms. Several flint points, though only an inch long, were curved like a cimeter, and used probably as flaying instruments. True disks, of various mineral substances, from an inch to five inches in diameter, having convex faces, complete the list of stone implements. Those of bone comprise several like hollow chisels, sharpened at one end, and pierced through one face, near the other extremity, so as to be fastened to a handle; these were used for dressing skins. One was formed like a poniard, with a worked hilt. With these may be connected arrow heads and sharp pointed weapons of the worked antlers of the stag, and tusks of the wild boar.

Of ornaments, I noticed pins used for dressing the hair, made of the columns of large sea shells. The head is generally round, sometimes oval, from an eighth to a half of an inch in diameter, retaining the diagonal groove of the pillar from which it is made. The stems vary in length from one to six inches. It would be tedious even to classify ornamental beads and buttons of shell work, such as are usually found in the mounds. These trinkets are perforated, and, in addition to their being articles of dress, were used probably as "wampum," the currency of the recent Indians.

A miscellaneous collection includes a hematite stone, wrought in the shape of a cup weighing half a pound; when rubbed or ground it furnished the war paint of the savages; also the extremity of a copper tube, two inches long; needles in bone and shell, from an inch to six inches long, with grooves round the head, to serve the purpose of eyes; and plates of mica. The use of mica plates, which are found of large size in some of the Western mounds, has excited some inquiry. Of a certain thickness, they make good mirrors. Beside their use for ornamental purposes, they were probably looking-glasses of the beauties of the stone age. There was also found a pipe of soap stone, having a stem five inches long, and a bowl with a broad brim, like a Quaker's hat.

Of earthenware, there was an endless variety of fragments of the usual black, grey, or red compressed clay, mixed with pulverized shells or stones. One kind I have never seen described. The sherds had a red coating on both sides, an eighth of an inch in thickness, evidently not a paint or a glaze. The red coloring might have come from the pottery being burnt in the open air, instead of baked in a furnace, were not the layer of uniform thickness and of homogeneous paste, unlike the material of the vessel, which was a gray mixture of clay and particles of shells.

I give the above memoranda to the general fund of information, touching a subject that invites inquiry on account of its novelty and ethnological importance. Every examination of the monumental remains of the ancient Americans brings to light some new feature in structure or type of rudimental art. And since archæology has become a science, investigators, for half a century, may be looking about for facts to complete the system auspiciously introduced by the antiquarians of Northern Europe, and advanced in our own country by the researches of Caleb Atwater (*Archæologia Americana*) and by those of the Smithsonian contributors to knowledge, especially Squier and Davis.

Rambler.

A Small Water Wheel.—There is in the town of Meriden, Conn., a Leffel double turbine wheel, running under 240 feet fall and driving a manufactory. It uses only about one-half of a square inch of water, and runs at the marvelous speed of 3,000 revolutions per minute, or 50 revolutions per second, which is by far the most rapid rate of motion ever imparted to a water wheel. This is, also, beyond comparison the greatest fall applied to the propulsion of a wheel in America. The wheel at Meriden is of every diminuteive size, scarcely exceeding in dimensions the old-fashioned "turnip" watches which our grandfathers used to carry in their capacious vest pockets. The complete success of this wheel has attracted much attention and affords further evidence of the wide range of adaptability of the Leffel turbine.