PROGRESS

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Progress

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EDITORIAL COMMENT.

Roads and Motorists.

In our motor section to-day we draw attention especially to the new departure in England whereby the motor interest itself has undertaken to put its house in order. Eminently British is this. Your Briton does not wait for the police or for the Legislature to hurry up. He just "stops the racket" if he thinks it wrong. Now there is no doubt that the racket in this case is wrong, for some motorists, bitten with the mania which is the curse equally of the motorist world and the other world, rush about the country, regardless of all laws human and divine. The Briton has discovered that there is no need to run to the law to ask for further protection. The decent motorist understands that the fault lies with the inconsiderate motorist, who has hitherto successfully defied the law. So long as there was a doubt about the justice of the law—as for example when the law wanted impossible conditions like walking ahead with a flag—motorists considered it good sport to circumvent the guardians of the law. But when the principle of circumvention was applied for the purpose of killing people carelessly and getting off scot free with a ribald tongue in a brazen cheek, then the decent motorist arose in his might, and, shaking the law by the hand, proceeded to make it hot for all offenders against decency, truth and considerate gentlemanly behaviour. Recognising that the public has as much right as they have to the use of the roads, they have taken measures to control the guilty through the medium of the innocent, who know the game quite as well as the guilty, and may be expected to play it properly. We may take it for granted that the worst evils of motoring in Britain are now numbered.

A Plea for the New Zealand Inventor.

BY PETER ELLIS.

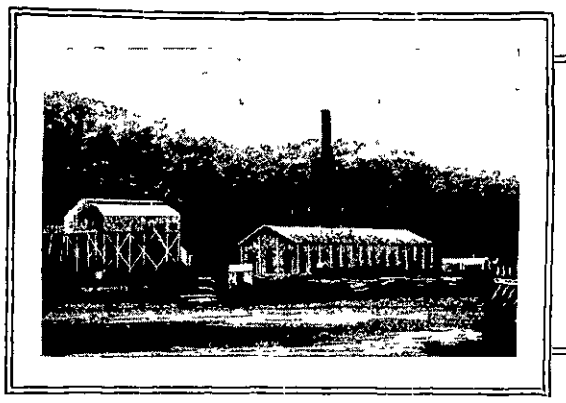
That the people of New Zealand are very inventive is shown by the records of the patent office. But can it be said that there is a correspondingly zealous spirit of enterprise among our moneyed men and speculators, who may do much to foster promising inventions, and so reap indirect, if not direct, advantage therefrom? The prosperity of a nation is largely due to inventors, and our Government may do worse than allocate some of their handsome surplus funds every year (when there is a surplus) to inventors who really make *bona fide* attempts, and sensible and practical efforts to improve existing appliances. Look at America from the inventor's point of view; the spirit of enterprise and push is so keen there in reference to inventions that every promising idea is readily snapped up and made the most of (if promising and practical) in the highest degree. Granted that 99 out of every 100 inventions prove useless, nevertheless it is worth while putting the 99 to the test in order to produce the successful one. Calculate the total number of patents applied for, and compare the cost with the value of successful ones, and it may easily be seen how well it pays a nation to offer every inducement for *bona fide* inventors to exercise their powers. Yet alas! I believe many valuable ideas perish on the threshold of nativity for lack of nourishment. Ninety-nine failures to secure one success is good speculation, compared with some fashionable ventures, to wit, games of chance, and the like, without one ray of promise, save mere "Devil's Luck," in which so much useful capital is sunk, but from which the industrial community reaps little indeed. The pity is that the spirit of perseverance in utilitarian industrial enterprise does not dominate our speculators as it does our inventors, for often long before a likely patent can reach fruition the speculator backing it tires and shifts his interest to another plane, only to find wise men step in where timid souls are scared, and reap the benefit at the critical stage. Mark the progress of the successful speculator, and you will generally find him "hanging on" when others slack their hold, allowing, of course, that 'ere he ventured on his project the chances of success were promising. Mark, too, the progress of the successful inventor; here, again, dogged perseverance crowns his aim "mid struggles fierce with friend and foe." No better illustration may perhaps be found than Edison's great fight whereby he lit his lamps. Impossibility, a very Goliath of Gath, has often to give way before a persevering shepherd boy with a puny sling and stone of his own invention. This giant says "You can't"; the persevering genius says "We will, we'll travel fast, we'll drive, we'll fly, we'll conquer earth and air"; 'tis done, and marvels yet to come the world must see. Now, if God's Own Country, Maoriland, must hold her own with other favoured lands, the purse strings must be loosed toward that end. Not in the football field, though eminent its place, nor racing track, good as it may be, nor in the daily dance of sensuousness, is found a nation's wealth. "The man behind the gun" is he who makes what is not yet, but still must be, as fate demands. Though failure after failure strew the way, we must go on, and win, and conquer. 'Tis evolution's way; the eternal grind of elements, gives birth to being.

To our Advertisers.

Our advertisers are respectfully notified that the services of Mr Phillip Palmer, who occupied the position of advertisement canvasser upon our staff were dispensed with some months ago. Our advertisement department is now controlled by Mr. Simpson.

MR SIMPSON, Chief of Advertising Department.

The Hon. R. A. Loughnan, who has been in charge of the editorial department of PROGRESS since December, 1906, continues to occupy the editorial chair.



Electricity and Mining

Westport Stockton Colliery..

The Westport-Stockton Coal Mine.

The Westport-Stockton Coal Co.'s Mine, which was opened on October 6th, 1908, is easily the most interesting coal mining proposition south of the Equator, and, in view of the extent of the coal deposits, and the high calorific value of the coal, one of the most interesting in the world.

A general description of the plant will be interesting, as illustrating the combinations of rope haulage and electric haulage used.

The coal deposits lie at a height of from 2,500ft. to 3,000ft. above sea level, and the converse of the usual practice had to be met in this case, namely, bringing the coal down instead of raising it, as in the majority of coal mines.

The general scheme that has been adopted is the use of two main inclines with steel rope haulage, by which the trucks are handled, the loaded cars going down pulling the empties up, the rope speed being controlled by a powerful hydraulic brake on each incline. From the head of the top incline to the mine the electric locomotives handle the trucks both ways, the small "gathering" locomotives making up the loaded trains by gathering loaded tubs from the various working faces in the mine proper, and breaking up the empty trains, distributing the empty tubs to the faces.

POWER HOUSE.—The Power House is of ferro-concrete construction, and is fireproof throughout. It is 174ft. long by 50ft. wide, and is divided into three compartments—engine room, condenser room, and boiler room.

There are two main generating units, each consisting of a British Thomson-Houston 3-phase Generator, 375 kw. 6600 volts, 60 cycle, direct connected to and on common bedplate with a 475 b.h.p. Bellis and Morcos triple expansion engine, the set running at 400 r.p.m. The engines exhaust into a Worthington Surface Condenser: capacity of condenser, 26.000lbs. of steam per hour with circulating water at 55deg. F. A Worthington Centrifugal Pump draws circulating water from a well near the Power House.

The three-throw Edwardes type air pump is engine driven by an engine of 25 b.h.p. condensing.

A Webster feed water heater is installed capable of raising 26,000lbs. of water per hour 30deg. F., using exhaust steam from the two boiler feed pumps and the engine driving the automatic stokers.

There are four Babcock and Wilcox boilers, each capable of evaporating 8,000lbs of steam per hour, from and at 212deg heating surface of each boiler, 619 square feet. They are fitted with super-heaters capable of superheating 150deg. The boilers have automatic stokers and chain grates with 4-speed gear feed, the stokers being driven by a small 15 b.h.p. simple engine.

The boiler feed pumps are Tangye manufacture. There are two of these, each capable of supplying the boilers with 75,000lbs. of water per hour against a pressure of 150lbs. steam.

It will be noted that the auxiliaries are of sufficient capacity to take care of the ultimate engine and boiler capacity of the plant, which will be double that at present installed.

There are two exciter sets, each consisting of a British Thomson-Houston 14 kw. 88-volt generator, direct connected to and on common bedplate with Bellis and Morcos simple engine condensing, the set running at 600 r.p.m.

For lighting about the plant, and for operating a number of d.c. motors used on the elevators and tipplers in the main coal storage bins, a motor-generator set is installed in the power house. This set consists of 100 kw. d.c. 280-volt flat compound Generator direct connected to a B.T.H. 3-phase 6300 volt form K. 150 h p. motor, the set running at 705 r.p.m.

The main switchboard consists of eight panels of white marble and three blank panels to provide for future extensions. From left to right, the switchboard is made up as follows:—

Feeder panel for generator of motor-generator set.
Generator panel of motor-generator set.
Starting panel for motor of motor-generator set.
Two blank panels.
Two main generator panels.
Main high tension feeder panel.
Blank panel
Two exciter panels.

The d.c. voltmeter for the motor-generator set is mounted on extreme left panel, the synchronising indicator and exciter voltmeter, together with Tirrill regulator, being mounted on extreme right panel.

HOISTS.—There are two small auxiliary panels near the main board, one for the control of a 40 k.w. 6600 volt primary 230 volt secondary transformer, this transformer supplying current for the operation of a 52 b.h.p motor connected to Lidgerwood hoist. This hoist is located near the bins, and is used to pull the Government Railway coal trucks out of a dip on to an incline, from which they are distributed by gravity into the various tracks under the bins for loading. After loading, the trucks also run by gravity to the main siding, where they are made up for despatch to Westport. The second auxiliary panel is for the control of a 75 k.w. 6600 volt primary 230 volt secondary transformer, this transformer supplying current for a 112 b h p. motor connected to Lidgerwood hoist This hoist has two drums with main and tail ropes, and corresponding brake and friction clutch levers. The one drum is used for hauling loaded coal tubs from the foot of No. 1 incline through the Ngakawau tunnel to the bins, the other for drawing empties from the bins through the tunnel. An auxiliary arrangement is also provided so that tubs and miscellaneous material can be hauled up from the shops and stores to the tunnel level.

RIGHT-OF-WAY.—The Ngakawau tunnel is 28 chains long, and has an average grade of 1 in 60, in favour of the load. The tunnel commences about 100 yards from the bins, and runs through to the foot of No 1 main incline. This main incline has a grade of 1 in 3.25 for 17 chains, and a further grade of 1 in 4.25 for 16 chains, in favour of the load. On this incline the tubs are handled on a steel rope 1¾in. diameter, the loaded tubs pulling up the empties, the whole movement being controlled by a powerful hydraulic brake located at the top of the incline. At the head of No. 1 incline No. 2 incline starts. This starts with a grade of 1 in 5 for 21 chains, and a further 1 in 19 for 17 chains, in favour of the load. The tubs are handled on this incline with a 1¼in. diameter steel rope, this being controlled from an hydraulic brake, located at the top of No. 2 incline, the method of operation being identical with that on No. 1 incline. Jacket water for the cylinders of both the hydraulic brakes is supplied under natural pressure.

ELECTRIC LOCOMOTIVES.—At the head of No. 2 incline the trucks run on to a level plat where the main electric locomotives begin their run. These main locomotives deliver the loaded tubs from the mine to the head of No. 2 incline, and pull back the empty tubs. At present the company have three of these main locomotives and two "gathering" locomotives. The main locomotives weigh 20 tons each, and are equipped with Sprague-General electric type M. control, to enable them to be worked as separate units, or coupled, as desired. Their draw-bar pull is 7500lbs., with a speed of 8.2 miles per hour. In order to guard against any possible chance of a locomotive taking down a loaded train of trucks getting away on the steeper grades, a third rail is located in the middle of the track, projecting a few inches above the level of the two outside rails, a very powerful toggle brake on the locomotive engages both sides of the head of this centre rail, giving tremendous brakeing power. This type of brake is known as the Fell brake, and has been applied by the engineers of the General Electric Company to these 20-ton locomotives.

The smaller, "gathering" locomotives, are of the G.E. standard I M.-101 type, weighing 6½ tons each, with a draw-bar pull of 2500lbs., and a speed of 7.4 miles per hour.

The d.c. trolley potential throughout is 250 volt. As before stated, these small "gathering" locomotives are for pulling full tubs to be made up in trains for the big locomotives to handle, and for breaking

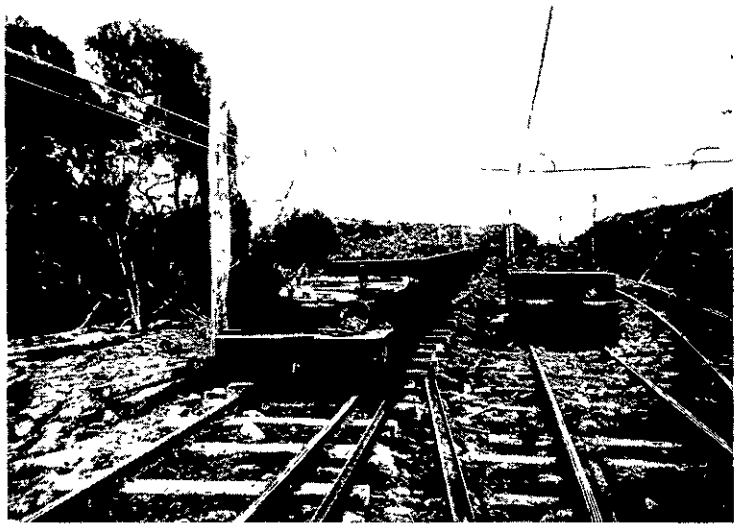
up the trains of empties and distributing the empty tubs to the working faces.

The coal tubs weigh 1500lbs. each empty. and when loaded 4500lbs.; in other words, each loaded tub carries 30 cwt. of coal.

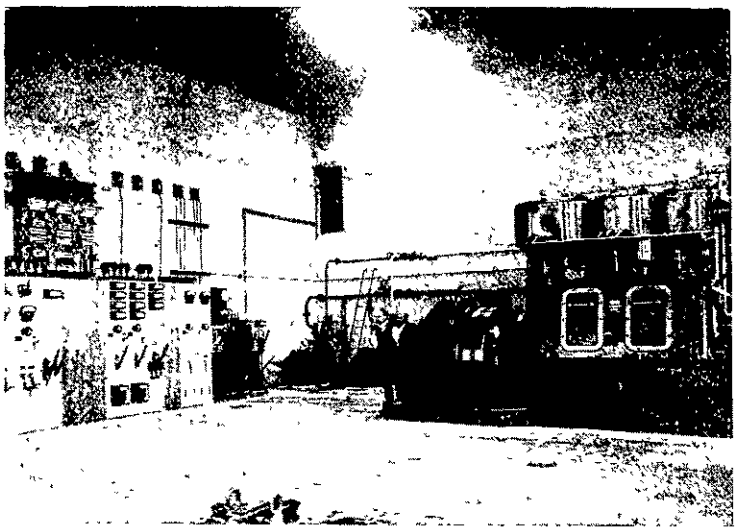
the farthest point of overhead construction.

TRACK.—The track from the head of the top incline right into the mine is of extremely solid construction for this type of work, having 56lb. rails on substantial

the main locomotives hand over the loaded trains, to No. 1 sub-station, is 35 chains, grades varying from 1 in 132 to 1 in 12, an average of 1 in 25, all in favour of the load, with a minimum curve of 2 chains.

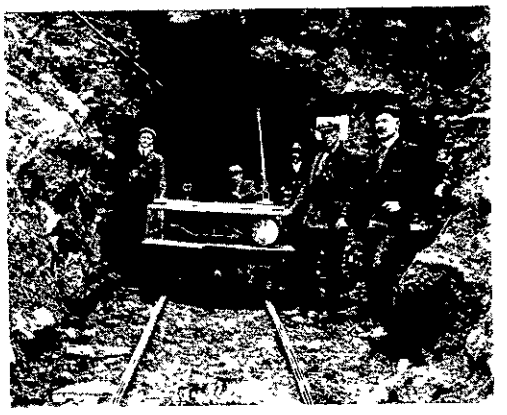


ELECTRIC MOTIVES AT HEAD OF NO. 2 INCLINE

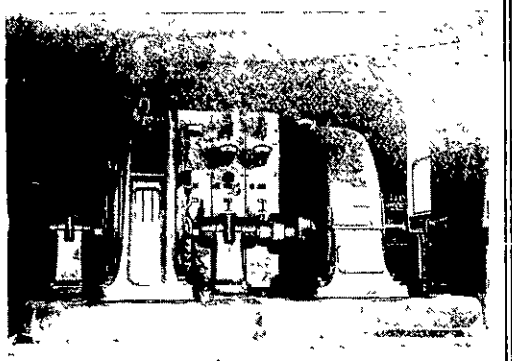


INTERIOR OF POWER HOUSE.

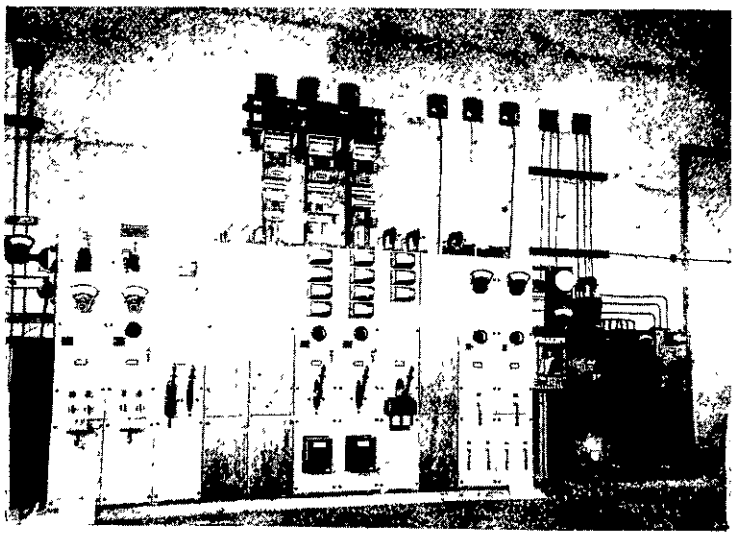
LOCOMOTIVE AND LONG TRUCK TRAIN.



ELECTRIC LOCOMOTIVE AT MINE MOUTH.



ROTARY CONVERTER FOR DRIVING TRAMWAY.



MAIN SWITCH BOARD IN POWER HOUSE.

BABCOCK & WILCOX BOILERS WITH CHAIN GRATE STOKERS.

The "gathering" locomotives are equipped with a reel automatically worked from the locomotive axle, containing 900ft. of flexible twin cable, to enable the locomotive to have an operating range of this distance beyond

sleeper construction. The rails are 40ft long, and at each joint are bonded with two No. 00 bonds, being cross-bonded every three rails. The gauge is 36 inches.

From the head of the top incline, where

From No. 1 sub-station to No. 2 sub-station, at the mouth of "A" tunnel, is 145 chains, grades varying from 1 in 12 to level, average grade being 1 in 21, with a minimum curve of 2 chains, all in favour.

From No. 2 sub-station to No. 3 sub-station, through "A" and "B" tunnels, is 79 chains, "A" tunnel being 15 chains long and "B" tunnel 64 chains long, grades varying from 1 in 10 to level, average 1 in 17, in favour of the load, minimum curve 5 chains radius.

"A" tunnel has been run purely for construction purposes, but coal will be won in all the other tunnels.

As the mine is developed, track will be continued through "C" and "D" tunnels, extending 110 chains beyond No. 3 sub-station, and excellent coal has been proved for two miles beyond this point. The track is single at present, and is provided with necessary turnouts to handle the traffic. In the whole layout, however, provision has been made for double tracking throughout.

OVERHEAD CONSTRUCTION.—With regard to the overhead construction. This is also of a most substantial character. The trolley used is General Electric Co.'s grooved No. 0000 throughout, and in parallel with it for the whole run is a bare stranded cable of 600,000 c.m. The feeder cable is tied to the trolley on an average every 150ft. The trolley wire is 7ft. 8in. from the level of the head of rails.

SUB-STATIONS.—Three sub-stations feed the overhead trolley network. These are identical with regard to electrical equipment. In each sub-station is a motor-generator composed of a d.c. 280 volt flat compound 200k.w. generator direct connected to and on common bedplate with a 3-phase 6300 volt form K. 300 b.h.p. motor, the set having three bearings.

