of her predecessors are elaborate poems. Without doubt literature has gained on the whole from its submission to the teachings of the scientific spirit. Yet the results have not in all cases been as satisfactory as in the works of Thackeray and George Eliot; for Walt Whitman and Zola are also products of the Realistic school.

Another result of the influence of the scientific spirit is to be found in the stricter application of the laws of verse. This is perhaps nowhere more manifest than in the difference between the modern English sonnet and its predecessors. At one time any poem in fourteen lines was entitled to rank as such. The sonn has now to be written in strict accordance with the laws of the best Italian sonneteers. As is natural, the strict application of law to a language and literature, like English, remarkable for its lawlessness and disregard of fixed rule, has resulted in an artificiality, which has had a very deteriorating effect upon literature at the present day. It will be sufficient to refer to the Sonnets of D. G. Rossetti as an instance. The attempts, too, of Mr. Swinburne and others to introduce French forms of verse into the English language have been far from happy in their result.

Perhaps in no case has the scientific spirit won greater triumphs than in the change it has effected in the manner of translation from one language into another. One of the best specimens of translation in the old style is Edward Fairfax's version of Tasso's "Jerusalem Delivered." It is delightful reading as an English poem, but with Tasso's meaning the greatest liberties are taken. Chapman who executed his translation of Homer in the reign of Elizabeth shows no scruple on several occasions about expanding a single line of the original into several of his own. Macaulay's joke about Homer becoming "translated" in Pope's hands is proverbial. To the old theory of translation there is little fear of our ever returning. Not only the exact meaning of the original has to be preserved, but its manner and spirit. In the case of poetry, analogous metres have to be selected. No one has done better work in reforming our theories of translation than Matthew Arnold whose lectures on translating Homer were delivered in 1861. Milman, Conington, Bayard Taylor, Longfellow and Lewis Campbell may be mentioned as some of the most successful among modern translators; while Sewell's translation of the "Georgics" and Robert Browning's version of the "Agamemnon" are instances of the modern theory pushed to a ridiculous extreme.

VIBRATORY MOVEMENT OF BELLS.—M. Mathieu, a French experimenter, has recently studied the vibrations of bells, considering the case of an ordinary bell in which the thickness in any meridian increases from summit to base. The essential differences between the vibratory movement of a bell and that of a plane plate is that, while in the latter the longitudinal or tangential movement and the transverse movement are given by independent equations, the normal and tangential motion in the former are given by three equations which are not independent. The pitch of the notes of a bell does not change if the thickness varies in the same relation throughout every part, since the terms depending on the square of the thickness may be neglected, at least for the graver partials. It is impossible to construct a bell so that it shall vibrate only normally, and with a hammer the tangential vibrations are of the same order as the normal vibrations. A purely tangential motion can be realized only with a spherical bell of constant thickness.

GENERAL SPECIFICATIONS FOR ORDINARY IRON HIGHWAY BRIDGES.

BY J. A. L. WADDELL, C. E., B. A. Sc., MA. E.,
Prof. of Civil Engineering in the University of Tokio, Japan.

As the heading implies, the following specifications are *general* in their nature. they are intended for *ordinary* iron highway bridges and are designed to present to parties interested in bridge construction, more especially those upon whom falls the responsibility of letting bridge contracts, what in the writer's opinion are the requisites for a good structure. The part of these specifications relating to the proportioning of main members and details is in accordance with the writer's previous papers on "Bridge Pins—Their Sizes and Bearings," "A System of Designing Highway Bridges," and "Details in Ordinary Iron Bridges," while the parts relating to tests of material is taken from Prof. H. T. Bovey's excellent little work on "Applied Mechanics." A few other portions are copied from approved specifications.

By ordinary highway bridges are meant simple truss bridges, having no novel and peculiar features, such as a combination of arches and trusses, cantilevers, etc, in short the bridges which one meets with every day in travelling through the United States. These specifications are general enough in their nature to include all the ordinary styles of truss, but are more particularly applicable to the Pratt and Linvill which are by far the most common trusses for iron highway bridges in America.

Highway bridges may be divided into three classes, viz.. those for cities and their suburbs which are subjected to the *continued* application of heavy loads, those for cities and their suburbs which are subjected to the *occasional* application of heavy loads; and those for country roads, where the traffic is lighter. Let us call these divisions classes A, B and C.

Live Load.— SPECIFICATIONS.

Span in feet.	Moving load per square foot.	
	Classes A and B.	Class C.
0 to 50	100 pounds.	80 pounds.
50 to 150	90 "	80 "
150 to 200	80 "	70 "
200 to 300	70 "	60 "
300 to 400	60 "	50 "

Dead Load.—The dead load is to include the weight of all the iron and wood in the structure excepting those portions resting directly on the abutments, and whose weights do not affect the stresses in the trusses; also, if necessary, an allowance for snow, mud, paving or any unusual fixed load, that may ever be placed upon the bridge. Pine lumber is assumed to weigh two and a half lbs. per ft. C. m. and oak lumber four and a third lbs. per foot. C. m. Should in any bridge of, or below, two hundred feet span the calculated dead load differ more than seven per cent., or in any bridge above two hundred feet span more than four per cent. from that assumed, the calculations of stresses, etc., are to be made over with a new assumed dead load.

Wind Pressure.—The wind pressure per square foot