ornamentation are a branch of architecture, the other two of the three components being constructive and distributive. Then, since the architect must know construction, he should possess all the technical elements thereof, and be able to prepare his own strain sheets, precisely as the engineer does at the present time, the architectural features in the engineer's case being a mere adjunct, while in the architect's case they are an essential.

The written protests I refer to are, of course (and may be more or less disagreeable) unpalatable to some or all of the parties concerned. The architect and contractor both fear that they may thus estrange or rile the proprietors into calling some other architect or builder pliant enough to do the needful and run all risks, "ruat coelum," but the absolute necessity of such action on the part of both architect and contractor in case of foundations of doubtful efficiency, has been so often and disastrously illustrated by the many failures alluded to, and the cost of repairing and rebuilding, that it is to be hoped that proprietors themselves, parish or other authorities, will see the necessity and philosophy of such action on the part of the architects and builders, and it certainly is not fair to saddle the contractor with the cost of underpinning or rebuilding, when they, (the authorities) have from motives of economy decided on a cheap "platform" or "grillage" foundation, where a piled or down to rack structure should have been decided on from the beginning. And in buildings in general, too much reliance is placed on the supporting powers of the outer walls. It is too easily forgotten, and more frequently ignored, that while each of the outer walls bears only one-quarter of the weight, the central wall will have double duty to perform, and hence the fact that so many structures sag at the centre. Another thing of vital importance in the rigidity of a building, and the supporting power of its floor, is that as far as possible every joint should have three points of support, or that they be made to extend from end to end of the building, while supported at the centre, or where there are two intermediate walls, that each alternate joint be made to reach and to bear upon the wall or the opposite sides of the corridors. Where this is not done the floors sag disgracefully towards the centre, and the mere walking across them causes everything in the room to shake and tremble most disagreeably, as with a certain building erected in Quebec, where not from negligence or any consideration of economy, but from sheer ignorance on the part of the architect of the difference between the strength of a beam when secured at the ends and extending to other points of support, as compared with one bearing loosely at its extremities on the supporting beams. Look at the late London, Ont., disaster. Had the joint in this case been of a single stretch from wall to wall, their combined strength, even without the beam which broke, would have gone far towards supporting the weight of the crowd in the room where the collapse occurred, and at any rate their resisting powers added to those of the incriminated beam would have prevented the accident; but on the contrary, every one of the joints were in two length width, their ends meeting on the centre beam, hence the failure.

For THE CANADIAN ENGINEER.

ROAD MATERIALS AND CONSTRUCTION.

BY W. M. WATSON.

When making roads we have the privilege of copying the system of construction used by the makers of the old Roman roads, which are yet sound and firm, and the later methods used by Metcalf, Tilford and Macadam, who revived the Roman and Swedish process of road-making in a lighter and less expensive form. This country is rich with first class materials, which only require to be intelligently put together to make good roads. Each old road-making sample shows us that every road and street must have its roadbed well drained. When making a new road the sod and small under brushwood should remain, if convenient, intact, because the rootlets make a tough foundation to build the stone bed on. In places where artificial banks have to be made to raise the level of the road, or when crossing bogs, marshes and soft places, a good thickness of pea straw or brushwood, etc., should be laid across on the soft material before commencing to build the stone foundation.

When the Romans set out a new road, they cut a trench along each side line at least one foot deeper than the bottom of the intended roadbed. These were filled with large boulders, or a rough drain was made, with outlets at short distances into some natural water course, which efficiently drew off all the water from the under side of the foundations. Macadam rounded his roads a little on the surface, the crown being at the centre, giving them a gentle fall to each side. He constructed his roads by laying down three, four, or more layers of stone about six inches thick, rolling each layer down even on the surface to the same shape and grade that the road would finish. He suited his material used to the nature of the ground and the traffic that would afterwards use the road, always placing the largest lumps at the bottom, and rubble varying from one inch down to one-quarter inch for the top course, having the whole rolled hard and tight together, but using no sand or soft material except water. Hard frost cannot hurt a road that has a dry foundation.

Short residential streets might be made to fall a little to a central channel only about one inch deeper than the road surface, placed vertically over the main street sewer, having iron storm water grids that would serve both the purpose of ventilating the sewer and drawing the water from the street. This methed does away with the nuisance of having costly trapped gullies, with large pockets filled with decayed matter, throwing off disagreeable odors, close to the sidewalks and the houses. It saves digging across the street to the gullies, besides the value of the branch lines of pipes from the centre sewer to the gullies. It allows the wagons to get close to the sidewalks, and gives a width of dry road during a rain storm and frosts near to the houses where it is most needed. It also prevents the traffic from passing over the main drain where the road is weakest. Then the roadbed and foundation falling to the centre can be easily made to drain itself into the main pipe sewer, and last, but not least, the side of the streets will not be so slippery as under the present system in frosty weather. This method of grading streets is by far the cheapest, and the pavement is more durable and healthier for our climate.

We now come to roads suitable for traffic in populous cities, requiring smooth surfaces, and we revive again the customs and road materials used by the old Babylonians, and of Egyptians. There are numerous kinds of materials manufactured for roads and sidewalks that will stand any kind of weather, and that may be got at a reasonable cost, wearing from 20 to 50 years, and always be neat in appearance and comfortable to the wearer during the whole of the material's lifetime.

For instance, where high temperature destructors are used to destroy the garbage, the residuum is a very hard burnt clinker and fine ash. C. & A. Musks, of Bootle, Eng., have invented a press and other machinery to manufacture the clinkers into concrete flags equal to stone, and