The switchboard consists of three panels of white marble.

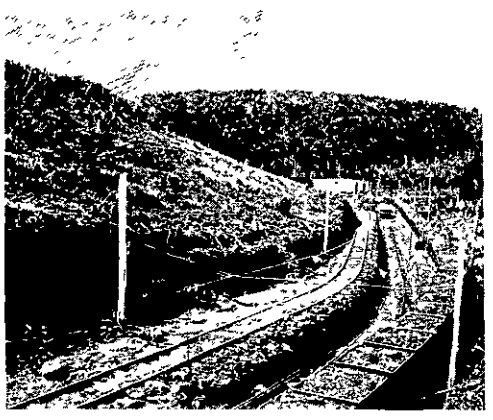
From left to right,—

Starting panel for motor with automatic oil switch.

D.C. generator panel.

D.C. feeder panel with voltmeter on swinging bracket.

TRANSMISSION LINE.—The three sub-stations operate in parallel, and are served



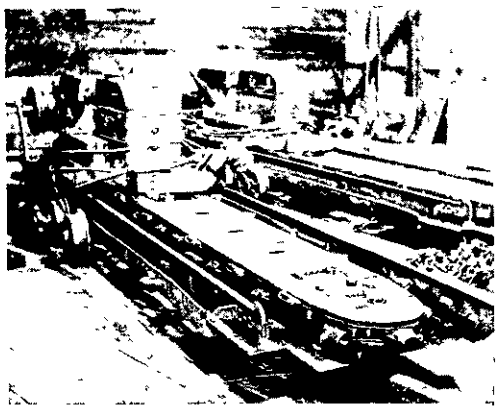
SIDING IN ELECTRIC TRAMLINE.

with 3-phase current at 6600 volts, the transmission wires throughout being No. 0 hard drawn bare copper: total length of transmission line, six miles.

A lightning arrester ground wire of five No. 16 stranded galvanised wire is run throughout the high tension line, stapled to the top of each pole, and is effectively grounded on an average every fourth pole, the distance between poles averaging 150ft. There are nine transpositions in the transmission line.

TELEPHONES.—Telephone lines connect the three sub-stations, power house, offices, etc., on metallic return, and are run on the transmission line poles from the power house to the beginning of the tramway track, and from that point to the end of the line follow the overhead construction. Each locomotive carries a portable telephone, by means of which a train can at once communicate with any of the points on the telephone network.

VENTILATION.—With regard to ventilation. The mine is exceptionally fortunate in this respect, in that but small fan capacity is required to assist and maintain the natural ventilation. Two fans, each driven by a 30 h p. B.T.H. 3-phase 500 volt motor, are used, one being located in the centre of "B" tunnel and the second in the centre of "C" tunnel. These motors are belted to centrifugal fans. The object in using 500 volt 3-phase motors for driving the fans is that this service will be con-



THE ELECTRIC COAL CUTTER.

tinuous, irrespective of any possible interruptions to the trolley overhead network. In addition to the above there are six Sturtevant blowers, each belted to a 5 h.p. d.c. 250 volt motor, which will be located as required at different parts of the workings, the motors taking current from the overhead trolley.

DRAINAGE.—The natural drainage is so excellent that the only provision made is a small Worthington pump, direct geared to a 5 h.p. 250 volt d.c. motor, this outfit being portable and readily moved to any point in the mine where it is necessary to pump out any small dips that will occur in working.

COAL-CUTTING.—For the winning of the coal, machines will be principally employed. The company are starting with two Sullivan board and pillar chain machines with 6ft. cutting bar, each machine driven by a 30 h.p. G.E. motor. These machines are the first of their class to be used in New Zealand. The Company have already proved 30,000,000 tons of coal in sight, the coal averaging about 14,000 British thermal units, being practically as good as the very best Welch coals mined. The seams vary from 6ft. to 12ft. in depth in the workings already opened, and the coal is entirely free from slate and bands.

With regard to the actual workings, the mine is extremely fortunate in having a solid sandstone roof, which will necessitate the use of very little timber for its support, this fact necessarily greatly increasing the rapid winning of the coal, with a corresponding decreased cost of production.

STORAGE BIN.—The main bin into which the coal is finally delivered has a capacity of 5,000 tons. It is divided into three compartments, two of 2000 tons each for the storage of unscreened coal, and one of 1000 tons capacity for the storage of screened coal. The loaded tubs run into the bin by gravity, being thrown into any one of the tipples desired, when they then turn over and discharge the coal on to the travelling elevators, which in turn deliver it to the various bin compartments. The tipples work automatically, the loaded tub in turning over carrying up an empty tub, which is then run down on the siding ready to be made up in a train for its trip back to the mine.

The main bin is composed entirely of ironbark built on pile foundation. Its loading capacity, if required, is 35 trucks at a time. The loading doors work in a horizontal plane, and are opened and closed by hydraulic rams operated at a pressure of 220lbs. per square inch, the pressure being obtained from a small stream near the top of the main incline.

The three elevators are operated respectively by two 10 h.p. and one 15 h.p. General Electric Co. C.q. motors, and the shakers are operated by three 5 h.p. Co. motors.

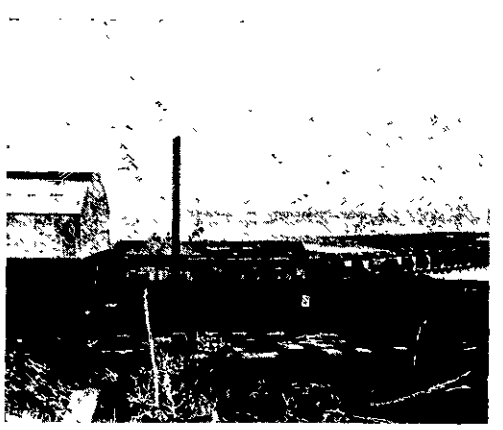
After coal is delivered from the bin into the trucks of the Government Railway, these trucks, averaging about 9 tons each, are pulled 22 miles to tidewater at Westport, on the West Coast of the Southern Island of New Zealand, this port at present admitting steamers to a draught of 22ft., although the Government (under the authority of an Act passed last session), have just authorised the expenditure of £200,000 to facilitate coal handling and enable steamers of 30ft. draught to enter the port.

Other large coal deposits in the neighbourhood are being taken up, and will doubtless be in full operation in the near future, making Westport one of the largest coal handling ports in the world.

Although the mine is on the coast, no harbour accommodation is available nearer than Westport, which at present is able to handle 1,250,000 tons of coal per annum.

The engineer of the company, Mr Broome, has proved himself a remarkably able man by the very complete and excellent layout he has made of the whole mine.

The complete contract for the electrical apparatus has been carried out by the Australian General Electric Co., and all the electrical apparatus is either General Electric Co., U.S.A., or British Thomson-Hous-



POWER HOUSE AND BINS.
Another view is shown in heading page 44.

ton Co.'s manufacture. The contractors have been ably represented by Mr. J. Schmidt, acting in the capacity of their constructing engineer.

The figures in centre picture, page 45, are:—From right: Messrs. Reece, Browne (mine manager), and Barlow (electric engineer), driving.

The General Electric Co., U.S.A., and the British Thomson-Houston Co., of Rugby, are represented in Australia by The Australian General Electric Co. The New Zealand representatives are the National Electrical and Engineering Co., Ltd., a purely New Zealand company, having headquarters at Dunedin, and branches in Wellington and Auckland.

Our Industries:

The Wunderlich Factory.

No. XXVII.

The Wunderlich Ceiling Factory.

COMPARISON is the sense which is most appealed to when the visitor enters this factory, for the sight of the very progressive industry before him compels him to bear in mind the past and the future, as well as the present. The present is a neat factory, compact, businesslike, evidently a going concern. The past, Australian, extends back twenty years. In Sydney the Wunderlich industry began with one room, one product, half a dozen workmen, a limited capital, and an unlimited stock of brains and enterprise. The capital limit advanced rapidly to £10,000 paid up, ran swiftly up to £25,000, and before many years it reached £145,000, spread over many establishments employing hundreds of skilled workmen, sending out goods to all parts of Australasia and to most of the Pacific countries.

With this state of things the factory at Newtown, established by the enterprise of Messrs. Briscoe and Co., makes at present but small comparison. But the past of the present establishment justifies the belief that the comparison of the future will show a better balance In an industry like this, a going concern to-day means a vast business to-morrow. They turn out in Sydney at the parent factory over 2,000 tons of sheet steel annually, in the form of ceiling material, amounting to some three millions of square yards, an aggregate big enough to ceil 200,000 12 x 10 rooms; and at the same time there are worked other metals, copper, zinc, galvanised iron, aluminium, nickel, and more, all used for various architectural purposes. Such an output, together with the evident and growing popularity of the departments of the same throughout the Dominion, is the best guarantee of the great development awaiting the newly-established industry which Messrs. Briscoe and Co. have taken in hand.

The building, on the hill top of Adelaide Road, with its bright, cool-looking roof of Marseilles tiling, is a prominent landmark, visible from most parts of Newtown. Passing through the offices, you enter the lofty workshop of wood and iron, 166ft. long by 34ft. in breadth, and 20ft. in height, with a roof of 10ft. pitch. It is splendidly lighted, and there is a travelling gantry with high speed gear, very convenient, and capable of picking up anything on any part of the floor and carrying it anywhere, to stack or load carts or unload them, or anything else that may be desired of it. Your eye falls on a few machines, a painting machine, a drop hammer machine, and a guillotine, with a couple of electric motors with shafting and belting above, and cases of reserve stocks of steel sheets, 30 gauge, the manager tells you—in various positions. A few men working about the machines, smoothly and fast, and that is all.

The practical man is delighted, for he sees in this compactness of simplicity and this easiness of working the evidence of work to be depended upon—evidently the result of much experience and thought.

GROUP AT THE OPENING CEREMONY, NOVEMBER 3RD, 1908

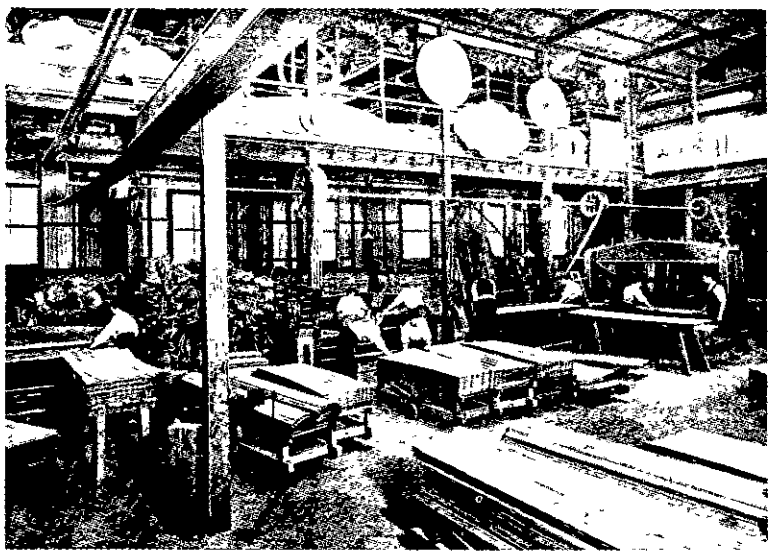
But the man bent on picturesqueness of description is disappointed, finding but small woof for his warp of words. It is not a case for "words, words, words." Nevertheless it is very interesting

Take that mechanical painter the workmen are serving with steel sheets, feeding them one by one into the rollers of the machine. These rollers (two) stand one above the other in a trough full of liquid paint; they are worked by a small electric motor, a little giant of seven cubic feet and five horsepower, that is heard not at all, and does strenuous work in an undemonstrative sort of way; there is a screw and some rubber arrangement regulating the thickness of the paint laid on the sheets as they pass between the rollers. The paint is continually splashing in the trough, but not a drop falls outside to make a mess—it is a little thing in itself, but a great demonstrator of the care and forethought of the planning. This paint, moreover, for all its fluidity, does not drip from the sheets, as they emerge each with a light, even, perfectly finished coat, which dries quickly in the racks put up for the purpose. This coat of paint is "the priming," fit to take on any artistic work that any artist may feel called upon to execute. The paint is mixed by a mechanical mixer, which, owing his life to the electric spark, never leaves off mixing steadily and well. What is the mixture? That is the firm's secret; and it certainly looks as if it were worth keeping. Talking output, we get better information. This painter, with his mixer and the aid of two men, can put through some 5,400 sheets a day. Compare that with a daily hand work compass of 60 to 70 per man. The world of factories is certainly not "The Land of Nod."

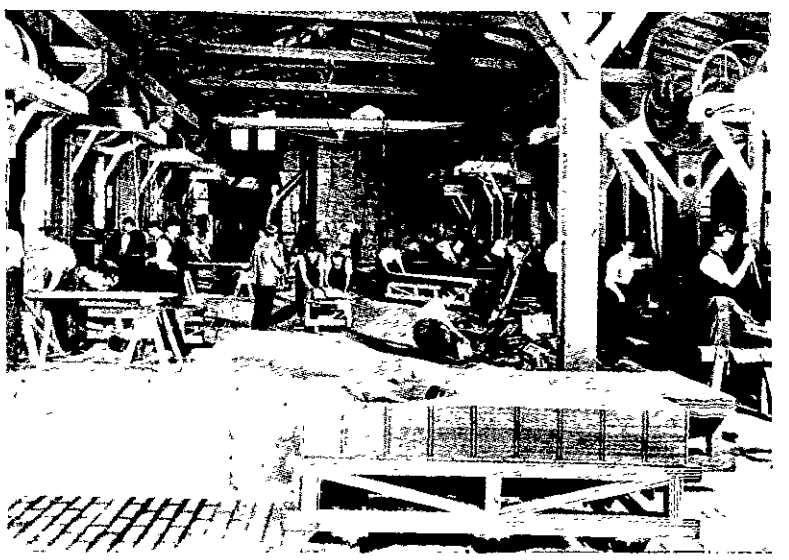
The dried sheets go next to the embossing process. Overhead there are wheels and pulleys actuated by a twenty horse electric motor,, not much bigger, however, than his brother who does the painting. Attached to the wheels and pulleys is the "drop-hammer," a solid block of metal which stands ready to obey the word of a workman standing by. When that word is given—by a cord, for in this noisy business of what use in the mouth of man?—the hammer comes down with a tremendous thud.

Below stands a die, on a base of cast steel which weighs some 10 tons, and the hammer strikes fair and square for the die, but hits the steel sheet which the workmen interpose, and you have a pattern embossed on the sheet. Suppose there are four squares to the sheet, the workmen move the sheet on after every blow, and the hammer comes down, and so on until the sheet is embossed from end to end. From the hammer the sheet goes to the guillotine, by which it is trimmed with mathematical accuracy so as to take its place in its destined scheme of decoration without further trouble.

The patterns are in great variety fit for ceilings, wall linings, wall exteriors, cornices, dadoes, overmantels, brackets, all things that architects design and artificers execute. They suit a vast variety of



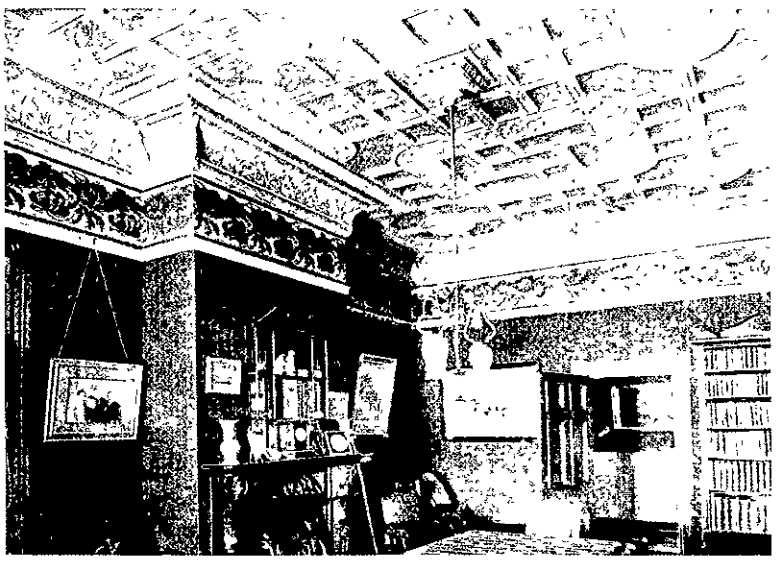
THE GUILLOTINES FOR CUTTING AND TRIMMING THE STEEL PLATES.



THE STAMPING MACHINERY. POWERFUL DROP-HAMMERS.

WUNDERLICH INTERIOR—DRAPED CEILING.

WUNDERLICH INTERIOR—TEA ROOM.



WUNDERLICH INTERIOR—LIBRARY.

WUNDERLICH INTERIOR—DINING ROOM.

schemes of decoration, all planned by the firm's architect, and the firm is ready and willing, even anxious to stand or fall, by them. They go further, even, for, like some politicians, they declare that "these are our unalterable sentiments and designs, but if you prefer others, just trot them out and they shall be made in our factory." Which means that the firm is prepared to turn out work according to any design that may be sent in to them for the purpose. That was what the firm did for the ceilings of the Sydney Town Hall and of the Wellington Town Hall, for example.

Such is the factory started by Messrs Briscoe and Co. the other day. We publish illustrations of the exterior and of the group of persons in whose presence the Mayor of Wellington declared the place open for business.

To show the future that awaits the enterprise, we have given some illustrations of the works in Sydney (the drop-hammer room and the guillotine room), together with various examples of the decorative work in situ. The order of the processes is as follows. Artists design the schemes and patterns, under the supervision of the chief architect of the firm. Modellers put these designs into plaster, and moulders turn them into metal. These are the dies used under the drop-hammers as above described. It takes three separate departments to turn out the dies, and there are several long galleries in which thousands of the dies are stored ready for issue at a moment notice. The painting and the embossing follow, as described, the difference being numerical, more machines and more noise, the latter being in the Sydney works, where twelve are going at top speed all together (at Redfern), deafening. It is noteworthy that, before the embossing, every sheet is overhauled carefully and nothing in the least degree out of order permitted to go on.

Then come processes more complicated, A department is busy with the making of the stamped parts of plans requiring building up, those ceilings, for example, which give the idea of great weight with deep shadows, and elaborate ornamentation of centre pieces and other devices. Another department is occupied by tinsmiths—skilled metal workers—who build up the parts stamped. The work is very elaborate and extensive, and requires great skill. In addition, there is an engineer's department, in which all repairs are effected to machinery, and new machines made as required; there is a carpenters' and joiners' department, in which is made the elaborate woodwork often required in the decorative schemes ordered from the firm. There are packing sheds and show rooms, offices, board rooms and the rest. The administrative and factory buildings cover two acres at Redfern, and have frontage to three streets. They are provided with electric light, and the most up-to-date conveniences of all kinds, and power is supplied by a "Diesel" 95 B.H.P. oil engine, the only one in use in Australia.

There are 260 hands; they have from the first been on the best terms with the firm, their hours being 44. The Wunderlich were the first in Australia to establish a true eight hours factory day, and there is a provident fund liberally subsidised by the management. The maximum ruling wages have always been paid, and the firm has a library of technical works to which the whole staff has access, and it encourages study by paying half the night class fees of those who choose to take that method of self improvement.

If an industry with "points" like these does not succeed in the Dominion it will be for no defect of its own.

THE WUNDERLICH FACTORY, NEWTOWN.

Increased Mileage on Pneumatic Tyres with Decreased Pressure.

On this subject, to which we devoted, recently, considerable space, the well-known Mr. S. F. Edge writes:—

Sir,—As you are probably aware, I have made very considerable experiments to find out, firstly, whether reduced pressure decreases the speed of the vehicle fitted with pneumatic tyres or not, secondly, whether decreased pressure decreases or increases the life of the tyre. The first series of tests prove that reduction of pressure in the tyres makes practically no difference in speed.

