PROGRESS

NEW ZEALAND AND OTHER TIMBERS

JULY, 1912

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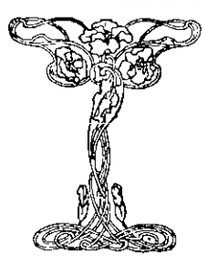

(See last page of Editorial Comments, page 1168).

Owing to numerous requests from our readers to make "Progress" a more convenient size, we wish all our friends to register their vote at the foot of this notice.

VOTING PAPER

To the Proprietor, "Progress"

I Vote that "Progress" be Reduced in size, (additional pages being added to retain present reading matter).

.....

or I Vote for "Progress" to remain as it is at present.

.....

[REGISTERED AS A NEWSPAPER.]

PROGRESS

With which is Incorporated

THE SCIENTIFIC NEW ZEALANDER.

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ADVERTISING RATES will be sent on application. The value of "PROGRESS" as an advertising medium is rapidly becoming recognized by advertisers. Circulation considered it is the cheapest advertising medium of its kind in the Dominion.

The Editor will at all times be glad to receive Illustrated Articles on subjects of interest for consideration, provided the articles are short and to the point, and the facts authentic.

Should subscribers continue to receive copies of this journal after expiry of current year, it will be accepted as an intimation that they are desirous of subscribing for a further period of twelve months.

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EDITORIAL COMMENT.

Some little while ago a deputation of architects waited on the Minister of Public Works in Wellington with a request for wider recognition of the competitive system as applied to the various buildings erected in the interest of the various Government departments. It seems to us that they would have liked to have had all the buildings thrown open to the competition of the profession. But that would be out of the question so long as the Government maintains an architectural department. For very good reason the Government found it necessary some time since to set up a law department minimising the expense of law to the State and making its practice in all things more uniform. The results were beneficial beyond the highest expectations. The same principle applies to the Department of Architecture, if in a less degree. On the other hand, it is desirable on great occasions to have wider scope for talent, and on such occasions the practice of competition might be well resorted to. We go further and say that with the excellent talent now in the profession in the Dominion it is possible. But this reminds us that the practice of the Government already is to call for competitive work. We mean that the precedent has been established at the request of one branch of the Legislature, with such good results that it ought for the future to be the rule. But beyond that it would not be advisable or possible for the Government to go. The ordinary work of Post Offices, minor railway stations, normal school building (we use the adjective in the untechnical sense) may be left to the Department, and the task of designing extraordinary buildings handed over to the competitive designer.

* * *

The old Government, with its links of twenty-two years, has been ousted and the new, with its recollections of the same number of years of Opposition, is firmly in power. The fact will be regarded by the public according to the political standpoint of each individual member. But all are, we feel sure, agreed that the new Premier is entitled to so much from a sportsman-like and fair-minded people. Nor is this all his claim. As one who has shown endurance, perseverance and greatness of mind in adversity, and a lofty equanimity in the hour of long-delayed triumph, he deserves the consideration of the fairest of trials. He begins with the finances of the Dominion in perfect order; a mounting revenue, a surplus of record proportions, and a vast loan authorization, as was made clear by the retiring Finance Minister on the last day of his occupation of the Government benches. The question for the public is whether he will last. To that the answer is simple enough. If he will take advantage of the general distrust of Labour caused by its pretensions and disagreements, he will stay on indefinitely. United Labour, claiming to speak for the majority, proclaimed that alliance with Liberalism was to it impossible, and at the same time made a public attempt to shake hands with syndicalistic anarchism. It is attempting to retrieve its hideous error by asking all men who work to drop the technical definition of worker and join its ranks. But this is an even worse insult to the moderate majority which constitutes the bulk of true Liberalism in New Zealand. Now therefore is the opportunity for a coalition which will secure the majority of mankind in this Dominion against the attempted domination of an organised minority following blindly the lead of a teacher imported from abroad insulting the population by the suggestion that it does not know enough to take charge of its own destiny. If Mr. Massey can engineer his way to a coalition on this line he will have a tenure of power practically permanent.

* * *

There is no satisfaction in following a great disaster with "I told you so." The only satisfaction possible in such circumstances would be on the part of the audience at seeing the prophet branded with a whip. But there is such a thing as justice even to one's self. In that spirit of justice we venture to remind our readers of something we said about the possibilities of the future when discussing the launch of the "Titanic" in our number of last August. Speaking of the alleged completeness of man's victory over nature as exemplified by this magnificent structure, we said: "All the forces of nature are at his command. Are they? Well, some day a rebellious berg, envious of the other berg (the berg that is spelt with a 'u,' and is warm and comfortable and handy), some rebel of that sort, will get in the way of your leviathan, and then!" We have only to add now that a berg did get in the way and—. The point is that the berg would spell disaster, and it did.

Now what is the moral of this disaster? Listen to Mr. Conrad, the writer of things maritime, a man with more force than Bullen, and more directness than Clark Russell, with practical knowledge equal to either one or the other or both; in short, a recognised high authority of the sea. He speaks in a recent writing of the "fatuous drowning of all these people, who to the last moment put their trust in mere bigness, in the reckless affirmations of commercial men and mere technicians, and in the irresponsible paragraphs of newspapers booming these ships." "Fatuous drowning" is good.

The first element of fatuity was the belief in the unsinkable character of the leviathan realise it when you read that poor Colonel Aster, replying to the survivor who advised him to "jump" with him and swim to the nearest boat, which was only half full, declared that only a fool would do such a thing because "this ship is unsinkable, Sir." Not long ago a report, supposed to be scientific, because made by men of "expert" reputation, engineers skilled in maritime construction and the incidental scientific formulae, was actually sent to the Board of Trade.

The Board shelved it, and it passed muster with the thoughtless world as an accepted demonstration. Do not, therefore, blame the poor Colonel. Moreover, the theory has its apologists even yet. After seventeen hundred of our fellow creatures went to their death on that awful night off Cape Race, fatuous people with long lines of alphabet after their names keep on declaring that if the ship had struck the berg end on all would have been well. They insist that the "Arizona" some years ago went full butt on to a berg and confined the damage to the fore compartment, being able to get into port all right.

Of course these things are a little mysterious. But the cases are not on all fours. The "Arizona" was under 5000 tons, and did not have a higher steam capacity than fourteen knots. Besides, she was not going full speed. On the other hand, take the "Titanic," with 45,000 tons going at not less than 21 knots, and probably much faster.

Take also the incident of the Wellington wharf some years ago. Our wharves are mighty structures of wood and iron, to which everybody points when descanting on the skill and success of Mr. Ferguson's work as engineer to the Wellington Harbour Board. A steamer, forging slowly up to her berth on one of these grand structures, took some eight feet out of it just as a child takes a semicircle out of a slice of bread and jam. In Sydney Mr. Conrad saw a similar trick precisely. A big liner coming to the Circular Quay, then a wood and iron structure, had got all way off her, falling short of the right distance from the wharf. Her skipper ordered a turn or two of the screw, and she got them. A pilot standing by said she would not crush an eggshell if she did foul the wharf. And then she fouled. It was a ramming effect, which ripped and tore and splintered the piles, stringers and baulks with the noise of a great tree crashed down by the gale.

Mr. Conrad asks what if the wharf represented an iceberg in a fog and a ship went end on to it at the most slow of fumbling feeling rates of speed. He says something would be damaged, but not the berg. We thus understand the hesitation with which the witnesses—experts—before the enquiry in London are hesitating to say anything about the unsinkable effect of compartments.

But "if the ship had struck end on it would have been all right." And how are you going to make sure of a strike head on? Are you to instruct the officers to that effect? Mr. Conrad in this connection grows prophetic, imagining a scene of the near future when things shall have developed according to present appearance of progress. It is an examination for Mate before the Board of Trade. Grizzled examiner speaking to applicant, young, innocent, rosy: "You are at night on the bridge in charge of a 150,000 ton ship with a motor track, organ lift, &c., &c., &c., &c., with a full cargo of passengers, a full crew of fifteen hundred cafe waiters, two sailors and a boy, three collapsible boats as per Board of Trade Regulations, and going at your three-quarter speed of say about forty knots. You suddenly perceive a berg on the bow. What would you do?" To which the applicant answers without hesitation, "Put the helm amidships in order to hit end on." So much for the "end-on" theory.

In this humorous skit we have other points of fatuity sketched for us. There is the boat fatuity with which the whole world is dealing, and there is the manning fatuity, under which the expert seaman is kept at as low a figure as possible and the land lubber element is put practically in charge of the ship. Had there been seamen enough in the "Titanic," it is said by experts, that with the existing appliances 500 more lives could have been saved. But there was no seamanship to rely on, or not enough, and the captain and officers had to look on helpless while precious minutes were flying past.

It reminds one of the recent description of our old friend Captain Crutchley. Most of us who were here twenty years ago remember the Captain as one of the most characteristic skippers of the N.Z. Shipping Co. Capable in action, picturesque in language, with an infinite contempt for everything at sea that pretended to be a sailor and wasn't. In a recent writing—for the Captain has devolved into a prolific writer of the magazine order, principally in connection with naval matters—he has spoken his very direct mind about the manning of great liners. "Run by a sort of hotel syndicate, composed of the Chief Engineer, the Purser, and the Captain," says the annoyed sailor, and observe he has, in the fineness of his irony, put the Captain last of the three. Well done, old "Trunnion!"

Mr. Conrad completes the picture by calling these leviathans "a sort of Marine Ritz, proclaimed unsinkable, and sent adrift with its casual population on the sea without enough boats, without enough seamen, but with a Parisian cafe and four hundred of poor devils of waiters to meet dangers which, let the engineers say what they like, lurk always amongst the waves, sent with a blind trust in mere material, light-heartedly to a most miserable, most fatuous disaster."

Nor is wireless excluded from this sweeping charge of utter mismanagement, which deals with ships not properly commanded, manned, or equipped, or even seeming to contemplate the rough troubles of the sea. It has been established by evidence that the vigilance of wireless does not extend through all the hours of the twenty-four. The operators go to bed like reasonable people on shore after closing their instrument and locking up for the night. The theory apparently is that if disasters will not confine themselves to reasonable hours they deserve to be neglected. Why, it is beyond doubt now that the operator on the "Carpathia" was within ten minutes of his bedtime. Hence if the "Titanic's" message had been ten minutes later the adherence of this man to his fatuous system would have cost the lives of all the people in the boats. Not a soul would have lived to tell the tale of the "Titanic." Fatuity, therefore, we see, though taking most prodigious toll of the "Titanic's" vast population by no means did its worst.

Moreover, if the weather had been bad, fatuity would have still further shone in the glare of preventible death, which in its bearing on the responsible shoulders is unpleasantly like unto murder. There were many men among those set to manage the boats carrying the rescued passengers who had never had an oar in their hands in their lives—some of the poor devils of cafe waiters who had been so punctiliously provided. Some women who knew how to handle oars actually took the work out of the hands of these incapables. Add to this insufficieny of boatmen, the insufficiency of boats, and the want of power—in these days of motor engines a want criminally inexcusable—and you realise the full extent of the fatuity of the modern system of sending ships to sea.

* * *

There are many kinds of change. At one extreme there is the change of which the fear perplexes monarchs"; at the other, change is but another name for progressive development. Between the two, our PROGRESS lies at the present moment a-thinking. We have made a mark with care and pain through good times and evil, and our success has been such that our friends have got accustomed to us as we are. They look for our monthly appearance in the familiar form, carrying the same pages, which have made many things interesting in architecture, engineering, aviation, astronomy and invention, shipbuilding, art, science, and many things more, all known to many readers of appreciation and sympathy. Thoughtful minds have, however, been struck with the idea of change. At first it was but a suggestion that the size of the page might be thought unwieldy, and this suggestion grew and grew until gradually it resolved itself into a conviction, the sort of conviction which asks questions with the air of infallibility: "Why not have a size that will go comfortably into your pocket."

Now the pocket argument is sometimes at the top of what the money market calls "The High Finance." It is high enough at all events to inspire respect in the average business breast. In that aspect the idea seems to make appeal to us. Not that we desire to reduce the volume of the reading given to our readers. That would be unprincipled as well as inexpedient, ungenerous and unprofitable. A change, however, would undoubtedly lend itself to a re-arrangement of the matter published, under which more variety could be given to the publication without trenching on the usefulness of the departments now having attention.

The new arrangement suggested to us would be to reduce the size and increase the number of pages in proportion. This would certainly favour multiplication of departments. We have considered the advisability of adding several new features. For example, to Architecture and Building on its present lines, we propose to add a special section about the home, well illustrated, so that those intending building may be kept well up to date in the numerous ideas, designs, etc., for outside appearance and inside comfort which are now so rapidly coming into vogue: The latter, we feel assured, will be of special interest to our lady readers. Another department relates to the motor industry and its developments, now very considerable. There are thousands of motorists in the Dominion to whom a section of the issue can be made intensely interesting. Frankly, on this subject of change or no change we should like a few hints and suggestions from our subscribers and readers as to what *they* feel on this important question.

We wish to draw attention to our voting paper on page 1162 of this issue, and trust that all our readers will register their votes.

Timbers of New Zealand

AND OTHERS.

The Timber Resources of New Zealand.

BY W. R. JOURDAIN, Department of Lands.

[*The publication of this article and the use of the illustrations has kindly been authorised by the Hon. Thomas Mackenzie, F.R.G.S., Minister of Lands and Commissioner of State Forests.*]

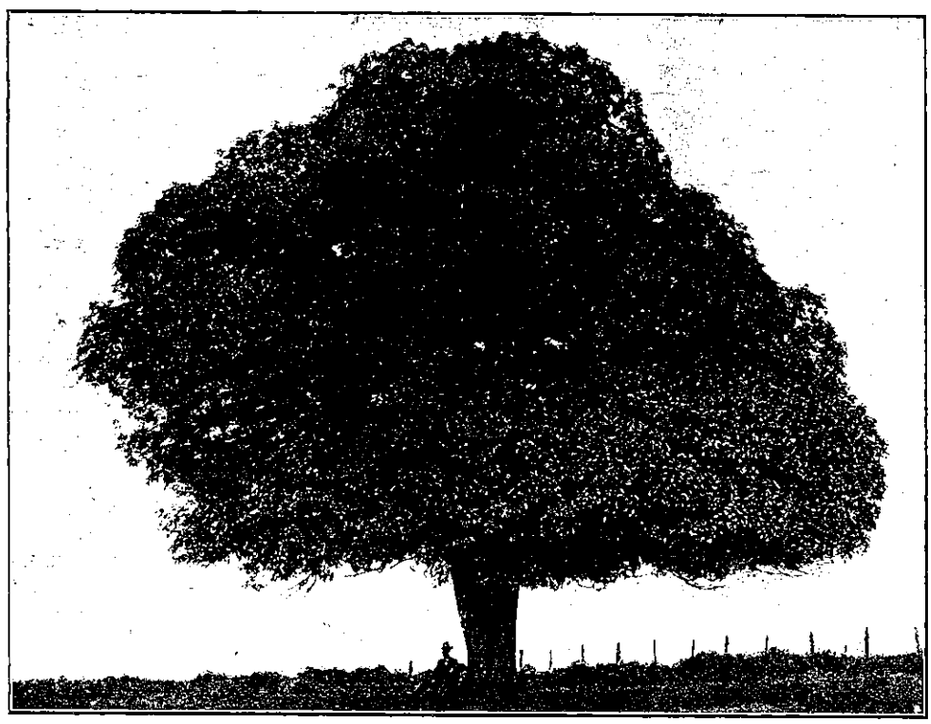
The question of the future supply of timber for commercial purposes is one of the most serious problems presenting itself to the nations of the world, and practically every country is viewing the future with doubt and dismay. The special position of New Zealand in this respect is endeavoured to be set forth in the following article.

Before going into this phase of the subject, however, it may be well to point out that the growth and preservation of trees is required by a nation for more than one purpose.

They comprise:

1. The supply of timber to the building and allied trades and for commercial purposes.
2. The maintenance of climatic equilibrium.
3. The protection of the soil, prevention of floods, and the supply of humus.

In this paper only the first requirement will be dealt with to any extent, but it may be well to emphasise the necessity of maintaining the equilibrium of climate. Although trees may not attract rain to any extent, yet they undoubtedly serve to precipitate rain from passing clouds and condense the moisture from mists and humid weather. In this way, they help to moderate the excessive heat and cold and act as a kind of break upon the extremes of temperature. Their chief function, however, is the protection of the soil. When a heavy rainfall occurs on exposed country, its tendency is to sweep the surface soil into gullies and streams, and the rain may not penetrate deeply into the earth. A heavy downpour may swell the volume of water in a neighbouring river many feet, but if the sun shines soon afterwards the earth is little affected as the rain has probably not penetrated sufficiently into it. The loose soil on the surface, however, has been swept into the bed of the adjacent streams, and in this manner the bed constantly rises, thereby causing successive floods in the rainy season, whilst the river requires the erection of stop banks, or periodical dredging to keep the channel sufficiently deep to contain the ordinary volume of water, together with the occasional rise after heavy rain. Such flooding through denudation of the soil has caused immense damage in China, and most of the countries of the Old World, and even in New Zealand, the lower reaches of the Wanganui, Manawatu, Oroua, Tutaekuri and Rangitikei, etc., periodically show the disastrous effects that follow when the head waters of the rivers and streams and the land surrounding same, are cleared of their natural covering to a large extent. Forests act as vast natural sponges, collect the rainfall, conserve it for days and weeks afterwards, and forest streams seldom overflow, seldom require clearing, and yet are always fairly full of water. Consequently, the surrounding country derives advantage from the presence of forests around the head waters of streams as well as along their banks. However, to pass to the subject of this article.



PURIRI (*Vitex littoralis*).

Present Timber Supply in New Zealand.

The Department of Lands and Survey has from time to time published reports on the timber industry, and from estimates made by its officers at various times, the following information is gathered.

In 1905 it was considered that there was then standing on Crown lands milling timber to the extent of over 20,000,000,000 sup. ft., and a little over 21,000,000,000 on private and native lands, making a total of forty-one thousand million superficial feet. At that time the total output from the sawmills of the country was a little over four hundred million superficial feet per annum, and it was considered that there might be sufficient timber to last the country (with prudence) seventy years.

In 1907 the estimate of timber was 36,000,000,000 sup. ft., a decrease of more than five thousand million super. ft., and the annual output had increased to 432,000,000 sup. ft. In consequence of a more detailed inspection of the forests and the milling timber therein, the official estimate was a future supply of less than 70 years, possibly to a considerable extent.

In 1909 a very extensive report, entitled "Forestry in New Zealand" was published, giving much valuable information. It was then found that out of the total area of 66,568,876 acres in New Zealand, the area under forest was 17,074,003, of which over two million acres comprises national parks (such as the West Coast Sounds area, Arthur's Pass, Egmont, &c.) scenery and climatic reserves, and that there was then growing within the Crown and State forests and on private and native freehold lands, a total of about 33,000,000,000 sup. ft. that might prove suitable for commercial purposes. The annual output was still well over four hundred million feet, and it was estimated that only one-half of the timber just mentioned was likely to be used for commercial purposes and available for sawmilling, the remaining timber comprising birches, miro, tawa, rata, kowhai, &c. (10,664,382,948 sup. ft.), whilst a large portion of other timber was situated on land difficult of access and unprofitable for working at the present time.

The felling and removal of trees for timber purposes is sometimes a very costly process, judging by the remarks made by Mr. J. R. Reed, in a timber transaction case heard at the Supreme Court at Auckland. Mr. Reed stated that when a kauri tree was in an almost inaccessible place—for instance, in a deep gully, it would be necessary to erect plant and hauling gear costing £50 to remove the tree, whereas the timber when cut

up and placed on the market, might only realise the sum of £20.

The output in 1909 was expected to gradually increase to 450,000,000 sup. ft. during the next generation, and to 500,000,000ft. at the end of twenty-five years.

The estimated probable duration of the timber supply from the native forests of New Zealand was then reduced to between thirty-five to forty years, but as large supplies may be expected from abroad during that period, the term may be extended to perhaps fifty years.

In 1909 there were thought to be 15,000,000,000 sup, ft. of rimu in our forests suitable for sawmilling; 2,500,000,000 kahikatea; 570,000,000 sup. ft. totara; 485,000,000 sup. ft. kauri; and 3,423,000,000 sup. ft. matai. The remainder of the timber was birches and miscellaneous.

There were then 423 sawmills working in the Dominion, whose estimated cutting capacity was 755,465,480 sup. ft. per annum.

The latest figures taken from the Census of 1911 are: —

Sawmills and Sash and Door Factories.—534 in number, as against 334 in 1900; hands employed, 6871 male and 6 female; wages paid, £774,402; horse-power 19,484; total cost of materials operated on, £1,253,153; quantity of sawn timber manufactured, 296,033,017 sup. ft., valued at £1,725,827; total value of manufactures, £2,699,888, as against £1,268,689 in 1900.

MATAI-TREE, SEAWARD FOREST.

Characteristics of New Zealand Forests.

