bearing may then be considered as a series of layers of soft metal enclosed in a casing of metal almost as hard as the arbor itself. The microscope reveals this disposition very evident; and if one of these bearings be carefully submitted to heat, so as to cause the soft metal to run, the rest remains in the form of a spongy mass.

The results obtained with various kinds of bearings used on the Belgian and German railways are thus givan: Bronze composed of 83 parts of copper and 17 of tin, costs 3 fr. 25 c per kilogramme, and wears at the rate of 11·6 grammes for four bearings per 1,000 kilometres, the cost being 0·37 fr.; bronze containing 32 parts of copper and 18 of tin costs 0·032 fr.; the same applied to carriages with brakes, wears at the rate of 109·5 grammes, and costs 0·335 fr.; white metal, composed of 3 parts of copper, 90 of tin, and 7 of antimony, costs 3 fr. 73 c., wears at the rate of 14·8 grammes, and costs 0·055 fr.; ditto containing copper 5, tin 85, and antimony 10 parts, costs 3 fr. 66 c., wears at the rate of 11·3 grammes, and costs 0 41 fr.; ditto composed of lead 84, and antimony 16 parts costs 1 fr. 84 c., wears at the rate of 12·2 grammes, and the expense is 0·018 fr. per 1,000 kilometres; lastly, phosphorus bronze costs 4 fr. 37 c., wears at the rate of 2·3 grammes, and the expense is 0.010 fr. only, bnt when applied to carriages with brakes, the wear rises to 9·5 grammes, and the expense to 0·041 fr.

Philosophy of the Welding of Metals.

The science of molecular mechanics is is yet in its infancy, and for this very reason it presents a rich field for investigation and experiment. We are already acquainted with iron, for example, in very many physical conditions. We have learned within a few years how te obtain it melted like steel and cast iron. But how numerous are the things which yet remain for us to learn, in order to understand the properties of even these various states of iron, in order to explain the peculiarities which they present when viewed from the standpoint of construction; in order to establish the relation which should subsist between these molecular states and resistance of the metal under various strains, in order to have as difinite a theory for working iron cold as for working it hot. This knowledge which may be called the physics and molecular mechanics of iron, is still very rudimentary.

I will attempt to lay before you a sketch of what I foresee in these molecular studies, at present unfortunately too much neglected. I will enter upon the subject through a phenomenon well known to every one.

It is a matter of common knowledge that iron is capable of being welded; that if two pieces of iron be heated to a temperature called for this very reason a welding heat, and then be pressed together, either by hammering or by energetic presure, the two pieces will be firmly united, i. e., welding tegether. Why is this? The only explanation which we can find in the best works on chemistry or metallurgy is the following:—"At a white heat iron acquires the property of being welded, a property which it shares with the metal platium only." But obviously there is no evidence here of any mysterious and special property called "weldability," there is only the effect of a very general cause, the manifestation of a molecular property elsewhere abundantly active in nature.

Take two pieces of ice, and at a temperature a little below zero, press them very gently together, they become at once welded to each other. This is the phenomenon, first observed by Faraday and subsequently investigated in so fascinating a way by Thompson and Tyndall, which has received the name of "regelation." Thompson explains it in the folloming manner: For all bodies, like water, which have the property of diminishing in volume as they liquefy, pressure, which tends to bring the molecules closer together, lowers the temperature of fusion. Consequently, when two pieces of ice are rubbed against each other, fusion takes place between the surface of contact, at a temperature below zero. Of course, as soon as the pressure ceases, solidification is again produced, and the pieces are welded together.