The second series of tests prove that you can use your tyres with less pressure than was commonly thought, and, therefore, the whole car rides more easily and smoothly, and at the same time the tyres actually last longer. The tests have all been carried out on the road on my own six-cylinder Napier.

The weight of the car complete, as I generally drive it, was a shade under 35 cwt. The result was that with 60lbs. pressure in the front tyres (880 x 120) they ran 88 per cent. further than when the pressure was kept at 70lbs. to the square inch, and when the pressure of the back tyres (895 x 135) was reduced from 85lbs. to 70lbs., I got an increased mileage of 49.9 per cent. It is, therefore, clearly proved that reduced pressure means greater comfort on a motor car and less expense in tyre bills.

I am now carrying out experiments with still lower pressures, but owing to the distance one has to run, it takes a considerable time to obtain results.

* * * * *

A Reply to Mr. F. Edge.

(J. A. Maclinch.)

I feel it a duty to disagree publicly with Mr. Edge's recommendation to inflate pneumatic tyres to a low pressure. His argument may apply to himself as an expert, but it will certainly cause great trouble and expense to the ordinary motorist, because, unfortunately, he deals with the question of inflation from the point of view of an expert driver, and, having driven with him, I must say that one can hardly feel any motion or side play when he is at the wheel. This, however, was when he kept his tyres inflated, and I have not recently had that pleasure, but I very much doubt if even he, as an expert, can prevent the side play with slack tyres, although he most unconsciously in his driving studies momentum and side strains every yard he goes The average motorist cannot be expected to do this, and he ought to consider the enormous unnecessary strain upon a slack tyre when turning a corner, caused by the swaying of the car, which creates a sawing action upon the edges of the cover by the rim.

These excessive strains, added to the undue wear, caused by the extra hinging of the tyre when driven insufficiently inflated, are exceedingly severe on the tyre and costly to the user.

When a car turns a corner at a fast speed with a slack tyre, the rolling action and side strain are much greater than when turning on hard tyres, because once a car starts to roll sideways on its tyres, it takes a great deal more to stop it than if checked in the first movement sideways, which checking does take place with a fully inflated pneumatic tyre. For the same reason, one is much less liable to side slip with a properly inflated pneumatic tyre, which grips the bed of the road than with a soft, flabby tyre, which the car rolls on and drags sideways with it.

For these reasons I entirely disagree with the advice given, and I think that it is a matter of great importance to all motorists that the following recognised scale should be strictly adhered to as most suitable and economical.

Section, 66mm.—To carry 600lbs. per wheel. Air pressure: Back tyre, 70lbs.; front tyre, 65lbs.

Section, 85 mm.—To carry 660lbs. per wheel. Air pressure: Back tyre, 80lbs.; front tyre, 70lbs.

Section, 90 mm.—To carry 900lbs. per wheel. Air pressure: Back tyre, 85lbs.; front tyre, 70lbs.

Section, 100mm.—To carry 1000lbs. per wheel. Air pressure: Back tyre, 85lbs.; front tyre, 75lbs.

Section, 105 mm.—To carry 1050lbs. per wheel. Air pressure: Back tyre, 85lbs.; front tyre, 75lbs.

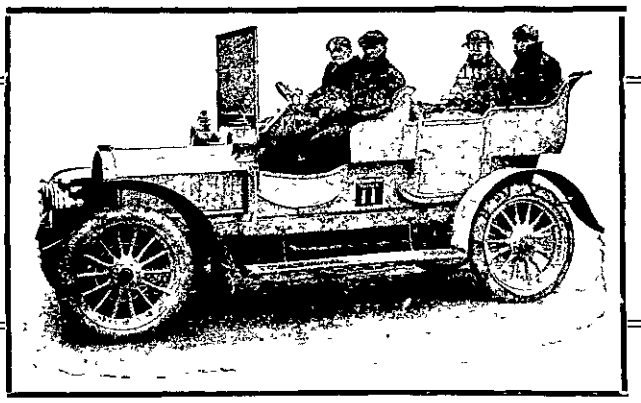
Section, 120 mm.—To carry 1300lbs. per wheel. Air pressure: Back tyre, 95lbs.; front tyre, 90lbs

Section, 135 mm.—To carry 1400lbs. per wheel. Air pressure: Back tyre, 100lbs.; front tyre, 95lbs.

Over 180,000 acres in Ceylon are planted with rubber. The total acreage under tea is unchanged. Tea and rubber are interplanted over 60,000 acres, and cocoa and rubber over 12,000 acres.

The Japanese Government has raised the wages of artisans, engineers and shipwrights employed in the Government dockyards to 1s. 3d. per day.

Motors



Motoring

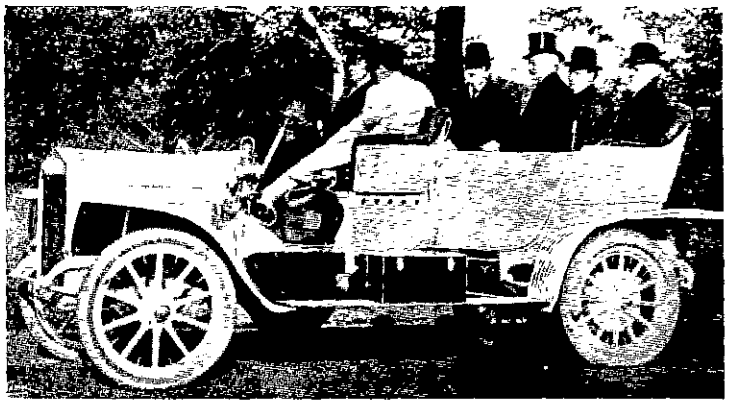
A Great Reform: Control of the "Inconsiderate Motorist."

In July last the President of the Local Government Board—John Burns to wit—gave a very significant warning to the inconsiderate motorists who had then made life unbearable to the majority of the users of the roads throughout Britain. He said. in answer to some questioner, Cathcart Wason, the persistent ex-New Zealander. if we remember right—

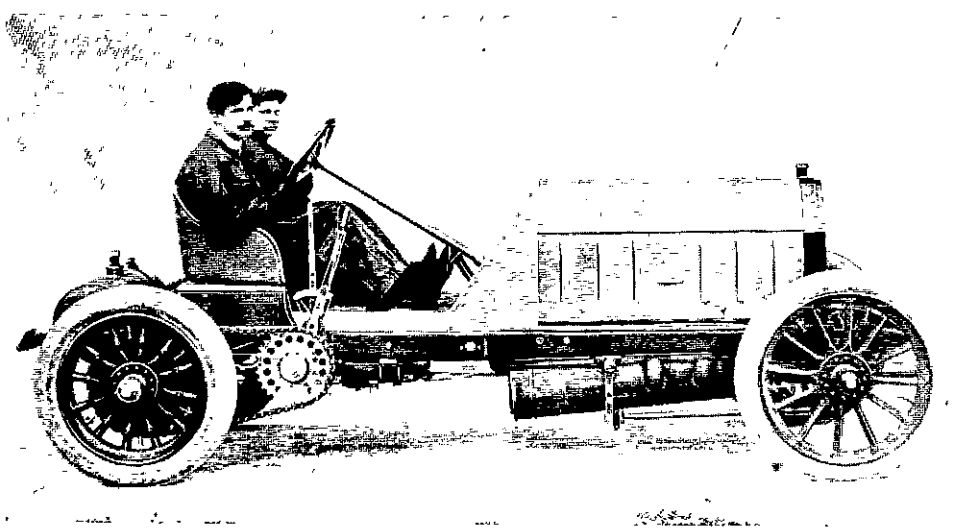
"Motorists would be well advised if they realised that public opinion was hardening considerably against the man who owned a motor-car and drove it under conditions and at a speed which were not in accordance with the neighbourly and kindly amenities that ought to exist among all drivers on the roads. They would be well advised if they recognised how public opinion was moving, and did not provoke the department to go to the extreme length anti-motorists had advised them to go, which he would be very reluctant to do. They had to be told and, if necessary, compelled to put their house in order."

How true these words were may be estimated from the lengthy correspondence which we published from the *Times* and various other journals in our November issue. No one could go through that correspondence without coming to the conclusion that the motor drivers of the British world have among them some very black sheep indeed, whose bad behaviour justifies the public feeling setting in so strongly against the motorists of Britain.

Later in the year the Royal Automobile Club took the matter up and drew the attention of its general committee to investigate and report. That body did so with most commendable promptitude. Briefly it devised a scheme for the suppression of what it styled "a nuisance which is one of the most important questions of motor politics at the present time." It went on to condemn the behaviour of certain motorists, a small proportion, it is true, but such, nevertheless, as to cause grave inconvenience and discomfort, and frequently considerable danger, to other users of the King's highway. For fear lest this should prejudicially affect motor legislation in the near future, the committee advised the Automobile Club to take the matter up, organise all the clubs under itself, leaving each to supervise the motor traffic in its own district, and to do so by getting each club to appoint a committee for the purpose, called the "Inconsiderate Driving Committee." It advised, in addition, the establishment of friendly relations with all the cyclist organisations, the issue of an invitation to the general public to report all cases coming under their cognisance to the local club, the latter undertaking to keep the correspondent informed of all proceedings and their results. Also to come to a proper understanding with the police on the subject, so as to convert what is now a hostile basis into mutual relations of help. The following is the text of the report as to the repressive measures recommended as a working system:—



MR TAFT, PRESIDENT-ELECT OF THE UNITED STATES.
Between two Campaign Speeches



NAZZARO AT BROOKLANDS on the F.I.A.T. Racer before running up to 120 miles an hour

REPRESSIVE MEASURES.

It has been agreed that any necessary repressive measures are to be taken by the club in whose area the car complained of is registered. The name and address of the registered owner of the car may be obtained by application to the proper registration authority on payment of the fee of 1s. It is necessary in order to obtain such information to give adequate reason for requiring it, and if it is stated that it is required for the purpose of investigating a complaint of inconsiderate driving, the information will at once become forthcoming.

In an ordinary case in which the offence is the first known to have been committed, or is of a trivial nature, it will probably be sufficient if the offender be seen personally whenever possible, or failing that a letter should be written to him pointing out the importance of displaying every consideration on the road. In more serious cases stronger action is necessary, and the following are among the steps which may be taken:—

1. Where, in the opinion of the local club, the circumstances demand it, to suggest prosecution.
2. To expel from membership of his automobile club.
3. If a professional driver, or one otherwise entered on the competitors' register, to recommend removal of his name for a certain period.
4. If a driver holding R.A.C. certificate or registered for employment to recommend withdrawal of certificate or removal from register.

The local club will keep a proper record of every complaint which, in the opinion of its Inconsiderate Driving Committee, is justifiable, and a "complaint book" will be supplied for this purpose. The Inconsiderate Driving Committee will periodically examine this record with a view to taking special action in any case requiring such a course.

The essence of the scheme is:—

(*a*) Active co-operation between the local clubs and the police.

(*b*) A closer union between the local clubs themselves, and combination to suppress inconsiderate driving.

(*c*) All investigations into reports of inconsiderate driving to be conducted by

the club in whose area the offence is committed.

(*d*) All repressive action to be taken by the club in whose sphere the car is registered.

Of course the club was to co-operate to the utmost of its power with the local clubs. It was a scheme complete and fairly workable, and, above all things remarkable, for the good will with which the leading motorists of the Kingdom went into it.

Almost at once the whole of the local clubs took up the suggestion, and the motor world is now engaged in the business of setting its house in order.

At the same time the Local Government Board was not idle. It addressed itself to the County and Borough Councils, and discoursed to them anent the evils of the motor traffic due to the inconsiderateness of the few, who ought to be repressed. One reads the document with much attention, seeing that its author is the practical John Burns, and the object is to help the motorists who are trying to help themselves. Before deciding upon fresh legislation, the Board draws attention to the provisions of the existing law, which, it thinks, should be sufficient to prevent most of the evils complained of. In particular it considers that racing, either by motor-omnibuses or other motor vehicles, on the public highways should be rigorously suppressed. The circular acknowledges that a speed of ten miles an hour may often be exceeded with safety, and offers some advice as to the conditions in which the lower speed limit may properly be imposed. After inviting the road authorities themselves to help in diminishing the risk of accidents by the rounding off of street corners, the pruning of hedges, and other measures, the Board discusses the dust nuisance, which, it fears, cannot at present be altogether removed. It recommends the road authorities, however, frequently to water the roads

Alcohol for Fuel.

An advantage of this fuel is its cheapness, as we have shown from time to time, but it is an advantage that falls short of predominance. It has now been discovered in Queensland, we understand, that a percentage of the molasses running from the sugar mills is alcohol, which can be separated at a cost amply repaid by a selling price of sixpence the gallon. Mr. Cheal, who writes to us on this subject from Auckland, suggests that the Government would do well to take up the industry. He cites the case of Russia, which makes alcohol a Government monopoly. Russia is, of course, not exactly the model for a free country to form itself upon, generally speaking. But there may be exceptional reasons in this case. Any move in the direction of cheap fuel would be welcome, especially if it took the shape of a large national profit in connection with what the Prohibitionists would call an innocent trade. The only way for a start would be to secure the option over the whole Queensland and Fijian output of molasses. How long the Governments of those countries would permit the resulting profitable monopoly to be enjoyed by this Dominion is another matter. Possibly the monopoly would find itself soon in the category of things that get short shrift At any rate, there is room for an inventor to extract the alcohol at the price, or if an inventor is not required, the place will be for the first enterprising business man that comes along.

The Magneto.

If given a fair chance a good magneto is a most reliable instrument, but we must say that many magnetos do not have a fair chance. They are put in such a position that they are constantly bombarded with splashes of oil from the engine, flywheel, or gear, and very often, too, they are exposed to wet not only when the car is over-copiously washed, but when driving in heavy rain they are sometimes just in a position where they get quite a lot of it. Now, a little wet or a little oil does not hurt the magneto, but when the machine is constantly soddened with one or the other trouble is apt to arise; in fact, it is sure to arise eventually, and it could all be overcome if the magneto were covered. Many cars have a neat, strong leather cover which completely envelops the magneto machine, and we certainly think this is a desirable precaution in the majority of cases. It is true that some magnetos are so placed that they are protected entirely, or almost entirely, from wet or oil splashes, but even these would be better for being covered up, as the cover keeps dust out of the machine, and that must tend in the long run to a longer life of the distributer and working parts generally.

Concerning Varnishing.

The average motor mechanic regards the work of renovating motor bodies as exclusively a coachpainter's job, and so it is when it has to be done thoroughly, but as all of us are more or less slaves of appearances—our customers more so—it may be usefully noted that a coat of varnish on top of dull paint makes a car *look* as though it had been renovated, and as it is quite easy to do it quickly and well, there is no reason why it should not be done by repairers oftener than is the case after a thorough overhaul, and when the car owner has neither time nor inclination to wait for the coach-painter's slow and methodical procedure.

The constant washing of car bodies, of course, destroys the original coat of varnish, and the paint work takes on that dead lack-lustre appearance which makes it appear as though re-painting is essential.

For instance, we have a car in our repair works now which has not been painted and lined for two years, yet the paint on the body and the engine bonnet is good, though dull. After some extensive repairs to engine and chassis, I had the painted parts washed quite free from all traces of grease, and likewise had the workshop floor swept free from dust and very liberally watered.

Then, after closing time on Saturday night, two of us put in a couple of hours overtime with a varnish brush each, and half a gallon of best pale carriage varnish, which we applied as thinly, evenly, and deliberately as possible upon the clean, dull paint.

Thus Saturday night, Sunday, and Sunday night were available for the varnish to be drying within closed doors, in an atmosphere comparatively dustless with what it is during the ordinary week days. The car body has now quite a smart appearance, which is in keeping with the extensive repairs previously effected.

The essentials to success in this matter of re-varnishing are best quality carriage varnish, good brushes, a surface free from grease to work upon, and an atmosphere free from dust.—*A Manufacturer in Print*.

The Motosacoche.

A correspondent writes enthusiastically declaring that the growing popularity of the handy little Motosacoche has been frequently remarked, but it is not till one's business or pleasure takes him to remote and the more inaccessable parts of New Zealand that the quality of this popularity is properly understood.

I am, he says, an ardent admirer of this natty little motor cycle, and watch with interest its conquest of our country.

This was forcibly impressed upon me recently when a fellow passenger in the s.s. "Kahu" informed me that his way home to Castle Point, on the East Coast, lay over the side of the steamer (with his Motosacoche), into a surf boat, and thence per motor along eight miles of ocean beach, broken here and there with patches of huge boulders over which, of course, it was necessary to lift his motor. Again, when gazing from the train at one of the stations on the Main Trunk line with the wondering eyes of a stranger in a strange land, a back blocker on a pack-laden Motosacoche looked so grotesquely up-to-date that an involuntary smile went round the carriage. A well-known traveller for an American oil firm, was recently met crossing the Otira Gorge to Christchurch. He had his wife on her ordinary cycle coupled to the side of his Motosacoche, and his proud and tolerant smile as the pair glided by, clearly showed he had no desire to adopt such obsolete methods of travelling as coaching. In the Waikato, Rotorua, the rough bush tracks from Gisborne to Opotiki, over the Rimutaka, Hokitika, the gold fields of Central Otago; in fact, everywhere is the Motosacoche finding its way into man's everyday life.

One reverend gentleman considers the fact that morning service is separated from his evening service by 50 miles, of very mixed road, nothing extraordinary now he has a Motosacoche, while country doctors hail their Motosacoche as the greatest blessing of the century. It is the fact of its extreme adaptability on all classes of roads and tracks that has made the ordinary bicycle popular, and I have not the slightest doubt that in a short time the easy and luxurious Motosacoche will not only secure enormous patronage from the non-cycling public, but will also largely displace the push bicycle here, as on the Continent.

Racing—A Renunciation.

(S. F. EDGE IN *Auto-Car*.)

Sir,—The views which have been so well expressed in your colums with regard to dangerous motor racing have interested and impressed me greatly.

I feel that you will realise that the question is a very serious one for the manufacturer.

There can be no doubt that the rapid development of the automobile has in the past been very largely due to racing, and the public undoubtedly then took a great interest in it; but your recent utterances have developed the fact that there is now an immense volume of public feeling against dangerous racing, and that there is a general idea that the automobile is developed and established so sufficiently that racing demonstrations of an extreme type are no longer necessary.

As one who has been responsible for most of the racing in this country, I think it may perhaps be my duty in deference to public feeling to be the first manufacturer to publicly announce my intention of withdrawing Napier cars from all dangerous competitions.

In making this announcement I hope the public will accept my assurance that my sole object in automobile racing in the past was to demonstrate the ability of a British manufacturer to hold his own in this high type of engineering against any one in this world, nothwithstanding the long start our faulty legislation gave our foreign competitors in this great industry.

I feel that that object has now been achieved, and that the British motor-car now leads in type, design and workmanship.

As I have said, this matter is a serious one for the manufacturer, and it is possible that abstention from racing contests may, as some think, react upon my firm. I must therefore qualify this declaration of my withdrawal from abnormal contests by claiming liberty to lead the way again if I have mistaken the trend of public feeling.

I would add that my decision in relation to racing will involve no relaxation in every possible scientific effort towards the refinement and development of the British motor-car.

The Mastery of the Air

A Record of the Achievements of Science in the Realm of Aerial Navigation

The Fatal Voyage of Zeppelin No. IV.

An account of the sensational flight of Count Zeppelin's big "dirigible," from the pen of a journalist who sailed with him, is deeply interesting and suggestive. Emil Sandt writes in a German paper:—

"To the north I could see the Hohentwiel. Behind us lay the Swabian See glistening in the morning's sun. In the south-west I saw Thurgau wrapped in violet light. On the horizon the lofty peak of the Saentis rose broad and jagged, capped with ice and snow. Below us writhed the Rhine. I looked across at the propellers. Count von Zeppelin had signalled full speed ahead. The giant airship trembled. The propellers seemed like disks, revolving with furious speed, and yet as transparent as locust's wings. They gave out a note like that of a deep organ, so loud that the human voice even when lifted to a shriek, could hardly be heard.

