

MARBLE MOVED BY PRESSURE

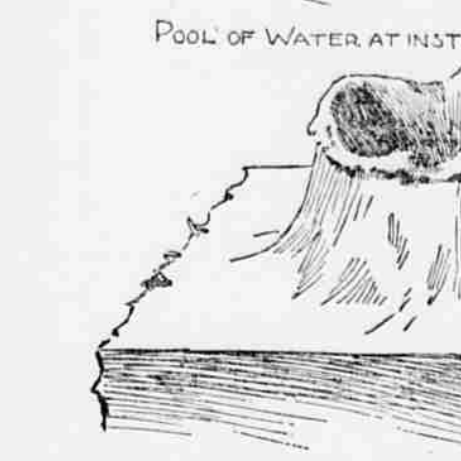
A Discovery of Broad Significance in Industry and in Geology.

RESULTS OF NOVEL EXPERIMENTS

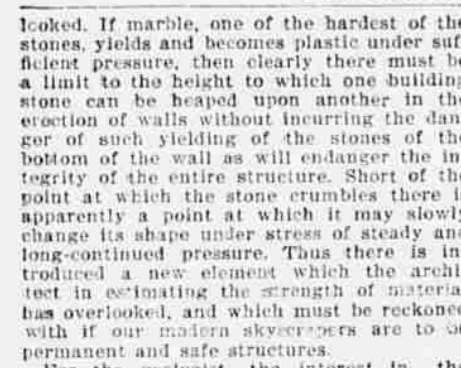
Instantaneous Photographs of a Ball Falling into a Glass of Water and Bullet Entering an Armor Plate.

Some very remarkable experiments just reported by Prof. Adams and Nicholson of McGill University tend to show that a substance so hard and brittle as marble may, under certain conditions, be molded like clay. They placed a miniature column of pure Carrara marble in a sheath of iron and submitted it to graduated, but long-continued pressure, with the result that the marble shortened and thickened, bulging so as to swell the iron sheath. The iron then being cut away, the marble no longer cylindrical, but greatly altered in shape, remained still solid and brittle as before. No increase of temperature or other agency than the pressure was applied in producing this result.

This experiment remarkable in itself, has implications that make it of peculiar interest to persons as widely separated as the scientific geologist and the practical house builder. For on the one hand it tends to throw light on intricate problems as to the formation of the earth's crust, while on the other it suggests a danger from the building of such skyscrapers as are springing up in our cities that hitherto has been quite overlooked.



POOL OF WATER AT INSTANT WHEN BALL FALLS INTO IT



ARMOR PLATE PENETRATED BY CANNON BALL. ARMOR PLATE AND WATER FOUND TO ACT IN A SIMILAR MANNER WHEN PENETRATED BY BULLETS.

Looked. If marble, one of the hardest of the stones, yields and becomes plastic under sufficient pressure, then clearly there must be a limit to the height to which one building stone can be heaped upon another in the erection of walls without incurring the danger of such yielding of the stones of the bottom of the wall as will endanger the integrity of the entire structure. Short of the point at which the stone crumbles there is apparently a point at which it may slowly change its shape under stress of steady and long-continued pressure. Thus there is introduced a new element which the architect in estimating the strength of material has overlooked, and which must be reckoned with if our cities are to be permanent and safe structures.

For the geologist, the interest in the proof of the plasticity of marble rests on the light it throws on certain obscure formations of the earth's crust. It proves that under the conditions of pressure existing deep in the crust, stones may be molded into new shapes without being melted. In point of fact, the molded marble of these experiments, when examined under microscope, was said to present many resemblances to certain natural rocks whose peculiar cleavage had been difficult to explain. It sometimes seems as if a layer of rock had been twisted from its position in which it apparently had formed. Sometimes it is the result of chemical changes in the rock that it has been partly melted during the process, and then there is no difficulty in explaining it, but where this has not occurred it was difficult to believe that the change of shape has actually taken place. But these experiments leave no doubt in the matter. However brittle a rock may seem to be, it is really, so it appears, a plastic substance, capable under proper conditions of being molded into any shape as surely, if not as readily as putty or dough is molded.

EXPLAINS MOTION OF GLACIERS.

