

All the civil engineering of ordinary buildings in which no machinery was employed, were clearly within the functions of an architect, although there might be a great deal of iron used in the construction, but it must not be forgotten that there was much special design and construction now introduced into even such work as roof framings, that it had passed into a separate branch of engineering, and a specialist skilled in workshop practice would possibly take an architect's plans for the iron roof of a theatre, the carrying out of which would cost, say sixpence a pound, and by his knowledge, produce exactly the same appearance and strength for half the money.

Of course any engineer employed in association with an architect in such a matter as the foregoing, whether as an assistant or fellow professional, would, if he had any sense only look upon himself as subordinated to the architect, just as an architect would do in a complementary case. Mr. Horbury Hunt, the President of the Institute of Architects, spoke on this point, and the writer of the leading article in the *Sydney Morning Herald* of the 24th ult., emphasized the same relation of the two professions, using the words "as the whole is greater than its part, the lesser should be subordinated to the greater." If, therefore, an engineer has in hand a warehouse, factory, mill, engine house, or railway station, as the *Herald* puts it, clearly there is no architect required, because such buildings are *prima facie* purely engineering structures, and they fulfil their intended purposes equally well with or without any æsthetic treatment, and if an architect should be entrusted with the carrying out of such work, it would be because he is a civil engineer and not because he is an architect.

Should the engineer, however, desire, and the proprietor be willing to pay, for these structures being treated in an ornate manner, the engineer, if he were wise, would place such work in the hands of a competent architect to receive the ornamentation required, and such architect would as a matter of course "clearly understand"—as Mr. Horbury Hunt said—

that he was in a subordinate position to the chief one held by the engineer.

In like manner when an architect had a qualified engineer to assist him with the structural details of his bank, mansion, temple, or other buildings, such engineer would of course be subordinate to the architect. From the number of speakers who referred to the dreadfully inferior class of constructive ironwork that was being turned out of shops for the Sydney buildings—including Messrs. Cruickshank, Nelson, and others, all experienced men—it clearly showed that all the architects of the city did not take the precautions which the more experienced and careful members of their profession did with regard to obtaining engineering assistance.

It was not every architect who was in the fortunate position of being able to keep a qualified engineer on his staff, and while it was a fact that our buildings as a whole were a credit to the city, and to the professional men that designed them, yet it was equally true that a great deal of the ironwork that had been introduced into them of late years could only be spoken of with bated breath. Those gentlemen who referred to the system obtaining at present, under which there often was an entire absence of proper drawings and specifications, to show the arrangement of the plates, or define the class and quality of the workmanship, when girders are required, and who also spoke about the construction of girders being left so much to the manufacturer, clearly emphasized this point. Mr. Cruickshank, a highly competent judge, placed the evil beyond controversy. Although the trade or business of girder building did not imply a knowledge of design and proportion, such manufacturers would naturally prefer to turn out good work if they could get a price for it. An erroneous idea that weight meant strength on the one hand, and close competition among the makers of builders' ironmongery (who have been so much without proper direction and supervision in this branch of business) on the other hand, had probably been the reason why

such a demoralised class of work had been turned out, for which the makers under the circumstances were certainly not to blame. It did not seem to have been perceived that a low price per ton was not necessarily the cheapest ultimately, and that while five tons in a girder at £16 might look a big thing for the money, three tons at £25 would be a better transaction if it resulted in a stronger and higher class job. It was a fact beyond controversy that many thousands of pounds had been wasted in Sydney by defective designs of girders, even where there was good workmanship, as well as by putting tons and tons of metal where it had to be carried without adding in the least to, and in fact taking from, the carrying power of the girders. Many gentlemen in the room were in a position to enlarge on this point, but for very obvious reasons it would be inexpedient for them to do so. Mr. Nelson, as an employer and not an officer of a manufacturing firm, was not under the same restraint, and spoke out boldly and clearly on this subject, as well as on the practice of architects asking for tenders from manufacturing engineers without supplying either drawings or specifications of what they wanted. Particular attention should be given by this meeting to the actual case that was cited by one speaker where a large company of manufacturing engineers did tender—as sub-contractors to a builder—to construct and erect machinery, under a vague and indefinite agreement, to the satisfaction of the architect, and where the architect was satisfied and gave his certificate; but as he gave it to the middle party, who was in difficulties, the unfortunate engineer, who should have had the certificate to present to the employer when their work was satisfactorily completed, had to go without their money.

