Improved Direct-Acting Steam Hammer.

Simplicity being, next to efficiency, the most important point to be aimed at in the design of steam hammers, the form illustrated in the annexed engravings should commend itself to all who have occasion to use this class of tools. There being, with the exception of the regulating valve, but one moving part in this hammer, there seems to be nothing left to be attained on the score of simplicity. Fig. 1 is a perspective view of the hammer, and Figs. 2 and 3 vertical sections showing two positions of the hammer.

The ram being down, as in Fig. 2, steam is admitted to the annular channel, A, and from thence in the direction of the arrow, through the vertical passage, B, to the under side of the piston, C, the passage, D, communicating through the piston with the portion of the cylinder above the piston, being open to the exhaust as seen, whatever steam there may be above the piston escaping in the direction shown by the arrows through the passage, E, to the exhaust. The steam admitted at A, and passing up the passage, B, lifts the piston until the passage, D, connecting above the piston, opens to the steam inlet admitting steam over the piston. Notwithstanding this, the momentum of the ram continues the upward stroke until the passage, B, opens to the upper exhaust, when the parts are in the position seen in Fig. 3, to which we will now direct our attention, similar letters denoting the same parts.

The pressure of steam above the piston combines with the weight of the ram to carry it down with great force, until the passage, B, is uncovered to the steam inlet, A, and the passage, D, is open to the lower exhaust port, when the motion is reversed, the piston cushioning on the steam admitted through B.

The admission of steam and consequent speed of the hammer is regulated and governed by the foot of the forger, as plainly shown in Fig. 1. A hand gate also may be placed on the steam pipe if desired. Thus a slow and light blow, or a rapid and heavy one can be obtained at pleasure. For work requiring rapid and uniform blows, such as drawing small steel, making cutlery or edge tools, planishing saws, etc., this is a very efficient hammer. We witnessed its operation at the works of the American Tool Steel Company, corner Kent avenue and Keap street, Brooklyn, E. D., N. Y., with great satisfaction. This hammer is the invention of David Joy, of England, and has been patented in this country by Merrick & Sons, 430 Washington avenue, Philadelphia, Pa. For terms and prices address as above, or Geo. Birkbeck, Jr., the agent, at their office, 62 Broadway, New York city.