Another interesting question as which new light is thrown by this experiment is the perplexing one of the motion of glaciers. As everybody knows, a glacier is, in effect, a great river of solid ice. It is especially well known that the ice stream flows along its channel slowly, to be sure, but just as surely as a stream of water. The early students of glaciers doubted this, but numerous careful observations, culminating with the famous ones of Prof. Tyndall, have demonstrated the point beyond all controversy. Of course the bed of the ice stream is usually steep, and hence at first sight it seems nothing remarkable that the ice should slide along it. So the famous explorer of the Alps, de Saussure, who was among the first to recognize the motion of glaciers, explained this motion as mere sliding of the ice. Very soon, however, other observers saw that this simple explanation by no means sufficed, for the most casual observation showed that the channel through which the glacier moves—its banks or borders—is not usually of uniform width from beginning to end, but, on the contrary, widens and narrows much as the channel of a river. And like the river of water, this river of ice at all times completely fills its channel, spreading out into lagoons or ice bays, and is found to widen and narrow into a slender stream as the walls contract. Clearly, then, the ice stream changes its shape just as the stream of water does, yet how is it possible, since ice is a solid, and a very brittle solid at that?

Numerous explanations have been put forward in elucidation of this puzzle, but the one that has seemed to have greatest plausibility and hence has gained greatest currency assumes that the ice in the depth of the glacier is being constantly melted by the pressure of the mass above it, and as constantly reformed, being molded into new forms during the moment of transition. The justification of this hypothesis is found in the fact, which was first demonstrated by Prof. James Thomson, the brother of Lord Kelvin, that pressure, if sufficient, greatly lowers the melting point of ice, and in the further fact that a cake of ice if cut in two or broken into fragments will recombine into one mass if the parts are kept in contact. It was pointed out by the Scotch geologist and mathematician, Dr. Croft, that the sun's rays, beating upon the surface of the glacier, might penetrate into its transparent depths, and, being retarded at the bottom, might heat the ice at the depths to a temperature above that at the surface, and this cause would manifestly act in conjunction with the increased pressure at the bottom of the glacier, to effect the melting of the ice there. At no time, however, would there be any great surplus of heat there, and the portions of ice thus melted would be certain to recombine almost instantly, because of the large quantity of heat which is abstracted and rendered latent whenever ice changes into water. But during the instant of transition from ice to water and back to ice again the particles of the mass might slightly change the form under influence of pressure of gravitation, and thus by an endless series of infinitesimal jerks, as it were, the glacier would creep on as it is observed, the glacier would creep on as it is observed, the glacier would creep on as it is observed.

Now, however, the experiments regarding the mobility of marble put quite a new complexion upon the question of glacial movement. For if it be proved that marble, a substance far harder than ice, and quite as brittle, can be molded by pressure alone into new shapes, it seems perfectly plausible that a much less degree of pressure might mold ice into new forms by causing its molecules to slide over one another without the intervention of melting. In this view, ice and marble, and, of course, all other solids, are to be regarded as merely very stiff or viscid liquids. Gravitation alone does not suffice to make them flow, as it does more liquid liquids, but when additional force is applied their mobility becomes apparent.

This view, indeed, as applied to such solids as iron and other malleable metals, is not new, for the mobility that such solids undergo, under pressure, as when hammered, is familiarly known. A curious experiment recently made by Prof. Strahlcr has illustrated this in a very vivid way. By means of an ingenious apparatus K. has been possible to

photograph the surface of a bowl of water as the moment a ball dropped from a height falls into it. The photograph being instantaneous, the water splashed up about the ball gives the impression of a solid crater. But the curious feature is that exactly such crater as this is formed in fact when a cannon ball is fired into a sheet of armor plate. About the mouth of the hole where the ball enters the iron is a bulging rim or crater of iron, which was manifestly splashed up exactly as the water splashes up about the miniature ball, making the observer feel that the iron and the water are really of one physical nature, one being merely a little harder than the other. The experiments at McGill make it clear that the same thing is true of marble also. That, when in a broader view, brittle solids are only very viscid liquids, just as malleable solids are very tenacious liquids. Perhaps some day we shall mold our statures out of marble instead of slowly carving it, as is now done.

RELIGIOUS.