It seemed to the author that it was a positive indignity to a respectable firm of manufacturing engineers that they should be placed in such a position, although it might suit firms of factors who employed agents to secure work, and then farm it out where they could get the separate parts the most cheaply.

The President of the Builders' and Contractors' Association, Mr. Jones, as the result of their experience, emphasized the fact that builders would prefer to be in the hands of an architect just as an engine builder, machinist, or other iron worker would prefer to be in the hands of a consulting engineer, and for the reason that there was closer contact between the respective parties, who are naturally associated not only in training and knowledge, but in actual business, and it did seem on the face of it wrong for contractors to be working under responsibilities to inspectors who could not possibly be acquainted with the detail and practical problems that arose in the course of the work.

The author thoroughly agreed with Mr. Mansfield, than whom no gentleman present was more competent to speak, that a sharper line should be drawn between architects' and engineers' works than now prevailed in Sydney, and that engineering constructions should be under the direction of engineers.

Until a year or two ago it was the regular thing for all the leading architects of the city to have an engineer in association with them to design and supervise the construction of mechanical engineering works, such as lifts, for the buildings they were carrying out, and the most happy results had ensued for all parties; some of these buildings had plants working well still which were put in long years past.

As Sydney progressed this branch of engineering was taken up by agents for firms often hailing from abroad, whose object was of course to get orders for such machinery, the orders to be based very often on ornamental specifications of such agents' own composing, or without any specifications and drawings at all.

With machinery made like "razors"—to sell—of course a consulting engineer was most undesirable, and influence was actually brought to bear that there should be no one called in who was able to protect the interests of the proprietors until after the contract was let for some of these imported plants.

In one case where the author was afterwards engaged, he found there was a clause in the contract stipulating that certain apparatus should be carefully protected to prevent freezing in our Sydney climate, but there was nothing to indicate such matters, for instance, as to whether an important machine to be supplied was to be of the value of £30 or £300, consequently a very poor thing had to be accepted. The result of this touting for engineering work by agents, for that was what it really amounted to, had been a partial revolution in the method of supplying the machinery to buildings.

The faculties that went to make up a successful canvasser for the sale of ready-made machines were not the same as those which secured perfection and appropriateness in the actual design of intricate machinery itself. The value of the one was estimated by the capacity for getting rid of something one had to sell, but of the other by the ability to meet a special want in the best way at the least cost. It was a consequence of the introduction among us of the canvassing system, that instead of the proprietor paying 5 per cent. to a professional man for a set of plans and specifications, under which all contractors tendered on a level and toed the same line, he now often paid 15 per cent. in commission, had no means of comparing the tenders received (as they were all based on the contractor's idea of what was wanted), and got a job that often required subsequent remodelling or sometimes entire reconstruction. Instances were not far to seek.

Local manufacturing engineers also were now often asked for tenders, and put to a very great expense to prepare specifications and drawings to send in with them. A notable case occurred recently where an eminent engineering company did this after a firm of factors had already virtually secured the order for the machinery required. The custom of making the working machinery a part of the builder's contract of course involved a profit to the builder on the transaction (which was certainly due to him under the circumstances) as well as the

architect's commission. The proprietor thus paid practically equal to three commissions without having definite detail plans and specifications prepared for him, but the sub-contractor, as a set-off, was often in the happy position of being able to do what he liked.

It was to engineers a most extraordinary thing to see the way in which most imprudent economy was often exercised by the adoption of defective or wasteful machinery in a building, while money was lavished in other directions. There was an actual case in New South Wales where hundreds of thousands of pounds had been expended on a building, and yet it had, like others, a lift more fit for a back store; the commonest fittings and appurtenances of the machinery were in close juxtaposition to the most elaborate finishings and decorative details of the building, and it had a car to hold twice as many people as it could take up. The author was not aware that a consulting engineer had anything to do with this.

When one had an extremely large experience in the machinery of buildings, and had studied it in a dozen different civilized countries, he might speak boldly and plainly without being considered egotistical. But if he knew that under certain arrangements there was a quite unnecessary risk of human life it would be almost criminal for him to be silent.

There had been cases in Sydney where lift cages had worked for months slung by a common unwelded S hook, like a butcher hung his meat by. Numbers of safety gears that would not work if the ropes were to fail had been made. Numbers of lifts had been turned bodily out of buildings as old iron on account of their defects. Men had been killed by the machinery failing, and cables had endangered life by giving way, or wearing out in less than one twentieth the time that other cables had safely worn.

