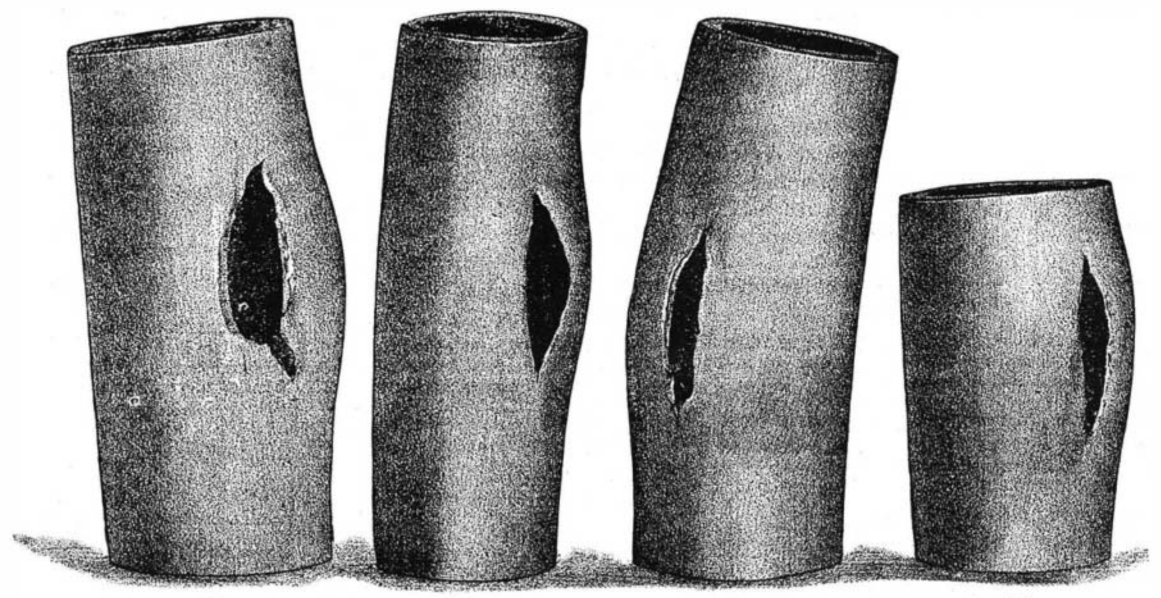
THE STRENGTH OF LEAD PIPES.

The accompanying engravings represent the fractures of several lead pipes tested to destruction by a German firm of manufacturers, from whom the Pintsch's Lighting Company obtain the lead pipes used in the installations of compressed oil gas apparatus, by which a number of the railway companies of this, among other countries, supply their railway carriages with oil gas. After trying the lead pipes of several English makers, the Pintsch Company was forced back upon the German makers, for lead pipes which would, for any length of time, stand the high pressure—90 pounds to 105 pounds—at which the gas is distributed for charging the carriage receivers. The makers of these pipes assert that they use only pure lead, but we are inclined to think that the figures representing the bursting pressure indicate the use of an alloy. The numbers placed below the several pieces of pipe shown in the engraving give the number of atmospheres at which the bursting took place, except in the case of that marked 73, which should be 75. The external and internal diameters of these are respectively 1·5625 inches and 1·125 inches; 1·3125 and 0·9375 inch; 1·4375 and 1·0625 inches; 1·375 and 0·9375 inch.

Calculated by the formula $S = \frac{p}{\text{hyp. log. } R}$, in which R= ratio of external to internal diameters, p=pressure in pounds per square inch, S=stress in pounds per square inch of the material of the pipe, the bursting pressures give a stress S=respectively 3,720 pounds=1·66 tons; 2,679 pounds =1·19 tons; 3,750 pounds=1·67 tons; and 2,460 pounds= 1·1 tons; or an average of 1·405 tons per square inch of section of the lead.



80 60 73 62

THE STRENGTH OF LEAD PIPES.

M. Jardine found that a lead pipe 1·5 inches diameter and 0·20 inch in thickness sustained a pressure of 1,000 feet of water, or 29·5 atmospheres, without alteration of form. Under 1,200 feet of water, or 35 atmospheres, it began to enlarge, and it burst under 1,400 feet of water, or 40 atmospheres, having swollen to a diameter of 1·75 inches. A 2 inch pipe 0·20 inch thick sustained a pressure of 800 feet of water, or 23·5 atmospheres, with scarcely any enlargement; but it burst under 1,000 feet, or 29 atmospheres. From these results, as given by Mr. D. K. Clark, it appears that the resistance of lead to a tensile stress is equal to 15 cwt. per square inch of sectional area, and that its ultimate strength is equal to 1 ton per square inch. We are not told how long a time these pipes were subject to the lower stresses mentioned; but there is little doubt that under long continued stress enlargement would take place at lower pressures than those which equal a stress of 15 cwt. per square inch of the material, so the ratio R would gradually decrease, S consequently become greater, and p less. The stress necessary to burst the pipes we have illustrated was no doubt brought to bear without much reference to the time occupied, and under the circumstances the bursting pressure might be somewhat high and would also be somewhat irregular, which probably explains the difference in the figures above given. These give a mean breaking stress of 28 cwt.; but it is not very likely that the same material in other form than that of a pipe would withstand so high a pressure, because at a slightly weak place extension commences, and though fracture is thus localized, the material is not supported by that around it.