It seems to me that the welding of iron is a phenomenon exactly similar to regelation. Such cases of actual regelation or welding of iron are sometimes seen in the welding of a spindle to its step when heatted by friction, in the absence of any lubricating fluid. The two pieces of iron are brought to a white heat, that is to say, more or less near to the fusion point. The repeated blows of the hammer, or the pressure of rolls, lowers the point of fusion and causes a superficial liquefication of the parts in contact, and thus welds the masses together; and this because like water, iron dilates in passing from the liquid to the solid state. Many other metals are similarly endowned, they all, therefore, may be welded like iron, if other conditions do not come in to oppose the manifestation of this property. Platinum welds easily at a white heat, because its non-oxidizable surface, like that of ice, takes on a superficial fusion. To weld iron successfully it is necessary that its furface should be clean, that is free from oxide. Iron containing phosphorus welds more easily than pure iron, because its point of fusion is lower. Steel which is more fusible still, welds at a lower temperature than iron, but the process is a more delicate one. Silver too, like iron and platinum, has the property of expanding when it solidifies; but as it melts at a cherry-red heat, it is easier to form it by casting than by welding. Bismuth and zinc are also included it the same class, but they are so very brittle near their fusion points that no one would think of attempting to weld them either by hammering or presure.

Iron in welding therefore, only follows the example of water. The careful comparative study of these two bodies, even though at first sight so comparatively dissimilar, connot fail to furnish results of great interest to the metallurgist. The work of the puddler is also based upon the same phenomena as that of welding. When the puddler forms his ball in the furnace, it is done by rolling together or aggregating the crystals of iron as they form in the mass of melted iron and slag. In other words, the semi-fused crystals are welded or regelated together by the mechanical action of the puddler.—[M. Jorday in Iron.

Fritz Reuter.

Publication of the posthumous works of Fritz Reuter have been begun in Germany, and the first volume is accompanied by a very sympathetic biography of him by the editor, Adolph Wilbrandt. With the full consent of the poet's widow, a frank account is given of his passion for drink, which is rightly regarded as a disease, for which there was (after it had once been contracted) no moral responsibility whatever. In the beginning Reuter drank hard in order to forget his misery as a political prisoner in Prussia's sketches, and when, after seven years (he had been condemned for thirty), his deliverance came, he carried into private life this periodical craving which must be satisfied, which ran its course like a fever, and from which his wonderful constitution rallied invariably with renewed vigor. But the habit nearly made a wreck of him. He wanted to become a painter in opposition to his father's wishes, who sent him back to the university to study law. Here the temptation to spree was too much for him, and he next devoted himself to farming, with indifferent success, eking out his support by teaching. In this career he gained the friendship of a Pomeranian landowner, to whose confidence in him and knowlede of human nature Reuter owed the fortunate marriage which rescued him from an obscure and perhaps melancholy fate. This friend, knowing Reuter's betrothed to be troubled with scruples about the match, dared to lead her to where he lay under the influeuce of one of his attacks. The result justified his calculations. She resolved to undertake the saving of a life; and though she failed, as other trusting wives had done before her, to destroy her husband's appetite for drink, she had the rare consolation of seeing neither his constitution nor his morals undermined by it The wedding took place in 1851, and Reuter died only last July, of heart disease. As least as early as 1866, however, his powers as a writer had reached their climax. The drollery which characterizes Reuter's works found ready acceptance with the Mechlenburgers, who are never weary of hearing and telling humorous stories; and Reuter not only had a great store of these but told them exceedingly well before he ever put pen to paper.—Nation.

A Great Swimmer.

Captain Boynton, the American who jumped from an ocean steamship off the coast of Ireland, and swam thirty miles during one of the most terrific gales of the season, has been giving some very sucessful exhibitions of his swimming dress upon the Thames. Vast crowds of people line the banks of the river every time that he appears, and watch with the greatest interest his movements in the water. The other day he went down to Wapping Old Stairs and put on his swimming clothes, consisting of an india-rubber suit in two parts—one covering the chest, arms, and back of the head; the other the legs and feet. Thrs is put on over an ordinary suit. After being adjusted the parts are inflated by four tubes, and when full of air the wearer steps into the water without the slightest fear. Captain Boynton raised his flag, ate his lunch, read a book, blew a horn, and went through a variety of performances, to the great delight of the crowds assembled upon London Bridge and along the banks of the river. He was loudly cheered. At Temple Stairs he came out for a moment's rest, without showing any symptoms of fatigue, and soon after plunged in again and started for Putney. The success of this swimming dress has been clearly established. —*American Register.*