Fig. 1

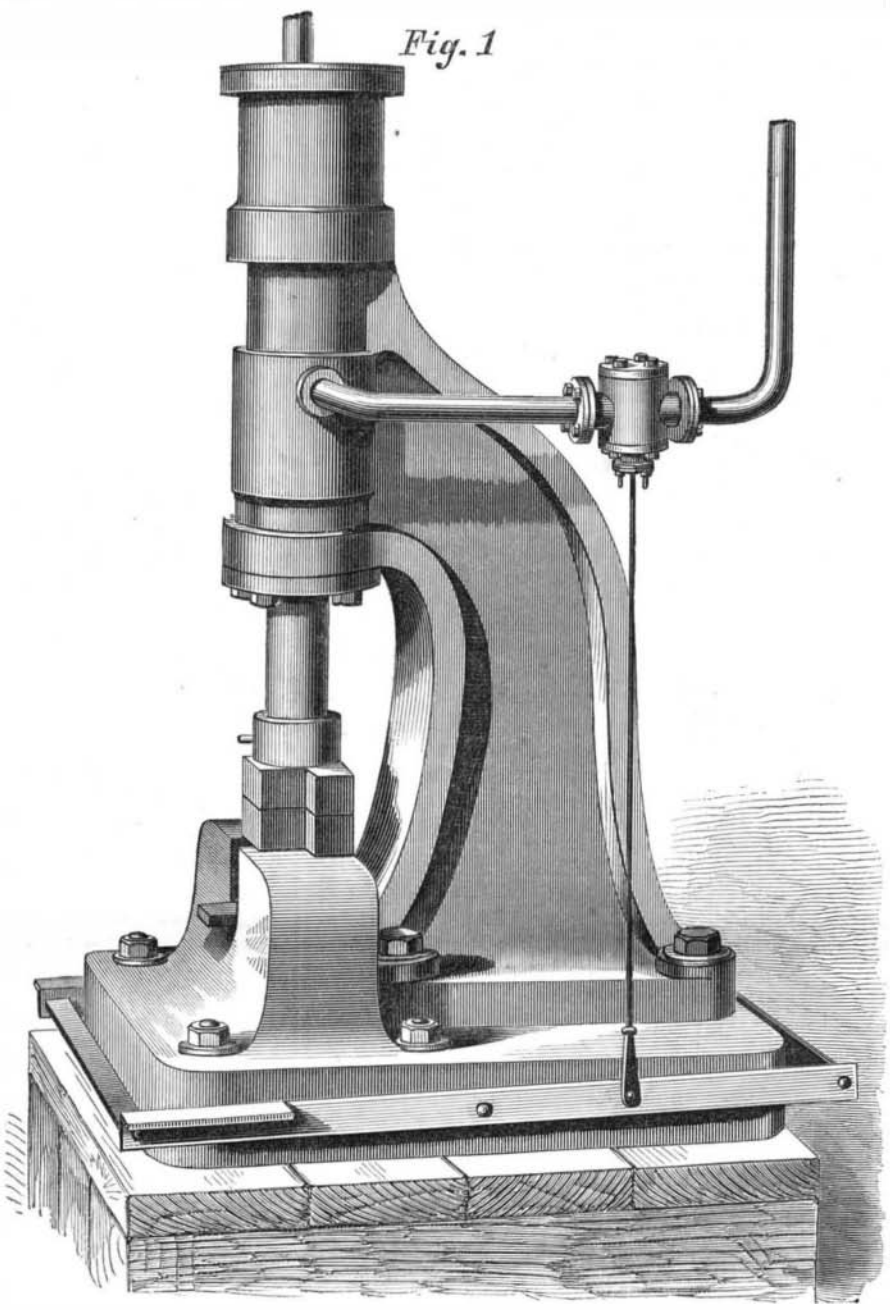


Fig. 3.

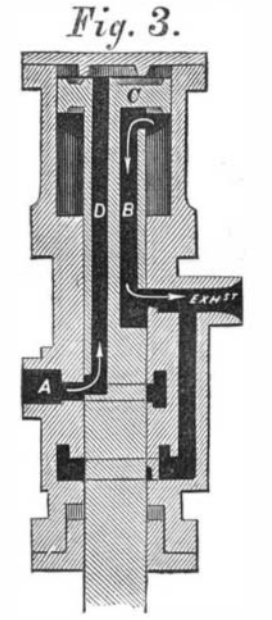
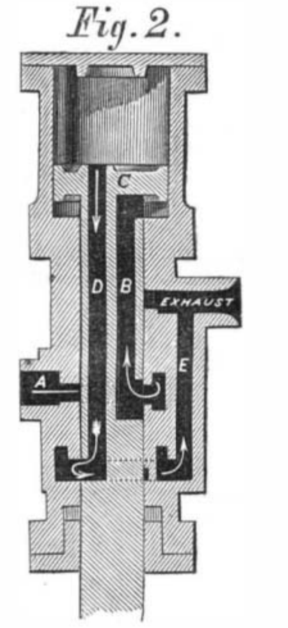


Fig. 2.



THE JOY PATENT STEAM HAMMER.

CAN WATER BE SOLIDIFIED BY PRESSURE?