The New Zealand forests contain an immense variety of trees of all descriptions, but with one or two features common to all. There are estimated by botanists to be no less than 86 different species of trees, although several of them are different varieties of the same tree, but practically there are at least seventy quite distinct trees. Now their common features are these:—

The timber trees are all evergreens, there not being a single deciduous tree amongst them. No matter at what time of the year you visit a New Zealand forest, it always presents the same appearance, a sombre, dull green relieved at times by the presence of young trees, which present a much lighter shade of green, and diversified by the flowers that appear on certain trees and plants such as the rata, pohutukawa, clematis, etc. They are all slow-growing, and in this respect compare unfavourably with timber trees of other countries. For instance, it is estimated that the manuka (or tea-tree) takes from 100 to 250 years to attain maturity; the rata from 200 to 450 years; the totara 470 to 800 years; the matai 270 to 400 years; the kahikatea 370 to 600 years; the rimu 400 to 650 years; and so on, whilst the giant kauri, now fast vanishing, is estimated to take from 600 to 3,600 years to reach its full growth.

The bulk of the indigenous forests are now to be found in the Waimarino, Nelson, Motu, Westland, and parts of Auckland district. Although forests still grow in other districts they are not very large and except on the mountains of the Tararuas, Ruahines and Kaimanawas, do not cover much area.

Supplies from Abroad.

But whilst New Zealand has been drawing largely on its timber supplies, almost every other country in the world has acted in a similar manner, and the same problem that now confronts us is facing the statesmen of other nations. An article on the "Forest Resources of the World," by Raphael Zon, Chief of Silvics for the United States, gave the following particulars regarding European countries that export timber.

Austria-Hungary is the greatest wood-exporting country in the world. The Austrian forests comprise chiefly spruce, pine, and fir, whilst only one-sixth of the wooded area is under hardwoods, comprising oak, maple, beech, birch, locust and alder. The Hungarian forests contain oak, beech and other hard woods, pine, spruce, birch, poplar, willow. The annual export of timber between 1895 and 1899 averaged 320,000,000 cubic feet. Sweden is the next great timber exporting country in Europe, nearly one-half of its area of land being under forest. The total timber exports (including for wood pulp purposes) averaged 350,000,000 cubic feet per annum. Conifers occupy 80 per cent. of the forest area, being mostly spruce pine.

Norwegian forests occupy over sixteen million acres, or 21 per cent. of the whole area. Coniferous forests comprise 75 per cent. About 69,000,000 cubic feet are exported. Finland also has large forests, occupying 52,500,000 acres, composed almost entirely of pine, spruce, birch, and to some extent, alder. The exports average

140,000,000 cubic ft. per annum. Germany has nearly 35,000,000 acres under forest, of which two-thirds comprise conifers and one-third hardwood. In spite, however, of the increasing growth of the State forests, the empire is unable to supply its own needs for sawn timber. Since 1863 the imports have exceeded the exports and the difference between them has been growing rapidly. The remaining countries of Europe are in the same condition and need not be regarded as being in a position to supply timber save in comparatively limited quantities and at a fairly high price.

Canadian Timber Supplies.

The Canadian forests are stocked with a large number of species, among which the three most important are white pine, found in the south-east part of the Dominion; spruce, occurring over large areas; and Douglas fir, found principally in British Columbia. The principal forest areas are in the eastern and western provinces.

The Year Book of British Columbia for 1911 states that it is estimated that British Columbia, with a total of some 240 billion feet of standing merchantable timber, possesses half the forest wealth of Canada. During 1910 the approximate cut of mills in that province was 1,040,000,000 feet, representing an increase of 300 per cent. since 1903. The foreign shipments in 1910 included 38,885,206ft. to Australia; 12,597,770 to Africa; 11,317,006 to South America; 3,213,308 to the United Kingdom; 878,786 to New Zealand, with others making a total of 72,967,761 feet for the year, showing an increase in five years of 21,389,873 feet.

The principal trees are the Douglas Fir (or Oregon pine), which is most abundant and is the most valuable tree is British Columbia. The largest trees are found near the coast, where trees of 300 feet are not rare, the average height of those felled for lumber, being 150 feet. It is chiefly valuable for structural purposes, being largely employed in ship-building, bridge work, and the construction of wharves. Its durability, when excluded from the air, adds greatly to its value for pile work in the construction of bridges and wharves.

The next in importance is the giant *arbor vitae*. It is seldom found more than 150ft. in height. It is chiefly used for the manufacture of shingles, for which purpose it is unequalled. The wood of the tree takes a brilliant polish. So great is the variety of shading in the colour of the wood that a large house may be finished in it without any two rooms being alike. It enters largely into the manufacture of doors and cabinet work of all kinds. Like all the cedars, it lasts well underground.

The yellow cypress is valuable for many purposes, but is not extensively used at present, the cost of transportation to the seaboard being too great. It is used for interior finishing and furniture, and commands a higher price than the foregoing timbers.

The western white pine, the black pine, the Engelman spruce, the Menzies spruce, the Sitka spruce, the western hemlock and other varieties of trees are also much used locally. The aspen poplar and broad-leaved maple are widely distributed and much in demand. The western larch, balsam fir, bull (or heavy) pine, are plentiful and used in minor quantities.

The natural advantage of British Columbia in many markets is obvious, and with the rapid development of Pacific commerce it may be assumed that within a short period its manufactured products will find conditions favourable to that profitable exchange of commodities which is the basis of success, and that with the development of pulp and paper, iron and steel shipbuilding and other industries, those markets will respond to the naturally favourable situation geographically, which exists.

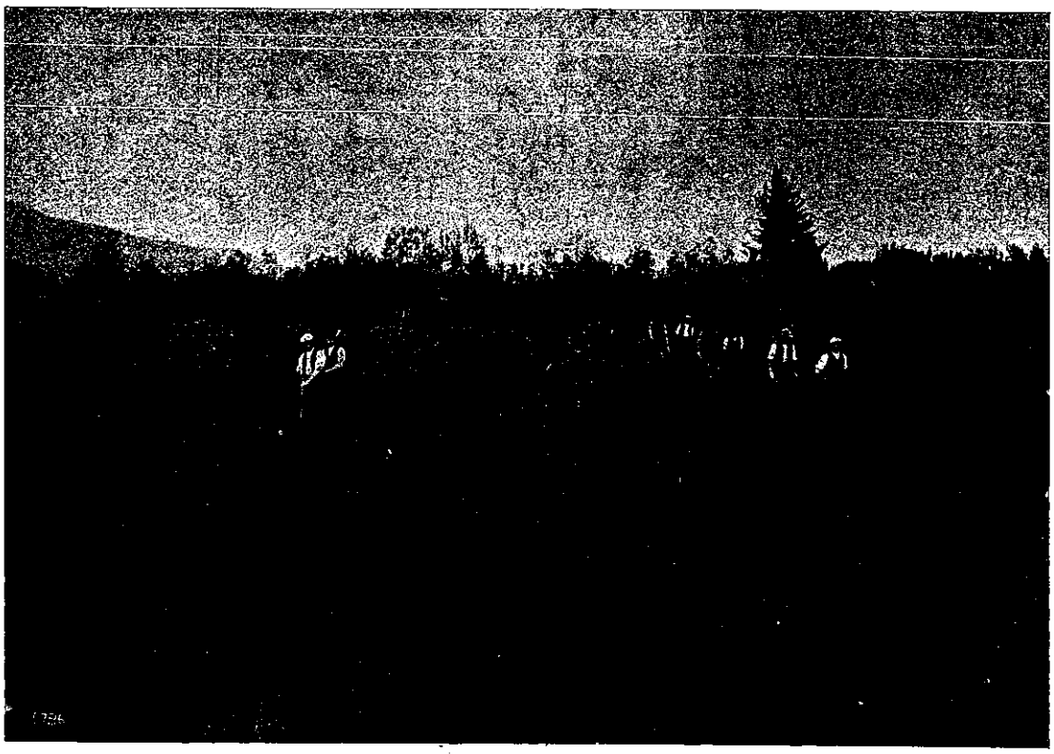
Principal Australian Timbers.

The principal Australian timbers used in New Zealand for building and constructional purposes, may be said to be the jarrah and karri. The following notes thereon may therefore be of interest:—

As it is always more or less difficult for anyone not constantly dealing with the two timbers (when cut) to surely distinguish one from the other, the following test is a very simple one and is fairly accurate. A splinter struck from jarrah and placed in a flame, generally burns to a firm black ash; one from karri to a somewhat woolly white ash, also when the flame is blown out, karri tends to glow for some little time, jarrah to go black out quickly.

Jarrah weighs about 70lbs. per cubic foot when first cut, and about 60lbs. when seasoned. The wood is of a reddish colour, very hard and dense, generally

A KAHIKATEA (*White pine*).

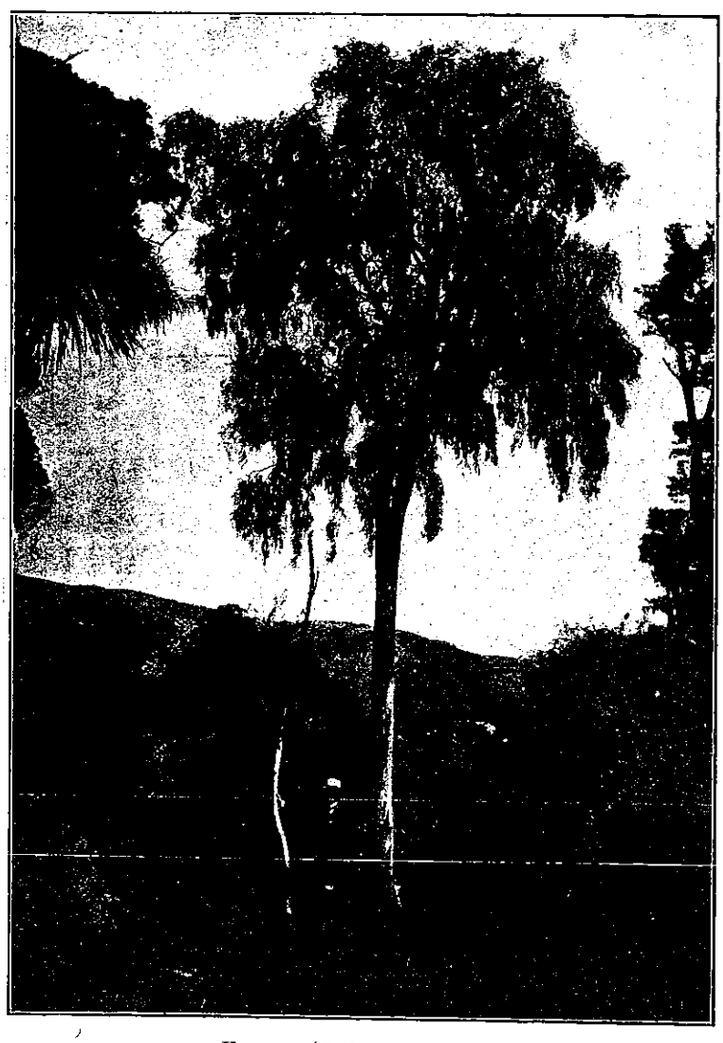


MACHINE AND DUTCH-HOEING LINED-OUT TREES.

straight in the grain, with moderately interlocking fibres, and shows very little sapwood, generally under 1 inch.

Karri weight about 63lbs. per cubic foot when fairly seasoned.

Jarrah is most generally employed for railway construction, sleepers, marine and engineering works, and building construction and is specially suitable for underground use, and where in contact with wind and water. Piles in river bridges erected 54 years have been withdrawn and found perfect in every respect. It cannot, however, be said that it would withstand the attack of the *teredo navalis*.



KOWHAI (*Sophora tetraptera*).

Karri is largely used for car and waggon frames, bridge timbers, flooring, planking, telegraph pole arms, fruit cases, and street paving blocks, being considered by many equal to jarrah in this respect.

Tuart is used in the framework of railway waggons, buffers, ship's beams, bridge supports, deck planks, etc., and especially in wheelwright's work.

Wandoo is deemed equal to jarrah for railway sleepers, also used for short piles, bridge and wharf planking, etc.

Full information regarding Australian timbers suitable for commercial requirements may be obtained from Messrs R. Dalrymple Hay, Director of Forests, Sydney; H. McKay, Conservator of Forests, Melbourne; W. Gill, Cons. of Forests, Adelaide; and N. W. Jolly, Director of Forests, Adelaide.

Heartwood and Sapwood.

Contrary to general practice in the case of other chief timbers of the world, the heartwood core of the eucalypti is to be avoided. Specifications for cut timber should, therefore, require freedom from heartwood, except in the case of piles, which are better round than squared. Sapwood, on the other hand, rarely measures above an inch in thickness and being often as hard as the inner wood, hardly needs to be particularly excluded except in cases of special importance. It is preferable to season all eucalyptus timber for at least twelve months prior to using.

Other Australian Timbers.

The following information has been obtained from the Forest Department, Sydney. Samples of the undermentioned woods are available for inspection at the Public Works Office in Wellington.

Apple-tree (*Angophora intermeda*).—Timber strong, tough, heavy and durable; subject to gum veins; used for naves of wheels, etc. Plentiful supply.

Blackbutt (*Eucalyptus pilularis*).—Timber strong, sound, hard, heavy and highly esteemed for house-carpentry, shipbuilding, bridge planking, street-paving blocks, etc., and is about equal in strength to rough ironbark. Suitable for export for railway sleepers. Plentiful.

Brush Box (*Tristiania conferta*).—Timber strong, hard, close-grained and durable; a much valued timber, and not likely to be attacked by white ants etc. Ribs of vessels constructed of this wood have kept perfectly sound for upwards of 30 years. Paving blocks. Extensively planted as ornamental shade tree. Plentiful.

Gum, grey (*E.propinqua*).—Timber resembles grey ironbark, hard, heavy, tough, strong, inlocked and durable; used for poles and shafts of carriages, spokes of wheels, railway sleepers, posts, felloes, shingles, etc. Plentiful.

Gum spotted (*E.maculata*).—Timber strong, elastic, and durable (free from sapwood); used for ship-building, naves of wheels, cart and buggy shafts, street paving blocks, etc. Timber splits well and the bark is beautifully spotted. Plentiful.

Ironbark (*E.paniculata*).—Timber much valued; hard, tough, strong, interlocked and durable; used for bridges, sleepers, railway carriages, beams, poles, building girders, etc. Fairly plentiful.

Ironbark, red (*E.siderophloia*).—Timber highly esteemed for strength and durability; much used for large beams, girders, sleepers, dray poles and other purposes for which timber of great strength and durability is required. Plentiful.

Mahogany, red (*E.rosinifera*).—Timber tough, durable; used for staves of casks, shingles, palings, rough buildings and paving blocks. Fairly plentiful.

Mahogany, white.—(*E.acmenioides*).—Timber pale, hard, heavy, close-grained and durable; used for posts and rails of fences, house and ship-building, plough beams,

piles, girders and paving blocks, etc. Fairly plentiful.

Mountain Ash, or Cugerie (*Flindersia australis*).—Timber white, hard, tough, close-grained and durable; used for building purposes, etc. Fairly plentiful.

Tallow-wood (*E.microcorys*).—Timber strong, hard and durable, and of a greasy nature, as local name implies; used for boat building, flooring boards and general building purposes. Not liable to shrink. Fairly plentiful.

Turpentine (*Syncarpia laurifolia*).—Timber exceedingly hard, heavy, close-grained and durable; used for piles and posts, for which it is said to be almost imperishable, being impervious to the Teredo Navilis. Plentiful.

At the present time 16,703,500 acres in Australia are specially reserved for timber, but the total forest area is 102,000,000 acres, although it is estimated that a larger area is more or less wooded. In 1909 the Commonwealth exported over 150,000,000 sup. ft. of timber, of which New Zealand was credited with only 25,423 sup. ft.; the only country, however, that received a larger amount was India, with 55,363ft. In the same year, New Zealand exported 69,959,470 sup. ft. into Australia, so that the balance of trade is largely in our favour.

WEIGHTS AND STRENGTHS OF TIMBERS USED BY NEW ZEALAND RAILWAY DEPARTMENT.

Timber		Weight per Cubic Foot Lb.	Strength Lb.
AUSTRALIAN ...	Ironbark ...	72	260
,, ...	Spotted Gum ...	64	220
,, ...	Blue Gum ...	64	210
,, ...	Karri	...	260
,, ...	Jarrah	61	170
TASMANIAN ...	String Bark ...	...	210
NEW ZEALAND ...	Maire	72	240
,, ...	Black-birch ...	49	160
,, ...	Red-birch ...	40	150
,, ...	Tawa	...	160
,, ...	Matai	47	140
,, ...	Kauri	30	130
,, ...	Totara	36	120
,, ...	Red-pine ...	38	120
,, ...	Silver-pine ...	...	120
,, ...	White-pine ...	29	100
AMERICAN ...	Oregon ...	36	130

Note.—The factors of strength represent the weight in pounds which will break a beam 1 foot long x 1 inch x 1 inch section fixed at one end and loaded at the other. The factors assumed are the results of a number of experiments.

STRENGTH OF TIMBERS.

Timber	Tension: Breaking weight in Pounds per Sq. In.	Compression: Breaking-weight in Pounds per Sq. In. End Grain	Compression: Breaking-weight in Pounds per Sq. In. Across Grain	Shearing Breaking-weight in Pounds per Sq. In. Parallel to grain
AUSTRALIAN—				
Ironbark ...	14,000	10,000	4,592	2,150
Spotted Gum...	10,300	6,700		1,600
Blue Gum ...				
Karri	7,000	7,000	2,568	...
Jarrah	12,000	...	...	1,835
TASMANIAN—				
Stringy Bark ...	...	...	...	...
NEW ZEALAND—				
Maire	...	...	...	...
Black-birch ...	...	...	...	...
Tawa	...	...	...	...
Matai	8,000	8,000	2,486	...
Kauri	10,000	7,000	2,240	...
Totara	6,000	6,000	2,240	...
Red-pine ...	11,000	7,500	2,867	...
Silver-pine ...	...	...	...	...
White-pine ...	10,000	7,000	1,658	...
AMERICAN—Oregon	11,000	6,000	...	600

TABLE OF STRENGTH OF PILLARS.—IRONBARK.

Ultimate crushing load per square inch = 10,000 lbs.
Factor of safety 8. Tabular Nos. in tons.

Length Pillar Feet	Lesser Breadth of Pillar in Inches: 3	4	5	6	7	8	9	10	12	14	16	18
1 ..	1 67	2 23	2 79	3 35	3 91	4 46	5 02	5 58	6 70	7 81	8 93	10 04
2 ..	2 48	3 10	3 72	4 35	4 91	5 66	5 02	5 58	6 70	7 81	8 93	10 04
3 ..	1 80	1 93	2 64	3 10	3 78	4 46	5 02	5 58	6 70	7 81	8 93	10 04
4 ..	1 11	1 73	2 38	2 95	3 60	4 21	4 84	5 58	6 70	7 81	8 94	10 04
5 ..	0 93	1 54	2 17	2 79	3 40	4 02	4 64	5 26	6 51	7 81	8 93	10 04
6 ..	0 78	1 35	1 97	2 60	3 22	3 84	4 45	5 09	6 32	7 57	8 93	10 04
7 ..	0 68	1 19	1 78	2 40	3 03	3 66	4 28	4 89	6 13	7 37	8 61	10 04
8 ..	0 45	1 08	1 61	2 21	2 84	3 47	4 08	4 71	5 91	7 19	8 42	9 67
9 ..	0 39	0 91	1 44	2 03	2 65	3 27	3 90	4 52	5 76	6 99	8 28	9 47
10 ..	0 55	0 66	1 30	1 86	2 47	3 09	3 71	4 33	5 59	6 80	8 01	9 20
11 ..	0 29	0 60	1 17	1 70	2 29	2 89	3 51	4 14	5 39	6 63	7 86	8 10
12 ..	0 29	0 53	1 05	1 55	2 11	2 71	3 32	3 94	5 20	6 44	7 67	8 90
13 ..	0 21	0 47	0 97	1 42	1 96	2 55	3 14	3 75	5 00	6 26	7 50	8 72
14 ..	0 19	0 41	0 79	1 30	1 01	2 37	2 96	3 57	4 81	6 08	7 31	8 55
15 ..	0 17	0 37	0 66	1 13	1 66	2 22	2 79	3 39	4 62	5 89	7 12	8 37
16 ..	0 15	0 33	0 60	0 94	1 56	2 07	2 62	3 21	4 48	5 68	6 93	8 17
17 ..		0 54	0 54	0 86	1 42	1 94	2 49	3 05	4 25	5 48	6 83	8 00
18 ..		0 27	0 49	0 79	1 28	1 82	2 33	2 89	4 06	5 30	6 54	7 80
19 ..		0 24	0 45	0 73	1 07	1 80	2 20	2 74	3 89	5 10	6 35	7 59
20 ..		0 22	0 41	0 67	1 00	1 59	2 07	2 59	3 72	4 98	6 16	7 42

NEW ZEALAND TIMBER.

Ultimate crushing load per square inch = 6,000 lbs.
Factor of safety 8. Tabular Nos. in tons.