"I walked down to the rear car to obtain a better view. Here the gigantic craft could be seen in a wonderful perspective. The sensation was strange. The giant ship obediently sank and rose. Obediently moved to the right or to the left, slavishly following the slightest pressure of the human hand. Sometimes its angle was such that the entire fabric seemed inclined like a kite. At times the forward car lay beneath us; at times we had to look up at it.

"As we neared the splendid falls of the Rhine at Schaffhausen, the Count brought the airship down, in order to ascertain whether the eddies occasioned by the waterfall would have any effect.

"We turned into the Reusstal, but were buffeted by the wind all the way up the valley. To the south the sharp jutting peak of Mt. Pilatus hove in sight. Soon Lucerne appeared, a jewel among cities. The lake itself shimmered brightly where it was struck by the sun; its darker portions lay like an emerald, held in a setting of heliotrope. It was like a melody in colours. Below us in Lucerne itself there was a hubbub and a great jubilation. The streets were crowded with gayly-clad people. The roofs were a-swarm. Zeppelin guided his airship down, and allowed it to glide full speed over the city at the height of the church steeples

"We travelled over the Vierwaldstaetter See, and crossed to Kuessnacht, to Zug Lake, and up northward to Zug itself. Then came the most difficult task which Prof. Hergesell had assigned to the airship. The craft was to carry us straight across to Lake Zurich, through a narrow pass, where it would be caught in a veritable cyclone. The motors groaned and rattled. The propellers howled a deep droning song. The airship did all that it could. The wind was dead against us, travelling with a velocity of nearly 31 miles an hour. The Count could easily have arisen and escaped the fury of the blast, but it was his purpose not to avoid obstacles, but to court them. Whenever the great airship showed signs of swerving, it was brought back into its course. Far below us in the valley the sharply-marked shadow of the airship, crawling slowly from tree to tree, showed us how hard it was struggling. There were minutes when it seemed as if we stood stock still, despite the infernal music of the propellers. Gradually the nose of the craft was thrust forward; once more the airship mastered the wind. We had forced our way through the pass, and were dashing on at full speed. The vast shadow below us travelled with the velocity of a bird over mountains, valleys, cliffs, and rocky points, over railway embankments and roads, over water and land."

It will be noticed that the writer speaks of the deafening noise made by the propellers. This upsets the balloon novelists whose craft move in deadly silence. The flight above described is shown in the second chart, page 54. The line of the last flight is given on the same page.

COUNT ZEPPELIN

THE FIRST TWO DAYS
(Trying the Propeller on a boat.)

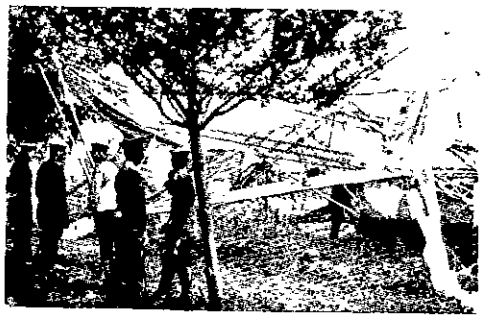
Reflections.

After the end of that last flight, it seemed as if the Dirigible must disappear from history. The only idea at first was to save the old Count from loss. But in Germany balloons and patriotism are convertible terms. While Englishmen wept over the Count, comparing him to Tantalus, and gushing over his torment, the Fatherland gave five million marks in a few weeks, for a little book of history and a postage stamp with his very striking likeness. Thus it is clear that all the loss has been recouped, and a good deal more is in hand than ever was before. It is from this book that we have taken our illustrations. The first is the Count's portrait, the second shows the first experiments with an aerial propeller, in which that novel machine drove the boat at a great pace through the water, another shows the airship being towed out for the start of her last voyage, another gives the view from her deck of the Rhine valley, and the three last are plans of the anchorage where the Zeppelin balloons have been built and exercised, and of the famous last flight of No. IV.

The whole story is told in this volume, from the inception of the first idea to the day of the disaster; and the beginning of the swift rebound and remarkable progress towards rehabitation is given in plain Teutonic prose, bright throughout with national pride. Moreover, it is full of pictures. Very early in the story is the picture of the first trial of the aerial screw propeller, which astounded all hands by driving the boat of the experiment faster than any sail had ever sent her through the water. Every stage follows of the strange, eventful Zeppelin history. In the centre, as it were, is the ancestral home of the Count, the scene of the evening labours of his life, which have produced the German lead in ballooning. Hard by is a picture of his little daughter, standing with the old man, ready to embark in the balloon's "Gondola"—a touching picture, which makes the Fatherland weep. The Fatherland itself lies spread out throughout the Rhine Valley showing the famous "Falls" and all its storied cities. Finally are the ruins of No. IV.—a great book and most touching.

The Accident.

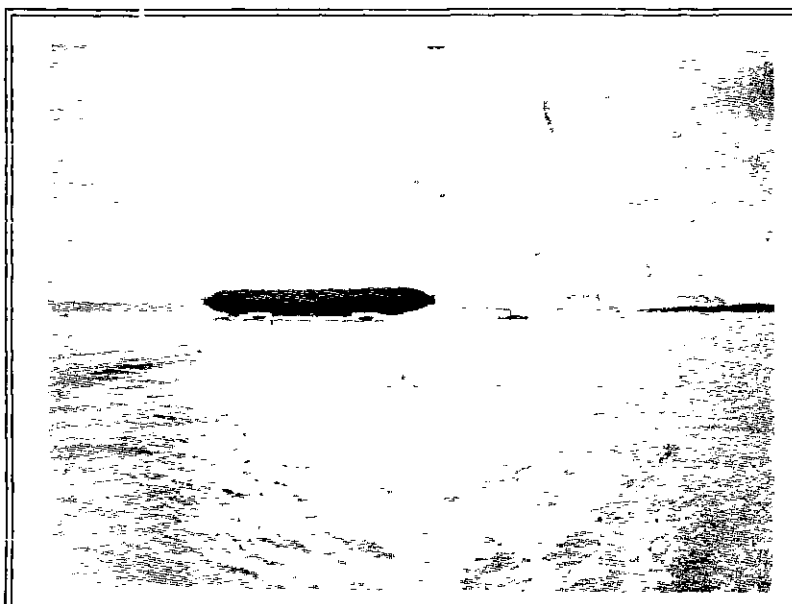
The voyage which ended disastrously in the burning of the balloon often described came to an end as has been told. It must have been enjoyable and impressive. Moreover, it may be gathered from the description which is masterly, that



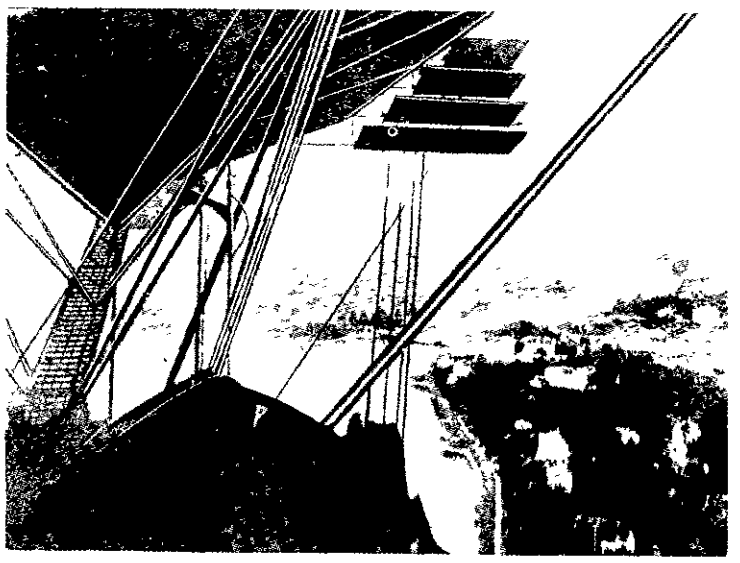
THE LAST DAYS
(Mourners and Ruins at Echterdingen.)

the type has got some command of the air, as the passengers noted when the Count forced his vessel through the defile. Our illustrations show the runs of the ill-fated ship. These are from the volume which has done so much to work up the subscriptions of the Fatherland to the large amount cabled as already collected.

In dramatic suddenness of catastrophe Count Zeppelin was like Orville Wright. In the sequel there is not the least similarity, Wright still lies in hospital, while his passenger is in his grave. The Count, on the other hand, has been extricated by the Fatherland from his misfortune. As soon as the disaster was known a wave of generous patriotic sentiment burst forth all over the land, and the rush of subscription was methodised. A special issue of stamps with the old gentleman's portrait was sold, and went like wildfire, and a little book, profusely illustrated, giving the history of the Count and of his balloon from their earliest days was issued, which sold like hot cakes. Between them these two brought in the tidy sum of five million marks, or £200,000 of our money. The expenses must have been considerable, but whatever they were it is clear that the £100,000 the Fatherlad started out to get for the patriotic nobleman has been just about received by this time. It gives warmth of colour to the recently cabled story of the veteran carrying the German Crown Prince round the Fatherland in a newly-furbished old balloon, meeting the Kaiser on the way, who greeted the pair with the customary infallibility and terseness of expression.



GOING OUT FOR THE LAST FLIGHT.



IN MID AIR. Looking Down the Rhine Valley.

It is well, for some infallibility is wanted more than can be secured for the dirigible type by even national subscriptions, and fervent patriotism. Before the disaster the poor Count had worked himself to the pitch of infallibility, in an article contributed to a periodical on the subject of "The practical use of airships." It was a fascinating article dealing with the development of a fascinating subject. It was wise withal, and prudent. It did not conceal the author's opinion that the use of the dirigible must be confined for ever—on the scale of the Zeppelin construction—to Governments and very wealthy individuals. It was based on a theory worked out by the author that with the average force of winds prevailing throughout Europe, a dirigible may depend almost always on going anywhere it pleases. This is his way of putting it:—

"My airship travels 4000 kilometres, or about 2,500 miles, in four days, going at the rate of twelve metres a second, or 43.4 kilometres an hour Through a careful study of the hourly report of the speed of the winds given out by the meteorological stations, the stormiest day was planned that could be conceived of in the course of a year from the longest period of the most violent winds. By comparing such a day with days of moderate winds the conclusion was reached—for middle Europe at least—that the most difficult conditions for an airship to weather are presented by winds blowing in the same direction at the rate of six metres a second for four days in succession at a medium elevation. Under such highly unfavourable circumstances my airship would cover 1700 kilometres in four days, and would have on hand at the end a sufficient reserve of fuel. Thus, on the most unfavourable days of the year, the ship could travel from Berlin to St. Petersburg, Moscow and Constantinople, though to reach the last two places would require nearly four days. On an average, under favourable circumstances, about thirty hours would be required: under less favourable circumstances about forty It would, therefore, make better time than the speediest train of to-day."

On this basis the Count built up a conclusion that the airship, once its capacity is known, could, by confining its voyages to half that capacity, be very usefully employed in new lands, or for strengthening a country's hold upon colonies into which no railroads as yet conduct, travelling by short stages of 300 kilometres each, as such short stages (there and back) require but little fuel. Under such circumstances the number of passengers could be comparatively large, as also the weight of cargo carried for making good stations at intervals in the new country.

Knowledge of the winds, he proceeded to explain, is far more necessary for flights over the ocean than for flight over the land. At present he regarded a flight of 1000 kilometres as the limit of travel over the ocean, but it is a matter of the prevailing winds entirely. As to war, he thought his airship would certainly be very useful for various purposes, such as scouting and striking the enemy's shipping. In commerce he ventured to say that most varied enterprises may be undertaken, and he even went into figures to prove that a capital of £40,000 could establish a balloon service between Berlin and Copenhagen with both certainty and a profit of 10 per cent., making a hundred trips a year both ways. But he planned another excursion, which, running between Stuttgart and Lucerne, might be made to pay 100 per cent. on the outlay, by its appeal to the Germans to visit the most famous places in the history of the Fatherland. He concluded with a short dissertation on the need for international agreements as to the use of the atmosphere by the airships of different nations.

"But why do I proclaim," he asked in conclusion, "aloud my aeronautic profession of faith. Why do I call attention to the extraordinary capacity for development of the rigid system by calling attention to past performances and pointing to scientific truth? Because the time is not so near as it appears to be when deeds will prove the futility of every doubt. Who will guarantee that such accidents as have occurred will not occur again?" But come what may, he was prepared to consecrate the rest of his life to perfecting the work to which he has put his hand.

Now a careful perusal of the account of the journalist who made the above trip in Zeppelin No. 4 will convince the most sceptic that the airship in question had got far beyond the point to which Wellman had advanced when he came to such terrible and decisive grief in his attempt to reach the North Pole. That can be seen in the episode of the struggle of No. 4 through the defile between the two hills so well described. The episode certainly showed a capacity for struggling with a certain amount of success against a moderately high wind. But the pace of the airship as stated by the Count in his article, 43 kilometres an hour, causes a limit to loom up which is fatal to the allegation of certainty of the voyages. Moreover, the Count, in the article, allowed for every possible contingency except two. One was the liability of the dirigible to be blown to leeward, and the other, the very contingency which wrecked the balloon with such swiftness of destruction. There was no shelter, by the way, when he was forced to camp for lack of fuel. And why was the fuel lacking? Enough had been put on board for the distance contemplated, and to spare. The shortage was, according to the accounts which have reached us, due to leakage. But why was there leakage? Probably because the gas bag had been unduly strained by the fight to force the ship ahead against the wind through the pass. Forced to descend for lack of gas, the ship was caught in a storm and wrecked without any resistance or delay whatever.

All these considerations, however, have no effect on the opinion of the German people or of the German Government. The Count's dirigible is in favour, he has obtained ample funds to build another and stronger ship, and he will experiment further with the ships he has already built. Once more he is careering through space, once more has he the most distinguished people of the land for his passengers, once more will he make a bold bid for the mastery of the air.

Zeppelin's faith is not dead, and he does not stand alone as a believer, for the Governments of all countries are building dirigibles as fast as they can. In spite of accidents in great variety they continue the race for the possession of the largest air fleet.

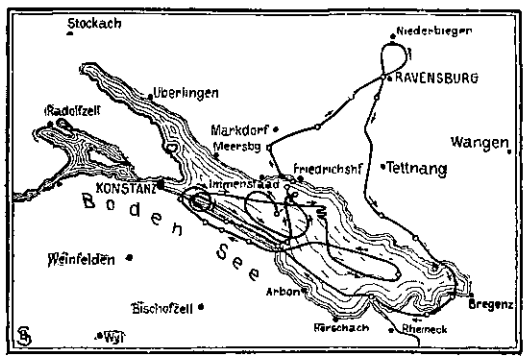
The veteran has a great nation behind him. But he wants more, he wants the verdict of science on accomplished facts. But science is standing back from him.

Here is what a veteran has to say on the subject:—

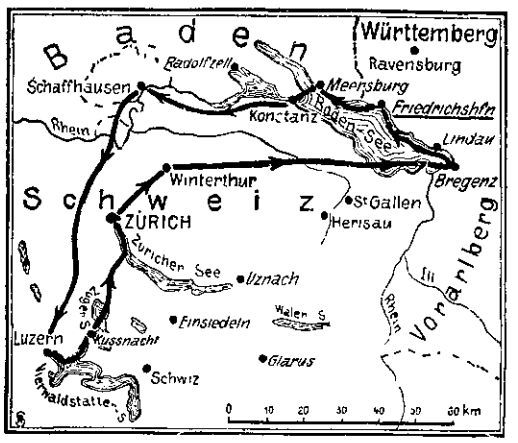
Hiram Maxim has always contended that the only machine which can ever achieve success is the heavier-than-air type. The British, French and American Governments accept this partially, for they are spending money on aeroplanes. Germany on the other hand, goes strong for the "dirigible," notwithstanding the Zeppelin disaster. Sir Hiram Maxim's words are worth quoting:—"It has always appeared to the writer, that it would be absolutely impossible to make a dirigible balloon that would be of any use, even in a comparatively light wind. In order to give a balloon sufficient lifting power to carry two men and a powerful engine, it is necessary that it should be of enormous bulk. Therefore, not only is a very large surface exposed to the wind, but the whole thing is so extremely light and fragile as to be completely at the mercy of the wind and weather. Take that triumph of engineering skill, the "Nulli Secundus," for example. The gas-bag, which was sausage-shaped and 30ft in diameter, was a beautiful piece of workmanship, the whole thing being built up of gold-beater's skin. The cost of this wonderful gas-bag must have been enormous. The whole construction, including the car, the system of suspension, the engine and propellors, had been well thought out and the work beautifully executed; still, under these most favourable conditions, only a slight shower of rain was sufficient to neutralise its lifting effect completely—that is, the gas-bag absorbed about 400lb of water, and this was found to be more than sufficient to neutralise completely the lifting effect. A slight squall which followed entirely wrecked the whole thing, and it was ignominiously carted back to the point of departure."

Orville Wright in America.

It appears, from the reports coming to hand in ordinary course of mail, that Orville Wright made his long hour flights before his brother Wilbur had got to that stage in France. On the 8th of September he flew for one hour and five minutes round the parade ground at Fort Meyer. On the 9th he stayed up longer, and got the cheers and waving of handkerchiefs of several thousand delighted spectators. "The 'aeronef,'" wrote an eye witness, "sped down the rail and mounted immediately into the air. . . . The crowd after giving one cheer as the big bird rose quiet and motionless, stood watching and waiting." After it had been flying steadily round and round the course for three quarters of an hour, the wind suddenly got up and blew ten miles an hour. At once the motion of the aeronef changed. Gone was the easy, steady motion hitherto so remarkable. No more stately curves; she began to "dip and dive" something like a ship in a seaway, "rising up suddenly and then rushing headlong down the steep slope of an aerial wave, until brought up sharply by the steady hand upon the levers, the figure guiding the machine sitting almost motionless. No difference did the breeze make to the man who has negociated winds twice as fast, and but little difference was noticed in the speed when the wind was on one side, in spite of the pitching and tossing. But against the wind the speed was perceptibly slower, and with it, as the machine swung round the curves, it seemed a veritable aerial express train, so meteoric was its flight." The travelling getting more uneven, the aeronaut decided to try what the air was like higher up, and sent his machine on a long series of spiral flights upward round the parade ground, till he got it up to the 200 feet level. There the going was easier a great deal, either because the puffs were quieter there, or there was less disturbance of the air currents from the houses and trees near the parade ground.



ZEPPELIN'S FIRST FLIGHT AND ANCHORAGE.



THE FIRST SUCCESSFUL FLIGHT.

Before the machine came down there was a strange incident. A dove, attracted by the monster whirring along, started in pursuit, and made desperate efforts to come level, keeping it up for over 300 yards. But the "man-bird" easily held its own. Brains and machinery triumphed over instinct and perfect knowledge of flying. Mr. Wright shot ahead of his competitor, the bird being "outflown, outclassed and outrun." Cheers and waving handkerchiefs proclaimed the victory, and there was a great deal of shouting. The machine eventually came down "alighting softly in a cloud of dust and a haze of congratulations, with shouts louder than ever."

The next day the triumphal progress was resumed, with great flights in figures of eight, and the speed registered by anemometer was 39½ miles an hour. The next day the aeronaut went up with an officer of the American Army, and after he had brought him safely back (after a stately flight at the rate of 38 miles) to earth, he started up again, and remained in the air, going fast, for over 74 minutes.

But there was a sad end in prospect. It came on the 16th. The flight began as the others, with grace and speed bird-like in every way. Wright had a passenger, Lieut. Selfridge, of the U.S. Army, and as they swung round the parade ground in stately fashion, the lieutenant waved his hand repeatedly to friends below. Everything seemed to be going quite shipshape and Bristol fashion. In the midst of this pleasant scene came the end.

"Suddenly, on rounding a corner, the machine appeared to lose its balance, like a bird killed on the wing, and fell to earth with a sickening thud." The fall was estimated by the onlookers at from 75 to 100 feet. Many rushed up to help. They found the machine smashed to pieces and the unfortunate passengers lying among the wreckage.