In No. 19 of the current volume of the SCIENTIFIC AMERICAN, a correspondent asks the question, "Is there any depth in the ocean to which an iron weight or bar would not sink?" We answered no. An exchange has taken up this subject. It says "it is the popular theory, that lead, at great depths, remains suspended in the water and refuses to sink further. The theory stated is not correct. The fact may be as alleged, namely, that the lead refuses to sink, on reaching a certain depth below the surface of the ocean; but this is not because it is equally balanced by the water, nor is it in a state of equilibrium. We presume it will not be denied that a solid will float on the surface of a liquid, as iron on quicksilver, only when the the specific gravity of the latter exceeds that of the former; also, that a solid remains suspended, or equally balanced, in a liquid, only when the specific gravity of the latter is exactly equal to that of the former. Now a cubic inch of lead weighs more than eleven times as much as a cubic inch of water; hence, in order that the lead may become suspended in the water, the latter must be so compressed that eleven and forty-five hundredths cubic inches shall occupy the space usually occupied by one cubic inch. Such a degree of compression can scarcely be conceived of as possible. A pressure of some hundreds of tuns to the square inch is required to reduce the volumn of a column of water five per cent, or one-twentieth of its bulk; while the pressure on a square inch at a depth of nine miles (the estimated depth of the ocean, in its deepest part), would be less than eleven tuns. But we are told that the lead does refuse to sink at a depth of about three miles, where the pressure does not exceed three-and-a-half tuns to the square inch; and, consequently, the specific gravity of the water can not be sensibly greater than at the surface.

"We come now to the perplexing question: 'Why, then, does the lead refuse to sink at great depths?'

"Of course, we take for granted, that the fact stated by seamen, who alone have had opportunity to state the same, is real—that the lead does actually refuse to sink, when it has reached a certain depth, though it has not yet reached the bottom. We have just seen that this fact can not be accounted for, by supposing that the water, at that depth, has become, specifically, as heavy as lead; for this supposition is contrary to what we know of the effect of pressure on water. Nor do we know of any well-established principle, by which this result can be accounted for.

"It can do no harm to offer a conjecture, which may help in solving this difficult question, even if it be not the correct answer.

"We conjecture, then, that pressure has somewhat the same effect on water that it is known to have on some of the gases; namely, that it reduces it to a solid form. We know that a reduction of temperature has this effect; and that water, in the solid form of ice, is not even so heavy, specifically, as in the liquid form. Now, pressure may, possibly, reduce it to the form of a solid, without any perceptible increase of specific gravity, and three or four tuns to the square inch may be the amount of pressure required to accomplish this result. It is also possible, that the solidifying process may be more or less gradual, which would prevent any sudden jarring of the lead on reaching the solid stratum of water."

We should have been loth to concede that the belief in the theory, that a weight of greater specific gravity than water would fail to sink to any depth which can be found in the ocean, prevailed to any great extent but for this singular hypothesis. It is fair to suppose that the public is not wiser than its teachers, and we therefore suppose this belief is one of those popular errors which still remain uncorrected. With a view of correcting it we shall first analyze the theory itself, and show that it is neither sustained by fact or reason; second, show the absurdity of the hypothesis framed to account for it; and third, as a matter of general interest, make some remarks upon the difficulties in deep sea sounding which undoubtedly gave rise to the error.

The theory is not based upon fact. Lieutenant Berryman, of the steamer Arctic, in 1857, in sounding the depths of the Gulf Stream, reached bottom at 4,480 fathoms, more than five miles, and in one case 6,600 fathoms, a depth of seven and one-half miles, were reached without touching the bottom. Some deductions are to be allowed for possible errors in perpendicularity, but they must be small in proportion to the general result.

Admitting that these facts do not prove that at still greater depths a point might not be reached where a body heavier than its own bulk of water would cease to sink, the consideration of the nature of that fluid itself forbids the supposition. The most elaborate experiments have been instituted to determine the compressibility of liquids, and it is even yet doubted by some whether the amount of compressibility which has been apparently determined, is not due to defects in the method of experimenting. Be that as it may, it is probably true that no solid is so little compressible as water It follows, therefore, that even if water were capable of being condensed so as to become of the density of lead under ordinary conditions, that a solid immersed in it and receiving the same pressure would also be condensed, and its specific gravity increased proportionally. Thus a body, if it begins to sink at all in water, must continue to sink until it reaches the bottom, unless the hypothesis that water solidifies under pressure be correct.