Length Pillar Feet	Lesser Breadth of Pillar in Inches: 3	4	5	6	7	8	9	10	12	14	16	18
1 ..	1 00	1 34	1 64	2 01	2 34	2 68	3 01	3 35	4 02	4 69	5 36	6 03
2 ..	0 90	1 20	1 50	2 01	2 34	2 68	3 01	3 35	4 02	4 69	5 36	6 03
3 ..	0 84	1 01	1 40	1 80	2 21	2 69	2 01	3 35	4 02	4 69	5 36	6 04
4 ..	0 50	0 65	1 24	1 60	2 01	2 40	2 81	3 35	1 02	4 69	5 36	6 03
5 ..	0 89	0 70	1 06	1 43	1 81	2 20	2 60	3 01	3 81	4 69	5 36	6 03
6 ..	0 30	0 58	0 92	1 27	1 65	2 02	2 40	2 80	3 61	4 42	5 36	6 03
7 ..	0 24	0 48	0 79	1 12	1 49	1 86	2 24	2 61	3 40	4 21	5 03	6 03
8 ..	0 24	0 40	0 69	0 99	1 34	1 70	2 07	2 45	3 20	4 02	4 81	5 63
9 ..	0 23	0 34	0 58	0 87	1 20	1 55	1 91	2 28	3 03	3 80	4 62	5 41
10 ..	0 20	0 32	0 51	0 77	1 08	1 41	1 77	2 12	2 87	3 62	4 40	5 20
11 ..	0 17	0 32	0 46	0 68	0 97	1 28	1 62	1 97	2 71	3 46	4 21	5 02
12 ..	0 15	0 31	0 40	0 61	0 87	1 17	1 49	1 88	2 55	3 30	4 04	4 80
13 ..	0 13	0 28	0 40	0 54	0 78	1 06	1 37	1 70	2 40	3 14	3 88	4 63
14 ..	0 11	0 25	0 40	0 48	0 71	0 97	1 26	1 57	2 25	2 97	3 72	4 42
15 ..	0 10	0 22	0 39	0 48	0 64	0 89	1 16	1 46	2 12	2 82	3 56	4 30
16 ..	0 09	0 20	0 36	0 48	0 59	0 81	1 07	1 35	1 98	2 68	3 40	4 14
17 ..		0 18	0 32	0 47	0 56	0 74	0 99	1 26	1 87	2 53	3 25	3 99
18 ..		0 16	0 30	0 47	0 56	0 68	0 91	1 17	1 75	2 41	3 10	3 82
19 ..		0 15	0 27	0 44	0 56	0 65	0 85	1 09	1 65	2 27	2 96	3 67
20 ..		0 13	0 25	0 40	0 55	0 64	0 78	1 01	1 54	2 16	2 82	3 53

To ascertain the safe load in tons for a pillar, take out the tabular No. for length and lesser breadth, and multiply by the greater breadth in inches.

Afforestation in New Zealand.

The question has frequently been asked, what is being done to grow timber to replace the vast heritage now being destroyed, either by way of sawmilling for commercial purposes, or for the purposes of settlement. New Zealand was the first of the Australasian States to face the problem. In 1896 a Forestry or Afforestation Branch of the Department of Lands and Survey was established, and year by year its operations have grown in importance. Beginning with a nursery at Tapanui, in Otago, a modest commencement was made with the business of tree raising and tree planting. Another nursery was soon started at Eweburn, and a third at Whakarewarewa, near Rotorua, in the North Island. Coincident with these nurseries plantations were begun in localities adjacent to the nurseries. Continued experimenting and watchfulness soon demonstrated what were the best kinds of trees to grow, and the annual report of the Afforestation Branch, presented to Parliament last year, showed the following results:—

Nurseries.

	Output of Trees since 1896	Trees in Nursery March 31st, 1911
Rotorua ...	28,399,975	8,937,630
Tapanui ...	9,174,036	6,350,545
Eweburn ...	1,986,107	1,750,265
Hanmer Springs	4,867,705	4,722,200

Besides the above, nurseries were started at Ruatangata (near Whangarei), Starborough (in Marlborough), and Kurow (in Otago), but have been discontinued through various causes. The cost of raising trees in the nurseries until they are ready for planting, has averaged £2 4s. 9d. per thousand.

Plantations.

	Area Planted Acres	Trees in Plantation
Whakarewarewa ...	4,634	9,640,636
Waiotapu	5,423	13,926,254
Puhipuhi	1,200	1,000,000
Dusky Hill	845	2,180,837
Conical Hills ...	1,895	5,164,862
Gimmerburn ...	173	152,896
Naseby	260	682,204
Hanmer Springs ...	1,452	3,951,951
Raincliff	205	50,000
Dumgree	209	569,640
Waitahuna	11	30,525
Totals ...	16,311	37,349,805

RIMU (*Red pine*), WAIMARINO FOREST.

It must not be overlooked that afforestation work provides a great amount of employment for comparatively unskilled labour, particularly in the winter months, when employment is scarce else where, whilst it is also a profitable commercial undertaking for the State.

In raising our future forests, much care and discrimination must necessarily be exercised in selecting suitable trees. Two things have to be taken into account. First, the trees must be relatively quick-growing, and secondly, they must be suitable for commercial and general requirements. The tree most in favour is the European larch, which takes about 70 years

LOG HAULING AT ARNOLD MILL, SHOWING WIRE ROPE.

KAURI LOGS AT MATAKOHE.

LARCH PLANTATION, WHAKAREWAREWA.

to attain maturity and it is estimated that in fifty years' time an acre planted with larch would contain 30,000 sup. ft., whilst in seventy years' time there would be about 40,000 sup. ft. of good, sound timber. The ordinary pine yields an equal amount, but the Douglas Fir is expected to produce nearly 50,000 sup. ft. in fifty years' time. Eucalypti have in many instances produced 100,000 sup. ft. per acre on exceptionally favourable soils, but the average yield is from 10,000 to 40,000 ft. per acre.

To show the difference in rates of growth between New Zealand and foreign trees, the following comparisons of plants raised in this Dominion, will be of interest:—

The matai (or black pine), at 7 years of age was only 19in. high, and when 24 years old had reached 14 feet.

The yellow pine was 42 inches high at 7 years.

The kauri was 8 inches high when 7 years old, and 36ft. high when 24 years old.

The rimu was 27 inches high at 7 years, and 35ft. at 27 years.

Foreign trees, on the contrary, were above expectation:—

The English sycamore at 7 years had reached 13 ft., and the English ash 12 ft.

The European larch at 7 years had reached 20 feet, and 36 feet at 10 years.

The Austrian pine at 7 years had reached 9 feet, and 22 feet at 10 years.

Pinus radiata, or *insignis*, was 35 feet high at 6 years of age. Eucalyptus was over 30 feet, high when 13 qears old, and the Douglas fir 10ft. high at 7 years of age. the Douglas fir 10 feet high at 7 years of age.

In addition to being so much quicker growing, some of the foreign trees, being deciduous, yearly shed their leaves, which combine with the soil to form a magnificent humus, and when an artificial forest is finally cut out, the ground below will be immensely enriched by the addition of such valuable covering to the original soil, which in our plantations, is frequently of a light or poor nature. Consequently, the plantations do good in more ways than one.

The present rate of afforestation provides an annual crop of from nine to fifteen million trees in the State nurseries, most of which are subsequently available for planting out in the State plantations. The area annually planted averages from two to three thousand acres.

The kinds of trees chiefly grown in the State nurseries and plantations, are as follow:—

European larch (*larix europaea*), of which 13,097,915 are in plantations in the North Island, and 4,773,361 in South Island plantations. When matured, it can be used for fencing, pit-props, gates, etc., and is a splendid timber for general farming purposes.

Corsican pine (*pinus laricio*), there being 4,039,785 planted in the North Island, and 2,343,609 in the South. Like all the pines in our plantations, the timber can be used for building construction, poles, scaffolding, joinery, etc. It is said to produce valuable timber ac 40 years of age.

Heavy pine (*pinus ponderosa*), of which 1,352,850 are in North Island plantations and 602,986 in the South.

TOTARA *Podocarpus totara*), PEEL FOREST.

Oregon pine, or Douglas Fir (*pseudotsuga taxifolia*), are also planted, there

Austrian pine (*pinus austriaca*), to the number of 1,368,630, are planted in the North Island, and 1,634,524 in the South. being 238,470 in the North and 207,205 in the South. Its use is well-known in the Dominion as building material. It may also be used for ship's masts, etc.

Norway spruce or fir (*picea excelsa*), is grown to the extent of 195,025 in the North, and 1,187,225 in the South. It may be used as moulding-poles, flooring, paper pulp, etc.

Eucalyptus has been planted to the number of 3,039,642 in the North Island, and 4,250 in the South.

Bentham's pine (*pinus Benthamiana*), to the extent of 257,875 are in North Island plantations, and 140,400 in the South.

English oak (*quercus pedunculata*), are in South Island plantations only, there being 376,550 planted there.

English ash (*fraxinus excelsior*), is planted in the South Island to the extent of 432,560.

Other well-known timber trees, planted in smaller quantities than the above, include blackwood, silver birch, *pinus radiata* or remarkable pine (known here as *pinus insignis*), Weymouth pine, redwood of California, black locust, sycamore, and numerous others.

When considering the number of trees planted in our State plantations, it is well to remember that they do not represent by any means the final crop. Trees are planted very close to one another, there being about 2,700 larch or 2,500 pine to the acre. Repeated thinnings will eventually reduce the crop to about 800 in the case of larch and from 600 to 800 in the case of pines at the end of fifty or sixty years, and it is only this final number that attain full maturity. Consequently, when dealing with the results of the Afforestation Branch it is better to take the *acreage* planted as the basis of reckoning, and *not* the number of trees.

Present Position.

In conclusion it may be pointed out that the present position of the timber industry in New Zealand, is this. The supply of timber from the native forests alone is estimated to last from 35 to 40 years. From abroad we may draw upon Australia, the United States, and Canada for many years yet and possibly from Siberia and Manchuria, although importations from these countries so far have been small and not as satisfactory as was anticipated. As a last resource, the timber from our artificial forests will in another fifty years' time considerably swell the available supply, and if the present planting operations are extended in the future, they will undoubtedly to a large extent solve the difficulty of procuring timber for commercial requirements in this Dominion.

The Electric Drive in the Sawmill.

Every experienced owner or manager of a sawmill knows that no absolute rule can be laid down, out of hand, as to the advantages of one form of drive over another. He is already well aware that each case—his own included—presents its peculiar problems; and that every method of driving machinery is to be judged not from the point of view of absolute efficiency and as applicable everywhere, but solely on its merits with regard to the particular conditions under which it is proposed to apply it. He knows that if there were a form of drive in existence which possessed the tremendous advantages over the steam or gas engine drive which these possess over hand labour, both he and everyone else who could afford it would have long ago adopted it. It is not pretended that the electric motor is such a form of drive, neither is there any immediately likelihood of such a form of drive being discovered. Of all this the business man is well aware. But he is aware of more than this. If he understands his machines—and any owner or manager of machinery who does not understand his machines might as well shut down at once—he knows what they are doing: he knows how much power, or, in other words, money and labour, he has to put into them, and how much work they are giving him in return. Such a man can grasp at once the importance of savings. If he is keen on making his business pay a good dividend, he will not mind doing a lot of thinking and going to a lot of trouble to find out where the savings can be secured, for he knows that it is the savings that chiefly count. The late millionaire, Russell Sage, used to say that any fool could earn a dollar, but it took another sort of man to save one. The New Zealand business man knows that just as well. Electricity owes a good deal of its success in driving saw-mill machinery to his keen appreciation of that fact; for in the case of saw-mills electricity is a great saver. It is on this quality and in this instance that the strongest claims on its behalf may be made. The conditions need only be studied in order to get the highest saving power out of electricity.

Electricity is a great saver in all those cases where the drive is intermittent as in sawmills. Its chief saving power may be said to lie here, whether the current come from the mains of a Corporation or Company, at, say, 1½d. a unit, or whether it be generated by the owner's private plant. It stands to reason that if a machine is running for only part of a day, it is cheaper to shut off the source of power from it the moment it is not wanted than to keep that source going all day. This is the simple case of electricity *versus* the steam or gas or oil engine drive. The steam or gas engine must be kept going so long as any machinery in the factory is running and demanding power. What is the saving here? Precisely the proportion of fuel or steam and shafting and belting, with the wear and tear on them and the boilers and the piping, and the cost of attendance, which that machine, if running, would take from the entire plant; for that proportion is being wasted while the machine is idle. An electric motor in its place, shut down and at rest, saves that proportion. Multiply whatever is calculated to be that proportion by the number of hours it occurs every working day of the year, in time and for overtime, and the figure saved will usually startle even the hard-headed business man. Yet this leaves entirely out of account the risk of a break down in the engine room. Suppose that to occur—and it is not infrequent—a day or even two days may be lost putting things right, the factory meantime standing idle.

The next great saving which the electric motor yields occurs in cases where the works have not been properly or cannot be conveniently grouped round or close to the central steam engine plant—where, in short, the buildings are scattered, as they frequently must be in sawmills, either through wrong initial design or through their having overgrown the original design. In such cases there are two main items of loss of which the manager of the sawmill run on a steam or gas plant has to take his choice. He must consider whether longer line of shafting, heavier belts, and a larger number of heavy gear wheels, with

POHUTUKAWA TREES, NEAR WAIWERA.

the increased consumption of steam or gas they demand, are worse evils than putting auxiliary engines down in various positions, and the consequent waste of steam in the long piping to feed these engines. Auxiliary engines, fed from the main boiler, are, it is well known, tremendous steam consumers, and the puting down of auxiliary boilers is out of the question. Here the electric motor forces the argument on its own account. Division and sub-division of labour is the sort of work to which, it may be said, the electric motor is born. For heavy tools a separate motor may be fixed to any machine in any position; and for ligher work, to each line shaft for group driving, likewise fixed anywhere. To estimate the saving here it is only necessary to ascertain what amount of power the shafting and belting and gear wheels will eat up. Fifty per cent. is a fair average. That fifty per cent. is lost by a steam plant. Nearly the whole of it is saved by the use of electric motors. The only loss that occurs in a direct motor drive is the practically negligible loss in the armature.

Lastly, for minor advantages: If the factory is a crowded one, and every inch of floor space is important, the electric motor occupies the least possible space, and can be placed anywhere. It does not darken the workshop with belting and shafting. It does not force the manager to put a new machine where he must, for he can put it where he likes. It usually carries with it its sister advantage—the safe and clean electric light. If steam machinery requires constant skilled attention, the electric motor requires practically none. It is self-regulating. It does not increase the flying dust nor increase the noise nor vitiate the air. And whether electric power be tapped off the mains or privately generated, the first cost of an electric plant properly installed will be saved in most works at from 1 to 3 years.

These, doubtless, afford the chief explanation of the fact that while in other form of industry the steam and gas engine drive can show their ability to hold their own fairly well, the modern sawmill, given suitable conditions, must adopt electric power if it is to have a chance of competing successfully for business. The power required by a wood-working machine is much greater than that needed for a metal-working tool of corresponding size. The transmission losses are, therefore, of much greater importance, and the saving proportionately greater. So true is it that not only do we find most recently established sawmills equipped throughout with the electric drive, but we find that it is considered worth while, in the case of old established mills, to go to the considerable outlay involved in changing over from steam to electricity for the sake of the saving secured. An account of such a change-over attended with the expected results, will be of considerable interest to all sawmill proprietors who still use the steam drive.

The extensive works of Mr. R. A. Naylor, of Warrington, afford one of the numerous cases in point. They cover some ten acres, and comprise sawmills, turning and planing shops, drying stores, and stacking and seasoning sheds, all on the ground floor. There are two large joiners' shops above the sawmills, and a carving room above these. The class of work undertaken varies greatly in character, including every sort of woodwork for dwelling houses, factories, hotels, churches, &c. A large trade is also carried on in heavy timber and scantling required for building purposes. The works are favourably placed on the banks of the river Mersey, which comunicates with the Manchester Ship Canal, whence a direct highway is afforded to the chief timber-producing countries of the world.

These works were driven exclusively by steam for over thirty years, when the opportunities for wide travel and observation which the nature of the business afforded the proprietor, convinced him of the desirability of adopting the electric drive. Warrington already possessed a generating station, which supplied electricity for light and power to the town, and also furnished current in the tramway system. Power was thus available in the most convenient form at the moderate cost of 1d. per unit, after the first 3000 units had been consumed; and the change-over to the electric drive was quickly carried out without in any way dislocating business.

The equipment consists of Westinghouse motors aggregating 250 horse-power, varying in sizes from 5 to 60, some being direct coupled to the machines, others driving groups. The large mill is driven by a 60 horse-power Westinghouse direct-current motor, running at 730 revolutions per minute, and coupled to the shaft by an 11in. belt, the shafting being run under the floor. This shafting drives four large circular saws, one 4ft. diameter, one 3ft., and two 2ft., and a band saw, as well as a 10-ton overhead crane, driven by endless ropes. In the adjoining mill is a log frame, capable of taking work 24 x 6in.; two deals are cut at one time, and six saws can be inserted to reduce the plank to thin boarding. There is also a continuous feed circular saw, driven by a 20 horse-power motor, and running at 1400 revolutions per minute. The motor in Fig. 1 has been bolted to two inclined beams, secured to the ceiling and floor, and is belted to a large planing and moulding machine capable of planing scantlings of any wood up to 14in. x 9in., its output being 15 horse-power at 1100 revolutions per minute. The works abound in modern examples of labour-saving devices for handling timber. Roughing, which could only be tediously performed by hand, is accomplished by these machines with wonderful dispatch.

Two bays of the sawmills exhibit further applications. A 10 horse-power motor, under the floor, drives several concealed lengths of shafting, from which a trenching machine, a circular moulding machine, and a saw bench are operated. A small 5 horse-power motor on a ledge in the wall drives a tenoning machine, whose knives revolve at 2000 revolutions per minute. A chain mortising-machine, operated by belts and counter-shaft, from a 7½ horse-power high-speed motor, is another prominent example of the independent motor drive. The belt shafting and table raising are effected through a single foot lever, depression of which starts the chain and brings the work up until the slot has been cut, the release of the lever being followed by the descent of the table and stoppage of the machine. In the same bay a large moulding machine is driven by a belt from a 15 horse-power motor, the belt being boarded in to shield it from damage by the constant moving of planks, etc., in its neighbourhood.

On the opposite side of this bay a 20 horse-power motor is belted to a length of shafting, and operates three circular saws in the adjoining mill, through shafting under the floor. A motor, developing 30 horse-power at 1050 revolutions, drives an edging machine, a panel planer, and a four-cutter moulder under the same roof as the circular saws, the motor, as in the previous instance, being belted to the shaft. Side by side with this motor is one of 20 horse-power, driving four moulding machines.

Fig. 1. LARGE PLANER AND MOULDER DRIVEN BY 15 H.P. MOTOR.

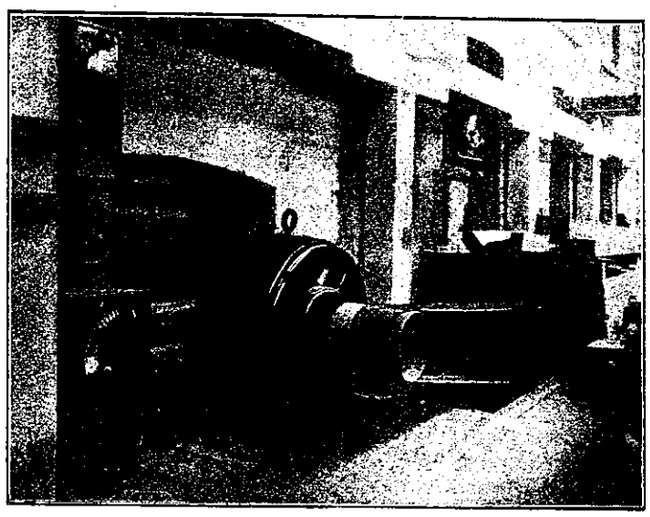


Fig. 2. A 60 H.P. MOTOR DRIVING LOG FRAMES AND OTHER MACHINERY

Motors and Aviation.

NOTES.

BY OUR LONDON CORRESPONDENT.

The Small Car.

This is the era of the small car. The golden age of cheap motoring, Government taxes and their contrary effect notwithstanding. The small car is working a mild revolution in motordom, for it is putting the self-propelled vehicle before an enormous purchasing class, and one which, heretofore, has had to be content to do its motoring on busses, and in taxis.

It must not be thought that the small car is a cheap and nasty vehicle. It is not. It comprises a stout little chassis, with a wee, *but powerful,* engine. Furthermore, the passenger accommodation is in inverse ratio to the size of the power plant. That is to say, the seating capacity is really ample. The modern small car is infinitely better value than the diminutive and underpowered vehicle which it has to own as a forebear. As to how this has been effected, it really does not concern the reader a great deal. Suffice it to say that there have been made great strides in the evolution of the engine, whose speed has gone up and whose weight has gone down. Thus the power resource of these little engines is very great. Again nothing in the way of reliability has been sacrificed; the reverse, in facts, holds.

My own car is a Delage, a French voiturete, of 10/12 h.p. The cylinder bore is 65 mm. The weight is about 13cwt. The tires measure only 710 x 85 m.m. This little car, painted grey, looks the essence of speed, and looks (in this case) do not belie. The Delage is fast, and it is reliable. Never a breakdown do I have, and tires seem to last for ever. Running costs aproximate to 2½d. a mile at the outside.

I could not afford to run 15 h.p., and I represent a big class, and a class which heretofor was not catered for. At last manufacturers have learned wisdom, and have pleased the public. The cult of the small car increases daily, and its increase is for the good of motoring.

The Motor-cycle at War Work.

A number of English motor cyclists registered their names and addresses some little time ago with the idea of assisting in carrying out a scheme of mobilisation. General Thorneycroft interested himself in the matter, quite unofficially, of course, and on a recent date he despatched fifty postcards asking the recipients to meet him at Daventry on the following morning as soon as possible after receipt of the postcard.