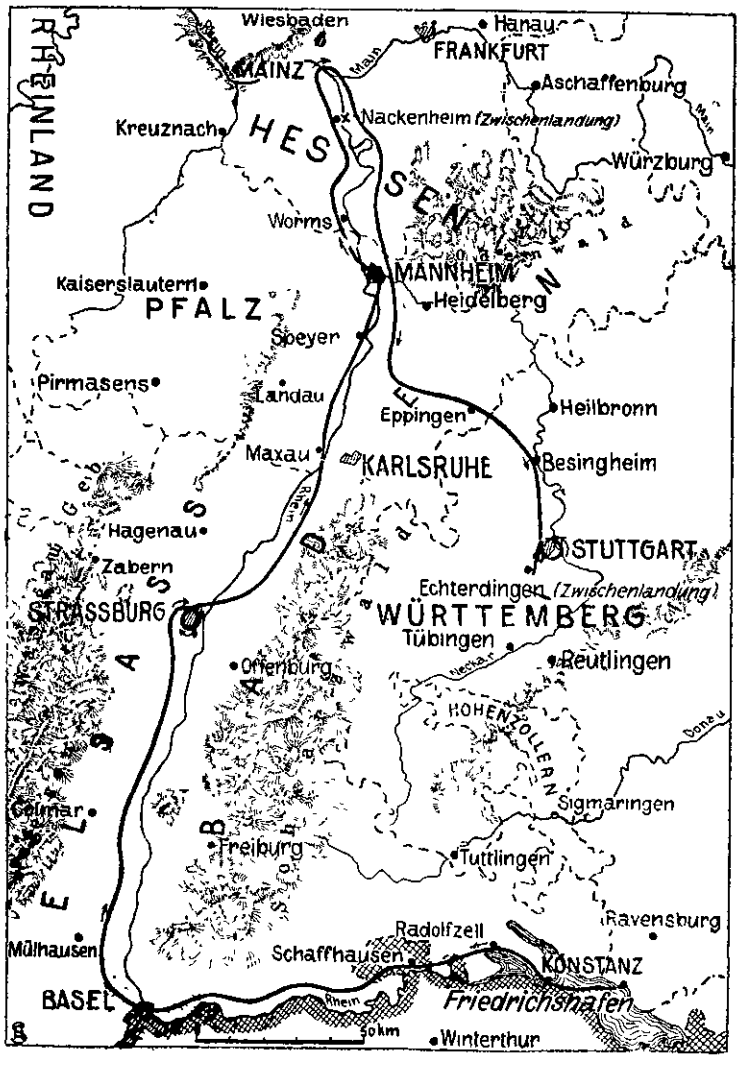
Another account—*Daily Mail*—gives the following details:—"The aeroplane was making its fourth circle of the parade ground, when the great crowd which had gathered to witness the flights saw a blade of the left hand propeller fly off. Instantly the machine fluttered uncertainly like a wounded bird. Then it turned completely over and plunged seventy-five feet to earth. A great cloud of dust rose, instantly shutting off the view of the wreckage."

All accounts agree that the primary cause of the accident was the replacement of the original propellers by a pair somewhat longer, for the purpose of increasing the speed. There was not room enough for the new blades to work free, hence the accident. There is some comfort in this, for it discloses that the cause was not any uncertainty or defect in the aeroplane itself.

The flights of Orville Wright are thus recorded:—

Sept. 9—1hr. 2min. 13sec.
Sept. 10—1hr. 5min, 42sec.
Sept. 12—1hr. 14min. 20sec.

The day after the accident Wilbur Wright was to compete for the Michelin Cup, and many thousands met to see the sport, but on receiving the news of the accident, he burst into tears, and shut himself up alone in his aeroplane shed.



ZEPPELIN NO. 1. THE LAST FLIGHT.

Great Flight by Mr. Wilbur Wright.

(Details—from "The Times"—of cabled condensation two months ago.)

"At Le Mans on the 21st Mr. Wilbur Wright surpassed all previous achievements in aeroplane flights, both for time and distance. It was not until 4 o'clock in the afternoon that, the wind having gone down, the aeroplane was brought out from its shed in the presence of Mr. Henry White, the United States Ambassador in Paris, and a crowd estimated at 8,000 persons. Much precious time was wasted in three false starts, but with his habitual imperturbability Mr. Wright persisted, and at 5.17 rose successfully into the air, and, flying at a height of 15 to 20ft., steered for the first turning post. The course is marked out by three turning posts forming a triangle, of which the sides are 1,000, 700, and 300 metres respectively. One official lap is therefore 2000 metres, but in taking the turns more distance is naturally covered, so that a lap generally amounts to at least 2,500 metres.

The flight proceeded with perfect regularity and success, for the most part at a height of from 60 to 75ft., until the oncoming darkness, and that alone, made it desirable for Mr. Wright to return to the earth. He had flown for 1hr. 31min. 25 sec., and had covered an official distance of 66 kilometres 600 metres, and an actual distance of considerably more—probably at least as far as from London to Brighton. As he only expended 22 litres of petrol, out of the 50 which he had on board, and two litres of water, out of the ten with which he started, there seems no reason why, with better luck in the afternoon, he should not have flown for three hours and a half.

By this magnificent flight Mr. Wright appears to be the holder—until he is beaten—of the Michelin Cup for the longest flight up to December 31 and of the prize offered by the "aviation" committee of the Aero Club for the best flight up to September 30. As the conditions for these prizes stipulate that competition for them must take place between sunrise and sunset, and be measured between the first and last turning posts passed in full flight, Mr. Wright will only be able to count for them so much of his total distance as he covered before sunset—namely, 38 kilometres."

This is important, as establishing a possibility of 137 miles on a consumption of 50 litres.

In the remaining days of September Mr Wright made some very remarkable flights. In one of these he took with him M. Tissandier, the son of one of the most famous of the aeronauts of the Second Empire, and the days of the subsequent siege, a fact which lent considerable dramatic interest to the flight. The son of the veteran balloonist said to a reporter that he "tried to have some sensations, but could not manage to get up anything. In fact, the only sensation he had was one of complete safety." After that Mr. Wright carried several passengers, one at a time. Of the flight on September 28th, the most remarkable of the whole series, the description of the Times correspondent who saw it, which we quote, is one of the most interesting in the record of aviation. After his usual deliberate examination of his machine, he started at about 1.45, and flew 1hr. 7min. 24 4/5sec. Of this time only 1hr. 7min. and 11 2/5sec. counts for the aero-club competition, but during the latter period he covered 48 kilometres 120 metres, thus raising the previous record achievement by about nine kilometres. "When he alighted about 20 yards from the turning post where I was standing, he explained that owing to the too free working of the lubrication pump he had run out of lubricating oil. Otherwise, he said, I could have gone on for two or three hours."

"Mr. Wright's habit is to speak the truth, and, indeed, so perfect is his control of the machine in a light breeze, such as prevailed this afternoon, and so regular the working of his motor, that there appeared no reason why he should not have continued flying so long as any petrol remained in his tank. He lost no water during the flight, and did not vary his speed more than a second or two per kilometre in ten kilometres." The machine flew, the correspondent added, with the steadiness of an express train about a height of 45 feet. During a flight of 55 kilometres on the 24th the wind got up, and the aeronaut found it hard work to struggle against the gusts, but the aeroplane behaved admirably, and the first 38 kilometres took only 31sec. longer than did the same distance earlier in a comparative calm.

It is interesting to note that during these exhibitions, Mr Farman has been making progress also, and on one occasion flew 34 kilometres in 36 minutes. Of his new machine it is said to have but little lateral roll, and to be under very good control. The weight carried was 650 kilogrammes.

The Wright Brothers.

It has been remarked that the conquest by the Wrights of the air is not more wonderful than their conquest of the public on two continents. Certainly the welcome accorded in the States was immense, and that in France nothing less. In the latter there is more of the dramatic touch. The land of Montgolfier, the inventor of the balloon, of Renard, the builder of the first "dirigible," of Santos Dumont, who first flew an aeroplane, and of Delagrange, who made the longest and the most sensational flight before the appearance of the Wrights, has, after bestowing ridicule on the brothers for their "profusion of advice and their economy of experiment," thrown itself at their feet with sportsmanlike readiness and promptitude.

The French journalists are never tired of contemplating Mr Wilbur Wright. They see in him a real bird; they talk of his "bird-like profile," they discuss his "unblinking eagle eye," they measure his "claw-like fingers," they dwell on his "hopping gait." All of which shows that the Gaul is nothing if he is not thorough.

The man, moreover, was peculiar, keeping by himself, living for his machine, protecting the same against all prying inquisitiveness. He camped in the machine's shed, slept in a cot alongside of the aeroplane, went to no hotel even for meals, but cooked for himself on a gasoline stove in the "Amurrean" manner; never spread his legs towards a cheerful club fire among his friends. Even the show of the aeroplane had no charms for him; for he would go out only when it suited him. Once there came ten thousand people to see him fly. He looked at them, went back into his shed, and calmly said that he wanted a little more practice in a breeze before he could think of showing in public. Delagrange, who went in to persuade him to make some sort of a flight, just to oblige all those people, was aghast at the failure of his well-meant attempt. "If it had been my case," said he, "I would have started out, even if it meant the smash up of my machine." But Wilbur Wright would not be drawn.

Another day a reporter tried to put him through his facings in a way the reporters have. Would Mr. Wright not fly across the Channel? No, Mr. Wright did not think that he would just yet. Why not? Only that it was a little too risky, and, besides, it would not prove anything more than a journey over land.

We remember when we were investigating the matter of flight, we were much struck by the fact that these brothers very persistently did everything for themselves, and we said so, especially noting how they had started out to invent an engine for themselves, rather than use the engines already in use by other people. They went all over the world in search of ideas before they were satisfied, and then they did everything for themselves. The same quality has struck the reporters and others. But these declare that the engine they made in their little bicycle shop at Dayton, Ohio, is heavier than the machines of Delagrange, Farman, and the others, and in comparison very clumsy.

An American writer in the *Independent Magazine* makes some very illuminating remarks about the brothers and their machine, thus:—The chief peculiarity of the construction of the Wright machines is the curvature that may be given at will to the aeroplanes by means of wires connecting the outer corners. The front edges are rigid, but the rear edges can be bent by moving a lever at the right hand of the operator. In making, for example, a turn to the left, the right wing is first tipped up at an angle, and therefore rises. But since it now offers a greater resistance to the air in this position, the machine would tend to turn towards the right, with this wing as a pivot. This is opposed by the use of the vertical rudder behind, which is manipulated by a second lever at the right hand. As soon as the machine begins to come round, both levers are reversed, and the left wing, offering now greater resistance, becomes the pivot around which the turn is made. A third lever at the left hand controls the horizontal rudder in front, steering the aeroplane up or down. This construction gives great stability, even in a wind, and however high it may be in the air when the power is shut off, it glides to earth at a gentle angle like a dirigible parachute. The Wrights have solved their problem in their own way, with no masters but the birds. Without money or influence, with no aid from the Government or the scientific research funds, they have worked out their invention in the good old American way, and have earned their success."

The Lift of Aeroplanes.

Draw a right-angled triangle, denoting the base by $A\ C$ and the verticle height by $B\ C$. The angle $B\ A\ C$ is then the inclination of the plane to the line of flight in still air, and the height $B\ C$ corresponds to the pitch of a screw. Suppose we assume $B\ C$ to be one-fourth of $A\ C$, say 1 foot and 4 feet respectively; the plane will then move the air downwards 1 foot for every 4 feet of travel. Assume the speed to be 44 feet per second; in one second therefore the air will be moved $44/4 = 11$ feet. V, the acceleration, therefore equals 11 feet per second. The total quantity of air moved per second is found by taking the sum of the lengths of all the leading edges of the planes. This sum multiplied by the distance moved in one second and by 0.08 and by V will give us the weight of air moved, and this weight multiplied by V and divided by 32 (g) will give the thrust, or lift, in pounds. If S = speed per second in feet on the line of flight, P the pitch = $A\ C/B\ C$ and V the acceleration = S/P, and L = length of the leading edges, we may write the formula as $0.08\ L\ S\ V^2/32$ = the lift in pounds. In Farman's case the speed S was 45 feet per second, L equaled about 96 feet—we do not know what V was, but assume it to be 10 feet—we get lift or thrust, $T = 96 \times 45 \times 10^2 \times 0.08/32 = 1{,}080$ pounds. It was actually 1,100 or thereabout.—Prof. Rankin Kennedy, in Engineering.

Aldus Manutius, a famous fifteenth century Venetian printer, had in his office a black boy, purchased from a corsair. The art of book production was at first so little understood as to be ascribed to Satan. The suspicion that the Evil One had something to do with the new art was intensified in Venice by the presence in the office of Manutius of his black servant. So strong was the feeling that there was grave danger of his place being wrecked by the rabble. Thereupon Aldus declared that any person not satisfied that the boy was flesh and blood could come and pinch him to make sure. The mistaken impression was thus removed; but before this time the name "Printer's Devil" had been attached to the boy, and has lived ever since as the nickname of the lad in a printing office.

Engineering.

North Island Main Trunk Railway.

THE OPENING.

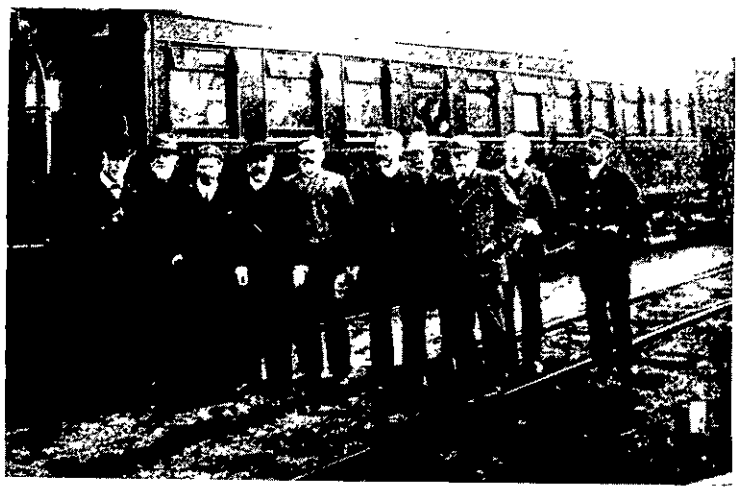
After twenty-three years the Northern Main Trunk line was completed on November 6th. Authorised by Parliament in 1884, begun by Sir Robert Stout, Prime Minister, who cut the first sod in 1885, and completed by his successor, Sir J. G. Ward, who drove the last spike in 1908, this line now rounds off the railway system of the North Island.

The last ceremony was performed by the Prime Minister, not by the Governor, as was the case with the Manawatu railway, when Sir W. Jervois handled the hammer. It was a new departure which the outgoing Minister of Public Works, Mr Hall-Jones, justified by the plea that as the Prime Minister of one period had cut the first sod, it was but right that the Prime Minister of another period should drive the last spike. Which was accordingly done, as may be surmised from one of our illustrations, faithfully taken for us on the spot.

The omens were bad for those who believe in such things. It rained, and the train from the South managed to run off the rails a little bit. But the trip proceeded to conclusion, as ordained, and no one was one penny the worse for the omens

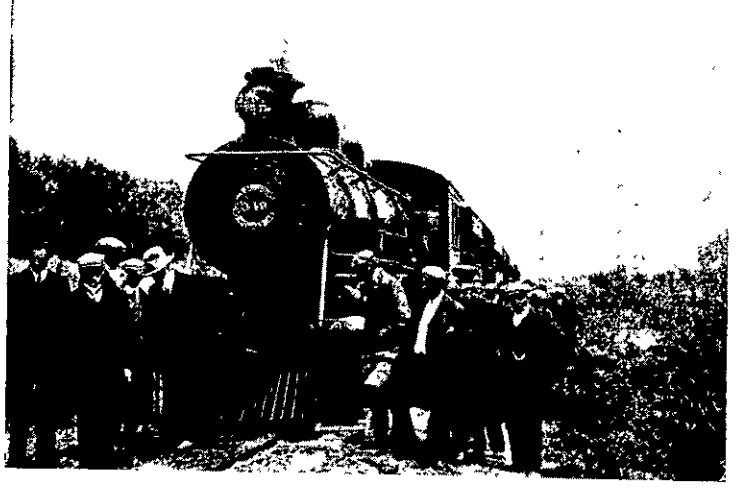
Before driving the spike, the Prime Minister was glad to see the presence of the Minister of Public Works at the writing on the line of the word "Finis," to which he had contributed the main part.

It is to the energy and ability of Mr Hall-Jones that the success of the more rapid prosecution of this great work since 1899 is due. In 1906 he promised the end in two years, and with the aid of his capable under-secretary, Mr Blow, and the engineers of the department, from the chief downwards, he kept his word. PROGRESS said he would, and PROGRESS is glad, therefore. No testimonial was ever better deserved than the little gold locomotive presented to the Minister the other day by the Wellington Industrial Association.



THE INDUSTRIAL ASSOCIATION

SIR JOSEPH WARD ABOUT TO DRIVE THE LAST SPIKE.



A STOPPAGE BY THE WAY

MAKATOTE VIADUCT

THE HON. W. HALL-JONES,
Minister for Railways and Public Works at the completion of the Northern Main Trunk Line, now High Commissioner for the Dominion in London

Why was the progress of the work accelerated? The answer to that question was supplied at the completion ceremony in two parts: one by the chairman of the Auckland Northern Railway League, the other by the head of the kindred Wellington institution. The answer is that there was a sudden appearance of railway leagues converging from opposite quarters.

This converging was a good thing. How good a thing may be seen in the speeches of the banquet which preceded the trip in Wellington. These speeches all struck the note of unity which is the special mission of the Main Trunk Line. Forty years ago, when Auckland ceded pride of place and Wellington became the capital of the future Dominion, parochialism reigned over both places in its most objectionable form. As communication bettered, the parochial giant became a dwarf. Later, the railways advancing reduced the parochial feeling still more, and when the day came for the driving of the last spike, there arose from all sides hymns of praise of the unity of broad ideas long deferred now come within grasping distance. These were emphatically corroborated by the meeting of the two Railway Leagues at the completion ceremony. The meaning of which is that with the last spike was buried the parochial hatchet so long and so obstinately flourished to their mutual disadvantage by the two great, growing rival cities of the North Island of this Dominion. Their future is assured by the completion of this railway. It will be the grand future that always awaits the re-establishment of good understanding between "friends long parted, grown single-hearted."

Development of the Bicycle.

A Strange, Eventful History 1870—1908.

Introduction.