We have no reason to believe that this hypothesis is correct. On the contrary we have many reasons to disbelieve it. All experiment teaches us that when any gaseous or liquid body is rendered solid, it does not instantaneously resume the gaseous or liquid form. It must absorb the amount of heat which it lost when it became solid, it being a law that bodies when they become denser impart heat, and when they become less dense absorb it. It takes time in all cases to accomplish this, and the larger the mass operated upon the longer time it will take. In former ages the bottoms of oceans have been upheaved. In every case where upheaval has occurred we find a fossil deposit which has been proved to be organic in its origin. How would this be possible if the water at the bottom were in a solid state? If that were so, large masses of this solidified water would have been upheaved, having all this deposit upon its upper surface, the gradual change to a liquid state would have generated rivers, whose force would have broken up and carried along the fossil deposit, and distributed and arranged it in forms strikingly different from that in which it is always found. Moreover, it is impossible if this solid state exists anywhere in the sea, and especially if it is solid at the depth of three miles, that such depths could have been reached as we have stated were reached by Lieutenant Berryman. In all the experiments to which water has been subjected, there has never been the least indication that it could be solidified by pressure, and it is most improbable that if it were possible such indications should have totally escaped notice. But as we have shown that there was no need for this supposition, as the supposed fact for which it was intended to account does not exist, we will pass to what was probably the origin of the error.

The difficulties in sounding great depths are very great. Formerly the twine used was so light that when a certain depth was reached its buoyancy was sufficient to float the lead. It became on this account necessary to improve its quality and density so that its specific gravity should not vary greatly from that of sea water, while at the same time it should have enough strength to sustain the weight used in making the cast. Twine was thus perfected until it was able to sustain a strain of sixty pounds without breaking, six hundred feet weighing only one pound. With this twine having a 32-pound shot attached, very much greater depths than had been previously possible were reached. Small wire has been used in lieu of twine, and we believe the line used by Lieutenant Berryman in the soundings above alluded to was partially composed of wire. The second difficulty was the determining the precise moment at which the weight reached the bottom. It was found that when the ball had reached the bottom the line would continue to run out, being acted upon by the force of deep sea currents. The shock could not be felt at great depths, and thus it was necessary to devise some method by which this important detail should be made determinate. If a line be made fast to one side of a river, carried across and allowed to trail in the water, it will run out rapidly from the side where it is not fastened. In sounding when the ball reaches the bottom, the same thing occurs. The ball becomes immovable while the under currents acting upon the line carry it rapidly out. So long as this difficulty remained nothing certain could be ascertained. And still another difficulty was discovered. The counter currents made bights in the line, so that the length of line run out was not a correct indication of the depth reached. These difficulties were overcome by the inventions of Brooke and of Massey. The former invented a self-detaching apparatus by which the weight when it reached the bottom would be instantly released. At the same time a small portion of the bottom would adhere to light hollow tubes attached to the line, so that when recovered the character of the bottom could be ascertained. The latter invented a small instrument by which the exact vertical distance traversed by the weight in its descent would be indicated. The form of the lead was subsequently changed to a double cone about two feet in length, having its greatest diameter four inches from the lower end, and tapering from this point to the top, where it was about two inches in diameter. Through the center of the lead, which weighed from one hundred to one hundred and fifty pounds, an iron shaft extended. In a hollow at the lower end pieces of quill barrels were inserted, which penetrating into the bottom retained a portion. When this apparatus was used on the steamer Arctic by Lieutenant Berryman, the detaching apparatus of Brooke was dispensed with as Massey's sounding machine was sufficient to determine the depth when enough line was run out to render it absolutely certain that the bottom been reached. Delicate self-registering thermometers were also attached to the apparatus, by means of which it was ascertained that the sea was much colder at greater depths than near the surface. With this apparatus the deep soundings we have described were made, and there is no doubt that they were very nearly correct.

CHROMO LITHOGRAPHY.