Practically every man came up to scratch, and riders arrived from distances varying from 160 to 20 miles. This gives an idea not alone of the enthusiasm of motor-cyclists, but also of their potential worth in time of war. The number of motor-cyclists in the United Kingdom stands now at a really colossal figure, so that there is no blinking the fact that here we have a very important, if somewhat neglected military force. For scouting and for dispatch riding the "single-tracker" is ideal. Its speed is truly great, while its reliability gives it a comprehensive radius of action.

THE BLUE MOTOR FLEET.
A unique photograph taken of the Cheltenham "Looker-on" by Messrs. Debenhams, Longman & Co., Ltd., of the Bristol Tramway's new Motor Service.

Oil in Britain.

Just as New Zealand has had its little flutter over the Taranaki and Gisborne oilfields, so it now happens that oil has been struck in the far away Shetland Islands. If the rumour is not merely true, but is also of substantial merit, it is possible, though at the moment I do not venture to say probable, that the Oil Trust and its grip on the Home market may receive a severe check. We have had oil, shale oil, produced here for some time, but price and production difficulties have kept it beyond the reach of most car users. It is time some relief from the Yankee oil kings was forthcoming. Prices here are kept up to a scandalously high figure—1/3 and 1/4 a gallon for oil in England is absurd when it is remembered that the same commodity is being marketed at the same day and hour in the States for a matter of about 8d. less. We urgently require remission from this serious and unnecessary burden, and home production would secure it—possibly.

The Fall of a Famous Aviator.

The widespread regret shown for the serious accident which befel Jules Vedrines, a Frenchman who stands on an equal with any aviator in the world, even if his feats are not above those chronicled by many airmen who have become famous, shows in what esteem his performances were held, both in his own country and here in England. Vedrines is certainly rather an extraordinary individual. A couple of years ago he was a mechanic and nothing more. Now he is—Vedrines. His brusqueness when he finished the "Circuit of Britain" for the "Daily Mail" £10,000 prize a mere hour after Andre Beaumont, will be called to mind by PROGRESS readers. His mortification was real, and he made no attempt to mask it.

It is not all "violets" to be a flying man, as Vendrines can vouch. For a star performer there is a lot of money to be made, but the risks are great. Every few days one learns of fresh fatalities. Now it is a Frenchman; then it will be some other poor unfortunate dare-devil. The last victim, at time of writing, is Allen, who put out from the Welsh coast *en route* for Ireland, and has never been seen or heard of since. He has met with a similar fate to that which overtook Cecil Grace last year.

I have a cousin who flies for the Navy at Eastchurch, and he tells me that he quite often has premonitions and gruesome fears. Yet he loves the sport for the sake of these very thrills. He goes up daily and thereby endures so continual a risk that it seems difficult to see how he can avoid meeting with some serious accident eventually, how he can avoid geting "cold feet," in the slang of the flying man.

The "Titanic."

It is not often that a general catastrophe makes any lasting impression on the individual who learns of it as a mere item of news. Yet I feel supremely affected by the loss of the "Titanic." It seems such a little whole ago that I wrote you about her launching (see August PROGRESS). How all of us who watched this ceremony were moved to marvel at the immensity of the ship, at her projected speed, her perfect safety and immunity from any of those maritime cataclysms which, at brief notice, terminate the career of so many smaller vessels. Her wonderful bulkhead system, in fact, which, it was declared by the designers, gave each passenger the right to count himself as free from misadventure as if he were upon dry land.

That was the picture the artist painted, and he garnished it around with portrayal of all the splendour of the ship's accoutrement. The swimming bath, the safes, winter garden, gymnasium, lifts and other luxuries or conveniences.

But all these were of small avail. For "God sent an iceberg," and we have since realised afresh the limitations of humanity. That on a calm night, on a fine night, the most glorious steamer yet constructed could prove a death-trap for fifteen hundred poor souls is a fact difficult to imagine. Horrible the whole affair is. I can see the "Titanic" as she left the slip at Belfast, amid toot of siren, and took the water for the first time with a gentle plunge. I can

picture up the "Titanic," her side gaping raw, as she quietly settled, and then, with a sound indescribable, plunged head down into abysmal depths. Down, down; fathom after fathom; into regions where no daylight penetrates, where no sound is heard. There to lie and slowly moulder alone, but not forgotten. Horrble indeed. And as she plunged she left behind her a seething mass of impotent humanity as powerless to conserve their lives as drowning rats.

But it is an amelioration to know that everybody behaved splendidly on the doomed ship. The boats were lowered probably for the first as well as the last time), and got safely away. A multi-millionaire was turned back from the boats by a seaman worth but a few pence. The only trouble was that there were not enough boats. That is the scandal of the "Titanic." With her swimming bath, and her gymnasium, and winter garden—she had not boats enough. Oh, yes, she had all that the Board of Trade demanded. But the Board of Trade has been asleep for years. The builders and designers traded (and pardonably, too, viewed through the glass of modern competitive financial self-preservation), on the somnolence of the Board of Trade which did not know there were any steamers beyond the 10,000 tons limit which determined the maximum number of boats to be carried. "So many boats for 10,000 tons or over."

There has been a great deal of nonsense talked about the "Titanic"; by myself included. She was praised as the greatest maritime thing that ever happened. Her builders and designers were snowed under with fulsome flattery and adulation.

And she was a death trap. And those who sent her to sea knew she was a death trap. What ought to be done to them—and to the Board of Trade? From a monetary point of view the White Star people will suffer, for not alone was the big ship only partly insured, but the claims by the public, as already adumbrated, are likely to reach many millions. One insurance broken declared to me that the claims to be settled, and the loss to be met will probably reach a total of nigh on twenty millions!

If this be the price of mercantile supremacy we have truly paid in full. And it is hard to realise that this ill-fated "Titanic" is the very boat I saw a-launching down in Belfast so brief a while ago.

A Dirge from the Shops.

(By Owen John, in "The Autocar," April 27.)

We know. We little brethren of the wheel,
Forged, drawn, and made in the same wells of flame.
Proud of the mightiest sister of our steel,
We know. We grieve. To you was not the blame.

We know. Blind, clean, and strong in your dark caves.
Your only light, the light we too do make.
Swift to obey—one touch, and Ocean's waves
Were yours to rule, her paths were yours to take.

Under the One Great God all work is done.
In His great Will our further strength doth lie.
His harnessed forces make the whole earth one.
"The World is Ours!" men shout—*and then they die.*

It was not you. Your perfect engines gave
Their best, your mighty power was ever proof.
Was it too good? Atlantic's vasty grave
Tells of the smashed and broken warp and woof.

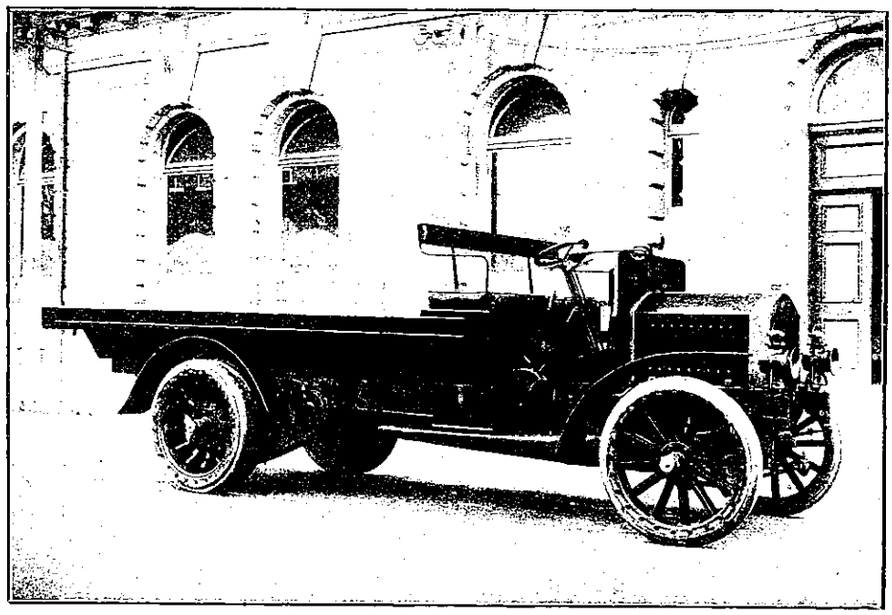
Tells of the pride of man, the fall of power,
Tells of the final end of pomp and worth;
Millions and million's worth—dust in that hour
God sent a little iceberg from the North
To tell us they are human—so that we
May know where end for all the paths of fame.
Yet—O lost sister—though we grieve for thee,
You did your work. To you there is no blame.

The Blue Motor Fleet.

Cheltenham, England, is now equipped with a public service of taxis, motor cars and motor char-a-banes, the Bristol Tramway Coy. having recently commenced running this service, which is called the Blue Fleet, and is illustrated on page 1178. The taxis are 5-seaters, and the char-a-banes carry twenty-one pasengers.

Albion Commercial Motor Vehicles.

We illustrate below the latest addition to the fleet of similar machines, owned and operated by the Post and Telegraph Department in Wellington. The vehicle was landed complete ready for the road a few days ago, and makes the fourth to be commissioned for the mail service in Wellington.



WELLINGTON POST AND TELEGRAPH DEPARTMENT'S LATEST MOTOR VEHICLE.

Like its sister lorries, it is of two-ton carrying capacity and fitted with a 16/20 h.p. engine. Such satisfaction has been afforded by the output of the Albion Motor Car Co., of Glasgow, that Messrs. Grapes & Riley, consulting engineers, of this city, have been instructed to duplicate the existing plant at an early date.

When this is effected it is proposed by the authorities to dispose of the last of their horses, and to undertake the whole of the mail transport in Wellington and its environs by motors.

This transformation is rapidly taking place in the public services throughout the entire world.

Diesel Engines for Motor Cars.

In view of the attention which is being devoted to the Diesel engine for almost all purposes of power production in sizes up to 12,000 h.p., it is somewhat curious that so little is heard of the attempts which are being made to adapt it to smaller powers, and perhaps it is not generally realized what an enormous field would be opened for this motor in sizes up to 20 h.p. The business done in small oil engines is almost incredibly large, and no prime mover is more essentially suited for driving pumps and small dynamos, for agricultural work and for various other purposes. For motor-cars it is, of course, practically universal in the shape of the petrol engine, and it is a striking fact that up to the present the Diesel engine, which has gained such success in almost every sphere of power production, has not been employed in this direction, where the type of engine utilized is particularly expensive in operation, needing, as it does, a costly fuel, and having an efficiency relatively low when compared with the Diesel motor.

Many attempts to solve the main difficulties connected with the economical construction of a small Diesel engine have been made, and it is as well that these difficulties should be clearly borne in mind, for they are indeed important, though by no means insuperable. When it is considered that the cost of the fuel oil for equal work is approximately one-fourth or even less in a Diesel engine as compared with a similar petrol motor, it is easy to see what large savings are capable of being effected, and what a wide influence such a reduction would have on motor-car users and particularly on the large motor-omnibus companies, since the cost of petrol for a single motor-omnibus in regular service in London is well over £100 a year. A further important point is the absolute safety of the heavy crude oil of high flash point which is used in Diesel engines as compared with the dangers of petrol.

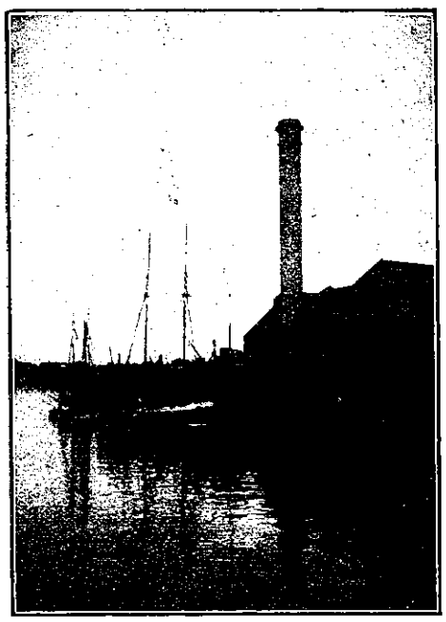
It has been said, and with some truth, that the Diesel engine as now built is primarily adapted for powers above 30 h.p. There is no doubt that below that figure its cost is high when compared with the perfected motor-car engine of the ordinary type. But it must be remembered that the latter is the result of many years' experience, and that the very large demand which now exists has permitted of general standardization, and this, with the large output, has enabled the cost of manufacture to be brought down to a very low point. Admittedly the Diesel motor can never attain the same level of cheapness, for the reason that it must be constructed

(Concluded on page 1189.)

Engineering & Electricity

New Electric Power Station, Auckland

It has been found necessary, owing to the rapid growth of the city, to extend the electric power supply. The old site being



CHIMNEY, POWER HOUSE, FROM THE WHARVES.

quite unsuitable, a new area has been acquired. The position of the new power house is almost an ideal one, being centrally situated, on the water front and in close proximity to railway. Furthermore, the coal supplies can be taken direct from the coal steamers and dumped into the storage bins. Everything points to a most successful undertaking, and one that should be capable of being most economically operated.

A short description, with a few photos, are certain to be of interest.

The building to house this new plant is necessarily of considerable dimensions, measuring some 190 feet long by 112 feet wide. It is carried on a foundation which is composed of about 600 piles, driven to the solid rock some 25 feet deep, these piles supporting a concrete raft approximately 2ft. 6in. thick.

The boiler house is 112 feet long by 93 feet wide, and 38 feet from raft to the tie rods. In this building is housed at present 4 large boilers and the necessary equipment, and there is provision for 8 more. It is proposed that all should be of the water tube type, fitted with superheaters and mechanically fired. The first four are of the well-known Babcock & Wilcox type, and with the rest of the boiler-house equipment, are being supplied by Messrs. John Chambers & Son., Ltd., Auckland.

The chimney for present requirements is of considerable dimensions, being 150ft. high by 10ft. in diameter, constructed of ferro-concrete.

Coal will be delivered into a hopper in front of the boiler-house, where it will be automatically weighed and picked up by a bucket conveyor capable of handling 40 tons per hour. This conveyor will travel the whole length of the centre of the boiler-house close to the roof, and will deliver coal into steel bunkers over the boilers, whence it will be fed into the hoppers of the automatic stokers. The bunkers will be 100 feet long, 21 feet wide and 14 feet deep, having a total capacity of about 1000 tons. Outside coal bunkers will be added later as required. The conveyor will then pass into the ash pit under the central gangway of the boiler-house, where it will pick up the ashes and deliver them into a hopper inside the boiler-house.

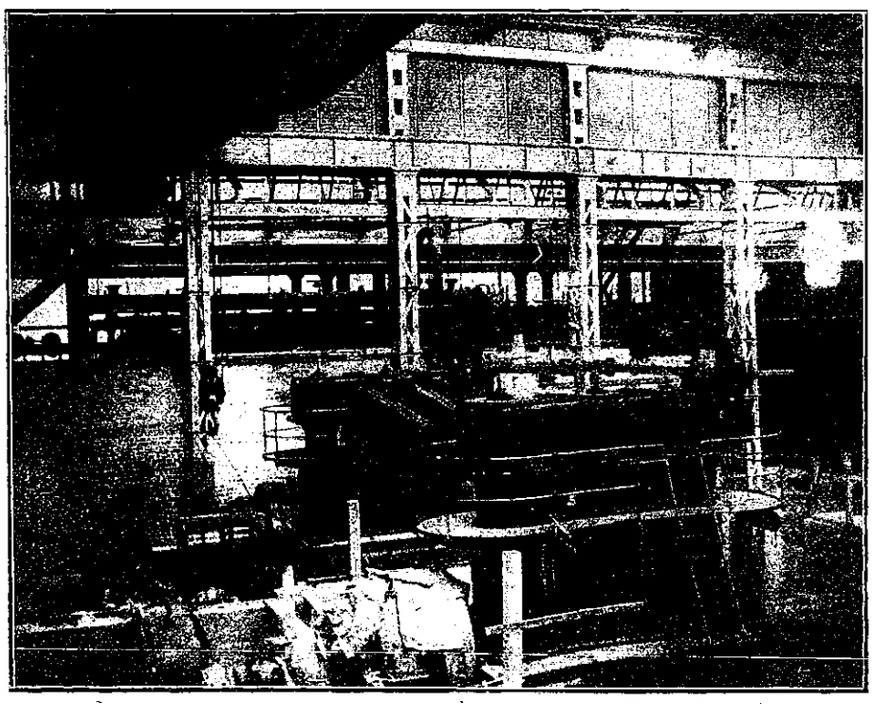
The engine-room, parallel with the boiler-house, is 112 feet long and 80 feet wide, the height being 50 feet from the raft to the tie rods. Herein is the first equipment of four steam-driven, direct-current, low-pressure generators, two of 500 k.w. and two having a capacity of 1000 k.w. Each set is capable of carrying an overload.

These four sets are to supply a continuous current at approximately 460 volts straight to the consumer, similar to the existing supply, and is considered the simplest, cheapest, safest and best for a limited range. By this system the heavy cost of transforming machinery is saved and the loss in efficiency due to transformation is avoided. At a later date, in order to supply consumers not in the vicinity of the power station, a high tension, three-phase alternating supply at 6000 volts will be required, and provision is made for two large turbine driven alternators.

The engine-room is equipped with a 15-ton electric driven travelling crane. Ample provision is made for the switchboard. Below the engine-room floor, in the basement, are the condensers, one for each of

SHOWING GIANT TRAVELLING CRANE, CAPABLE OF MOVING 30 TONS.

the 1000 k.w., and one common to both the 500 k.w sets, the inlet and outlet pipes will each be 2ft. 6in. diameter.



ENGINES AND TWO GENERATORS IN COURSE OF ERECTION.

The engine-room plant is being supplied by Messrs. Siemens Bros., Ltd., through their local representatives, Messrs A. T. Burt, Auckland.

The foundations and chimney have been erected by the City Electric Engineer's Department, and the whole installation is under the supervision of the Chief Electrical Engineer, Mr. Alex. Wyllie, who is also responsible for the general scheme.

The illustrations were photographed by our special reporter when in Auckland.

Lake Coleridge Hydro-Electric Scheme

Steady progress is being made with this scheme, though the cold and wet weather is doubtless against any very rapid progression. The cottages for staff and workmen are nearing completion and with the approach of summer a busy settlement will be established at Lake Coleridge.

The following tenders have been accepted:—For the pipe line, the Dunedin Engineering & Steel Co., Dunedin. For the transformers, the National Electric & Engineering Co., Dunedin. For the electric crane, F. S. Greenshields & Co., Wellington, representing James Carriek & Co. Other tenders for generators and turbines have not been decided.

LAKE COLERIDGE POWER SCHEME (RAKAIA RIVER BED).
The dotted line to the left shows proposed new road; the square, site of power house; the pipe shows the tunnel outlet position.

We give another view of the Lake District, which conveys a good idea of the surrounding country.

CANNON.

BY PROF. ROBT. SCOTT, M. Inst., C.E.

(*Continued from Page 1146, June Issue.*)

THE PROJECTILE.

Cast iron was once extensively used for shot and shell.

Up to a very recent date English shells were of cast iron with chilled points, but to defeat modern armour the very finest material must alone be used.

Nickel steel having a tensile strength of 40 tons per square inch is the material adopted, and then the point of the projectile is hardened and tempered.

The comparatively small bursting charge, the function of which is to explode the shell after passing through the plate, is noteworthy, also the simple percussion fuse with safety pin sheared on firing, which also causes the "cocking" of the fuse.

It is not, however, surprising that when such a shell strikes an hardened armour plate the small area of the point which has to bear the first impact, breaks up, and the shell is shattered without penetrating. Considered as a punch, the form of the head of the shell is incorrect. (Sir Joseph Whitworth always held that the armour piercing ball should be flat headed).

It will be realised too that when a shell of the ordinary form strikes at an angle the chances of glancing off a hardened plate are considerable, and only a very small percentage of hits are comparatively direct—at long ranges none—for the point of the projectile does not lie along its trajectory, but, owing to the gyroscopic action of its rotation, and also to air resistance, meets the object against which it is directed at approximately the same angle with the horizontal as that with which it left the muzzle of the gun.

Consider such a case.

The range is, say, 9,000 yards, which will require for modern 12in. gun 5° 4′ elevation; the projectile occupying 13.3in. in its flight comes down a path inclined at the point of striking 7° 18′ to the horizontal. Since the projectile has, owing to gyroscopic action and head resistance, at least kept its original inclination of axis, it strikes the vertical plate at an angle of 7° 18′ + 5° 4′ = 12° .22 with the horizontal, and the upsetting tendency is obvious.

Of course the plate may not be vertical, when matters will be better or worse, according as it is inclined from or towards the gun; in all probability it will not be at right angles to the plane of trajectory, when matters will be worse.

The expedient of placing on the point of the shell a soft metal cap of 28 tons tensile as against the hardened 40 tons tensile steel of the projectile has wonderfully improved its punching capabilities.

In the first place, when the projectile strikes the plate at a slight angle, the contact is on the edge of the cap on that side to which the axis of the shot is inclined, and a distinct righting couple, tending to bring it normal to the plate and therefore counteracting the tendency to glance, is brought into play.

Secondly, the hardened point of the projectile does not at once come in contact with the hard face of the plate. The first shock is distributed over a considerable area on the shell and not concentrated on its point, whilst the surface of the plate is shaken by the impact of the cap, so that its resisting power to the hard point of the shell which has now passed through the cap is much diminished, with the result that a plate, otherwise invulnerable, is pierced.