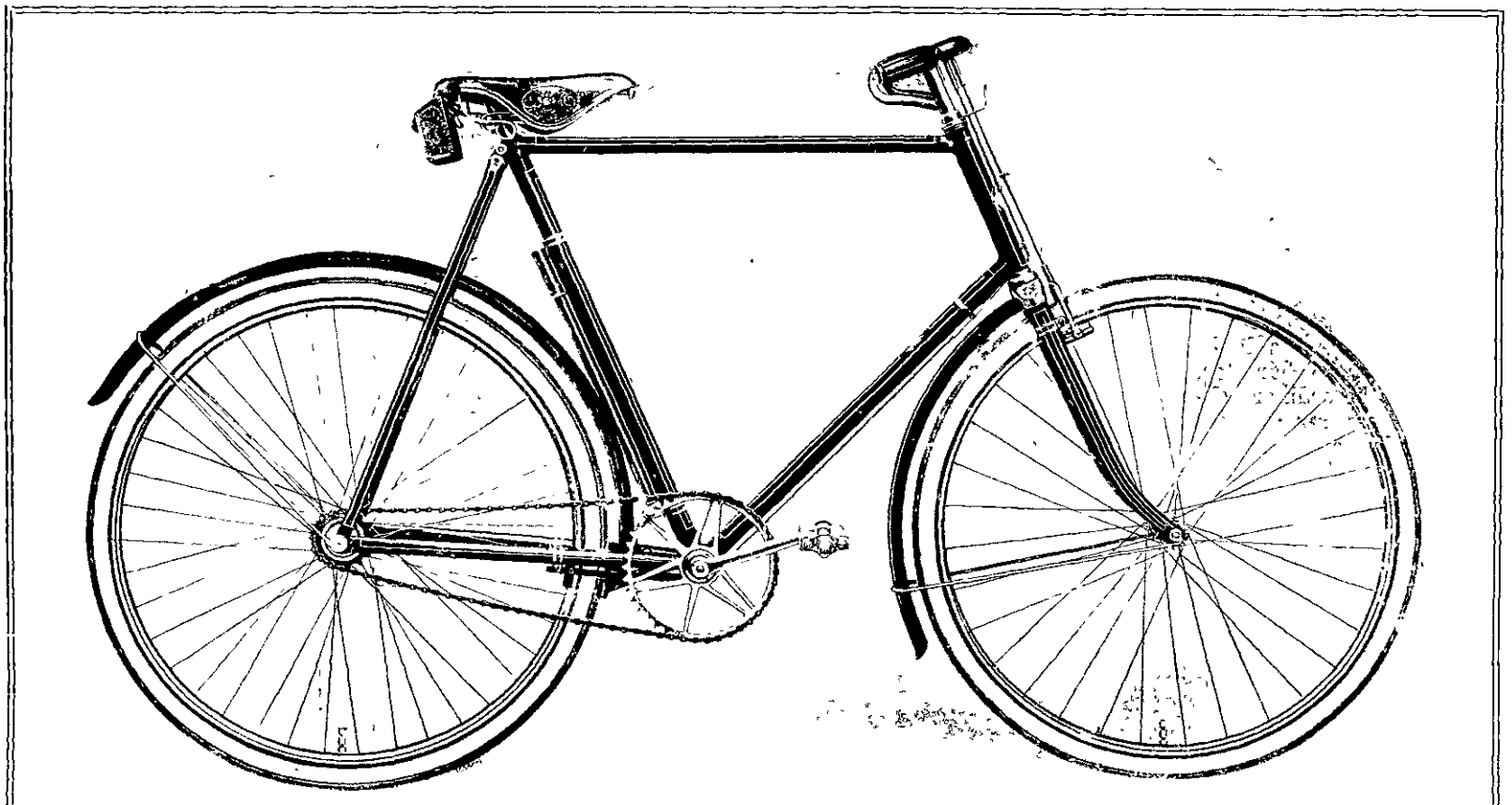
The "Byke" is on the list of things once prohibited by scientific authority. A great mathematician once predicted that as the average of man's walking speed under the best conditions is four miles an hour, and as the machine would be worked by the legs of man, therefore the average speed of the machine would never exceed, under the best conditions, four miles an hour. The machinists exhibited their reverence for scientific prediction by racing the human propelled machine up to nearly the speed of the galloping racehorse. But before this speed was reached, science had very carefully watched developments, and, without prejudice, quietly took charge and directed the evolution of the machine with happiest results.

The motor car affords another instance, with a moving story of the unholy combination between science law and popular and Parliamentary prejudice, whereby the enterprising motorist was kept back for years; and, what is worse, a contempt for law and constituted authority was fixed in his breast, whence have flowed a terrible list of undesirable consequences, which have made motoring a much hated and very much feared pastime. Still the engineers and the mathematicians and the men of science generally have done wonders for motoring.

Aviation has much to say of the same import, for science was at first committed to the theory that man's weight required a wing spread of a mile or so, and the demand was defended as a deduction from the great principles laid down by Newton himself. But already man has flown with exasperating ease for an hour or two and beaten a flying bird, in the presence of thousands of shouting people. As usual in these cases, science has taken a hold, and bids fair to guide the experimenters of the day into the perfection of bird flight. Indeed, there are men not without scientific knowledge who think that the perfection will be relatively to the birds who carry only themselves as is the perfection to the fishes of the steamship, which, by following the example of the fishes, who support themselves only in the water at great speeds, carry cargoes of tens of thousands of tons, and hundreds of passengers, also at great speeds, against stormy winds and raging seas.

In this connection, the popular mind has been too scornful of the trained intelligence. The story of the dog "Boonder," who lives now only in the immortal page of Bret Harte, supplies to this school of thought its favourite illustration. "Boonder" said his creator was known as "Boonder the Conservative" because "in matters that did not involve courtesy he was sincere in his likes and his dislikes. He was instinctively opposed to the railroad, and when the track was laid Boonder maintained a defiant attitude towards every rail as it was laid down." In like manner did he resist the introduction of gas into his native town, and spent "one whole day in angry altercation with the workmen." Also when the question of water works had been settled and work begun, "the grading of an adjoining lot was for a long time a personal matter between Boonder and the contractor." Yet, says Boonder's creator, all these works went on. Men quote and they laugh. But they forget the essential difference. The dog resisted blindly, resisted until one day—it was the day of the trial trip of the railway cars—he "barked himself out of all shape in the front, being thrown back several feet by the recoil of each bark," until in one of these intervals he failed to recover quickly enough, and the resister of progress perished a martyr to his conservative notions

Here we have the fundamental difference. The dog resisted blindly, whereas science merely is slow to accept the first claims of novelty, but maintains that watchful and unprejudiced attitude, which alone can command the eventful success of all scientific advance. This is why the development of the cycle has been along the lines of soundness and reliability. Science, having begun by quoting a formula which said the thing could not be done at all, ends by drawing up another formula which explains how easily it is done every day. Your simpler canine can only detect imposture—and there he carries in eye and nostril a veritable bunch of Spears of Ithuriel—but when it comes to rewarding merit, and consolidating and directing achievement, the comparison must cease between your canine and the eternal academy of sciences.



No. 6041 Model Bicycle with Up-to-Date Appointments

I.—The Bicycle.

It was first a velocepede— that is, after a painful experience of many wheels of dubious order and construction. And about the

year 1870 the velocepede came into the front of pedalling and prediction. The thought naturally occurs: "Is there a purveyor of bikes who was in the business in that remote epoch?" Echo immediately answers—if you happen to be in Victoria street, Wellington—"Yes!" The firm of Rudge Whitworth was in business then, and is in business now, after continuous service, and is, by Royal Warrant, manufacturers to the King and Prince of Wales. The fact tells of a vast store of experience, added item by item, till every part of the machine has its experts and its separate history. Going with the manager, Mr. Reynolds, into the warehouse, where the bikes of the firm are stored, you find them lying about in great variety after their voyage from the works at Birmingham and Coventry. Typical they are, as you may see at a glance, of the firm which has the longest experience, being distinguished for the longest sale list, and for a variety of specialities unique and attractive. Having watched the progress of cycling from those velocepede days, the directors of these famous works have arrived at the perfection of specialised parts, which tells its own history of the general development of the popular machine. The methods have long been scientific, followed by the most rigid tests, and the most exacting examination, and lately the system has been placed under the control of a magnificently equipped chemical and physical research laboratory established in 1901, for the sole purpose of testing and improving every detail of the manufacture.

These details are highly original in character, though to the ordinary observer it may appear that all bicycles are alike in every respect. They may be when the parts are bought from different manufacturers and put together by the makers, who are known to the trade as "assemblers." At the works of the firm every part is built and all are put together under the same roof, so to speak, for there are many roofs in this huge enterprise, and all the parts are protected by far-reaching patents. There are among these the Coaster hub and brake, the two-speed gear, and the three-speed gear. Of these the former has the advantage that the change of gear can be effected while pedalling, as well as while free wheeling, whereas in the latter the *modus operandi* is the simplest possible:—"The gear drives normally direct on the medium gear. A movement of the lever brings the high gear into action with an increase of over 30 per cent.; an opposite movement of the lever, on the other hand brings the low gear into action, with a reduction of 25 per cent. below the medium. The free wheel is available on all three gears."

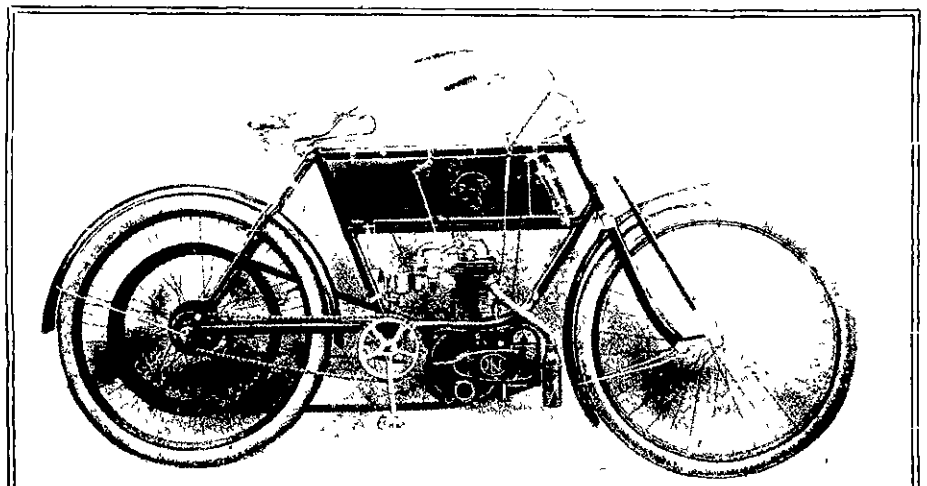
Among the specialties of the firm we see the No. 6041 Model—illustrated—as durable and fully guaranteed as all other Models made by the Rudge Whitworth firm fitted with Coaster hub and brake—a reliable, easy running and popular machine; the Model 6141, with similar equipment to above, and is the popular lady's machine; the Model 5 Aero Special Speed Iron, a fine racing machine; the ultra refined Model 2041, for the riders who are especially particular and pernickety in their cyclic taste; there are models for girls and boys, and there are models of light weight with great strength; in all, some seventy-five different models.

It is to be noted that all parts are interchangeable, whereby the great desideratum has been secured of rapid, cheap, prompt, and unerring repair, accurate fit, absence of friction and durability.

Other details are equally interesting. The frames are made of cold-worked high-grade steel exclusively; no malleable, cast or hot-stamped iron is used. They are consequently of uniform temper throughout, and possess unrivalled stiffness and strength. The flush joints give a perfectly smooth outline, with no ledges or angles in which mud or dust can lodge The hubs have cold-drawn bodies with bearing cups and cones of high carbon tool steel. The extraordinary durability of the bearings is universally acknowledged, and has only been achieved by years of experience and the employment of the finest grades of steel procurable. So far as the company can trace, less than one in 75,000 of the cones shows any signs of wear within the normal lifetime of a bicycle.

The vital organ of the bicycle, the front fork and crown supporting three-fourths of the weight of the whole concern, is specially provided for, being made throughout of cold drawn steel, and of a strength much above all possible requirements.

These specialties, together with a large range of standardised patterns, are among the results of experience which has grown up with the bicycle during the last forty years, and they demonstrate to the most careless observer how the marvellous development of the ordinary bicycle of commerce has come about.



LIGHT-WEIGHT F.N. MOTOR CYCLE.

II.—THE MOTOR CYCLE.

What more natural than the development from the ordinary to the motor cycle? Having established the machine on firm lines, the next thing was to give it the speed to which its form entitled it. With the advent of the motor car and its multitude of engines of new and strange device, the attainment of speeds commensurate with modern ideas and modern requirements very soon came about. The veteran firm as a matter of course kept level in this advance with its own traditions. Looking round we are not astonished to see a four-cylinder motor cycle among the stock This is known as the F.N. Motor Cycle, and is the only four cylinder in existence, and the only one of any sort that employs shaft driving. The latest model, built specially for the export trade, has a larger engine somewhat, and has a standard frame of 20 in., on which the rider can sit easily in the saddle and rest both feet on the ground. It has also heavier rims, which will take mostly any of the well-known makes of motor cycle tyres, and a larger magneto fitted with the highest grade ball bearings. Altogether the 1908 F.N. is thoroughly up-to-date.

The light F.N. has gone back to the original lighter power, and to make it take any hill, the engine has been provided with a geared pulley (multiplicateur), of great simplicity, consisting of a spur pinion wheel of 15th., mounted on the engine shaft and engaging with and driving by means of the 52 internal teeth of the V-shaped engine gallery. The engine makes three revolutions before the pulley has made a single turn. The result is increase of the diameter of pulley and decrease of diameter of the belt pulley on the back wheel, thus providing mechanical and rational conditions for the working of the belt. Hence the possibility of gearing with single gear to 8 to 1, enabling the machine to climb any hill and at moderate pace. The machine can be ridden very slowly with great comfort, and will work up to a speed of 28 miles. With the geared pulley, moreover, there is this marked advantage, a big one, that the tension of the belt drive can be regulated while driving. Thus there are no stoppages from slack belts. Not the least advantage is that all the working parts of the geared pulley are lubricated from the engine, and are enclosed in a dust proof covering. The machine weighs no more than 120 lbs., and it has spring forks which absorb all road vibrations and shocks by means of compressed double springs. Safety, comfort, easy but adequate speed, and power for every sort of hill makes this light F.N. an ideal machine for all business riders, with belts often lasting for 7000 miles.

The development of the power of these motor cycles is very interesting, inasmuch as it is but eight years since they were first introduced, showing, as it does, the remarkable advance of four h.p., the first engine having been of 1 h.p., against the present largest size of 5 h.p. This, of course, was due to the need for hill climbing, not to any desire for racing successes.

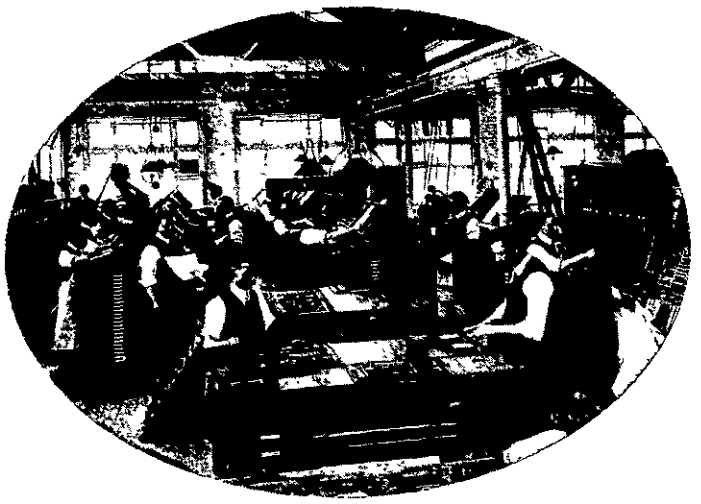
It must be understood, at the same time, that high power is not an unmixed good. High-powered air-cooled motors, having proportionately smaller cooling surfaces, are apt to overheat just when the high power is most wanted.

To obviate these many drawbacks, the F.N. have produced, after long and careful study and experiments, a new type of motor cycle that should meet with the rational requirements of motor cyclists.

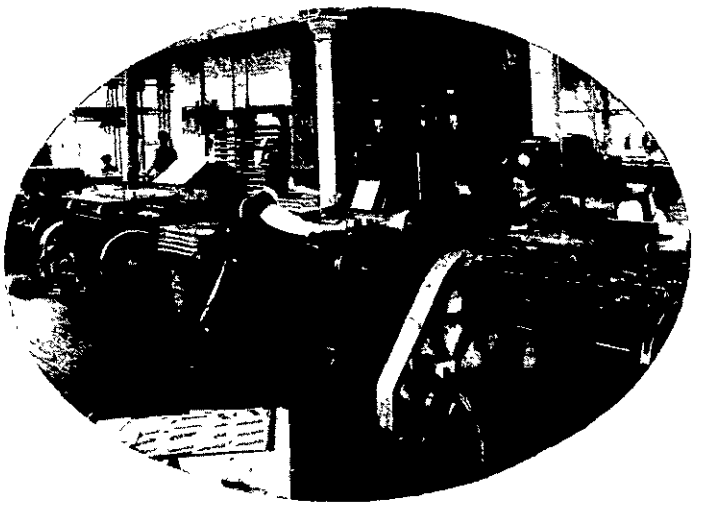
The sale of the Rudge Whitworth, known as "Britain's Best Bicycle," of the F.N. motor 5-6 four cylinder, and the light-weight ¾ single cylinder motor cycles, is controlled by E. Reynolds and Co., Ltd., Victoria street, Wellington, and they can be obtained from representatives in all main centres and towns throughout the Dominion.

The Home of "Progress."

Messrs. Whitcombe & Tombs Ltd. new Wellington establishment in which "Progress" is printed.

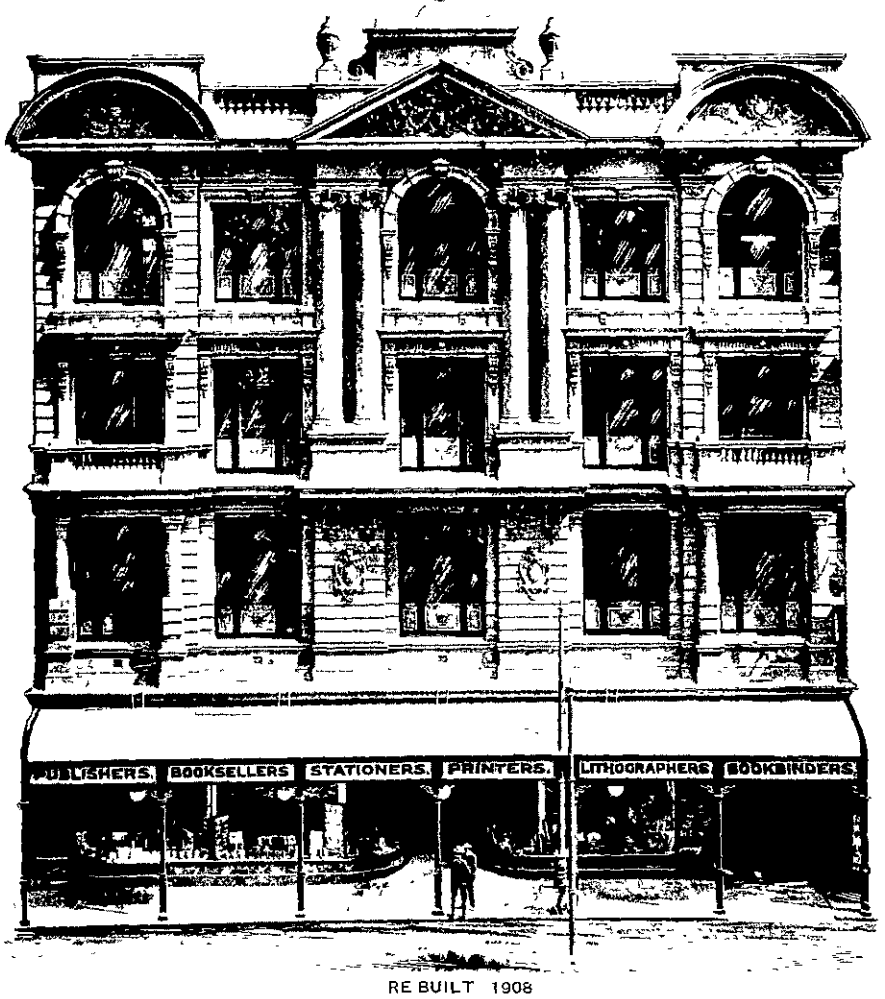


COMPOSING ROOM



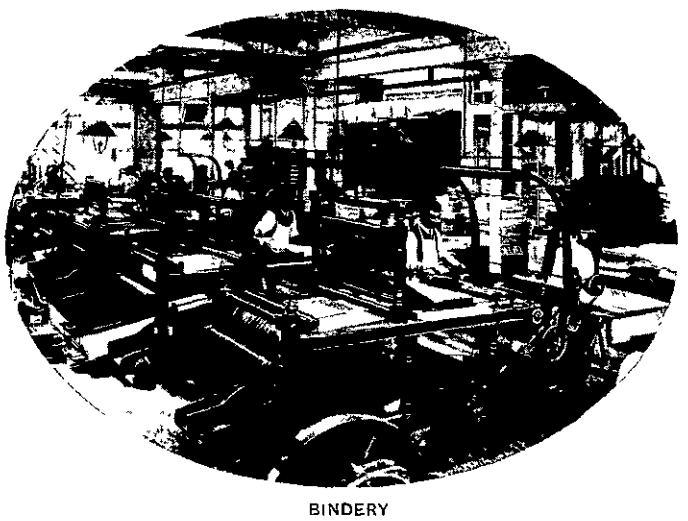
LETTERPRESS MACHINE DEPARTMENT.