Without admitting all or nearly all that is claimed for it, we must admit that chromo-lithography is a wonderful art. It is not necessary to believe that the chromos so much praised by some of our exchanges are exact copies of the paintings they represent, to properly estimate their worth An exact copy of a painting was never yet produced ; nor yet so nearly produced as to obtain the full effect of any truly great picture, whether it was done by the most skillful painter or by chromo-lithography. It is enough that a well-executed chromo is better than a badly painted copy, for most of the painted copies are bad. Chromo-lithography gives a good picture at a cheap rate, for which it is justly entitled to praise. The process is a difficult one, although the principles upon which it is based are simple enough. The effects most difficult to produce in chromo-lithography are those which are produced in painting by the blending of colors while they are fresh and soft on the canvass. This blending can never be produced in any other way so perfectly as the artist can do it with his brush, and it is the comparative absence of these effects which enables an expert to detect, even at some distance, a chromo from an oil painting. In the former, the colors are superimposed ; in the latter, they are mixed.

Lithography is the art of drawing upon stone, and taking impressions of the picture thus produced upon paper. The prefix *chromo* signifies colored. The art, as practiced in Europe, and, until lately, in this country, is entirely distinct from engraving. The stones from which the impressions are taken being perfectly *smooth*. Latterly, the last impression is taken from an engraved stone, by which a nearer approach to oil painting is secured. This improvement is due, we believe, to Mr. Prang, of Boston, and has greatly added to the artistical effect of the pictures.

The stone used is a peculiar species of limestone found in Bavaria, which is capable of receiving a very fine polish, beside possessing chemical qualities which render it adapted to the purpose. The stone is cut into plates of the proper size, as many plates being requisite as the different colors necessary to complete the picture. Each of these plates has a separate portion of the picture drawn upon it. The drawing is executed with a colored chemical preparation, which, upon the subsequent application of suitable re-agents enters into combination with the stone itself, and becomes permanent. The drawings are so made, that were they all superimposed upon each other, and the plates were transparent, by looking through them, the entire picture would be shown complete. The lines which constitute the drawing have an oily surface which repels water, so that when the stone is dampened with water, and printers' ink or oil colors are applied, the ink or the colors, being repelled by the moistened parts of the plates, adhere only to the lines of the drawing. Thus, when an impression is taken, these lines only are transferred to the paper.

Every stage of the operation requires the most delicate and accurate manipulation. Conceive the difficulty of making a drawing on thirty different plates, each plate having upon its face numerous fragments of the entire picture scattered in different positions, the whole to be so accurately done that when one after another shall have been proved by an impression taken upon a single sheet of paper, a complete picture will be presented ; and remember that a variation of a hair's breadth will destroy the work. Another difficulty is what is technically known to printers as registering. This means the placing of any number of sheets, always in the same position, upon the plate or form, in the press. The greatest accuracy is required here, as all the preceding nicety of workmanship counts for nothing unless this is secured.

The final operations consist in embossing and varnishing. The former gives the rough grained appearance to chromos which is seen in oil paintings, and softens the outlines of the picture. This brief sketch will give an idea of the methods employed in this art, which, if it can not equal, is familiarizing the American public with the works of the great artists, hitherto entirely inaccessible to those not having the means and opportunity to visit the galleries of Europe, where the most of them are only to be found.

THE smoke from the late volcanic eruption on the Sandwich Islands floated off in a line of one thousand miles across the sea, and was so dense that at a distance of 500 miles officers of ships were prevented from making their observations.

Submarine Telegraphy—A Curious Phenomenon.

The Memphis *Appeal* gives an account of a case which has very much perplexed the electricians. We allude to the late obstruction and restoration of telegraphic communication with the trans-Mississippi. For some weeks past the cable has been working very irregularly. At intervals no communication could be had for hours, and all at once it would revive and the fluid pass through it as usual. This state of affairs continued for several weeks, and at last communication ceased entirely. After several ineffectual attempts to revive it, it was determined to raise it and find out the reason for the cessation. The cable crossing at this point is considered one of the best ever laid in this country, having been manufactured originally for the Red Sea, but for some reason not used, and afterwards was purchased and laid down by the Western Union Telegraph Company, at a very heavy expense. The operation of "under running" and taking the cable up was successfully performed by Colonel Coleman and Captain Baker, in a steam tug with a barge attached. As it was raised, and at intervals of a few yards, a needle was driven into the cable so as to touch the conducting wire, and instruments were applied to test the soundness of the portion raised. When near this shore by this means it was discovered that the disturbing cause lay within a space of twenty yards between two points. This piece was cut out, the two ends spliced, and the cable immediately worked throughout its whole length. The piece cut out was brought ashore and examined by Colonel Coleman and Captain Baker at their leisure, and developed one of the most singular facts in telegraphing that has ever come under their notice. On cutting the cable it was found that about four inches of the conducting wire had been burned out, and was gone completely. It is supposed that a severe shock of lightning had passed along the land line of wires, and had left them and followed the cable, burning this piece out in its possage. The curious and inexplicable part of the affair is the action of the cable after the burning. At times a current of electricity passed through and communication was kept up between Memphis and Little Rock ; then ceasing entirely for awhile, it would again revive, keeping up this fitful action, as we have stated, for some time before its total suspension.