Girders had been built in which a large proportion of the rivets were loose. No attention had been paid to the position of the joints. Two butts had been superimposed with only

one cover plate, and that slight for one of them. Hand riveting had been preferred to machine work through three or more thicknesses of heavy plate, and the most wasteful disposition of material had been common. These and many other things were known to the members assembled, but it would not do to particularize.

As long, however, as important machinery, on which human life depended a thousand times a day, was bought and sold with as little and perhaps less ceremony and precaution than the encaustic tiles for the entrance of the building received, so long would the danger continue to exist.

The author felt from the reception that was given to the paper that he had been fully justified in bringing these questions before the several professions interested. The conclusions which he had drawn from the opinions expressed in the discussion follow, and if they did not exactly voice the opinions of the meetings, he asked the President to allow dissent to be expressed, or if necessary a division to be taken. His own opinions throughout had been kept entirely in the background, in order that this reply should have the authority which must result from it being an embodiment of the expressions emanating from such representative men as those who took part in the proceedings, and not an expression of his own individual views,

CONCLUSIONS.

1. In all specifications for buildings where machinery is likely to be wanted, provision should be made for engineering contractors coming on the ground under the consulting engineer to the proprietors.

2. Iron firms should not tender for buildings; and builders—except in such cases as small hand lifts and other machinery of comparative insignificance, should not tender for engineering works.

3. All contracts for machinery or girders, unless of little value, should be let to the manufacturing engineer direct, by

either the architect or engineer as the case may be ; and such manufacturer should receive his certificates direct from the professional man who is responsible to the proprietor.

4. (a) The practice of giving skeleton outline of what is required, and requesting a number of contractors each to undertake the expense of separately formulating detailed schemes and providing drawings and specifications, is indefensible among professional men of standing.

(b) It is a fact that under such a system contractors cannot consider the immediate first cost, and cut down the quality and nature of the work wherever possible.

(c) It is not possible to properly compare a number of tenders for work when all are on a different basis, as it is when all the manufacturers tender to properly prepared plans and specifications.

(d) A remedy would be for all respectable engineering contractors to unite in refusing to tender except on definite particulars of what is required.

5. (a) It is quite fair that the builder should make 10 per cent., or as much more as he can, if the machinery contracts are made through him.

(b) It seems doubtful if it is fair that the architect should only receive 5 per cent. by the side of this, when he is the person actually responsible to the proprietor.

6. It is absolutely and certainly unfair to the proprietor that he should pay the 15 per cent. unwillingly, because he can get the work done under special professional experts better and cheaper for 5 per cent. commission ; but if he thoroughly understands the whole of the circumstances, it is perfectly fair to him if he pays 50 per cent. more than there is any necessity for him to do.

7. (a) It is not right that important machinery of an intricate nature, often involving danger to life, should be treated like bells, mantelpieces, and other sundries of a building, as of no particular importance.

(b) The interests of the proprietors of the structure should be conserved by having strict technical specifications and plans for such machinery, instead of nominal ones, in just the same way that the architect designs and specifies for the building itself.

8. (a) It is true that girder construction has in numbers of cases descended to a wretchedly low level in Sydney.

(b) It is desirable, unless some alteration takes place, that all such work should be subjected to official inspection.

(c) It is much more desirable that all engineering works in a building should be designed and carried out under recognised experts, than that business should be hampered by too much official inspection.

(d) It is not necessary that the building contractor should be the contractor for the machinery of a building, and it is extremely undesirable in most cases.

(e) It would not be a good thing if builders were to keep stock plans of hotels, banks, and suburban villas, and supply special ones to their customers, and were to send around gentlemen as canvassers to persons about to build, offering such wares, to the setting aside of architects altogether.

(f) If the present tendency is not stopped, it is certainly likely that there will soon be very little place for either architects or engineers "to come in at all," as *independent professional men*, because, under such a condition of things, they will become the servants of the builders and manufacturing engineers, preparing the plans for such contractors to submit to their customers, already too much the case.

Finally, all architects, consulting and manufacturing engineers, and builders of recognised position, should unite in upholding the dignity and respectability of their professions and callings, and should set their faces against any customs under which they themselves or their clients are placed in false positions. To this end the Councils of the several Architects', Engineers', and Builders' Associations should unitedly direct their early attention.