The secondary stress in the cross plane is very easy to determine theoretically. The engineer should not think, however, that these theoretical results are exactly true. The Engineering News, in a very able review of the practical aspects of secondary stresses, notes that truss plane secondary stresses are self relieving. It is also to be noted, in regard to cross plane secondaries, that the warping of the truss as a whole, which must take place when a series of posts is bent from the floor beam action, causes the inside half of the diagonals to take a disproportionate stress, which tends to develop an outward bending in the post. The eyebar, or diagonal angle CD, in Fig. 2, will have a stress appreciably greater than that in AB. This excess, multiplied by the arm CD/2, produces a bending moment opposite to that produced by the bending of the floor beam.

It is certainly not possible in contracts with small allowance for engineering, to compute the relief of the secondary stress from this cause. The secondary itself is not expensive to compute. The amount of this relief can never exceed one-half the secondary stress, since it is the imposition of a uniform moment upon a moment varying from zero to a maximum.

There is, however, one thing that the secondary stress calculations for vertical posts can teach us, which is worth while bearing in mind when designing these members. In two examples in Hirei, "Statically Indeterminate Stresses," pages 167-8, the moments M_1 and M_0 are computed for a railway and a highway bridge bent. The change of moment between top and bottom of the post is found to be 52,000 lbs. and 36 lbs. respectively. For heights of 20 ft. and 16 ft., the value of S_1 in these bents is 2,600 lbs. for the railway bridge and 2,250 lbs. for the highway bridge. Remembering that a certain amount of the wind load on the top chord is certain to be carried down the posts, it seems quite possible that there may be a shear of about 4,000 lbs. in the post.

If, then, this post is latticed in the cross plane with single-rivet lattice bars, each rivet of the latticing throughout the whole length of the post must endure a considerable stress. For a shear of 4,000 lbs., and with two systems of 60° lattices, this stress would be 2,000 lbs. × 1.15 = 2,300 lbs. This is not a very large stress for a single rivet, if only it were the average stress in a joint of several rivets. Here, however, the safety of the whole structure depends upon the ability of each of a great number of rivets to bear alone a load of over one ton. Such a reliance upon single units of construction is contrary to the principles of good design.

The conclusion which I wish to draw from these considerations is that the latticing of vertical posts of bridges should all be in the truss plane, in spite of the loss in pin plate metal. Where channels are turned with their webs in the truss plane a web plate should be used to connect them.

LARGE STEEL INGOTS.

Messrs. Cammell, Laird and Co., Limited, of England, have just turned out two very large steel ingots at their Grimesthorpe works, Sheffield. One of them weighs nearly 140 tons, and will form the base of an armor-bending or straightening press for a neighboring firm. It was cast from three furnaces, then reheated and placed under the 4,000-ton hydraulic press, in which its thickness was reduced from 4 ft. 6 in. to 3 ft. 6 in., and the top end, weighing about 40 tons, was cut off. After being again re-heated, it was rolled down in the armor-plate mill to a thickness of 2 ft. 7 in. The second large ingot is an octagon of 137 tons, for a gun jacket.

Messrs. Cammell, Laird are at present very busy with naval construction work, including castings for the two battleships now being built at Devonport and Portsmouth, and for the Audacious and other vessels which are in hand at Birkenhead and Fairfield.

A NEW PETROL CAR.

The Leyland Motor Company, of Leyland, England, have recently constructed a new petrol car, which is now in operation at Hepsham. The car is driven by petrol engines and runs on the tramway lines, an adaptation, in fact, of the motor driven 'bus to tramways.

The Leyland Motor Company, of Leyland, near Preston, have constructed the car, in so far as the driving machinery is concerned. It is a single-decked petrol driven tram car, of 55 horse power, and has seating capacity for 37 passengers. The general particulars are as follows:—The transmission is from the four-speed gear box through universal joints to a gear case on one of the axles. The two axles are connected together by a roller chain, and the axle gear case contains heavy spur and bevel gears and reverse gear, the whole running in oil on ball bearings. The ordinary pattern tramway hand brake is fitted, and a large diameter external band pattern foot brake is fitted immediately behind the gear box. The car, which is completely controlled by the driver from either end at will, is built up of angle irons and timber on the usual tramway practice. The body is well finished, all the side windows being made to raise and lower by screw operating gear. Plain varnished seats are placed crossways with a central gangway. The car is lit by elecric light by means of a number of metallic filament 10-candle power 6-volt lamps, supplied by current from a dynamo driven from the engine on the Trier and Martin systems. The length of the car over collision fenders is 31 ft., width over all 7 ft. 7 in., length over corner pillars 21 ft. 6 in., total height 10 ft. 1½ in., gauge 4 ft. 8½ in., wheel base 8 ft., weight of car complete 7 tons 5 cwts. The sub-contractors were as follows:—For car body, the United Electric Car Co., Ltd., Preston; electric light, Messrs. Trier and Martin, London. The approximate cost is $5,250.

At the first trial of the car, Mr. C. B. Nixon, the representative of the Leyland Motor Company, gave some figures on cost of operation, etc., as follows. It was, he said, an ordinary tram car body built by the United Electric Car Company. It was fitted with a 55-horse power four-cylinder petrol motor, capable of developing 60-horse power. As the car was intended to run on a road that had steep gradients, and was somewhat greasy, it was thought better to couple the two axles together with a large driving chain, to get the adhesion of both axles. As to the cost of the running of the car, that remained to be tested, but he thought it might safely be assumed that it would travel eight miles with a gallon of petrol, or at the rate of a penny a mile for fuel. It generally took two units of electricity per car mile, and if the cost was 4 cents per unit the saving in current would be considerable. The cost of maintenance and general running would be about the same as a motor 'bus, 2 cents to 3 cents per mile. The cost of the track must be put against the cost of the rubber tires of a motor 'bus, which would be about 3½ cents per mile. A motor 'bus would do 45,000 miles a year for $1,800 in the cost of rubber tires, but it could be seen that the track could be maintained at less than that amount.