It will be observed from the forms of the fractures, which are clearly shown in our engravings, that they are those which are usually seen in lead pipes in vertical or approaching vertical position, and are burst by frost in winter. These, as well as other fractures, are usually attributed to the expansion of water in freezing; but a little reflection will show that as this expansion takes place as the water solidifies, the fracture produced by it alone would be in the form of a long crack only wide enough to permit of the slight expansion which takes place between 39 degrees and 32 degrees Fah.

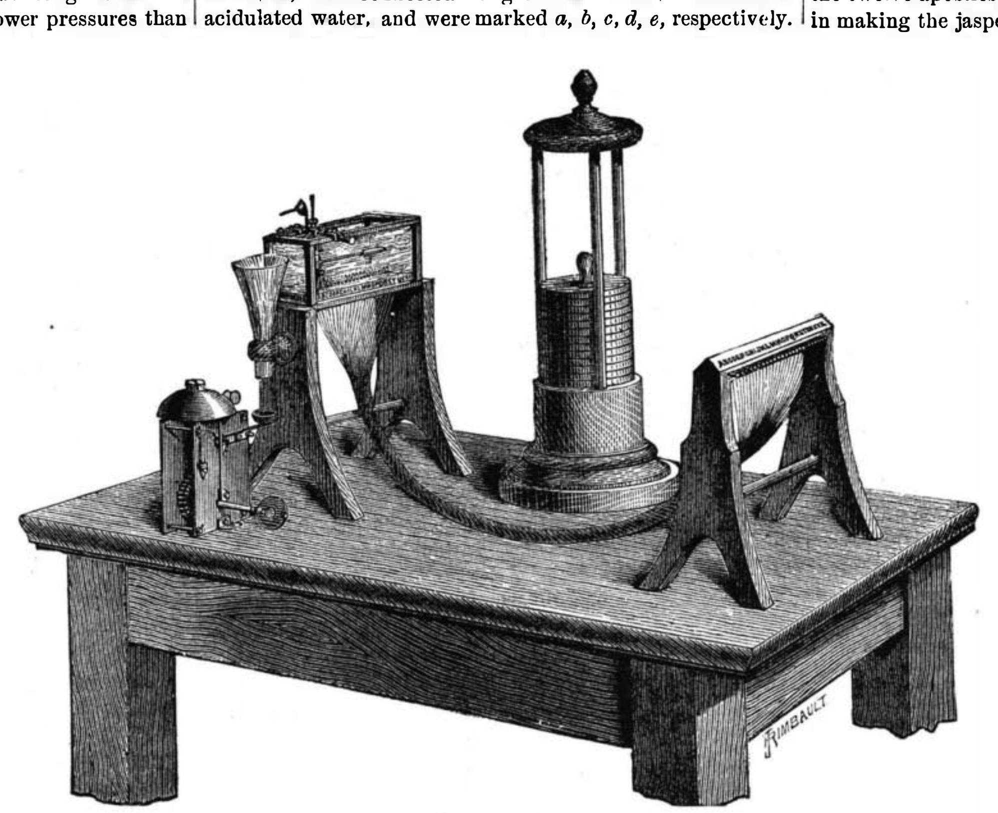
When lead pipes are burst during frost, the fracture being more or less wide, short, and localized at a considerable swelling, the bursting is not always directly due to the freezing and consequent expansion of water and solidification.

In freezing, water gives up a large quantity of its contained air, and this rises to the upper parts of a pipe, or to any part where it gets caught, as in the upper part of a bend.

As the water in the pipe falls from 39 degrees to 32 degrees Fah., or from 4 degrees to zero Cent., its volume increases from 1 to 1.000122, and this, acting on the imprisoned air, compresses a highly elastic medium, which remains under pressure even after the water has become solid. By this means the pipe is swollen and thinned where the air is imprisoned, and by a repetition of the process a burst takes place, which is assisted by the expansion of the air when the thawing sets in, the expansion of air per degree being 0·00217, which is so much greater, as above seen, than that of water.—*The Engineer.*

SOEMMERING'S ELECTRIC TELEGRAPH.