The cap is attached by rolling or hammering a projecting bead of metal on its rim into a dovetail groove upon the shell.

The battle which has been waged for so many years between gun and armour is at present nearly a draw.

4″ of Krupp steel to-day is equivalent to:—

5½ inches of Nickel steel Harveyed.
6 inches steel.
9½ inches compound armour, or
12 inches of wrought iron.

Krupp armour contains:—

0.35 per cent. Carbon
0.3 per cent. Manganese
0.1 Silicon
3.5 Nickel
2.0 Chromium.

The steel is made in an open hearth furnace:—

(1) Cast into a flat ingot.
(2) Annealed.
(3) Forged or rolled,
(4) "Carbonized" or "cemented" By being placed in furnace, covered with charcoal, then sand, and kept at red heat for several days during which it takes up carbon from the carbonising material.
(5) Finished by re-rolling and machining.
(6) Hardened by heating to about 850° C. and then quenching surface with water sprayed on under pressure.

The plates are secured to backing by top bolts with reduced shanks. These bolts enter the back of the plate for a few inches.

Great accuracy and long range in the gun would be of little use were it not possible to:—

(*a*) Determine the range of the object fired at.

(*b*) Make corrections for the relative velocities of the object and the gun platform and for the bias of the gun and the effect of wind.

(*c*) Acurately lay the gun on the object aimed at.

The range is determined by optical instruments known as range finders; that of Messrs. Barr and Stroud is one of the most simple and efficient.

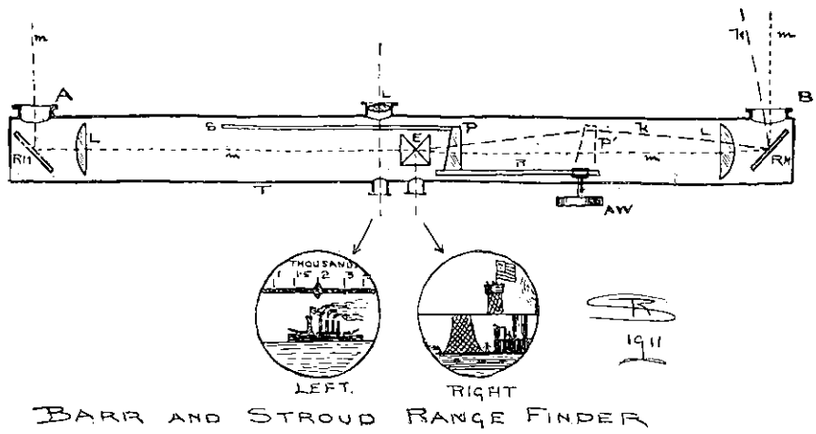


FIG. 14

It depends for its action on the fact that if any object at a finite distance be viewed from either end of a base, however short, the lines of sight are inclined to one another by an amount which is dependent on its distance.

If the object be an infinitely great distance, the rays are parallel.

In Barr and Stroud's range finder the upper half of a distant object is viewed from right-hand end and the lower half from the left-hand end of a short base.

By means of mirrors, lenses, and prisms, these views are brought to the same eye piece.

If the object be at a great distance, such as one of the heavenly bodies, these views coincide.

If at a finite distance they are relatively displaced owing to the angle made by the rays.

By the movement of a correcting prism they can be brought into line, and it is this displacement of the correcting prism which registers the distance or range of the object.

In the diagram (Figure 14) are parallel rays, from say one of the heavenly bodies, which enter the tube T through the openings A and B and are reflected by the mirrors R.M. through the lenses L.L. to the collecting prisms E., and the object appears without distortion in the right-hand eye piece and agrees with the direct view seen through the left-hand eye piece el.

Should, however, the telescope be directed on say the fire control tower of a vessel at 3,000yds. distance (by means of the left-hand eye piece) the right-hand ray will be inclined and the upper half of the object displaced with reference to the lower.

But by moving the correcting prism P to say P by means of the adjusting wheel A.W. the displaced view will be brought into line with the lower half.

The adjustment of the correcting prism moves a scale showing the range across the image of the object seen in the left-hand telescope.

Since the prism has a movement of some 8" the scale is a fairly open one.

Afloat, range finders are mounted in the fire control station.

Formerly the indications of the range finder and the deflection to be allowed for the relative motion of the vessels were transmitted to the gun stations by telephone and the gun sights set accordingly.

This method was liable to confusion and broke down completely in action.

It has been superseded by the "follow the pointer" arrangement of Vicars, Maxim and Co.

The ranges as called by the observer at the range finder; are put on a transmitter by an assistant and appear on a dial on every gun mounting, where by causing a pointer to follow the dial indicator the sights are elevated to the proper degree (there is an independent calibration adjustment for each gun). Should the vessels be approaching one another at a steady rate, a clock in the transmitter is started which drives the mechanism at a suitable speed and thus automatically indicates at each gun the decreasing range. The action of this clock can be accelerated or retarded at the transmitter.

Similar arrangements are adopted for transmitting the deflections to be allowed for wind and relative transverse speed.

Such refinements and the range and accuracy of modern guns have rendered the old sighting arrangements useless.

All but the smallest of guns are now fitted with twin telescopic sights mounted on either side of the gun on a single frame, and thus capable of being simultaneously adjusted for elevation and deflection.

A gun layer is at each of these telescopes.

One is responsible for keeping the gun trained on the object and manipulates the training gear, whilst the other (the captain of the gun) controls the elevating and firing gear.

Ball bearings and nice adjustment of weights have rendered it possible for a 6in. gun to be kept on a torpedo boat in a heavy sea by these two men with hand gear alone, without undue effort or fatigue.

Running-out springs on top, and Hydraulic Buffer below gun.

The vast difference in the means adopted for working of the 6in. gun now-a-days as compared with the time of Nelson, is evident when we compare the relative guns crews: 13 men manipulating the old 32-pounder 6in. ton gun as against the 4 working with several times the speed the 6in. 125-pounder 81/3 ton quick firer of to-day.

Much of this advance has been due to the substitution of breech for muzzle loading, and much due to the development of the mountings.

The first advance was the adoption of the carriage and slide actuated by tackles for training, but curiously enough it was not an engineer, but a sailor, my father, Admiral (then Commander) Scott. who first adopted wrought iron and mechanical means for manipulating heavy guns.

The use of the hydraulic buffer soon became general in the land service, and it has for many years been the standard arrangement for arresting the recoil of nearly all sizes of cannon.

In the hydraulic buffer, a piston works in a cylinder filled with oil, and consequently can only move if the oil is permitted to pass from one side of it to the other.

The openings through which the fluid can so pass are restricted in area, and consequently if the motion be rapid, the fluid friction, which varies as the square of the velocity is very great, and there is a great difference in the pressure on the two sides of the piston which acts in opposition to its motion.

As it is desirable to keep the maximum pressure within reasonable bounds, and that the resistance should be constant and at this maximum, in designing a buffer, the velocity curve for uniformly retarded recoil is first plotted on the available base length: this will show rapid increase and then slow decrease.

If now the areas of escape openings are made to vary with this curve, a constant difference of pressure will be maintained in the cylinder and a constant resistance to movement be afforded by the piston rod.

(*To be continued.*)

Harbour Works at Newcastle.

The northern breakwater of Newcastle Harbour, New South Wales, has been carried out to nearly its extreme length, work having been in operation there for some months past. It will be finished off with a round-head about 60ft. in diameter in order to prevent the sea washing the end away. The Public Works Committee of the State recently inquired into the proposal to extend the southern breakwater, and they have now reported in favour of it. It was originally suggested that the two breakwaters should be extended simultaneously, and when the additions to the northern breakwater were entered upon the Minister of Public Works promised that if it induced a greater range inside the harbour the extension of the southern breakwater should be put in hand. With part of the work completed this result was experienced. The range inside the harbour was increased, and the Public Works Committee have accordingly recommended that the southern breakwater should be extended a distance of 460ft. at an estimated cost of £54,000. It is understood that there will be no delay in carrying out the work, which shipmasters and others maintain will render the port much safer to enter, as it will tend to smother the heavy sea that breaks across the entrance when the wind blows strongly from the south or south-east.

Yachting and Astronomy.

The auxiliary "Taniwha" is being overhauled and repainted throughout by R. Martin & Co. with Velure enamel. Quite a lot of the boats are adopting this finish for their cabins and topsides.

Many of the Wellington fleet are still in the water, although dismantled and ready for slipping but the bad weather that has prevailed lately has prevented hauling out.

Work on the "White Wings" schooner is almost completed. She is now 58 feet over all, and will be a greatly improved vessel in looks at any rate, when she takes the water next season. Another ton of lead has been cast on her keel.

The "Venus" is having her dead wood re-modelled, after the season's sailing. The improvement should make her considerably better to windward, though she was by no means bad before; in fact, she was quite a credit to her youthful builder.

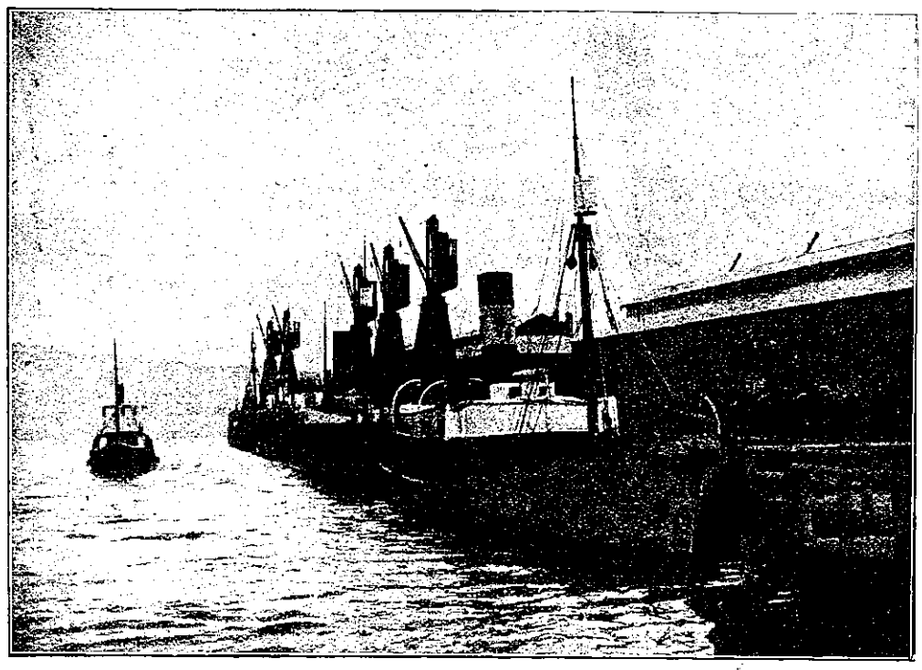
Mr. Ted Bailey has a lot of small jobs, repair work, etc., in hand at his shed in the Boat Harbour, amongst which I noticed a fine little 16-foot whale boat nearly completed.

Mr. C. Bailey, Junr.'s yard, Customs St. W., Auckland, is full of work, as usual. I noticed Mr. Chappie Hall's auxiliary yawl with her priming coat and sheathing on. She is a fine, able-looking cruiser, and is fit to go almost anywhere. Her engine is rather a new departure for the Dominion, as it runs on crude petroleum, a great saving in these days of benzine famine. The interior fittings are going in now. She will be one of the most comfortable cruisers in the Dominion.

The cutter for the Free Church of Tonga is finished. The main cabin, which is well lighted by swinging ports and skylight, has sleeping accommodation for 16 persons in two tiers of bunks, the upper set swinging down and forming backs to the lower sofas in the daytime. In the fo'c'stle are four bunks for the crew.

The launch for the Government fisheries is nearly completed.

Press of other matter has unavoidably kept much good yachting news out. Next month, however, a considerable amount of space will be devoted to yachting and motor boating. There will be a design of a tiny auxiliary cruiser, cheap to build, but with good sleeping accommodation for two or three.



THE NORWEGAN WHALING FLEET AT GLASGOW WHARF, WELLINGTON.
An artic'e dealing with life on these vessels will appear shortly.

Astronomical Notes for July.

(By the Hon. Drector Wanganui Observatory.)

The Sun is in the constellation Gemini till the 18th, when he enters Cancer. His greatest distance from the Earth is attained on the 5th, when he is situated at a distance of about 94½ millions of miles. His declinations north is now decreasing; it will pass from 23.1 deg. on the 1st to 18.5deg. on the 31st, and his altitude at noon will increase by the difference during the same period. The solar surface, when seen during the past month, has presented no tendency to spottedness in the higher regions and faculae have been singularly rare for some months past.

The Moon, in her monthly circuit of the heavens, comes into the vicinity of the planets and some of the brighter stars, and serves as a convenient pointer to them. She will be near Uranus on the 2nd, Saturn on the morning of the 11th, Venus on the 15th, Mercury on the evening of the 16th, Jupiter on the evening of the 24th, and Uranus again on the evening of the 29th. Her path through the constellations visible in our evening skies will be as follows:—In Virgo on the 18th to the 21st, and nearest the bright star Spica on the latter date. In Libra on the 22nd and 23rd, Scorpio on the 24th and 25th, and nearest the bright red star Antares on the former date; Sagittarius on the 26th to the 28th, Capricornus on the 27th to the 30th, and Aquarius on the last night of the month.

Phases of the Moon in New Zealand mean time:—

Last quarter ..	8 days	5 hrs.	17 min. p.m.
New Moon ..	14 days	12 hrs.	43 min. p.m.
First Quarter ..	21 days	4 hrs.	48 min. a.m.
Full Moon ..	29 days	3 hrs.	58 min. a.m.
Apogee	2 days	0 hrs.	6 min. p.m.
Perigee	15 days	11 hrs.	30 min. a.m.
Apogee	29 days	4 hrs.	18 min. p.m.

Mercury is a morning star throughout the month. He will be in conjunction with the Moon on the evening of the 16th, in his descending node on the 20th, at his greatest elongation on the 26th, when he will be removed from the Sun's centre towards the east 27.5 deg. of angular measurement, at which time a good opportunity is afforded for observation of this somewhat elusive wanderer.

Venus is a morning star in Gemini, close to the Sun's place, at the beginning of the month. She will pass into superior conjunction on the 6th, after which she will come out as an evening star in our western skies, but too near the Sun's place to be well seen, for some time. She will be in conjunction with the Moon on the 15th, and in perihelion on the 23rd.

Mars is an evening star in Leo, but owing to his great distance, is not a very conspicuous object at this time. He will be in conjunction with the Moon on the 17th when the two bodies may be caught near the western horizon, shortly after sunset, Mars being the reddish star about five times the moon's diameter away to the south, or above the Moon at the time.

Jupiter is the bright planet of the evening skies, rising in the early evening, under Scorpio; his bluish-white light contrasting finely with the reddish glare of the Scorpion's heart. He will be in conjunction with the Moon on the evening of the 24th, but no less than nine diameters of our satellite away to the north of her.

Interesting phenomena of his four larger moons may be looked for by those possessing good telescopes on the following evenings:—2nd, 6th, 8th, 9th, 10th, 13th, 15th, 16th, 17th, 18th, 24th, 25th, 31st.

Saturn is a morning star in the constellation Taurus, at this time. He presents a fine object in the telescope when observed just before sunrise. He will be in conjunction with the Moon on the 11th.

Uranus is an evening star in Capricornus, slowly retrograding amongst the stars of that constellation. He will be in conjunction with the Moon on the 2nd, and again on the 29th of the month.

Neptune is an evening star close to the Sun's place at the beginning of the month. He will be in conjunction with the same on the 16th, and with the Moon two days earlier.

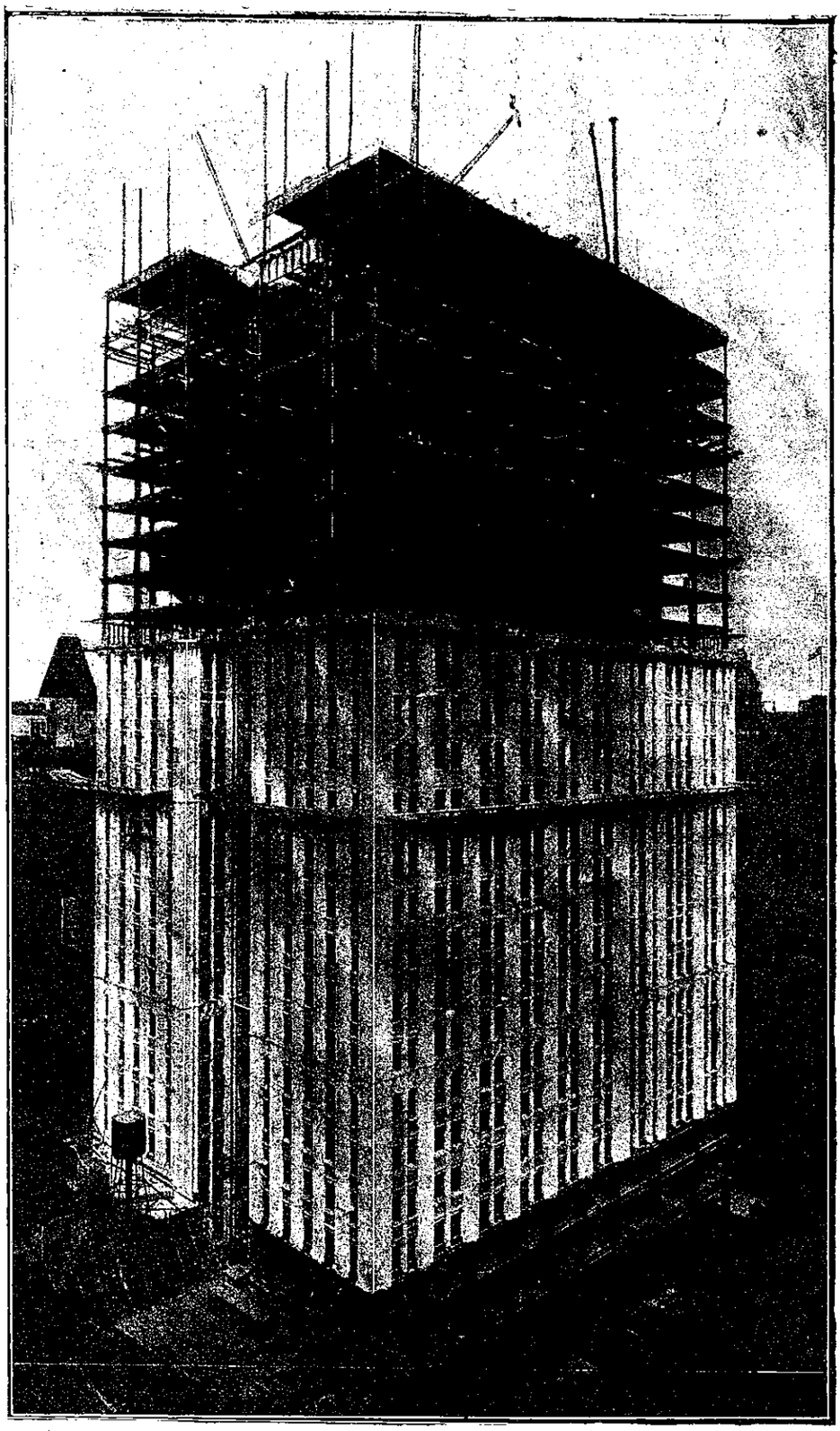
Meteors.—There is a radiant located in Aquarius, not far from the star Delta. This is a variable radiant and has not made a marked display for some years, but should be watched.

June 30th, 1912.

Architecture and Building

The Tallest Building in the World

New York, the city of superlatives, is again surpassing itself and the rest of the world, in erecting gigantic buildings, a direction in which it has always held the lead. The 55 story Woolworth Building, with its 20,000-ton steel framework, now in course of erection, is a good example of American enterprise and the architecture of the ferro-concrete age. We in this Dominion can hardly form a conception of the immensity of this "skyscraper," which rising from a basement only 200 by 150 feet, towers above its surroundings to a height of 775 feet. Let us try for a moment to grasp what this means. The tallest buildings we have in our cities are mere pigmies of six stories, while the Woolworth has 55, over nine times as many. Mt. Victoria, which dominates Wellington city, is a fairly high hill, though its sloping spurs take off somewhat from the appearance of its height of 640 feet, yet if we were to place the highest building in the Dominion on top of Mt. Victoria, the Woolworth Building would still tower some few feet above it. To gain the necessary stability for this enormous building, the foundation has been sunk to bed-rock, through 115 feet of earth and quicksand, and the various columns are supported by 69 piers of partly reinforced concrete. Mr. W. E. Ward, of New York, writing in "Dunn's Review" for March, says of the foundations: "Except where conditions call for rectangular shapes the caissons are cylindrical, varying from 8ft. 3in. to 18ft. 9in. in diameter, each being loaded to a maximum of about eighteen tons per square foot. Generally speaking, the columns step concentrically upon these caissons; but in some instances, on account of modifications made in the plans after work was commenced, the load of the columns had to be transferred to the caisson centres through massive steel girders acting as cantilevers. These girders are perhaps the stiffest and heaviest class of pieces in the entire structure, some being as much as two inches in thickness, having an average depth of eight feet, and weighing upwards of sixty tons. Such is the foundation upon which step the sixty main columns of the Woolworth Building, each of which is in itself of no meagre proportions. Distributing the weight of the whole structure over its base of 31,000 square feet, these columns are designed for a maximum load of 4750 tons each, which calls for base dimensions of 3ft. 6in. by 3ft. 8in., giving a total cross section of metal per column of 650 square inches. The steel framework of which these columns are the uprights, will weigh 20,000 tons, which, together with the vertical load from the other materials, is allowed for under the New York building code at the rate of 150 pounds per square foot for the first and basement floors, and 75 pounds per square foot on the beams of the other stories. Apart from this crushing stress, the stiffness of the steel frame is called upon to withstand a wind pressure of 30 pounds per square foot over the entire surface of the buildings' enormous sides. The maximum direct compression from windage on a single column reaches 2,500,000 pounds, and to this must be added 200,000 pounds



THE TALLEST BUILDING IN THE WORLD. This photograph shows the Woolworth Building, which has reached the 25th storey—a little under half its height.

delivered from the floor bracing. Away aloft, between the 55th and 50th floors, the inclined members of the pyramidal lower top will take up the thrust of the wind stresses, and no especial provisions for delivering them to the columns are contemplated. From the 50th to the 47th floor, deep floor girders, with solid gusset plates, will serve the same purpose. Between the 42nd and 28th floors the exterior wall columns are to be braced against the wind by extra deep wall girders and by knee braces, reaching well in toward the centre of each story. From the 28th floor to the street, every panel between the outside columns along the greater dimension of the building is stiffened by a full-depth web portal, with heavy flanges. Transversely, the bracing has been done with single portals stretching across the width and in the wake of the tower. As each floor is laid, all the elements of the steel frame-work are given a one inch coating of cement mortar, the interior spaces are filled in solid with concrete, and the whole is then encased in a 3-inch shell of terra-cotta. Such is the character of the 20,000 ton skeleton, now more than half completed, that will carry the greatest tensile and shearing load ever imposed on structural steel.

