their greater reliability. The second method is the most flexible, in that there are no such limitations of ratio of width to thickness as the direct upsetting process necessitates. One fact in regard to upset-bars must not be overlooked, and that is the distortion of the fibre, and consequent change in the character of the iron. This is sure to be extreme, if the operation is performed under too low pressure, or if the bar is heavy and the head large, in proportion to what may be called the mass of the upsetting-machine. Where bars are wide and thin, there is a very great distortion of fibre since a large amount of iron must be forced back to fill the moulds, and which a slight etching with acid will develop very clearly. It is owing to the deterioration of the iron in the heads of upset-bars that American experiments have resulted in somewhat different proportions from those made in England on bars of English manufacture. Whether upsetting is done by repeated impact, or by the steady, continuous pressure of the hydraulic ram fed from an accumulator, there is a marked difference in the result. Iron is most susceptible to change of form without deterioration when operated upon in a highly heated state, and since a bar commences to cool the moment it is taken out of the furnace, the most rapid means of shaping it will injure it the least. A fibrous bar, operated upon in a cold state, will be so modified in its molecular arrangement as to become crystalline. Again, in operating upon the end of a bar, just from the heating furnace, it must of course be firmly gripped