ly increase the expense, owing to the necessity of construct­ing a bridge of much larger dimensions than would be re­quired were a proper oblique arch introduced, which, from its exerting its thrust in the most advantageous direction, is stronger than any other of the same magnitude. For, besides endeavouring to preserve a certain degree of equi­librium amongst the several parts of an arch,@@1 it is consider­ed still more necessary to the insuring the greatest strength, especially where the span is considerable, and the up­per passage narrow, that the beds of the courses of the stones should be everywhere at right angles, both to the soffit or under surface of the arch, and also to every ver­tical plane running in the direction of the road or other pas­sage carried over the bridge. There is no difficulty in ful­filling or combining these conditions in a square bridge, but it is very different with the oblique sort.

Writers on the theory of bridges for the most part say nothing of the oblique arch ; and the few who do mention it, generally content themselves with slurring it over in such brief, vague, or general terms, as to he nearly unintellig­ible. Those again who have professedly drawn up, what they reckon practical rules for workmen, have, for the most part, tacitly assumed it as perfectly ascertained and indisputable, that the conditions above mentioned may, with only a little more labour, be equally well attained in the case of the ob­lique, as in that of the square bridge, by merely making the courses of the stones to form portions of the thread of a square threaded screw, or rather, perhaps, of a thread some­what of the dovetailed form ; the highest part of each thread, or that on the crown of the arch, being at right angles to the direction of the road. Such, in particular, is the doc­trine laid down by Mr. Nicholson, and also by Mr. Fox ; and it is not a little amusing, that the honour of inventing this sup­posed valuable theory has been warmly disputed between these gentlemen, or at least their friends.@@2 When the soffit is to be a cylindrical surface, the side of the screw-thread may, it is true, be readily formed so as to be everywhere at right angles to the soffit ; and, as all the beds of the courses of the stones would have the same curvature, the stones might be conveniently prepared beforehand, which is a great re­commendation to the scheme. But unfortunately, the other, and by far the more important condition of the two, name­ly, to have the beds of the courses everywhere at right angles to the direction of the upper passage, can by no means be accurately fulfilled by the figure of the screw ; for no two parallel planes can both of them cut the same thread of the screw at right angles, if they intercept a less portion of it than a revolution, so that a thread which has the pro­per position or direction at the crown of the arch, can have it at no other point ; its direction on the one side of the crown being too much inclined to the course of the under passage, whilst, on the other side, it is too little inclined.

However, although it thus appears that the principle of the screw thread cannot well serve the purpose of the skew bridge, especially when the obliquity is great; yet there can be no question that the beds of the courses of the stones might always be formed with such a curvature as would make them very nearly fulfil both the conditions above specified; but as the several parts of this curved sur­face, if different from that of a screw, would necessarily be far from being uniform, the stones, owing to their requiring to be of so many different shapes, could not, without im­mense labour of measurements, drawings, and innumerable patterns, be prepared beforehand; and, therefore, most pro­bably, the easiest way of putting such a scheme in practice, would be to prepare the stones no faster than they are re­quired in building, and then it would be easy to form each stone in such a manner, that two of its opposite sides, or at least the middle parts of these sides, should be as nearly as possible at right angles, both to the soffit, and also to the direction of the passage over the bridge. In this way of working, the soffit need not be restricted to the cylindrical form, because it may suit equally well though of a very different figure. We are aware, that something similar to the method just mentioned has been already acted on, and has also been heartily ridiculed as unscientific and unsys­tematic; but it will be quite in time to condemn it when once a better shall have been substituted in its stead: for, most assuredly, if closely followed up, it should form an incomparably more perfect structure than that with the screw thread. The like remarks are equally applicable when the material is brick.

Some bridges may be said to consist generally of a plat­form supported by a set of curved iron ribs, which either abut like a stone arch against the piers, or, if the curvature be small, and especially if there be nothing to abut against, each rib has its extremities connected and kept from spread­ing, by a straight rod crossing the span underneath. Ribs of this last construction are often used as beams for sup­porting floors in large buildings; for, being in effect beams of great depth, they only rest or press downwards upon the piers or walls supporting them, and so have no horizontal thrust. Curved iron ribs, whether with or without the rods, are equally applicable to the oblique as to the square arch, since each rib may always be placed in a plane, which is both vertical, and runs in the direction of the upper pas­sage. The horizontal rods, though generally of unnecessarily great strength throughout the most part of their length, are commonly rendered very weak near their extremities, owing to their either being very needlessly pierced with large holes near the ends, or by being very much reduced there, for the purpose of being formed into a screw. Com­mon sense, one would think, could not fail to hint to even the most inexperienced, that to resist a longitudinal pull, there is no use in having one part of the rod stronger than another; because one weak part will render it as likely to fail, as if the whole were equally weak. Neither is it ne­cessary that such rods should be stronger at the middle to sustain their own weight, since they are commonly suspended there by a vertical strap.

It is evident that the opposite horizontal thrusts of an arch, formed of any other materials as well as iron, might, in a similar manner, be made to annihilate or counteract each other by means of horizontal rods beneath, so that a com­mon square arch, having the thrusts obviated in this way, could be used instead of a skew bridge, wherever there is sufficient head-room for the horizontal rods, and likewise space for carrying out a mere wall as far as will square the faces of the arch, and support its weight at the two pro­jecting corners; no additional embankment being required where there is no thrust.

An elegant mode of constructing arches of brick, with­out requiring the aid of anything like ordinary centring on the great scale, has been introduced by Mr. Brunel, and is equally applicable to the oblique as to the square bridge. The principle of this, as originally adopted, and its suf­ficiency tested in constructing the shaft of the Thames Tunnel, depends on the cohesive power of Roman cement, coupled with a system of ties, the most eligible material for which Mr. Brunel found to be hoop iron. After the piers have been constructed in the usual manner, a mould, curved according to the figure of the arch, is fixed to, and stretched

@@@, The mode of attaining an equilibrium in an oblique arch, is a subject on which no one, so far as we know, bas entered. It seems ge­nerally to be taken for granted, that the obliquity makes no difference; but though in this we cannot acquiesce, our limits will not admit of attempting to discuss the question

@@@’ See Philosophical Magazine for April 1836, January and March 1837, and Reports of British Association for 1838.