By far the most striking feature of the construction at its present stage is the perfect balance of the system under which every detail of the work is carried on. A squadron of cavalry at drill could teach these iron-workers nothing about organising men to act as a unit. What is the finished product of one gang is approached and worked upon by the next as raw material, and so on until each nameless length of blackened steel, distinguished from its fellows only by a few painted hieroglyphics, finds its way from the truck that delivers it at the sidewalk to the derrick the handling gang, the setters and the fasteners successively, until rivetted in its allotted place. Even then there are still the painters and plasterers, who finally blot out the identity of the piece as an element in the steel frame.

The greatest single difficulty encountered is the extremely restricted horizontal space limit, and facilities are provided for multiplying the working limits of the hoisting derricks. Derrick works with derrick, and the material is conveyed from one to another, and to its final resting place, with wonderful accuracy and speed. Other materials, such as brick, tiles, terra cotta, mortar, stone, etc., are quickly chuted from the trucks into the basement and raised to the desired level by fast running hoists operating in most of the twenty-six elevator shafts, and the progress of the work keeps them running at so high a speed that the contractor has been obliged to forbid workmen from riding on them.

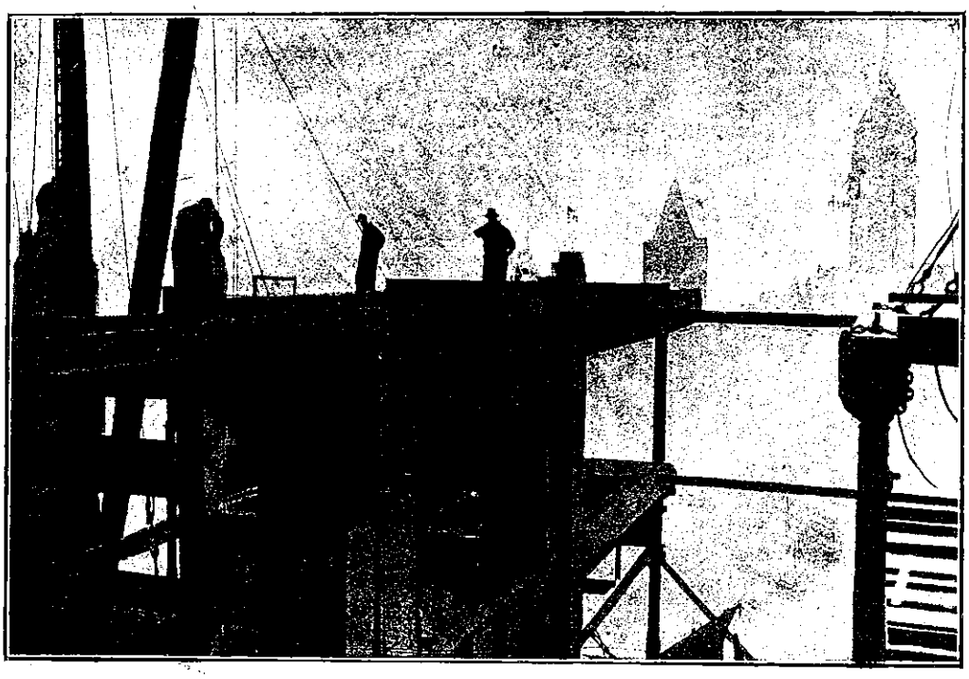
Some of the larger pieces, caissons and structural members, requiring special trucks and many teams of horses to handle them, are delivered at night or on Sundays, to avoid obstructing the heavy traffic that moves during business hours. Altogether material is handled at the rate of about a thousand tons a week, floors and walls being built simultaneously, the riveting painting and fireproofing following closely.

The outside wall is granite to the fifth story, where it will be superseded by terra cotta construction, and the rather heavy character of the lower masonry changes abruptly to an almost pure Gothic style. Fireproof doors and windows of pressed steel are being installed as rapidly as the wall construction can receive them, the exposed exterior windows being glazed with wire clamps.

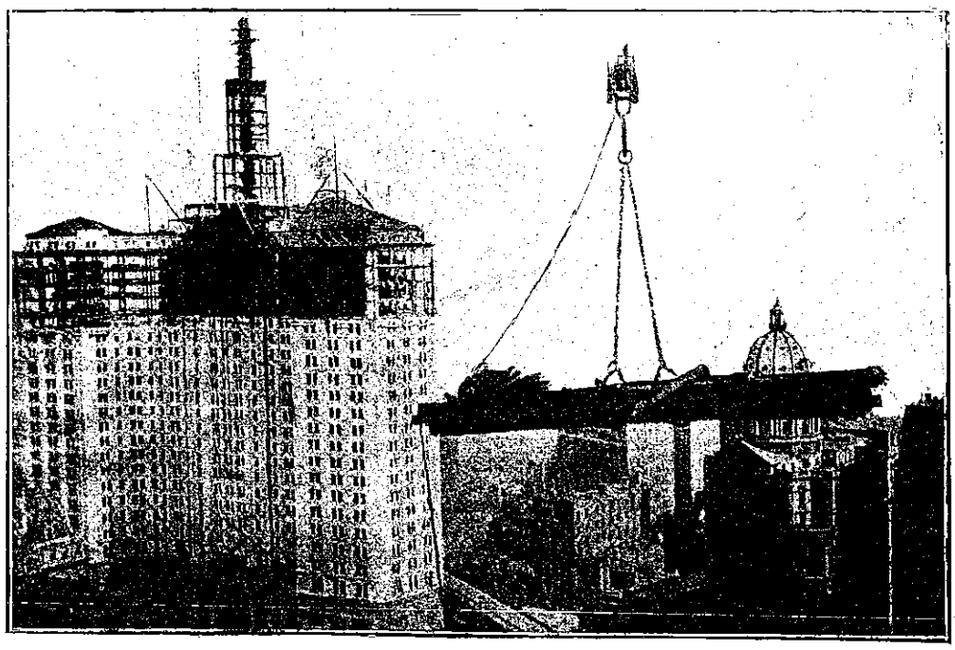
All the installations of water main pipes, and the piping for hot and cold water distribution to every room, the conduits for electric lighting, and even telephone wiring, are being laid at the same time.

The iron stairways, of which there are four, to supplement the 26 elevators, are built at widely separate parts of the building, in a special fireproof steel shaft with double steel doors at each landing.

When completed, the Woolworth Building will have a frontage of 155 feet on Broadway, and extend into the block to a depth of 200 feet. The main building, which will cover the whole ground area except for an interior open court 35 by 96 feet, will contain thirty-one stories, and above this will rise a tower 84 by 86 feet, which will extend with the vertical walls to the 50th floor, with an offset at the 42nd floor, where the dimensions will be reduced to 69 by 71 feet, and at the 47th floor where there is to be a further reduction to 59 by 61 feet. The height from sidewalk to 31st floor, which marks the top of the main roof, will be 400 feet. The tower will rise 270 feet further, a good-sized building in itself making the height above the sidewalk 670 feet. Here it is to be surmounted by a pyramid 54 feet square at the base, in which are five additional floors and an observation gallery, the last-named being 730 feet above the street. The crowning detail—ball, lantern, finial or whatever it may be, will stand 775 in the air. But since there are two stories below the street which have not been considered in these figures, the total span of this colossal structure when completed will be about 885 feet, or over a sixth of a mile.



STEEL WORK ON THE CENTRAL TOWER. Some of the largest ever erected.

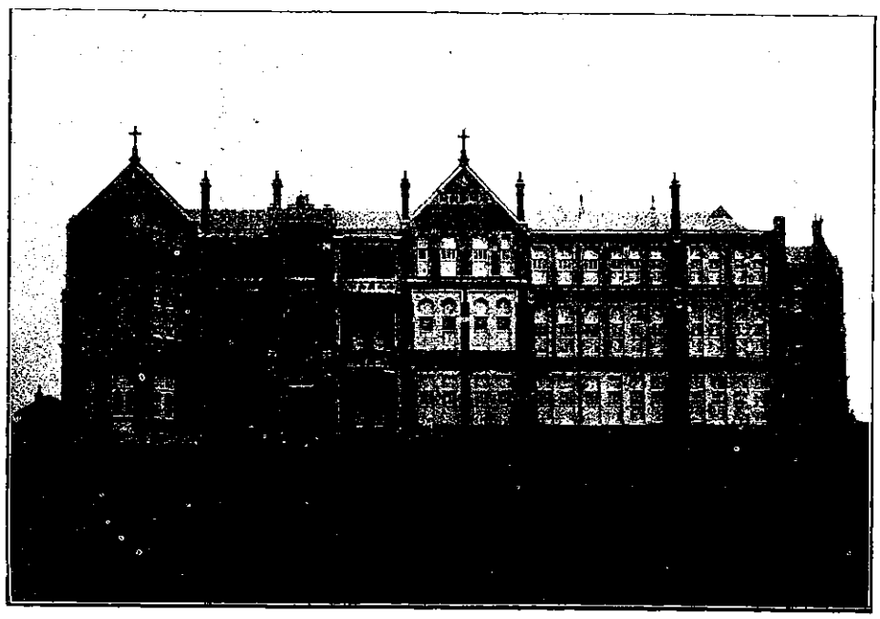


A VIEW OF THE NEW MUNICIPAL BUILDINGS FROM THE 25TH FLOOR.

New Convent at Wanganui.

This fine building, erected from plans prepared by Mr. J. S. Swan, of Wellington, for the Sisters of St. Joseph, stands in a charming garden of six acres on St. John's Hill. The building is 188 feet long and 100 feet wide, and the height from ground to ridge is 60 feet, there being three stories. Externally the building is of a simple Tudor-Gothic character, with walls of "pressed" facing bricks and compo-dressing. The roofs are covered with grey asbestos slates. Internally the finish is simple, but good and substantial, the walls being finished with plaster, the dadoes being heart of rimu. The interior has been arranged by Mr. Swan to give the utmost accomodation and comfort, and is consistent with the most modern practice in regard to lighting, ventilation and sanitation. Nothing has been omitted which care and forethought could plan for the well-being of the future pupil and sister inmates.

The contractors were Messrs. Campbell & Burke, of Wellington, and the clerk-of-works was Mr. J. T. Waterhouse. The sub-contractors were as under: Plumbing, H. W. Davies & Co. Wellington; plastering, Joll Bros., Wellington; painting, A. J. Watts, Wellington. The contract price for the complete building, including fittings, is said to be £17,894.



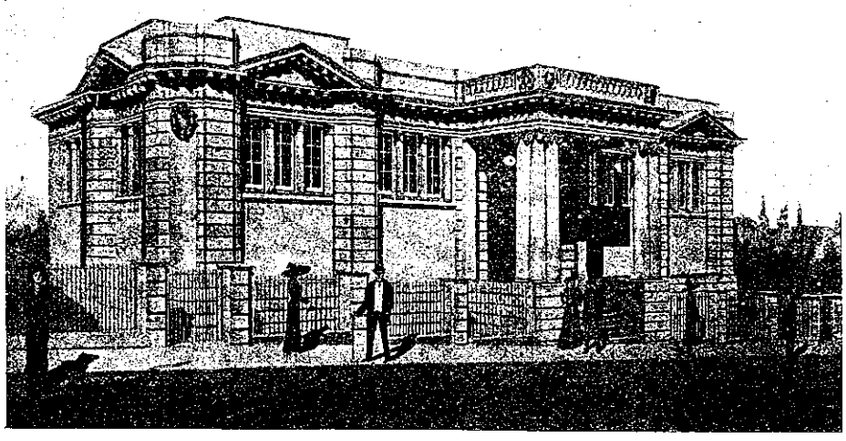
NEW WANGANUI CONVENT. J. S. Swan, Architect, Wellington.

Branch Library Competition.

We reproduce three designs in order of merit, as awarded by the assessor, for the Branch Library Competition, Mount Eden, Auckland. There were 16 competitors for this competition, who submitted 18 designs.

We are glad to be able to show the plans in two instances, but were unable to get the other for publication.

The conditions call for a one storey building, to cost not more than £2500, with the following accommodation: Reading room, 800 floor space, fitted with shelving to accommodate 10,000 volumes; Librarian's office; lecture hall, to seat 300; committee room.



1st. PERSPECTIVE MT. EDEN LIBRARY. Mr. E. Bartley, Architect, Auckland.

The first selected design of £50 was Mr. E. Bartley's, Mr. H. C. Grierson being second (£20), and Mr. Cecil Trevithick, A.R.I.B.A., being third.

Fundamentals of Building Art.

(By JOHN T. MAIR, Associate Royal Institute of British Architects. Special Certificated Graduate in Architecture, University of Pennsylvania, U.S.A.

That the general public is at present in an attitude of mind eminently favourable to things artistic has been proven by the splendid attendances at the "Baillie" picture gallery and magnanimous response to the call for the National Gallery. Such being the case, the time is opportune to remind the public that the painted picture is but an off-shoot of the oldest and grandest art—the art of building.

How little this is realised! Even Mr. Henry James, in his charming and intricate account of a "Little Tour in France," alludes to architecture as the least personal of the arts. The architect does not agree with him. His art is indeed less responsive to the touch of human emotion than is poetry or music, and less graphic than painting or sculpture in the portrayal of passion, but it is yet one of the most clearly personal of these means employed by man to put sentiment into tangible form, and is an instrument of great power in the expression of thought or emotion. In the work of the architect can be manifested a wide range of feeling, from the free play of joyous fancy, as in Francis' Pavilion at Blois, to the fierce and warlike humour of the mediaeval castle.

It may show pride of power and strength, militant aggression, or the sublimity of faith. No art is more patent in the expression of the highest and boldest of human conceptions; none more a mirror and enduring proof of the quality of a civilization. Also, this art is so personal that its productions declare their authorship. Any building of distinctive character, whether good or bad, bears the impress of its author's individualtiy.

Thus it is possible, knowing an architect well, to identify his work.

Also, a building will indicate the degree of its owner's sensibility to beauty. In this respect a man's house may be either less or more than his castle, for it will surely betray his bad taste or sturdily defend him against the suspicion of it. This is because architecture is deeply personal and its range and power of expression considerable.

It is to an examination of these qualities that I invite your attention, with the desire of stating a few of the fundamentals on which the art is based. This I shall endeavour to do from the standpoint of the architect rather than the analyst.

Architecture is by common consent grouped with the fine arts, and its masterpieces are accorded high place among the supreme works of human genius. Regarded by many, and with justice, as the master art, it affords inspiration to the poet and orator, priceless evidence to the historian and the ethnologist, and indispensable material for the study of aesthetics and the philosophy of civilization.

This is true testimony to its importance in the development of human culture, but it leads us unconsciously to look upon this great and wonderful art as a purely aesthetic thing; a quality somehow manifest only in the external apppearance of a building, and having little relation to its construction or purpose.

In other words, architecture is apt to impress us as a thing of the past; a quality inherent in the world's great monuments, but somehow beyond our reach, unless we may, perchance, seize it by copying into our modern structures the forms or features of ancient buildings, which is, unfortunately, too often the means adopted. Almost the first question asked the designer of a building is, "What style is it?" I hope to show the absurdity of that question, and that living, as we do, in the twentieth century, our "style" should be the 20th century, which, shortly, means it should show to the world the accumulation of past experience correctly interpreted to meet our own requirements.

This craze for traditional style is fatal to a true understanding and a full enjoyment of the art; for we are thus led to regard it either in the light of archaeology, pertaining only to the dead past, or of aesthetics with its equally cold and academic relation to the present.

On the contrary, architecture is, to-day, and has been in each age, a living and creative art of intimate and vital relation to contemporary life. Very emphatically it is not an abstraction of a thing of occult mystery. This is because it owes its very existence to those human needs and impulses which call buildings into being and give them character—in which lies their architectural quality.

The building art, therefore, is broad and comprehensive in its nature, but its fundamental principles are few and simple.

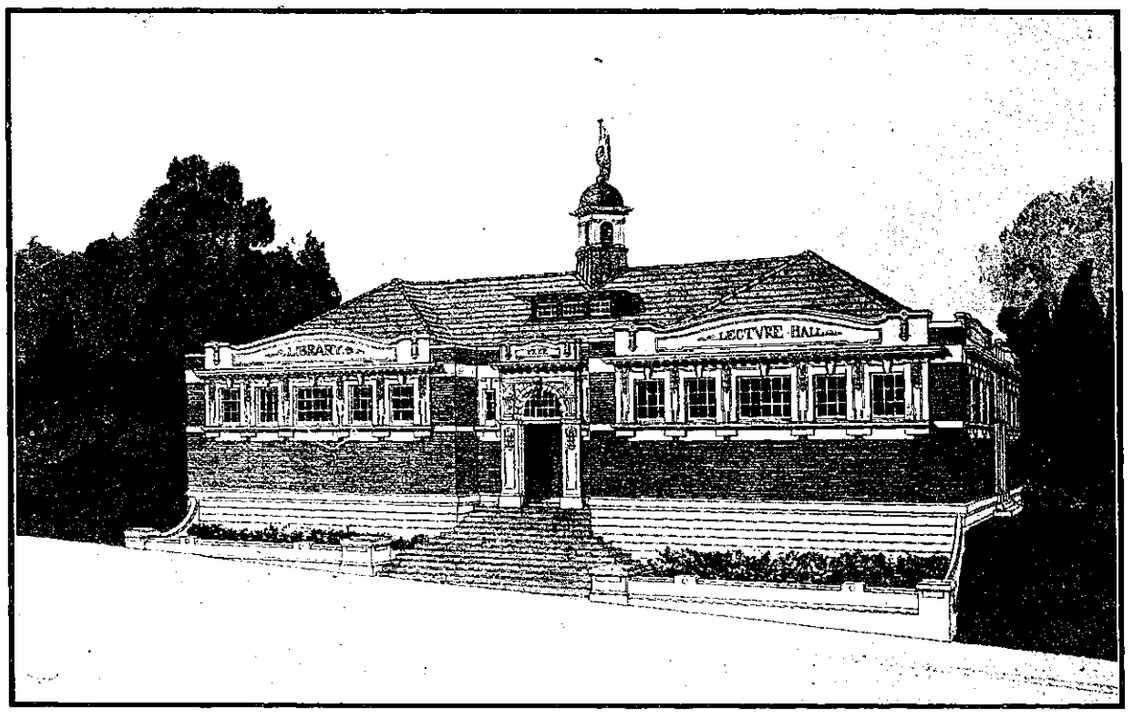
Many definitions have been given to architecture, but all associate the idea of beauty with that of building. It is, of course, more than mere building, but so also is engineering, which may be defined as construction seeking a maximum of efficiency with a minimum of material—hence cost—making its purpose purely materialistic; its destiny one of service alone.

without form and void, its construction is already predestined and the elements which will enclose its spaces are few and well known; the walls and the roof, the pier and column, arch and vault, beam and truss.

The kind and character of the enclosed spaces, however, and of their assembled mass, is unknown, and must be discovered. The solving of this problem involves both the interior and exterior of the building considered as a single conception. It means the shaping and grouping

the exclusion of the organs which they protect, and upon which they depend for their very existence.

Thus, upon entering a building the attention is drawn to the decoration and contents of the individual rooms, whereas these have formed only the final and least difficult phases of the architect's work. The real problem has been to produce a general scheme or arrangement of parts which should meet the practical requirement of the building in a form at once beauti-



SECOND.—PERSPECTIVE MT. EDEN LIBRARY. H. C. Grierson, Architect, Auckland.

Architecture, however, while it involves construction, both economical and efficient, and is dedicated to service, usually practical, is always influenced by considerations of sentiment. Wherefore, it has the three inherent properties of stability, utility and beauty.

Let us consider these fundamentals in order.

First, stability is of its very essence. The fabric must endure; age enhances its dignity and proves its quality. To ensure this it must resist the elements; withstand disintegration under fire or earthquake, and endure the severities of use. It is the art of building; of the assembling of materials into forms of strength and of fitness each for its special purpose.