The Presbyterian hospital of New York City attended to 25,000 patients last year. The Roman Catholic archdiocese of Cincinnati has a population of about 150,000. The Sunday schools of the Methodist Episcopal church of this country number 2,620,010 pupils.

There are 4 to 188 Christian Endeavor societies in the United States and 11,824 in the rest of the world. The last annual report of the Society of Jesus states that in all the world there are only 12,000 Jesuits, less than half of whom are priests.

The Homestead is the name of the rescue home for women in St. Louis. It is a roomy mansion and was recently given by James Stewart to the Salvation Army of that city. It is stated that for want of room 9,000 Free Masons were refused admission to the recent Masonic services celebrating the 200th anniversary of St. Paul's cathedral in London.

On the tower of a church in Fishport, Lancashire, England, a birch tree twelve feet high is growing. It is supposed that a bird carried the seed to the top of the tower and dropped it there.

It is stated that forty out of forty-five state constitutions contain acknowledgments of God; that recent revisions have retained such acknowledgments, and in the case of Kentucky and Virginia have inserted them for the first time. It is reported that the pope received as a Christmas gift a cross of gold set with ninety diamonds. The value of which is said to be \$9,000. This expensive present was subscribed for by several of the Roman Catholic societies in that country. The Christiana Endeavor society of the Abington, Ill., Christian church provides carriages for invalids and aged people, taking them to religious services. This society also supports a mission in India. The most popular preacher in Wales is reported to be Willie Powell, a boy of 13. He is the son of Baptist parents. He studies his sermons and is said to be thoroughly sound and evangelized in his teaching. He attracts great crowds and the effect of his sermons is said to be marvelous. Archbishop Kain of St. Louis has recently returned from a visit to the pope in Rome in a remarkably vigorous condition, both physically and mentally. Archbishop Kain also states that Pope Leo expresses the greatest interest in America and rejoices in the progress of the church under our free institutions. Miss Anita Corman Barzouzas, a Mexican, was a maiden in the chapel of the shrine of Guadalupe, in Vera Cruz, to the memory of her mother. She is the daughter of a rich Vera Cruz coffee planter and not only gave \$5,000,000 for the construction of the church, but planned and superintended the building of it.

FORCE OF A WORD.

"Columbia Verse, 1892-1897." She said something funny; "What's that you said?" "Exceedingly homely." "What's that?" "Visiting Auntie." "While in New York?" "Oh, by the way." "Where are you stopping?" "A snorer on her face." "A look of disgust." "Said something funny." "Not stopping, I trust." "Pray what could I stop?" "Perhaps I was thinking of clocks," he replied.

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FAMOUS WAR FEUD RECALLED Unpublished Letters Showing the Friction Between Rosecrans and Stanton. REMARKABLE UTTERANCES OF THE FORMER: Lincoln's Secretary of War Dubbed a "Liar" and a "Fiasco" Charges A. Dana's Caustic Comments on the Affair. MADISON, Wis., Jan. 6.—The recent death of Charles A. Dana serves to recall that a few years ago the writer, collaborating with General W. Butterfield, the historian (whose beautiful and accomplished sister set the world agog by marrying, in Paris, the talented Catholic divine, Father Pere Hyacinthe), gathered correspondence and other materials, for future use, concerning about twenty leading characters of the nation. All of that matter, some of it of the highest interest and value, is preserved here. In this collection are about 100 letters from Mr. Dana, and, as he never wrote or spoke without saying something interesting or instructive, I have been going over or two of his communications for publication. A single example—perhaps the last of the series now under mention—must suffice for the present. It was drawn out when a letter by General W. S. Rosecrans was sent to him with a request to explain, if he could, certain of its features—especially the evident bitterness of "Old Rose" and the alleged hostility of Caleb Cushing to Secretary Edwin M. Stanton. The Rosecrans letter, written when his author was register of the treasury, is given first, as follows, the name of its recipient being by request omitted: ROSECRANS' LETTER. WASHINGTON, March 16, 1867.—My Dear Sir: I thank you for calling my attention to Don Pitt's article in the North American Review, mentioning why Stanton was my enemy. I will look at it for history's sake. I had no personal controversies with him. In all I wrote or said to him, or regarding him, I have had an eye single to the public service and the truth of history, and never was animated, for a moment, by the spirit of personal interest or antagonism. The last words he ever spoke to me were in 1862, when, saying goodbye to him on my way to Corinth, he said: "Goodbye, general. If this