The rapid success of Napoleon's Austrian campaign in 1809 was partly attributable to the good use he made of the optic telegraph; and when he had left the country the Bavarian minister suggested to Soemmering, a member of the Academy of Sciences of Munich, that the Academy of Sciences might advantageously turn their attention to the subject of telegraphy, the great advantages of which had been so completely demonstrated before them. Soemmering caught at the idea, and appears to have immediately recognized that electricity was the agent of all others calculated to render the required service. At that time, says *Engineering*, the only known effect of an electric current which was suitable for the purposes of telegraphy was the evolution of gas, and upon this he commenced to experiment. He first constructed a small apparatus. He made a cable of five wires insulated by sealing wax. The ends of the wires, at one extremity of the cable, were connected to gold terminals in a vessel of acidulated water, and were marked *a, b, c, d, e*, respectively. The other ends were placed, two at a time, to the terminals of a voltaic pile, composed of plates of zinc, silver coins, and felt soaked in dilute acid. The contact was followed by the evolution of gas from two of the gold terminals, and thus any two of the five letters could be indicated simultaneously. The possibility of effecting the transmission of words by this system having been demonstrated, Soemmering proceeded to construct the full sized instrument shown in the annexed illustration, which was sketched from his original apparatus.



SOEMMERING'S ELECTRIC TELEGRAPH.

It consists of a receiver and transmitter connected by a cable of 35 insulated wires. Here the transmitter has 35 copper terminals in connection with the conductors, marked with 25 letters and 10 figures. Any pair of these terminals could be connected to the poles of the voltaic battery by flexible connections not shown in the figure, and thus a circuit established. The receiver had likewise 35 terminals; these were of gold, and were contained in a glass tank of acidulated water. To call the attention of the attendant an inverted spoon was arranged horizontally in the liquid, and collected the gases that were disengaged from certain terminals. When it became sufficiently buoyant it rose, and at the same time turned down a rod upon which there was loosely threaded a ball. The ball slid off, and, falling down a funnel, dropped into a cup at the end of a detent lever on a call bell worked by clockwork, releasing the mechanism and putting the bell into action. In signaling, the gas rose simultaneously from two of the gold terminals, the quantity from one being double that from the other, and thus two letters were sent at once, it being understood that the one which evolved the greatest quantity of gas preceded the other in the written word. This apparatus was completed in August, 1810, but it was used without the call bell in July, 1809. The first experiments were made over a distance of 38 feet, and then were rapidly extended to 1,000 feet, and, as soon as the inventor had perfected the insulation of his cable by caoutchouc dissolved in ether, to 10,000 feet. The telegraph was presented to the Academy of Sciences of Bavaria in August, 1809, to the Academy of Sciences of Paris in December of the same year, and afterward to various royal personages, but no one took it up, and although it was twenty-five years before a practical system was brought out, yet no one seems to have tried to bring Soemmering's invention into a form from which useful service could be expected.

Superstitions about Precious Stones.

Cornhill Magazine in an article on the above subject concludes that the superstition that yet lingers about the precious stones represents, happily, a fast diminishing quantity. Who would think now, says the writer, of attributing to each stone a special influence over each month, and wearing, therefore, the sapphire in April, the agate in May, and so forth? Yet our ancestors did this, and even appropriated to twelve kinds of stones the twelve signs of the zodiac and the twelve apostles. Perhaps there was some pious intent in making the jasper the symbol of St. Peter, the chrysolite of St. Matthew, or the uncertain beryl of the disbelieving St. Thomas; but the modern spirit needs not these reminders, and their value at any time must have been very doubtful. But, smile as we may at the superstition that ruled in bygone times with regard to precious stones, we have to admit that it was not altogether without its brighter side. In the dark ages, for instance, it can have been no mean happiness to possess gems which, like the diamond and amethyst, reduced war to a safe and pleasant pastime. What charm have we wherewith to face the perils and misfortunes of life comparable to the faith in their talisman which supported our ancestors? Who that remembers the agitations of a law suit and the nervous reliance placed in his solicitor, but might regret the faith which in a previous age and similar plight he might have felt in a morsel of chalcedony?

Science, moreover, in many cases leaves no compensation for the belief she dispels. It was no trifling alleviation of the peasant's lot that he might hope any day to find a rich jewel left by a snake in the grass, or vast treasures hidden in a mountain.

This hope is now gone, or going, from him, and perhaps few living Cornish peasants now look for the blue stone ring which their ancestors attributed to the action of snakes breathing upon hazel.

Who now that drinks the refreshing Vouvray wine, from Vouvray, in France, would ever think that the name of both wine and place had come from an old local belief in a dragon or viper (vouivre) that possessed a single eye, or carbuncle, which it laid aside on the ground, and which, if discovered, would lead its finder to immeasurable riches?