experts available report on it. If the scheme is right it will stand this; if it is not right, we can save millions. But now is the time."

LETTER TO THE EDITOR.

"A Light and Useful Roof Truss."

Sir,—The writer is inclined to disagree with the statement in the closing paragraph of the article on page 477 of the issue of October 14th, 1915, of *The Canadian Engineer* that "No apology is necessary for introducing" to him his old friend (or enemy), the "light and useful roof truss." He is inclined to be rather grouchy about it just at this time, because he is at present wrestling with the problem of how to keep an 80-ft. roof truss of this identical type from falling down. It is not that the type is at fault, for some of the claims made for it are sound; but the 45 ft. 9 in. truss described in the article is so far below the common standard of engineering practice in this country that it should not be so unreservedly presented without some explanations.

In the first place, it is "designed" for a total load of 12,000 lbs., or 24 lbs. per sq. ft. of roof. Of this, about 9 lbs. is the dead weight of truss and roof, leaving 15 lbs. per sq. ft. for snow and wind load. Now, last January we had, in southern Ontario, a combination of snow and rain and wind that loaded our roofs not far from the 30 lbs. per sq. ft., which is the usual minimum live load used in designing in this latitude. Many roofs went down under it. In Toronto 40 lbs. per sq. ft. is the minimum allowed, and for localities further north much heavier loads should be provided for. So it should be noted that this truss ought to be at least 60 per cent. stronger for use in Canada.

However, assuming a total load of 24 lbs. per sq. ft. and a depth of 5 ft. 6 in. at the centre (this dimension is not given, but the drawing scales that), the direct compression in the top chord is found to be 1,630 lbs. per sq. in. Toronto and Hamilton building by-laws allow a maximum of 1,100 lbs. per sq. in. for long-leaf yellow pine in direct compression. With such loads as we had last winter the direct stress would be 2,600 lbs. per sq. in. On the other hand, the bottom chord seems to have an excess of material for assuming the whole section can be counted on; the unit stress is only 415 lbs. per sq. in. In the same way, the stress in the purlins would be about 2,850 lbs. per sq. in.

The statement that "there are no secondary stresses in the fibre of either strung or bow" is incorrect. The bending of the top chord, or "bow," to its curve produces a fibre stress of over 300 lbs. per sq. in. in it. This is 30 per cent. of the allowable working stress, and it must be added to the direct stress. To hold this curved piece in place puts an initial stress in all other members of the truss.

Again, a snow load on one side of the truss only would produce shearing stresses at the centre, to be taken care of by the diagonal web members. These diagonals do not intersect on the centre line of the chords, and consequently must produce secondary stresses. When the truss deflects under its load all kinds of secondary stresses will be set up. The larger the truss, the worse these conditions become.

The placing of a monitor on the truss, which can be "done with such ease," will alter the line of stress so that it will no longer be a parabola, and more unknown stresses are developed. On the whole, the stresses in this type of truss are very indefinite, and instead of increasing the unit stresses as recommended they should be considerably reduced.

Considering Claim 2 made for this type of roof, viz., "small superficial area of the roof in relation to the area covered by it." This is due entirely to the shallow depth of the truss in relation to its span. The same result may be obtained with almost any type of truss at the expense of extra section in the chord members. For a large truss it would be very uneconomical to make the depth only one-eighth of the span like this small one.

The same argument applies to Claim 3, "the eliminating wind pressure as a factor in the stress calculation." But the wind pressure on small roofs is never calculated anyway, it being considered that the 30 lbs. per sq. ft. live load includes wind pressure. However, when the trusses rest on columns and it really becomes necessary to provide for wind pressure by using knee braces to make the truss and column act as a bent, this type of truss is a most unsatisfactory one.

There are other details of construction that are open to criticism. The use of double strips to form the purlins only adds to the cost and invites dry rot along the surface of contact.

Special care and expense is required to make a good roof when the sheeting is curved. Each strip of sheeting —in this case ship-lap—must end on a purlin and be especially well secured, for there is a strong tendency for the ends to spring up and cut holes in the roof covering. The smaller the span the more important this becomes.

Regarding the carpenter as a truss builder. In timber structures such as trusses where the full strength of the material is supposed to be developed, the ordinary methods of the average carpenter are useless. In a dwelling house a workman would consider a couple of 5-inch nails quite enough to secure a 2″ x 4″ scantling in place. In a truss it would require eight or ten nails to develop its working value in tension, but no ordinary carpenter would think of putting that many nails into it unless he were made to do it.

In the design of a small truss of 45-ft. span many fine points may be disregarded. In a 120-ft. truss, such as is recommended, when the stresses would be at least ten times as great, the members would have to be built up with many thicknesses and splices and the difficulties are so multiplied as to make such a truss, if properly constructed, very expensive. In small trusses, "skinned" as this one is, there is doubtless an apparent economy in first cost, but if a structural steel designer were allowed to use such light loads and relative high stresses in his work and ignore the effects of rust and defective material as the designer of this truss ignores dry rot and other undesirable properties of timber, the apparent economy would disappear.

Timber trusses have their place and use in construction, but their utility, durability and ultimate economy depends entirely upon the amount of care taken in their design and construction.

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Hamilton, Ont., October 19th, 1915.

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