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department can be of service to you, rest assured it will do it. That's so." I never found any occasion so thoroughly as this belied by this secretary. In my testimony before the committee on the conduct of the war, see its report, part 3, pages 1 to 18, some testimony is given showing his treachery toward McClellan. The Rebellion Record, when published, will illumine his character of the character of the man, and the country which reaped therefrom in 1862. After the close of the war I met General Caleb Cushing, a very eminent lawyer and statesman, and he told me that he had heard the impression of the character of members of the cabinet. Of Mr. Stanton he replied: "He is one of the worst men we ever had in public life." An eminent lawyer and friend, who came in while I was reading your letter, after looking over it, said: "I have looked into this matter. I was an ardent republican and great friend of Mr. Lincoln. I have looked into the evidence bearing on Stanton's character with impartiality, and while the time has not yet come to publish the results of my examination, any I may never publish them. I have no hesitation in giving this summary of my conclusions"—and I had taken down as follows, viz: "Well, enough of the evidence has been looked over to form a judgment, and it is this, that whatever feud it was 'come hot from hell' into existence with this man should bear the name of 'enmity.' This man built an emporium for (and) and crawled under it. That his friends have dragged him forth, and that the only service they have done for, can be for him is to drive him higher and higher to the weak hope that he may disappear from view on its final summit. Macaulay said that a man could no more know what a lie was until he had seen it. Stanton was a liar, and a liar's name can be known what a liar is by a thunder storm was before visiting the tropics or a catarrh without seeing Niagara." "Since then there have been discovered letters waterfalls, and if another flood were to come Stanton's lies would match the grander simile. Barere's lies were told after he had acted. Stanton kept a magazine of them to mix with his daily work. "Barere was trying to conform to a new generation. Stanton was receiving his own. If any doubt whether his judgment will stand, let him revolt. Let him go over for himself the amazing record now being produced—defeated even as the criminal would obliterate his tracks. Let him strip the golden mountains it circumscribes of every dollar it has or is to cost; leave back the human horrors piled up by this man's

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out laughing. El's Downend was suing Kansas City for \$5,000 because of injuries he received in tripping over a step in the sidewalk on Twenty-third street, near Wood-lawn. Attorney George Jones, representing the city, said all through the trial that the step was no more than the step to the witness chair in front of the jury, and a person would be no more liable to stumble over it. And you know, gentlemen, that no person would be likely to trip over that step before." "You know, gentlemen, that no person would be likely to trip over that step before." A moment later Mr. Jones started to go to the witness chair and stumbled over the very step and fell sprawling. The following cross-examination of a witness in a court in western North Carolina is published as an actual occurrence: District Attorney—Now, Mr. Blinks, you know before this court and jury that you knew the defendant's reputation in the community in which he lives, and that he is generally reputed an upright, peaceable, law-abiding citizen? Witness—Yes, sir. District Attorney—Now, Mr. Blinks, don't you know that Life Higgins has never done anything but loaf around and drink moonshine whiskey and fight? Witness—Yes, sir. District Attorney—And don't you know that he abuses and beats his wife terribly? Witness—Yes, sir. District Attorney—And don't you know that he broke up the Pigeon River camp meeting last winter and whipped the circuit rider? Witness—Yes, sir. District Attorney—And don't you know that he kicked his old father down the steps out of the yard and nearly killed him? Witness—Yes, sir. District Attorney—And don't you know that he was convicted in this very court three years ago of maliciously shooting Deacon Smith's hogs? Witness—Yes, sir. District Attorney—And don't you know that he was once accused of stealing a horse, and that the owner of the horse and the principal witness for the prosecution were killed just before the trial was to be had? Witness—Yes, sir. District Attorney—And don't you know that his neighbors all know these things? Witness—Yes, sir. District Attorney—Then how can you sit there and say that the defendant's reputation is good in the community in which he lives? Witness—Why, mister, a man has to do a heap-was things than that to lose his character in our neighborhood. Do you want a good glass of champagne? Cook's Imperial is an extra dry wine with a delicious bouquet.