It deals with material elements—stone, wood, steel and brick—things of gross weight and of great, yet circumscribed, strength. Whether in the soaring dome of St. Paul's, the vaults of a Roman bath, or the airy grace of a Gothic spire, every ounce of the countless tons of material must be supported, and the pressures and strains carried safety to the foundations in mother earth. Cold science rules here, and yet the structure is conceived in the love of beauty and achieves it in every line. Sentiment is the master, science the servant.

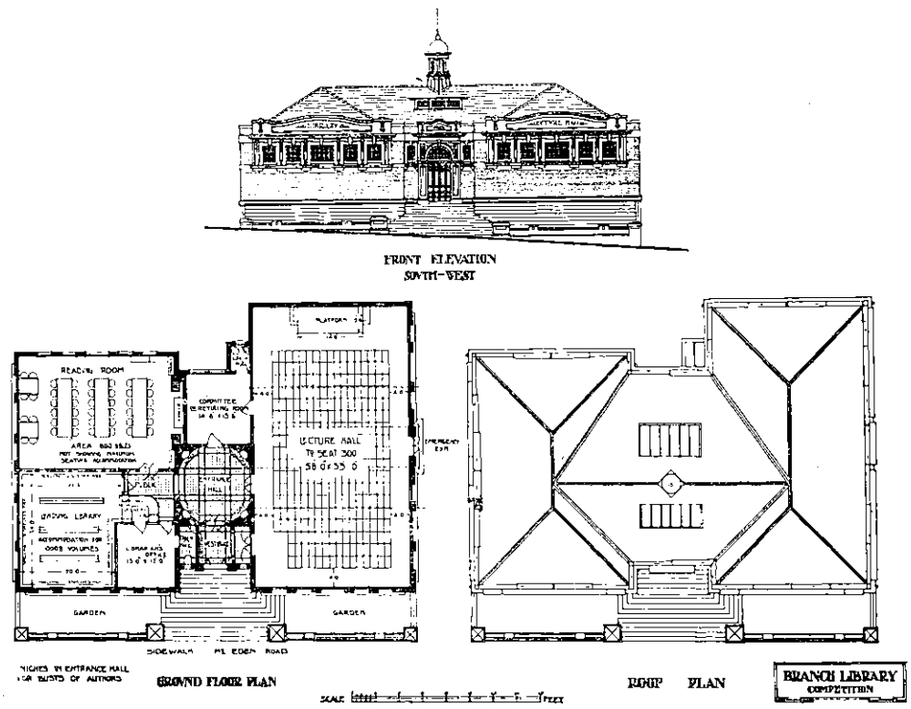
Science is the very essence of the result, for how little of dignity or nobility, or of any quality worthy our administration is left to a building whose construction is inadequate or a sham?

Then, also, stability gives to a building a certain element of character which has nothing to do with science or pure engineering on the one hand, and yet on the other is independent of the elements of beauty.

We feel this, whether it be in the gigantic strength of Karnak, the mass of the Colosseum, so like the very hills, or the daring yet certain thrust and counter-thrust of a Gothic fabric. This quality of stability is the expression of "power" in architecture.

In the second place, the building must adequately serve the purpose which calls it into being. This element we call utility or convenience. It is not the product of mere invention or mechanical skill exercised independently of the architect's other arts, and subordinate to them, for it largely controls the aesthetic character of the building. In the beginning, when in the mind of the designer, the building is yet

of all parts into a unified whole, each apartment or space being so formed and equipped as to meet its individual requirements, and so related to each other part that all will serve one central purpose.



H. C. Grierson, Architect, Auckland.

This requires the creating of one organism with many functions. The development of this is the architect's chief labour, yet it is most apt to be overlooked in a judgment of his work.

The contents, or internal organism, of a building are taken for granted quite as are those of the plant or animal form, whose anatomical frame and outer covering attract our interest to

ful and well constructed. If, then, these practical requirements be known to the observer, something of the difficulty of their solution is understood, and its success better appreciated.

Thus it is realised that the designer of the

building has worked under limitations, perhaps of great severity, and that the time required to produce it and the fees paid are only in simple proportion, for it is on the practical basis that the owner usually figures his architect's worth. He has been restricted as to cost, the peculiarities of the site and climate, and perchance of the client as well; he can use only those struc-

tural forms of known stability and economy, and has not a wide range of choice in the selection of materials, either as to their practical or aesthetic properties.

Under the conditions he must produce a building which will meet, with the greatest possible utility, the practical uses for which it is intended.

These demands on the one hand, and restrictions on the other, would seem to afford an ample test of the architect's creative ability. His dilemma, has, however, more than the proverbial two horns, for he must also achieve beauty. This cannot be secured by the addition of more ornament after the rest of the problem is solved, for beauty must be wrought into the very structure of the building. Every part and the grouping of all must be conceived with regard to it. Right here enters a potent factor, essential to the highest architectural quality: that of consistency of form to purpose. This, in the study of the design, requires careful attention, not alone to the actual form of the parts but to their shape, size, equipment and position as demanded by the uses to which they will serve. To meet these requirements will yield good proportion in respect to the use of the building, and produce one of the prime virtues of good architecture, for a building may have perfect harmony of form in an aesthetic sense, but be bad in proportion in respect to its uses. It thus shows good decorative but bad plan composition.

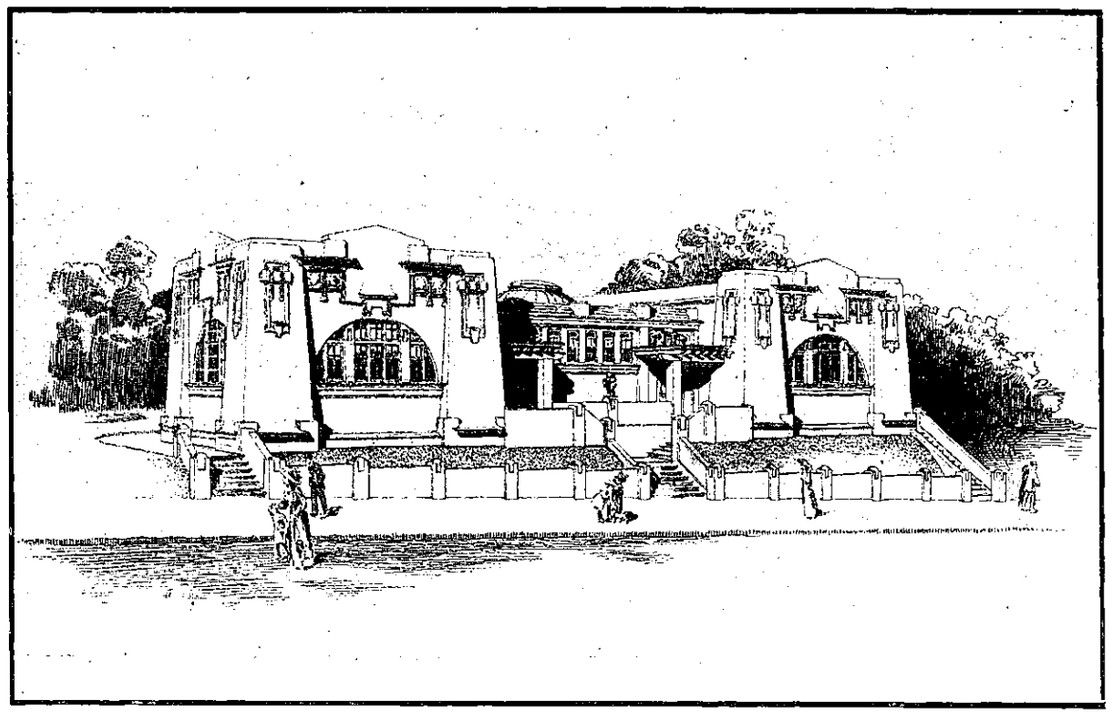
Thus the architect works out the whole internal economy of the structure into an organism not only practical in purpose, but of such a character that it can be naturally expressed in terms of beauty. This second quality of architecture we may call its logic.

The cause of beauty—the third fundamental—requires no pleading, for it is universally acknowledged as essential. Indeed, it seems to be regarded as the very essence of the art: not merely the Hamlet in the play, without whom all its meaning is gone, but the very play itself. This impression exists, perhaps, because pure beauty, having so much to do with the external aspect of a building, is the most obvious, or strikingly evident thing, about it.

It is not my intention, nor is it possible at this time, to exploit the question of what constitutes absolute or pure beauty in a structure, but I may state one point of interest. Architecture, like the arts of painting and poetry, has its grammar, deduced from what in the architecture of the past has been found its own limitations of action: its mode of expression. Factors which, in each of these arts, compel observance at the penalty of failure; no work of art being successful if it be not at least correct. Should it stop here, it is but partially successful and stands on the lower plane of the commonplace.

It may have grammar without style; style without grace or charm; charm without the higher spiritual significance of great art.

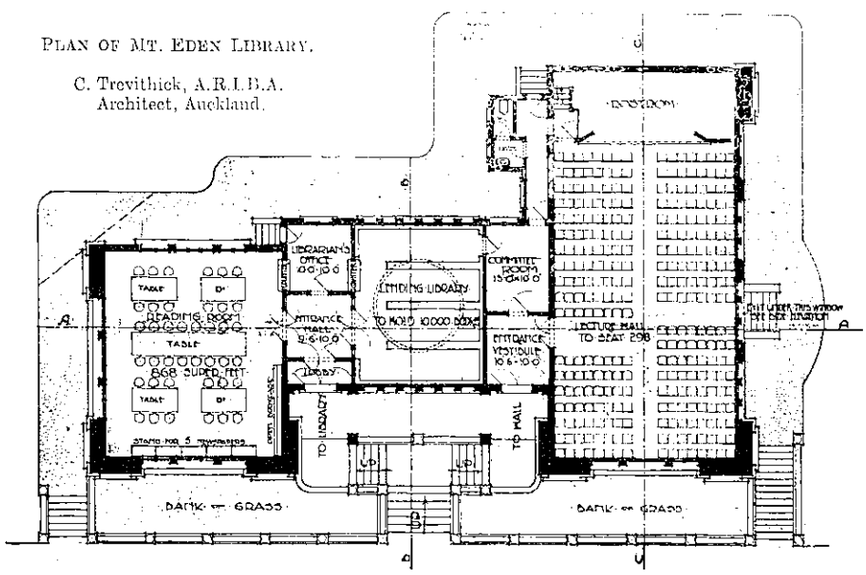
To return, then, to the general consideration of beauty. We may say that in its pure and abstract form it is only one of the phases of this aspect of architecture. Yielding, as it does, graces of line and harmonies of form and colour, it is responsible for much of the charm which attracts us, but does not reveal the deeper qualities; the nobler undertones of the symphony. These be in the significance of purpose and the underlying proportions which control the destiny of the fabric and determine its real value as a work of art. These qualities, which should be found in the general nature of the structure, in what we may call its anatomy: in the way it is organised and constructed; in which we may call its "power" and "logic."



THIRD.—PERSPECTIVE MT. EDEN LIBRARY. C. Trevithick, A.R.I.B.A., Architect, Auckland.

PLAN OF MT. EDEN LIBRARY.

C. Trevithick, A.R.I.B.A.
Architect, Auckland.



The expression of these qualities, or their outward manifestation, may be regarded as giving the building the character commonly known as beauty. This will consist, in a dual expression. The first of the functions of the building; the second of its sentiment. Under the latter head we may group such attributes as harmony of form and colour, purity of line, appropriateness of ornament, and the intangible something which gives the building its sentiment. Something else is also necessary—the expression of function. That is to say, the outward evidence of the internal organism. This should be such that the building easily and naturally declares itself to the observer making clear its purpose; in short, telling its story. Such may be done by a frank recognition of internal arrangements; by emphasising structural lines rather than ignoring or concealing them. The sum total of these qualities is shown by the character of the building. This, in all great works, is first of all one of sincerity. With this there may be found dignity or playfulness, religious feeling or intellectual calm, the assertion of power and authority, or the evidence of purely commercial or domestic character. To me the "character and sentiment of a building" is its highest beauty, the final flowering of the forces that have produced it. The element of beauty, therefore, is something more than skin deep; something not to be produced by a treatment of surfaces or the copying of what is considered good in England, America or elsewhere where conditions differ from our own. On the contrary, it has root in every consideration vital to the building: in time, in place, in people.

Turning now from a statement of the fundamentals, let us for a moment examine their bearing on every-day conditions. It is quite possible to understand and enjoy architecture without making a technical study of it, if only the fundamentals be borne in mind and certain errors of judgment be avoided.

These errors seem to be of two kinds. The first, and most general, is that architecture consists simply in making a building ornamental, or that it has to do with the purely decorative or superficial aspect of a structure, whose other

properties, it is thought, lie entirely outside the province of art, being wholly practical.

Thus the "man in the street" regards the "architecture" of a building as its decorations, added at so much per foot; justified as a concession to beauty, if they can be afforded, but after all merely an accessory to the thing of real moment: the building itself.

The other view is that of the man to whom education and opportunity have revealed the glory of old-world architecture, with its eloquent testimony of the past. This he feels, and rightly feels, is real architecture. He is impressed by some subtle quality which stamps it as a work of art, an achievement of human genius, and the quality is felt whether the dominant note in the building be one of religious aspiration or serene power, of sublimity or splendour, or pure loveliness. In the presence of such monuments one is impelled to believe that—

"Earth proudly wears the Parthenon
As the best gem upon her zone."

and with Ruskin, that Amiens was "built by God and man, by the stars in their courses, and the nations."

Thus the world's masterpieces impress with wonder and delight those who are by taste and education prepared for their appeal, and this impress naturally forms a vehicle of judgment in all incidents where architecture is concerned.

But here arises the error of believing that the reproduction of an ancient masterpiece, or of its large or significant parts, in a new building, assures to that building the quality of good architecture. Nothing could be further from the truth. The original is good because it was conceived and executed for a definite purpose, its every part having been influenced by and adapted to that purpose. To take such a building, or part of it, and adapt it to different uses, ruins the copy in the change, or renders it, if unchanged, a grotesque and meaningless thing.

No! Architecture is not to be achieved either by decorating a structure or by warping it into an imitation of something else.

It is the logical expression, a definite and a certain sentiment in the form of good building. If a structure be poorly put together, or badly arranged, its architecture is as much at fault as if it displays ugly ornament or discordant colour. There may be architecture, absolutely without ornament, and in its noblest aspect it is not dependent upon that element.

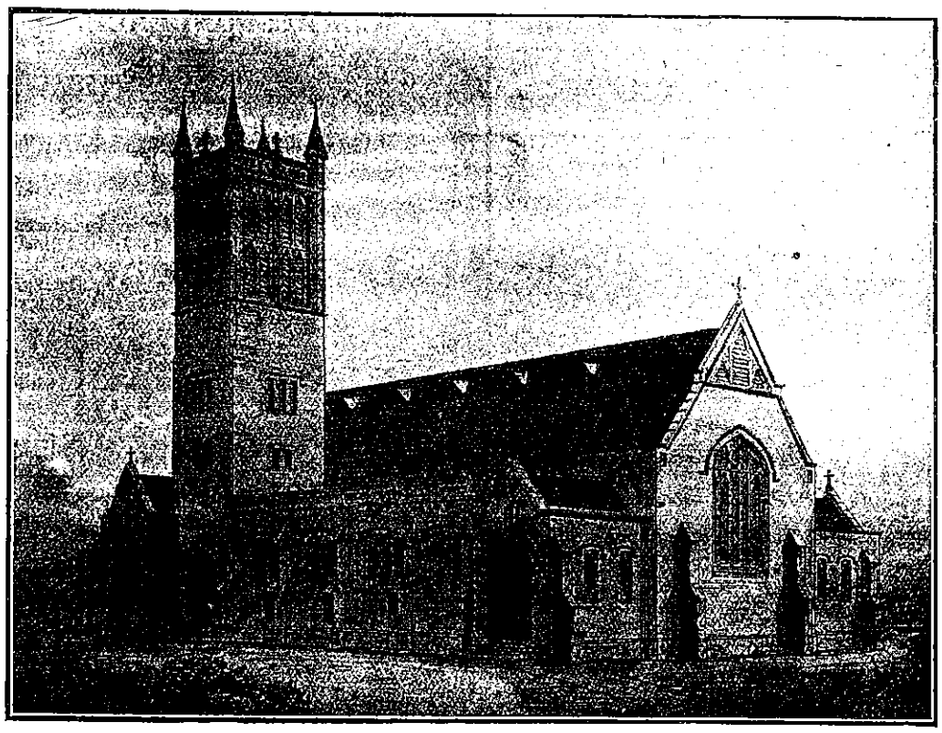
If a building be well built, conveniently arranged and executed with beauty of form and colour, then it is worthy the name of architecture, whether or not it achieves that special success and distinction which marks the world's greatest masterpieces in this grandest of arts.

RESIDENCE IN HUTT VALLEY. F. de J. Clere, F.R.I.B.A., Wellington.

This house is to be built on the hillside overlooking the Hutt Valley, and close to Melling station. Mr. F. de J. Clere, F.R.I.B.A., is the architect.

St. Hilda's Church, Island Bay.

This building is situated near the end of the tram line, and when finished will be a conspicuous object in the locality. The nave only has been erected, and the north and south walls are only of temporary weatherboards, but remainder of the general character of the building is shown. Messrs. Meyer & Illingworth were the contractors. Mr. F. de J. Clere, F.R.I.B.A., was the architect.



ST. HILDA'S CHURCH, ISLAND BAY. F. de J. Clere, F.R.I.B.A., Wellington.

Diesel Engines for Motor Cars.

(*Continued from page 1179.*)

with greater care, and better workmanship is necessary in order to produce a thoroughly satisfactory engine. It is always difficult to persuade a prospective buyer to pay a high price for an article on the score of economy in running costs, but with the good record which the ordinary type of Diesel engine has behind it there is little doubt that, once the public were convinced that a Diesel automobile engine is a thoroughly trustworthy machine, they would be willing to pay considerably more for it than for a petrol motor.

As now designed, the Diesel engine is rather more complicated than is advisable for motor-car work, the many valves being an undesirable feature, while it is particularly important that the air compressor, as usually adapted, should be eliminated and the over-all weight of the machine reduced. With the type of engine which is now being developed it is expected that all these points will be satisfactorily met. As the matter now stands, one of the largest firms in Germany have for some time past been engaged in carrying out costly and extensive experimental work, with a view of producing a small type of high-speed motor which shall, with slight differences, be suitable both for ordinary stationary purposes and for automobiles and the work has progressed so successfully that there is every probability of the engine being manufactured commercially in the near future. The firm in question have proceeded on the lines that the development must be on a large scale, and when they are themselves perfectly satisfied with the construction motors will be turned out in very large numbers by the aid of special facilities which are already being provided for the purpose. In England the engine will be manufactured by one of the best-known companies in the automobile industry, who have been paying much attention to the matter, while already the small Diesel engine, from 5 h.p. upwards, is being made by one of the firms building Diesel engines. It is apparent, therefore,

that progress, when once started, is likely to be rapid, and though the initiative comes from Germany this country is not likely to have to make up so much ground, as has been the case with Diesel engines generally.—"Times" (London), Eng. Supp.

CORRESPONDENCE.

A New System of Ferro-Concrete House Building.

(To the Editor.)

Sir,—I was much interested in reading in your May issue the description of a house being built at Stanley Bay, Auckland, by Mr. Peter Ellis.

My practical acquaintance with re-inforced or ferro-concrete dates from 1887, and in a series of articles written for "The Colliery Manager and Journal of Mining Engineering" (London) during the years 1888 and 1889, I advocated this class of work for colliery buildings at surface.

Several years ago I designed a method of construction for ferro-concrete houses which differs only from that of Mr. Ellis in having light "H" girders for studs instead of the latter being made of concrete with suitable reinforcement. Apart, therefore, from Mr. Ellis' design of the reinforced stud, the idea is not by any means a new one, and, if I am not much mistaken, will become very general in the course of a few years. The superiority of houses so constructed over wooden buildings is obvious.

I congratulate Mr. Ellis on his enterprise, and trust he will have much success.—Yours truly,

JOHN HAYES.
Mining and Civil Engineer
Late Inspecting Engineer of Mines, N.Z. Government.

Paparoa Colliery,
Roa, via Greymouth.
June 8th, 1912.

Building Notes.

WELLINGTON.

The following building permits have been received and approved by the City Engineer:—

From 11/6/12 to 25/6/12.—17 applications for permission to erect; 18 plans examined and approved.

City district, £8136; Melrose district, £2403; Wadestown district, £600.

From 25/6/12 to 9/7/12.—21 applications for permission to erect; 16 plans examined and approved.

City district, £792; Melrose district, £3305; Wadestown district, £25.

Among the important ones in the city district are noticed Nurses' New Hotel, Kensington Street, and Watkins, Hull & Wheeler's new premises.

Sixteen truck loads of kauri timber, and what is claimed as one of the finest planks that has come into Wellington for years—4ft. 6in. wide, 9ft. long, and 2in. thick—has just been landed at the King's Wharf from the West Coast Kauri Timber Company by the Holmdale.

The statistics published a short time ago with regard to contracts and extras, speaks very well for those in charge of these matters, in the expenditure of about £42,000 on Custom House, Te Aro Post Office, Magistrates Court, Kilbirnie Post Office, the extras only amounting to £250, and the only amount of any size was £1800 of extras on the £40,000 Public Trust Office, but the actual amount paid on contract does not exceed the original contract price.