PROGRESS, it is evident from these illustrations, is well cared for during the hours of production. The firm that prints it (Messrs. Whitcombe & Tombs Ltd.) does some of the best printing work in the Dominion, and is well housed everywhere, as may be judged by the fine building (of our illustration) which contributes a fair share to the architectural grace of the city of Wellington. PROGRESS, therefore, comes out every month under good auspices, and, moreover, in the best company, for the firm issues a great store of publications, well known and much read. The publishing work of the Dominion is as yet comparatively small, for local talent must serve its apprenticeship in company



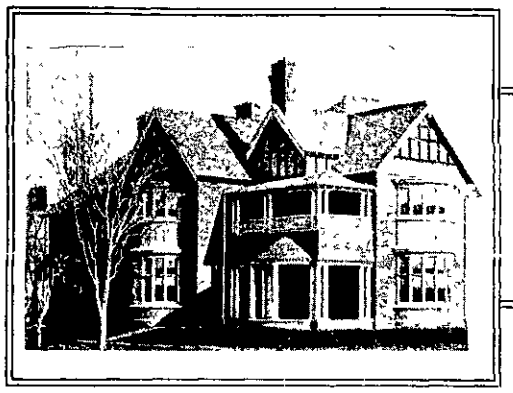
RE BUILT 1908

of the best that Great Britain has to offer. The small stream of local effort is here mingled with the great volume flowing in from the old country, braving comparison with courage, learning by example, and careful to follow the best traditions. In this well-organised home of the growing printing industry the local product gets the up-to-date treatment so necessary for its development along right lines. PROGRESS therefore, goes the regular round of this fine establishment, with comfortable reliance on the skill of all hands, the perfection of the machinery and the punctuality which is one of the best tests of well-managed enterprise.



BINDERY

LITHOGRAPHIC DEPARTMENT



Architecture and Building

Architects and Lighting.

THE MEASUREMENT OF ILLUMINATION.

A subject which is much neglected and little understood is dealt with in an important article by Mr P. J. Waldram, F.S.I., in the *Illuminating Engineer* for September. How to determine the proper amount of illumination, whether natural or artificial, for a building is a matter upon which many architects have but the most hazy ideas, though all recognise the advantage of securing sufficient light without needless glare.

Mr. Waldram gives a resume of existing regulations on the subject of lighting, and points out that these regulations do not take into account the varying conditions in which they have to be applied.

The aspect of a window (he remarks), its shape, the solid angle subtended in the clear sky visible from it, the colour of the opposing walls, and the interior decoration all affect its illuminating power, but so completely has the science of illumination been ignored hitherto, that not one architect in a hundred, probably not one in a thousand, would know how to calculate the additional window space required to afford equal illumination under adverse conditions.

Experienced architects, when fixing window dimensions, can depend upon the intuition derived from a series of previous approximations more or less successful; younger architects can only trust to guesswork and luck.

RESIDENCE, DUNEDIN. *B. Hooper, Architect.*

THE LIGHTING OF SCHOOLS.

The author quotes with approval the Building Regulations (1907) issued by the Board of Education for new schools under their control, but he points out that their want of precision with regard to lighting angles, visible sky, &c., is an eloquent testimony to the need of more exact knowledge of the extent to which such factors affect illumination.

The regulations are even more eloquently silent as to artificial lighting. They require detailed plans and specifications of new schools to be submitted for the approval of the Board of Education, including particulars of such items as sanitary arrangements, ventilation, boundary walls, desks, fireplaces, &c., but artificial lighting is not even mentioned.

With regard to the artificial lighting of buildings generally (continues Mr. Waldram), an architect applies at most only such simple rules as so much candle-power per square of floor space, without regard to the height of lights, the character of the reflection, or whether the globes are to be frosted, tinted, or clear. For the disposition of the lights he would probably rely upon the advice of the electrical or gasfitting firm whose tender is accepted. One would have to search diligently to find in England an architect measuring in candle-feet, and recording for future reference a degree of artificial illumination which he had found to be both sufficient and pleasing for any given situation. Yet the measurement of illumination by, say, a Trotter illumination photometer or "illuminometer" is simply a direct reading on the dial of an instrument of about the same size, weight, and cost as a hand camera.

ILLUMINOMETERS AND THEIR USE

The use of illuminometers would enable architects to invite tenders for electric lighting or gasfitting on the basis of specified illumination in candle-feet at certain points with specified lamps, globes, &c., and thus secure effects which had been found pleasing and satisfactory elsewhere. At present few architects would have the faintest idea of what illumination in candle-feet to specify at any given point, few still would know how to take the necessary simple measurements to see whether they had obtained it. But illumination in candle-feet at certain points (and not candle-power at uncertain points) is precisely what architects are most particularly concerned with. Their province is the result, the means lie in the hands of the engineer. At present architects know a little about the means and nothing at all about the result until they see it. New and economical systems of artificial lighting are constantly being placed on the market and widely used. Whereas a few years ago flat-flame gas lamps and arc and 8c.p. to 16c.p. incandescent electric lamps comprised practically all systems of lighting, there are today a dozen or more well-known systems whose illumination differs from these older ones almost as widely as they differed from candles and oil lamps.

Every day it becomes more important that the architect should be able to specify at least the general distribution of his artificial lighting and the illumination in candle-feet that he requires at every point. Not until he can do this can he compare intelligently the relative advantage and economy of different systems for the particular purpose which he may have in hand. The fact that he cannot do so is not so much his fault as that of engineers and scientists, who in this country have so neglected the science of illumination that the architect has no suitable textbooks from which to obtain the necessary information, and very few experts, indeed, who can assist him. This fact is clearly shown in the curricula of the different architectural schools. An examination of any syllabus shows, perhaps, one lecture on window areas to third or fourth students, the subject of illumination from different systems of artificial lighting being ignored as completely as it is in the papers of the qualifying technical examinations.

A COMPLEX PROBLEM.

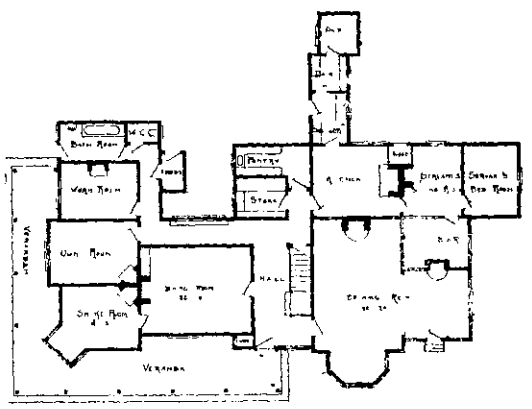
As the height and extent of buildings tends to increase, the problem of daylight illumination is becoming almost as complex as that of artificial lighting, and methods which, when combined with experience, are sufficient to predetermine successfully the daylight illumination of, say, a country mansion, can be hopelessly at sea over town schools, hospitals, and libraries, or blocks of buildings covering large areas.

Even if private clients may be satisfied to trust to their architects' skill and experience, the erection of practically all large modern buildings is in the hands of public or semi-public bodies or their building committees, the architect for any large building being almost invariably selected from the result of an architectural competition. Quite properly such committees, as the trustees of other peoples' money, look very closely into all possible details of proposed buildings. Architects need now, and will need even more in the near future, to justify their plans before such committees with regard to illumination as in other respects, and in terms certainly more exact than are in general use at present. Even if unable to state in candle-feet the illumination which, having regard to all the circumstances, will be given by the windows they have designed on the desks of schools, on the tables of libraries and public offices, and in the wards of hospitals with any given degree of sky brightness, they will, at least, require to be in a position to state definitely whether such illumination will vary from standard existing buildings, and approximately to what extent. They should certainly be able to explain in exact terms the illumination resulting from the artificial lighting they propose to employ, instead of merely stating the candle-power, and to refer to existing examples of similar illumination. None of these would be particularly difficult problems were the illuminometer added to the everyday working tools of the architect or of the expert advising him.

ANCIENT LIGHT QUESTIONS.

In disputes as to ancient lights the author advocates the intelligent use of the illuminometer as the only certain way of arriving at an equitable conclusion, and he points out that the experts who give evidence in these cases often betray ignorance of some of the most essential factors.

The problems involved in ancient light cases (he says) are really insoluble except by the application of practical photography, but when so solved they are quite simple. The law first requires to know whether a new building has or has not damaged the light of an existing one, to a degree below that generally obtaining in the surrounding districts, and which is, in fact, a nuisance. If that is the case it then requires such damage to be stated in terms which can be translated into monetary damages. Every window is simply a means for obtaining a certain proportion of the sky brightness for interior illumination. Windows with an horizon more or less obscured are naturally less efficient illuminators, but their efficiency remains practically constant throughout the wide range of constantly varying sky brightness. If the middle of a room enjoys an illumination of 2c.ft. with a grey sky brightness of 280c.p. per foot superficial, it will enjoy 0.5c.ft. with a grey sky brightness of seventy candles. The use of a Trotter illuminometer provided with a daylight reducer will fix for any room in a few minutes the ratio between sky brightness and interior illumination, and a comparison showing this "window efficiency" of rooms alleged to be damaged as compared with that of a number of rooms at the same floor level in the neighbourhood can be easily obtained, and is precisely the evidence required by the Courts.



PLAN OF MANGAWHARE HOUSE.

Felsen Nest, Seatoun.

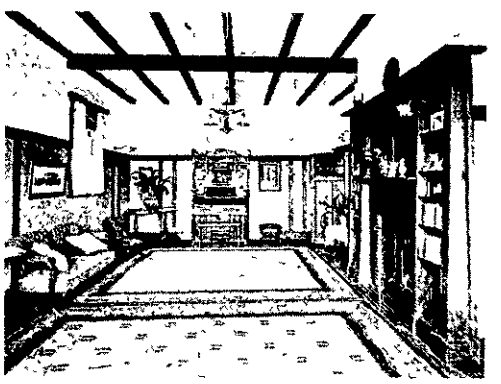
This is a very charming example of modern domestic work, just built for Mr. W. H. Green. It has considerable accommodation, and its pleasing proportions and well-designed windows make it very acceptable for illustration. In the whole arrangement, which is simple in the extreme, the architect's desire has been to produce an intelligent design suitable to local conditions without entailing any extra cost, and the contract price being just over £900, including internal decoration, we think that the result is eminently successful.

The house was planned to give the principal rooms a north-east aspect for the sake of the magnificent sea view, all windows receiving direct sunlight at some hour of the day. There are no unsightly back premises, the intention being that the house should look equally well from any point of view.

MANGAWHARE HOUSE *Rush & James, Architects, Hastings.*

FELSEN NEST, SEATOUN. *C. F. B. Livesay, Architect.*

HALL OF FELSEN NEST.



DRAWING ROOM OF FELSEN NEST.

The materials are local timbers on a base of concrete, and French tiles.

The principal floors are of polished jarrah, and all the woodwork in the hall is also of jarrrah. The accommodation comprises, large hall, dining-room, music-room, fernery, four bed-rooms, bath-room, kitchen, scullery and pantry, all under the main roof. The central passage, which is 6ft. wide, is ingeniously lighted throughout its entire length, from above.

The main feature of the house is the large music saloon, with its massive mantelpiece, which together with the rest of the joinery in this room, is of oregon pine treated with a rich walnut stain, the effect being very pleasing. Mr C. F. B. Livesay is the architect, and Messrs. McFarlane and Scott the builders.

We illustrate to-day the residence of Mr. F. S. Waterhouse, Mangawhare, H.B., which has just been erected by Messrs. Bull Brothers, contractors, Napier, for £3,300. Architects, Rush and James, Hastings. Included in the contract was a house built for the manager .

The new brick memorial schools which have been erected in Feilding by Mrs. Walter Johnston, will be soon out of the contractor's hands, and work of next year will be started under their roofs. Accommodation has been provided for 2000 children, with four large class rooms and an entrance hall 50 feet long and 16 feet wide for drill purposes in wet weather. All the interior wood-work is finished in picked heart of rimu, except the seats and desks, which are to be of kauri. The class-room walls have a handsome wooden dado all round, above which the plaster walls, etc, are finished in Keen's cement with enriched cornices, and centre pieces, etc., manufactured by the Carrara Ceiling Co. Each class room has special hylo plates and other modern conveniences, to enable the work of the schools to be satisfactorily carried out. The building has a frontage of 80 feet, and was designed by Mr. E. Coleridge, under whose direction the work was carried out.

Mr. C. F. B. Livesay notifies the completion of the contract for the erection of four tramway shelters for the Miramar Borough Council. Contractors: Hunt and McDonald.

Eternit.

Among the articles connected with the building trade which have come to the front of late, "Eternit," an asbestos-cement fireproof material, has well established itself. The article, in the form of slates of terra cotta and grey colour, is admirably adapted for roofing, for besides being fireproof and indestructible, these "Eternit" covered roofs appeal to the aesthetic taste. The sheets, both for internal and external use, have been applied to numerous public and private buildings throughout the Dominion, and are being used to a large extent by country people, owing, no doubt, to the facility with which the material can be applied. "Eternit" carries the hall mark of the authority of the Admiralty and the War Office, as well as London County Council, and various British and Colonial Government departments.

Work in course of erection under Mr. Livesay's supervision includes a bungalow at Island Bay for Mr. W. H. Coy, and a two-storied residence in Hawker street for Mrs. Goldfinch.

A contract has been signed for the house and stables for Mr. Gordon Williams, of Te Aute, H.B. Contract price, £1942. Architects, Rush and James; contractors, H. H. Campbell, Hastings.

UNIQUE TEST OF REINFORCED CONCRETE.

Beam, 12in. x 22in., reinforced with Kahn Bars 1in. x 3in.; span, 25ft.; load, 14 tons; deflection, one-sixteenth of an inch.

(The Editor, PROGRESS.)

Sir,—In your issue for July we notice an article on "Failures of Ferro Concrete," by a Mr. Lewis. We ask you as a matter of public interest to be good enough to afford equal publicity to our reply herewith. We are quite aware that your influential and widely read journal does not identify itself with the individual opinions of your contributors, and only inadvertently would be the means of giving publicity to a borrowed set of unverified statements casting aspersions on so universally accepted a method of construction as that of reinforced concrete.

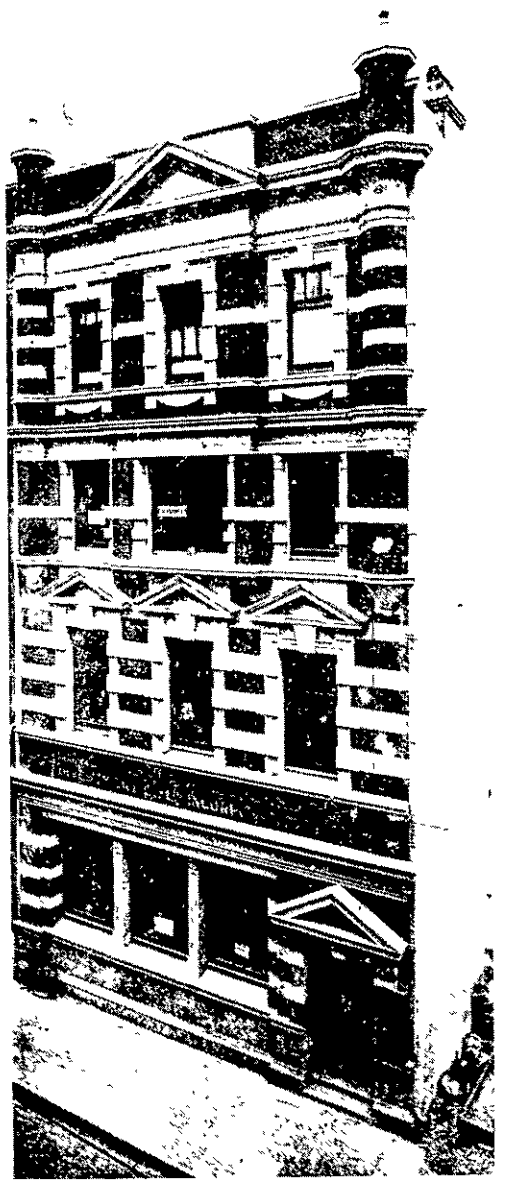
ELLIOTT, MACLEAN & CO.

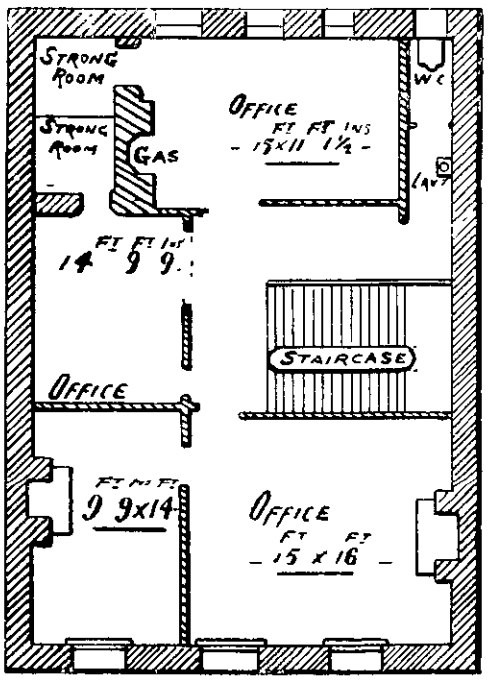
[Our correspondent, with whose request we have complied, is quite correct about our opinions It is generally understood, of course, that the editor of a journal is not responsible for either the opinions of his correspondents or those of the writers he quotes. For our part, we have given space to both sides in the Ferro-Concrete controversy, and with the very best results for Ferro-Concrete.—Ed.P.]

The tonnage of the world's merchant shipping fleet, according to the latest returns, is 37,554,904. Of this total no less than 31,744,904 tons represents steam shipping, and 17,611,096 tons of the whole is under the British flag.

Wellington Trust and Loan Company's Building.

Below we give the floor plans of this building with the street front. It is one of the most honest of the buildings which adorn the city, being content to depend on plain brick effects, without relying exclusively on plaster and stucco. It is a feature of the new block that is rapidly filling up the gap left by the great fire of 1906. The architects who have filled the greater portion of that gap easily persuade us, every time we look at their work, that the said fire was a blessing in disguise. It is the best possible answer to the critics who aver that there is no architectural taste in the Dominion.





WELLINGTON TRUST AND LOAN CO.'S BUILDING.—FIRST FLOOR.

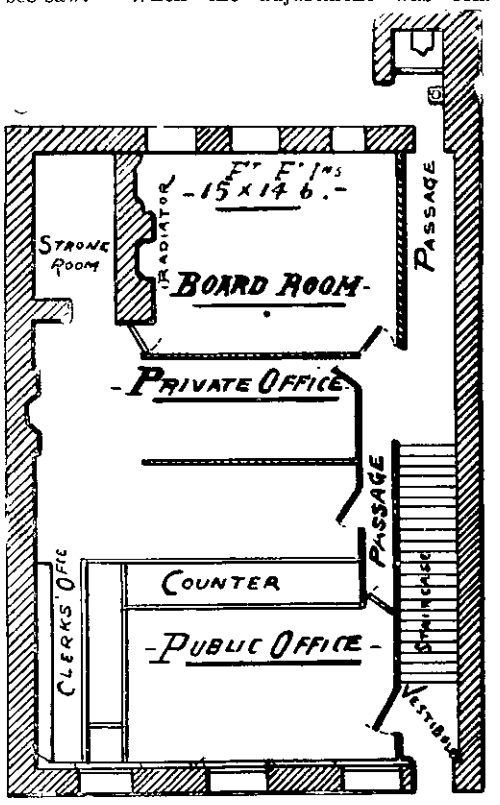
Concrete: Wet or Dry?