Many theories and surmises are advanced by the gentlemen connected with the telegraph office here as to the explanation of this remarkable phenomenon, the only one of which is at all satisfactory is that of Colonel Coleman, that 'a slight connection was formed between the burnt ends of the conductor by moisture which had penetrated the cable in sufficient quantities to keep up the circuit there being a battery on the Memphis end strong enough to drive the electricity through at intervals." This, says Colonel Coleman, to whom we are indebted for most of the above facts, is a remarkable case and may never occur again. The question now naturally suggests itself, cannot some mode be established whereby communications can be passed through large bodies of water without a cable? It has been proven it this instance that messages passed to and fro across the Mississippi without a metal connection. Let the scientific work it out.

Sleep--The Amount Necessary.

Prof. Dickson, in his Essay on Sleep, says the necessary amount must differ in the various tribes, as well as in different individuals, according to numerous and varied contingencies. The average proportion of time thus employed by our race may be stated pretty fairly, I think, at one third. The allotment of Sir William Jones, slightly altered from an old English poet, does not depart much from this standard:

" Seven hours to books, to soothing slumber seven,
Ten to the world allot, and all to Heaven."

The busy engagement of ambition and avarice may induce men to subtract more or less from their due repose, but any considerable deduction must be made at a great risk to both mind and body. Sir John Sinclair, who slept eight hours himself, says that in his researches into the subject of longevity, he found long life under all circumstances and every course of habit ; some old men being abstinent, some intemperate ; some active, and some indolent ; but all had slept well and long. Yet he gives a letter from a correspondent, recording the case of an old man of ninety-one years of age who had slept through life but four hours a day. Alfred the Great slept eight hours, Jeremy Taylor but three. Dr Gooch tells us of an individual who slept only fifteen minutes in the day; but it is scarcely credible. Bonaparte, during the greater part of his active life was content with four of five hours' sleep ; the same is said of Frederick the Great and of John Hunter. I know familiarly a person whose average has been even lower than this ; I have heard his wife say that they were married four years before she had ever seen him sleep. Seneca is quoted as telling the incredible story of Mecænas, that he had passed three years without sleeping a single hour. Boerhave says of himself that he was six weeks without sleep, from intense and continued study. Statements like these demand close examination and clear proof.

Of long protracted sleep there are numerous and wonderful tales, from the story of the Seven Sleepers of Ephesus and their dog—to be found in the early legends of the Church ; in the Koran, chapter of the Cave ; all over the East, as Gibbon tells us ; and even in Scandinavia—down to the exquisite Rip Van Winkle of our Washington Irving. In the *Philosophical Transactions* we read of one Samuel Clinton, a laboring man, who frequently slept several weeks at a time, and once more than three months without waking. In the *Berlin Memoirs of the Academy of Sciences*, there is a curious history of a lady of Nismes, who fell asleep irresistibly at sunrise, woke for a brief interval at noon, fell asleep again, and continued in that state until seven or eight in the evening, when she awoke and remained awake until the next sunrise.

Heat in Mines.

Everyone who has had anything to do with mining knows that water is one of the most formidable enemies the miner has to contend with. It begins to flow in as soon as the depth of an ordinary well is reached, and must be pumped out, at great expense, to enable the work to proceed. The steam engine was first devised for the sake of providing power to do this pumping, and was for a Cornish mine that Watt invented his great improvement on the original machine.