Mr GRAY YOUNG, architect, reports the following work in hand:—Residence of 6 rooms in Rimu Street, Kelburne, for Mr. Cecil Goulter; Watts Bros., contractors. Additions to Mr. F. W. Furkett's residence at Hataitai; Isaac Clark & Son, contractors. He is calling tenders for a cottage of 4 rooms at Seatoun, two houses of 6 and 8 rooms respectively, both two storeys, in Wilkinson Terrace, Oriental Bay, for Miss M. A. Alcorn. He is preparing plans for residence of 6 rooms in Oriental Bay, residence of 5 rooms at Hataitai, cottage of 4 rooms at Newtown.

Messrs PENTY & LAWRENCE architects, report, amongst other work:—Private hotel for nurses, of 20 rooms, in Kensington Street; Mace & Nicholson, contractors. Banking premises, with clerk's accommodation, at Blenheim, for the Union Bank of Australia; Jas. McKinley, contractor. Calling for tenders for banking premises and manager's residence, in brick, at Hamilton, for the Union Bank of Australia.

Mr. JOHN T. MAIR, A.R.I.B.A., reports:—Contract let for cottage at Khandallah to Messrs. Norling & Quinn, builders; £393. Eighteen tenders received for shop and dwelling at Hataitai; contract not yet signed. Plans in hand for a large fireproof concrete residence in Southland; also residences at Khandallah and Sumner. Satisfactory progress under weather conditions with the erection of the First Presbyterian Church and Hall at Invercargill; Messrs McKinnon & Hamilton, builders; the Deacon's Court has decided to erect the architect's original design for church at an increased cost of £1300. Completion of residence at Upper Hutt for Dr. Kemp; H. W. Shaw, builder. Completion of first part of concrete shops for Mr. H. R. Gibbs, at Upper Hutt; H. W. Shaw, builder.

Mr. JOHN S. SWAN reports as under:—Contract for additions, etc., to three houses at Roseneath; let to Mr. H. M. Davis. Contract for stained glass windows for Wanganui Convent; let to Messrs. John Hardman, Ltd., of Birmingham. Stables for hotel; being erected by day labour. Wrought-iron gate and concrete posts at Wanganui Convent; let to Mr. W. J. James, of Wanganui. Twelve tenders received for additions to Wellington Hotel for Messrs. J. Staples & Co., Ltd; lowest tender will be accepted in a few days.

Mr. BENNIE, architect, reports that the work on Messrs. Aulsebrook & Co.'s large warehouse is well in hand, and that the new dining-room for the Hotel Cecil is nearly finished.

Just at the present moment the Parliament House grounds look like a very bad back-block road in mid-winter. The destruction of the beautiful forty-year-old garden and the great waste of public money in connection with the whole scheme are universally condemned, and it is certain that all the members of the late Cabinet were not agreed as to the wanton destruction of trees and shrubs that has taken place. However, it has got to that stage with the new Parliament Buildings that it is absolutely necessary to push them on with all expedition. The late Minister for Public Works said that the Legislative portion of the building would be completed early in 1914, but judging by the present rate of progress it is likely to be much later.

Further extensions and improvements are to take place at the Gear Meat Company's premises at Petone. Some houses are now being lifted bodily and moved to make provision for the work.

Drainage work at the Lower Hutt is progressing favourably, although these recent rains are likely to cause inconvenience. A new 10 b.h.p. oil engine has been secured for the septic tank in this eastern section.

The question of cheap public telephones is still very much to the fore, and it is hoped very shortly to enable heaps of those who cannot afford, or do not wish, to have them in their own houses, to be able to communicate with others at a very low charge.

Wanganui proposes to erect a thoroughly up-to-date and comfortable theatre, and Mr. Henry E. White, architect, Wellington, recently submitted full working plans. It is to be erected opposite Chavanne's Hotel, and part

of the front premises are to contain shops and offices, whilst the theatre itself is to be about the same size as the new Opera House in Wellington, and having everything possible for the convenience and comfort of the players and the public.

On the corner of Park Road and Miramar Avenue a new Post Office for Miramar is shortly to be erected in brick. The building is also to contain living quarters for the officer in charge.

AUCKLAND.

Mr. G. W. ALLSOP, A.R.I.B.A., reports: Drawing out alterations to manager's house at Costley Home. Preparing plans for new manager's house at the Auckland Hospital.

Mr. R. W. DE MONTALK reports: Preparing plans for house at Stanley Bay and also alterations to a billiard-room in Manakau Road. Plans just finished for alteration to chemist's shop and billiard-rooms in Khyber Pass. The foundations for Cargen Proprietary residential flats are under way.

Mr. T. W. MAY reports being engaged on plans for a 7-story £25,000 building in Queen Street for Mr. T. Ellison, to be known as Ellison's Buildings. The structure will occupy the site of shops of Champtaloup & Edmiston, booksellers, J. Howden, jeweller, and Mrs. E. Martelli, tobacconist, and will have a frontage of 50 feet and a depth of 110 feet. The shops on the ground floor will have a total floor space of 3228 square feet and will probably be occupied by the present tenants.

Mr. W. H. GLOVER, Lic. R.I.B.A., until recently with Mr. E. Bartley, has commenced practise on his own account at Premier Buildings, Queen Street, and has just received tenders for new premises for the Auckland Fruitgrowers' Association. The lowest, that of H. Colbourne, for £6335, has been accepted. Mr. Glover is calling tenders for alterations and additions to a clothing factory in Donaldson Street for Mr. A. R. Meek.

The massive front to the new Public Trust Office is nearly bricked up, and is looking very imposing.

The new Post Office is practically complete. Almost universal exception is being taken to the steepness of the front steps and the height of the posting lobby above the street level.

Improvements and additions to country buildings are proceeding apace, and the latest contracts, shortly to be put in hand, are for a branch of the National Bank of New Zealand at Pukekohe, and a new general post office at Tuakau. Both will be handsome buildings, to be erected in modern style, and are intended to provide for present needs and future requirements, as the respective localities develop.

The National Bank of New Zealand at Pukekohe is shown on the plans (Messrs. E. Mahoney & Son, architects) as a two-storey building, with a frontage of 30ft. and a depth of 54ft., and includes the banking premises and manager's residential quarters. Messrs. E. Mahoney & Sons have drawn plans for a new building, one storey, 52 feet by 42 feet, for the Bank of New Zealand at Morrinsville, comprising Banking premises and manager's residence.

An up-to-date block of three shops, to cost between three and four thousand pounds, is being erected for Messrs. R. & W. Hellaby, at Birkenhead. It will occupy a space practically 60 feet square, and will contain dwellings, with a fine harbour view, above the shops, two of which will be let and the other occupied by one of Messrs. Hellaby's branches. Plans will shortly be issued and tenders called for a new school at Takapuna.

Messrs. E. Mahoney & Sons, architects, are busy with plans for a new brick building for Hallenstein Bros., in Cameron Street, Whangarei.

Additions are being made by the Education Board to the Grey Lynn and Mt. Albert schools.

The Bay of Plenty district is shortly to be provided with three new Native schools—at Matapihi, Pukehuia and Maungatapu. Master's residence will be built for each.

Messrs. WILSON & MOODIE, architects, have in hand the new handsome steel frame building for the A.M.P. Society at the corner of Queen and Victoria Streets. The frontage is 30 feet to the former and 82 feet to the latter. This building will probably be comparatively the most expensive of its kind in Auckland. There will be concrete floors and staircases. The exterior will be very handsome, the lower portion will be faced with Coromandel granite and above Mt. Somers stone will be used. At the summit of the building will be placed a group of statuary of Mt. Somers stone, the tallest figure nearly 11 feet high.

Messrs. Briscoe & Co. are having considerable additions to their premises in Customs Street East from plans prepared by Messrs. Wilson & Moodie, architects. This will give an additional frontage of 31ft. upon which building will be erected in similar style to that existing. Support will be by cast columns on bed rock foundations.

A new hot water supply, by the installation of two calorifers, is being made in the Auckland Hospital.

It is proposed to erect a theatre at Te Aroha shortly.

In Customs Street West the foundations of the buildings for Messrs. A. & T. Burt are being pushed ahead.

Tenders are now being invited by the Public Works Department for the erection of an infectious diseases hospital at Rotorua. It will be a single storey building in wood, and the main portion covers an area 68ft. by 22ft. 6in.

It is proposed by the trustees of the Elam School of Art to erect a new art school in Rutland Street on a site provided by the City Council.

The Superintendent of the Workers' Dwellings Department is now calling for tenders for the erection of thirty-six new houses at Ellerslie and Otahuhu. Particulars may be obtained from the Superintendent.

In the last three years new houses have gone up in Auckland at the rate of four per day. Within the Greater Auckland area 4000 new homes have been erected in three years. A leading land and property agent informed a "Star" representative that whereas the population of Greater Auckland stood at 110,000, there were not 100 empty houses in the whole city, and that people frequently spent half a day in searching for a house before they found one that had a "to-let" sign showing. Last year over a million sterling was spent on new buildings in Auckland.

Messrs. WILSON & MOODIE report the following tenders received for the A.M.P. Society's new buildings in Queen Street:—W. A. Hutchinson, £24,500 (accepted); J. D. Jones, £25,200; Grevatt & Son, £25,222; J. Webster,

£25,753; Philcox & Sons, £27,410; Julian & Sons, £27,997; and Craig Bros., £34,900. The following tenders received for the additions to Briscoe & Co.'s new buildings:—Lee McKinstry, £5397 (accepted); J. Webster, £5678; F. Nelson, £5790; Craig Bros., £5787; Grandison, £5990; W. C. Johns, £6179; J. J. Holland, £6248; J. Colebourne, £6250; McCullum & Crompton, £6300; and G. Pallard, £6410.

HAWKE'S BAY.

Hawke's Bay uses between 200 and 300 tons of cement weekly, and ferro-concrete work seems to be the principal form of construction in this province. 450 tons of cement were used by the Napier Harbour Board in the construction of the Glasgow Wharf.

Four tenders were received at the last meeting of the Napier Harbour Board for the supply of cement, each being at the same amount £3 7s. per ton, and it was decided to divide the order equally between the tenderers—the New Zealand Portland Cement Company, the Golden Bay Cement Company, the Milburn Lime and Cement Company, and Wilson and Co.

Messrs. C. D. KENNEDY BROS., of Napier, report that work on the Waihaparata Bridge is being pushed on. This structure is to be in ferro-concrete. The Esk Bridge, which this firm have also in hand, is the largest completed in the neighbourhood, being, with connections, about 300 feet long. The under structure is ferro-concrete and the super-structure timber.

We are watching with much interest in Napier the reinforced concrete building at Ahuriri Spit for Robjohns, Hindmarsh & Co., for which Mr. Frame is the architect, and Mr. Aleck Scott the contractor. The blocks are hollowed out and recessed for bonding, cast in moulds, a thick surfacing colour being applied at the same time, rendering them a reddish stone colour like Dumfries stone.

Messrs. BEAGLEY & ANGUS, contractors, Napier and Hastings, have the following work in hand:—In concrete: Acetone works and Napier refuse destructor. In brick: Grain store, Hastings; Tourist Motor Buildings, Hastings; Central Hotel, Napier; and one cottage, Napier South. In wood: Additions steam laundry and three cottages.

Mr. BLIGHT, of Hastings, reports building eight houses in the last eighteen months, including a six-roomed bungalow with piazza. The first house in Hastings in which electric light was installed. Cost £700; also 5-roomed detached cottage cost £500.

Mr. A. GARNETT, architect, Hastings, reports the following work in hand:—New Wesleyan Church in brick and cement plaster, with Marseilles tiles on roof, inside finished in Keen's cement, to seat 400, at a cost of £3078; almost completed; contractor, T. S. Styles. Grain and produce store in brick, to cost £1500; almost completed; Beagley & Angus, contractors. Bungalow residence, with Marseilles tiles on roof, and rough-cast exterior finish; to cost £560; just completed; G. Hamilton, contractor. Residence with Somerset tile roof, concrete foundations and external finish in rough-cast; to cost £1400; work well in hand. T. S. Dobson, contractor. Weatherboard residence with concrete foundations; to cost £450; carpentering almost completed; contractor, Mr. T Styles. First story addition to boardinghouse; just finishing; cost £480; E. Harmon, contractor. Skating rink at Clive, in wood and iron; to open next week; cost £380; J. Laurenson, contractor. Just completed, bungalow residence in Napier; cost £500; W. J. Rood, contractor. Calling tenders for residence, to cost about £580, with rough-cast and weatherboarded external finish.

Mr. LEIPST has been successful in boring the well for the Hastings Borough. The depth is about 160ft. in the gravel, 6in. bore. These artesian wells give a rise of 8ft. on an average. The derrick for boring is compact and portable, and is easily transported from place to place with a traction engine, which furnishes the power for boring.

Mr. J. A. LOUIS HAY, architect, Marine Arcade, Napier, reports work in hand as follows:—Doctor's residence, Bluff Hill, Napier, £1029. Doctor's residence, Marine Parade, Napier, £200. Shop and offices, Taumarunui, £1060. Two shops and offices, Wairoa, £1851. Coronation Hall at Petane, £825. Three-story brick building for Mr. S. Parker, Napier, £6567. Cottage in Cameron Road, Napier, £610. Bungalow at Wairoa, £768. Farmstead at Omapere, £1300. Dwelling at Mt. Herbert, Waipukurau, £2230. Garage for Tourist Motor Co. at Hastings, £2582. Several smaller works for Arcade Co., Neal & Close, Masonic Hotel, etc. Plans being prepared for Mr. T. Tokson, of Waipukurau, and Mr. W. J. Douglas, of Paukawa.

Mr. E. A. Williams, who recently severed his conection as architectural draughtsman, etc., on the staff of the Napier Borough Engineer, has started practice as an architect at offices in Tennyson Street, Napier, and has completed several residence of the pretty bungalow type, including the residence for the caretaker in the Wm. Nelson Park; also for Miss Heays, Mr. A. McCarthy, Mr. J. T. F. Fawcett, Mr. A. Stubbs, Mr. S. H. Tuck, etc., and the pumping station for the Napier sewerage scheme, and several other works in ferro-concrete, and has work in hand running into several thousand pounds. Mr. Williams was also draughtsman for some time to Mr. W. P. Finch, F.N.Z.I.A., architect, and supervised the erection and executed all detail work for the Napier Municipal Baths. Before coming to New Zealand, he served under Messrs. Spalding & Spalding, F.R.I.B.A., architect on church and office block work in the city of London, and under Mr. G. L. Sutcliffe, A.R.I.B.A., on large country residence work. Mr. Williams has been for some years past the instructor of building construction and drawing at the Napier Technical College, and was recently elected Associate of the N.Z. Institute of Architects.

Messrs. BURR & MIRFIELD, architects, of Hallenstein's Buildings, Gladstone Road, Gisborne, report.—The construction of a modern bungalow, consisting of 6 rooms, natural lighting and ventilation being features of the design; roof "Poilite" tiles; price, £700; contractors, Messrs. Colley & Co. Renovating the Gisborne Hotel for Mr. J. Martin, manager Mr. G. B. Oman; price, £120; contractor. Messrs. Colley & Co. Alterations to "Whatatutu" Hotel; £160. A 2-story furniture factory for Mr. J. Townley; price, £490; contractors, Messrs. Colley & Co. Warehouse and offices in brick and plaster (stone finish), also for Mr. Townley, having tiled vestibule on the ground floor, with offices on either side, and a large bond store and cellarage for Messrs. Parker Bros. & Sheridan, wine merchants. The top floor is designed as show-rooms for the D.A.C.; there is an oriel

window in centre of facade, while the skyline is relieved with pediment and coping flanked with octagonal terminals; contractors, Messrs. Colley & Co.; price, £4000. A residence at Kaiti of 7 rooms for Mr. J. Adair; price, £900. A homestead at Ormand for Mr. J. H. Reyno'ds, 2-story building of 14 rooms, 2 cottages for staff of staff, stable building and coach-houses; contractors, Messrs. Bowen Bros; price, £2500. Plans being prepared for Gisborne Fire Station, to cost £2500; Anglican Church, Kaiti, £700; shops and dwellings for Mr. F. W. Williams; repairs and alterations Bradley estate; new hotel, Hot Springs, Marere.

Messrs. LANGLANDS & CO. have the breakwater extension contract well in hand at Gisborne. The mole is to be extended 200 feet, and will be a great protection to the entrance. The contract price is, we are informed, £17,000. Wilson's Star brand cement is being used in the manufacture of the blocks.

Messrs. GRAHAM & BROWN, architects, Gisborne, report the following work recently completed:—Church at Manutuke in brick, exterior rough-east, roof Calmon's asbestos slates, wrought-iron frames and casements, glazed in leaded lights; contractors, Messrs. Colley & Co.; price, £2065. Premises for the Gisborne Club; contractors, Messrs. Colley & Co.; price, £1577. Residence, Tokomaru, for Mr. E. R. Murphy; contractors, Messrs. Clayton Bros. Residence, Puha, for the Hon. W. D. S. McDonald; contractor, Mr. George Smith. Master's residence for the Gisborne High School Board, and further additions to same; contractor, Mr. George Smith; cost £3288. Buildings in course of erection:—Holy Trinity Church; contractors, Messrs. W. Webb & Son. Business premises for Mr. J. R. Redstone, Peel Street; contractor, Mr. George Smith; cost £2700. Residence, Whataupoko, for Mr. W. G. Maclaurin; contractor, Mr. M. Haisman; cost, about £2000. Opera House, for the Gisborne Opera House Co., Ltd; contractor, Mr. George Smith; cost, £11,000.

Mr. G. Smith has the erection of the Gisborne Steam Laundry Co.'s factory well in hand. The framework and roofing are up, and the boiler is being installed. The washing and ironing plant is on its way out from home.

Building Tenders.

For the erection (in brick) of Departmental Buildings at Gisborne. Address the Secretary, July 31st. H. J. H. Blow, Under-Secretary, Public Works Office, Wellington.

For the erection of a Power Station at Miramar. Specifications may be seen and schedules obtained at the office of the Council, King's Chambers, Harbour Street, and at the office of the consulting engineer, R. L. Mestayer, M.Inst. C.E., 288 Lambton Quay, Wellington. Tenders, endorsed as specified, on 20th July, 1912. R. E. Bennett, Town Clerk.

For the erection of a building in Wanganui for the Government Insurance Department. Close 31st July, H. J. H. Blow, Under-Secretary, Public Works Office, Wellington.

For the erection in brick and stone of the new St. Paul's Presbyterian Church, Guyton St., Wanganui. Plans and specifications may be seen at the office of Matthew Russell, 13 Taupo Quay, Wanganui, or at my offices, where close on 24th of July, 1912, at noon. W. Gray Young, architect, 217 Lambton Quay, Wellington.

For the erection of banking premises at Hamilton, for the Union Bank of Australia, Ltd. Close 6th August. Penty and Lawrence, architects, Wellington.

Crichton & McKay, architects, Bank Chambers, Wellington, invite tenders for the erection of a branch Bank at Carterton for the Bank of New South Wales. Close 25th July.

Engineering Notes.

"Procrastination is the thief of time." Do not put off your enrolling with the Auckland School for Engineers, is the theme expressed in their advertisement appearing in to-day's issue. The principal of this school has had years of practical experience which enables him to deal with every subject in so interesting a manner, that the student cannot help but thoroughly benefit from a course of instruction. The record of passes for five years exceeds 700. Prospectus and full particulars sent on application.

Auckland City Council accepted the tenders of the following for branch sewers as follows:—Section A: A. F. Webb, £1704. Section B: McGrath & Co., £2089 19s. Section C: G. Fletcher and J. Manning, £1781 11s. Section D: R. A. Watson, £2267 12s. Section E: Christoff and party, £1188 8s. 6d.

Nelson Council have accepted the tender of the Anchor Foundry for £250 for the supply of iron standards, and that of T. Grimmett, for £209 10s., for the concrete work in connection with the same.

The tender of J. and A. Wilson, of Wellington, has been accepted for the re-erection of the church steps, Nelson, in stone. The whole of the work will be executed in stone, the steps and pillars on the landings being of granite from Tonga Bay, and the balustrades of rubble stone from the Boulder Bank. Mr. A. R. Griffin is the architect.

Napier Borough Council received the following tenders for the installation of electric lighting appliances in the Municipal Theatre: Tolley & Sons, Wellington, £1849; J. J. Niven & Co., Ltd., £2101. In connection with these tenders J. J. Niven & Co. stated that there would be a reduction of about £1000 in the initial cost if the power was used from their works at Port Ahuriri pending the completion of the municipal electric system. The tenders were held over, pending further information on these lines.

The tender of Anderson's, Limited (£120) for the supply of special pipe castings for the Christchurch City Council works, and that of Lilly Bros. (£99) for a coke hopper and steel floor for the city waterworks, were accepted at the last meeting of the Council.

At the Government examination for Engineers, the Auckland School for Engineers presented 41 candidates, 37 of whom were successful in obtaining certificates, as follows:—First-class Marine Engineer, two (Messrs. Lorne Murphy and H. A. Bower); Second-class Marine Engineer, two (Messrs. J. Penman and R. Lewis); Third-class Marine Engineer, four; First-class Oil, one; Second-class Marine Oil, one; River Oil, two; River Steam Engineer, five; First Stationary, four; Second Stationary, six; Loco. and Traction, six; Winding Engine-driver, three; Marine Driver, one.

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