Without this help many of the mines in England would be worthless ; and as it is, some of them are limited in their depth by the difficulty and expense of getting rid of the water.

A curious fact has, however, been lately brought to notice in regard to the Nevada silver mines. Heat, not water, is the chief enemy encountered after reaching a great depth, and, instead of pumping out water, the companies have to pump in air. A Nevada paper says :

" The increase in the heat of our mines is now beginning to give many of our mining companies more trouble, and is proving a great obstacle to mining operations in those levels lying below a depth of one thousand feet than any veins or 'pocket' deposits of water yet encountered. A number of the leading companies on the Comstock are now engaged in putting in engines to be used expressly for driving fans for furnishing air to the lower levels, forcing it through large tubes of galvanized iron. With this great increase of heat in our mines comes a great decrease of water ; in fact, in our deepest mine—the Bullion, which has attained the depth of twelve hundred feet—not a drop of water is to be seen ; it is as dry as a lime-kiln and as hot as an oven. In the lower workings of the Chollar-Potosi mine, which are a perpendicular depth of eleven hundred feet below the surface, the thermometer now stands at one hundred degrees—a frightful heat to be endured by a human being engaged in a kind of labor calling for severe muscular exertion. Here also we find the water to have decreased till there is at the present time a very insignificant amount, it being necessary to run the pump but four hours out of the twenty-four."

This corroborates the theory of some geologists, that the interior of the earth is a mass of melted rock. Suppose one of these Nevada miners should accidentally make a hole in the solid crust, what would become of him ?—*Sun.*

Editorial Summary.

THE largest tannery in America is claimed by Chicago. It belongs to the Union Hide and Leather Company. An exchange thus describes these works : They are situated on the north side of the Chicago River, and occupy nearly 5 acres, including docks The main building is 241 by 80 feet and 3 stories, and on this is a two storied superstructure 75 by 35 feet. The building is constructed without angles, inside, so that every workman is under the eye of the foreman. A steam elevator in the center of the building is used for hoisting purposes. The working force of the establishment is 100 hands, and its producing capacity 1 000 hides per week, including wax, buff and upper leather, and a small quantity of harness leather. About one half of this product is sold in Chicago, and one half in Boston. The beam-house is 140 by 41 feet, and the machinery in use comprises 3 Winn splitting machines, 2 scouring and 1 stuffing wheel, 1 hide mill, pumps, etc. The building is heated by means of 12,000 feet of 1¼ inch pipe.

A DESCRIPTION of a clock which is apparently only a single plate of glass having the usual figures of the dial upon it, and a hand which keeps the time with apparently nothing to move it, is circalating largely among our exchanges. This is probably no new contrivance but an imitation of the celebrated glass clock constructed by Houdin, the French *prestidigitateur* many years ago, which was so ingeniously devised, that a person looking at it ever so closely could not discover the works, although he might to all appearance look entirely through the entire apparatus and see all the objects upon the opposite side of it.

A LARGE meat in a very hard nut to crack was found by some burglars recently in San Francisco. A safe which resisted their attacks for a long time and demanded all their skill as cracksmen, at last yielded, and was found to contain a large—joint of cold mutton. This, with a few other cold edibles, comprised the entire contents, the safe having been used for some time as a refrigerator.

A VENERABLE plow is announced for exhibition at the Maine State Fair It has a seven-foot beam of white oak, a stout iron colter, an oak share sheathed with iron, and a pair of ash handles, like immense davits, projecting four feet in the rear. The wood is seamed and wrinkled, but tough and sinewy still.

DURING the recent laying of the siphon under the Seine at Paris, one of the divers employed remained at the bottom so long as to excite the alarm of the attendants. The bubbles which arose indicated that he was alive and remaining stationary, but he could not or would not reply to signals. Another diver was sent down, who found his predecessor gloriously drunk, and enjoying a cosey nap upon the bottom of the river.

THE Rappahannock Canal was recently sold for the paltry sum of $1 500. It had ceased to be of any value as an internal improvement.