(Contributed.)

The proper amount of water to be used in mixing concrete has been a much discussed question ever since the latter came into favour as a constructive material. Authorities have argued on one side and the other until it is hopeless to attempt to base a conclusion upon the current literature of the subject.

The writer has carried out a simple experiment which strengthens his confidence in wet concrete. The idea of the experiment was derived from a similar one, a description of which was published in one of the cement journals some seven or eight years ago.

Two boxes of equal size and shape were balanced, one on each end of a strong beam, which was supported under the centre like a "see-saw." When the adjustment was completed and the boxes exactly balanced, a support was placed under each and they were filled with concrete: one with a dry mixture and the other with a very wet mixture. The proportions of cement, sand, and gravel used were the same in each case, the only difference being in the amount of water used. The dry concrete was tamped very thoroughly, but the other was too wet to admit of any tamping.



WELLINGTON TRUST AND LOAN CO.'S BUILDING.—GROUND FLOOR.

As soon as the concrete had set the supports were taken from under the ends of the beam. The end containing the wet-mixed concrete sank at once, and the beam had to be shifted nearly two inches on its support in order to rebalance the boxes.

This indicated that the concrete mixed wet was much denser than the dry. This was verified when the boxes were broken away. The dry block was rough, and contained many unfilled spaces, while the wet was very smooth and contained no visible holes. When they came to be broken in half the wet block was much harder to split.

From the results of the above experiment, and from other personal observations and experiences, the writer concludes that a moderate excess of water above the amount absolutely necessary in mixing concrete is not injurious, but is, in fact, decidedly beneficial, as wet-mixed concrete is:

1. Denser, stronger, and more impervious to water.
2. Cheaper to put in place,
3. Easier to mix thoroughly, and
4. Gives a smoother finish on the surface next to the forms.

New Zealand Insurance.

New buildings for the New Zealand Insurance Company at Brisbane, Queensland.

Excavations are at present in progress in Queen Street for the New Zealand Insurance Company's new building.

The site chosen for this building is that adjoining the Union Bank of Australia, and has a frontage to Queen Street of 60 feet, with a depth of 148½ feet.

By making a short survey of the building (illustration of same in this issue), anyone can imagine it will be a magnificent building when completed. The entrance to the building will be through a massive masonry doorway, and the corridor of the spacious width of 13 feet.

The walls will be tiled, with a waggon vault ceiling, which will lead to the New Zealand Insurance Company's public offices. This apartment will be richly finished in silky oak, with ornamental plaster work.

The ceiling will be supported by twelve Ionic columns, with copper bases and capitals. This alone will help to beautify this chamber.

The design of the building is of a Renaissance type, which has been adopted suitable to the materials (brick and stone) selected. The cornice and lettering on the front will be carried out in copper. The roof, which is very uncommon, will be tiled with local tiles, and broken by shaped and sculptured gables and dormers on the four sides.

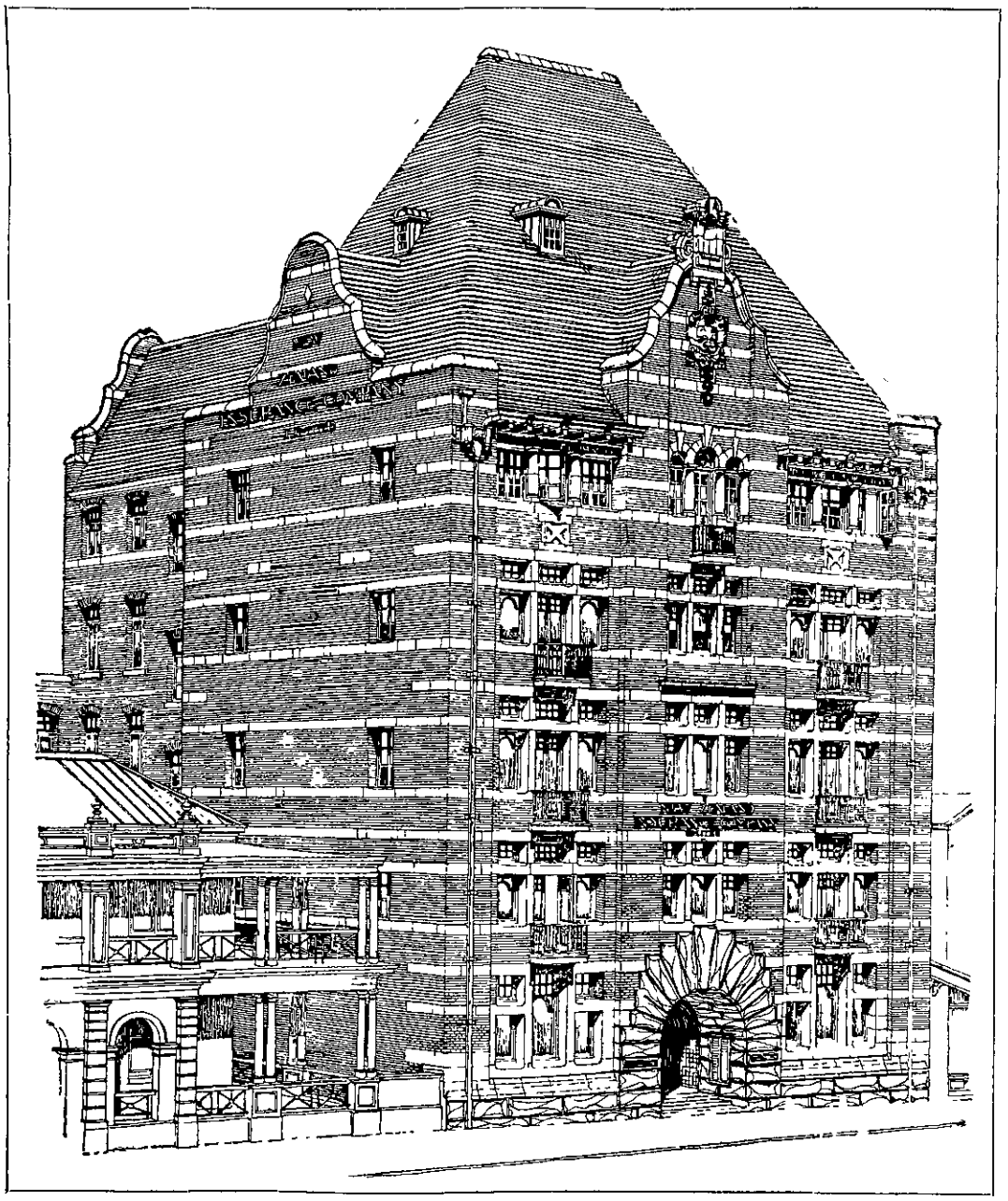
Messrs. Hall and Dods are responsible for the design, which is commercially and artistically satisfying.

This building will be the largest of the company's buildings in the Commonwealth, which goes to prove that Queensland is securing her share of the sky-piercer type of building. It is a good omen for the future prosperity of the State at hand, and the development of its enormous resources.

WELLINGTON'S BUSIEST CORNER—BYKO CORNER AND BANK OF NEW ZEALAND
Dawson's Building, King's Chambers and Hotel Windsor in sight

Messrs. Lowin and Bull completed early last month the brick additions to the Bank of New Zealand and buildings at Lower Hutt. W. Turnbull, architect.

Mr. Livesay has also received instructions ot prepare designs for an eight-roomed house at Karori, and a cottage at Seatoun.



NEW ZEALAND INSURANCE. Head Office for Queensland.

Messrs Clarkson and Ballantyne, of Christchurch, report letting contracts for:—Brick and stone church, Armagh street; contractor, R. J. Pugh.—Sunday School, St. Albans East, contractor, A. A. Swanson, junior.—Two-storey dwelling house for Mr. Nutt; contractor, J. W. Beauland.—Bungalow, at Riccarton, for Mr. S. P. Stevens, contractors, Harris and Watson.—Cottage, Antigua street; contractor, J. Hammett.—Cottage, Riccarton, for Mr. Olon; contractor, J. W. Beauland.

These architects have also in hand plans for brick house at Riccarton for Mr. W. Ballantyne.

Mr. E. Coleridge, architect, has accepted the tender of Messrs I. Clark and Son for the erection of a store in Tory street, Wellington, for Messrs. Shacklock and Co., the well-known range makers of Dunedin. The building, which will be built with walls strong enough to carry two extra floors at future date, will have a frontage of 75 feet, and a depth of 61 feet. Provision has been made for two large cart entrances and a jib crane, to facilitate the handling of goods, which will necessarily be very heavy. The elevation will be finished with pressed bricks relieved with cement facings, cornices, entablature, etc. The work is expected to be finished in about five months' time.

Astronomy

Halley's Comet.

(AFTER H. C. WILSON IN *Popular Astronomy.*)

In ancient times the appearance of comets filled the people with terror and "with fear of change perplexed monarchs." In England the most noted and the most terrifying of the whole series that disquieted the nation, during fourteen centuries was the Comet of April, 1066. None, on the other hand, seemed to the popular mind so amply justified as a prophet of evil. Having at the beginning of the year perplexed the brave Saxon King Harold with fear of change, and flown away out of sight, the end of the year brought justification with the decisive battle of the Norman conquest. This true prophet of old time has since been identified as Halley's comet. It was seen in the fifth and eighth centuries of the Christian era, but not honoured by the usual calculations. But its third appearance and its sequel, the Battle of Hastings, prevented men from forgetting its existence. Since then it has been proved to have a period of between 74½ and 79 years, having returned to the neighbourhood of the Sun ten times during the seven centuries. "The question now arises," writes Professor Wilson in *Popular Astronomy*, "will the next return be in favourable or unfavourable circumstances? Shall we expect to see a great magnificent comet, as in 1066 or 1456, or an insignificant object as in 1607? In order to aid in answering this question, I have gathered together the elements of the comet's orbit at the different apparitions which have been observed, and have drawn the consequential diagram," which we produce on this page of the present issue.

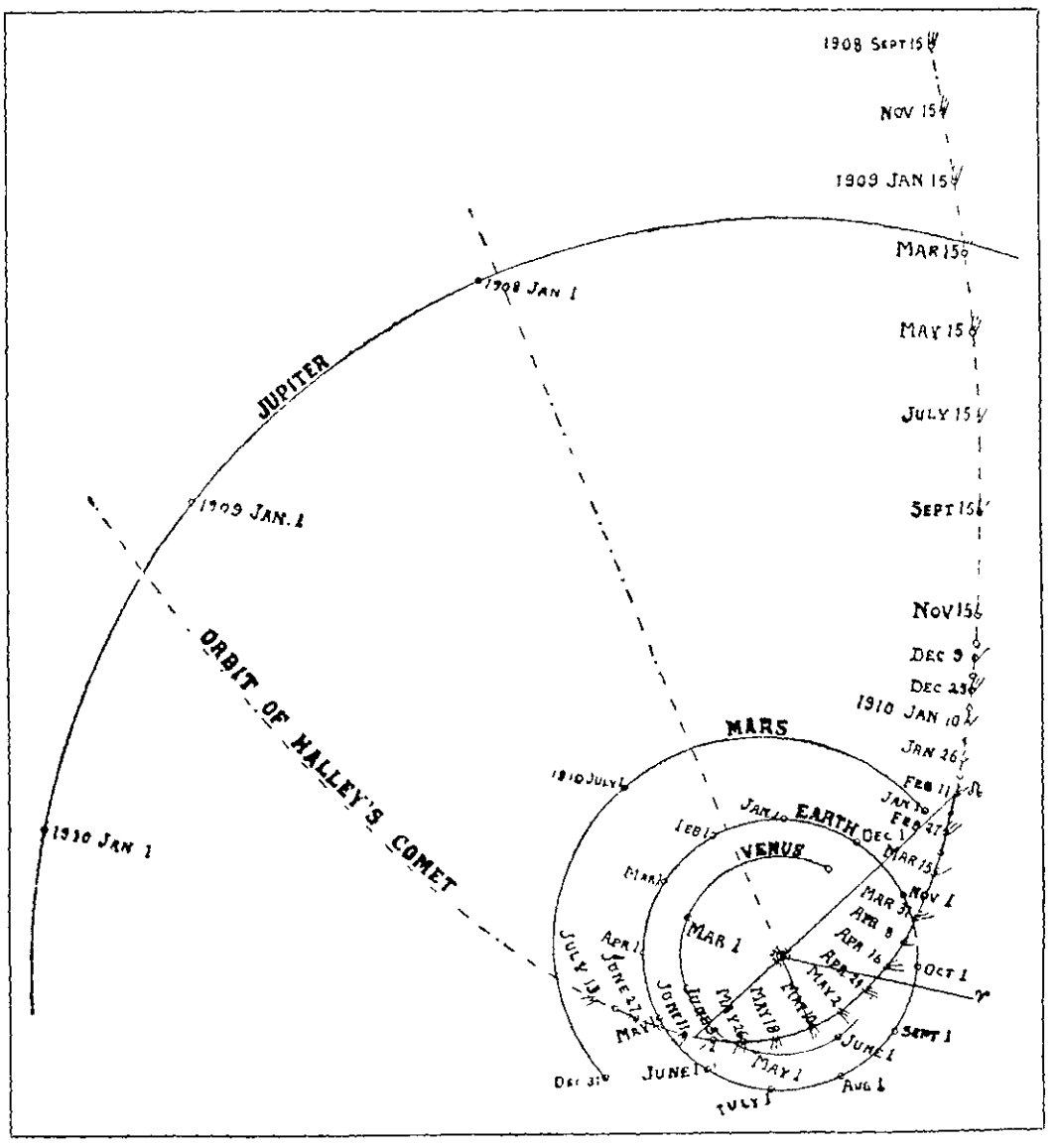
APPROXIMATE ELEMENTS OF HALLEY'S COMET REDUCED TO THE EQUINOX OF 1910.

Perihelion passage	Angle from ascending node to perihelion	Longitude of ascending node	Inclination of orbit to ecliptic	Perihelion distance	Period years
	Degrees	Degrees	Degrees		
451 July 3 ...	108 5	53 3	16	0.62	...
760 June 11 ...	107.5	52.5	17	0 60	...
1066 Apr 1 ...	...	...	. .	.	...
1145 Apr. 29 ...	...	...		. .	79.1
1222 Sept. 15 ...	105 6	51 6	16 5	0.07	77.4
1301 Oct. 22 ...	...	...	...	...	79.1
1378 Nov. 8 ...	107.77	54 67	17 9	0.584	77.0
1456 June 8 ...	104 82	50 08	17 62	0 581	77.7
1531 Aug. 25 ...	104.30	50 77	17 00	0 579	75 2
1607 Oct. 27 ...	107.25	52.66	17 14	0 585	76 2
1682 Sept. 14 ...	109.26	54 35	17 76	0 583	74 9
1759 Mar. 12 ...	110.65	55.92	17 62	0 585	76 5
1835 Nov. 16 ...	110.64	56 19	17 76	0 586	76 7
1910 May 10 ...	111 54	57.18	17 78	0 59	74 5

Motion retrograde.

The diagram was prepared by the aid of ephemerides of the comet computed by Mr. F. E. Seagrave, of Providence, R. I., and the elements differ slightly from those given in the last line of the table, but not enough to affect the shape of the diagram appreciably. Mr. Seagrave adopts May 10th for the date when the comet will be at perihelion. The computations of Messrs Cowell and Crommelin point to an earlier date, probably about April 8 for perihelion passage. Comparing this with the dates in the table we see that this coincides very closely with that for the apparition in 1066 when the comet was a famous object.

Now as to the 1910 apparition. The comet is now out between the orbits of Jupiter and Saturn. It will be within the distance of Jupiter's orbit after March 1st, 1909. It is possible that some one with the aid of a great telescope or a photographic camera may catch sight of the expected visitor during the winter of 1908-9. We may begin to search for it as early as September, 1908, provided that good ephemerides are at hand. Almost certainly it may be found by September or October, 1909. It will then be only a round nebula, whatever tail it has being almost directly behind it as seen from the earth. If the date of perihelion should be May 10, the comet will be lost behind the sun in the early part of April, reappearing in the morning sky about the first day of May. It should reach its greatest brilliancy in the last days of May but the morning dawn will prevent its having the most striking effect. It will pass between the earth and the sun about June 1, and there is a possibility then of the tail extending so far out over the earth that it may be very conspicuous in spite of the deep twilight in which the head of the comet must be observed. After June first the comet should be visible in the evening in the western sky, a more or less splendid object according as the effect of the lessening twilight or the increasing distance of the comet be the more important factor in changing its brilliancy.



HALLEY'S COMET The Orbit computed, showing probable dates of first appearance and Perihelion

Halley's Connection with this Comet.

As soon as Halley had completed his researches, the comet of 1682 appeared. He at once observed and exhaustively studied the new arrival, displaying extraordinary power of methematical analysis. He found the planet moving in a plane but little inclined to the ecliptic—we quote from Professor Mitchell's "Planetary and Stellar Orbs"—and in an eclipse of very great elongation, and receding at its aphelion period to the enormous distance from the sun of 3,400,000,000 miles; and he computed its period at seventy-five years. Looking over his researches by the light of these data, he found, as it were, a string of beads: comets appearing in line at seventy-five years distance approximately. The earlier portion of the string was probable, the later appeared certain. The first of the former category was the great comet of the year of the birth of Mithridates, 130 years before Christ. It was, according to all records, the most magnificent comet that has ever been seen by human eyes, and incomparably, therefore, the most famous in the list. In the years 248, 324, and 399 of the Christian era there are records of comets of remarkable appearance, all true to the Halley period. The rest are in the table above given by Professor Wilson, and it will be seen that they are all of the seventy-five year period, with aberrations accounted for now by the superior knowledge of astronomers who can make allowance for the perturbations due to the influence of planets since discovered.

This is the comet which may now be seen at any moment, according to Professor Wilson, though theoretically due in 1910, which undoubtedly will be the period of its greatest splendour for the current period, for the observation of which the position of this planet will be favourable. It will be for us the last luminous point of a long history, of which the first probably was seen just before the Roman conquest of Asia Minor. It is probable that the brightness of the last appearance of this flying visitor may equal that of the first, which was so famous throughout the world.

ELECTRICITY.

Wireless Telephony, Dynamo Electric Machinery.

Wireless Telephony.

De Forest, of wireless fame, has grown bold with success. Having made the record in the China Sea, during the Japanese war, in the installation set up by the *Times* in the steamer so famously commanded by Captain Colquhoun, a record subscribed to by the Russian and Japanese admirals, who hinted that spies are always hung, and by the British admiral, who feared he could not do anything to help his fellow countryman in case of misadventure, this inventor has now taken to telephony without wires, and is promising the world to bring the opera house to every man's private residence, for an initial cost of £3 for a pole on his roof, and an expense of four shillings a month during the opera season. For this bagatelle the customer will hear any opera that may be in the repertory of any company. Instead of repairing at 9 a.m. to the front of the opera house in the hope (often vain) of getting a place near the door, which is to open in ten hours' time, he waits calmly till he has digested his dinner, turns on the receiver, and hears the whole thing from beginning to end. No bad air, no boredom; no need, therefore, to go out for refreshment or to wish he were dead until the end of the stick's interminable song, which is beginning to be out of tune. Just lay down the receiver, and there you are—immediate relief! Cheapness, comfort, and the artistic paradise!

This is, however, in the region of promise; truly marvellous, but still only promissory. The electricians of the French Army have been doing things just as marvellous. Even more so. They have established easy communication between Paris and Dieppe, they talk comfortably with the station at Pointe de Raz, on the Bay of Biscay (Finisterre), and they are about to astonish the weak nerves at Tangier, of murderous Arabs, over-zealous German consuls, and Foreign Legion deserters, Sultans and preachers of Holy Wars.

The Italians, on their side, take second place to none. They have the Professor Majorana, and they are proud of their compatriot in the decisive demonstrative way that the Latins show their pride in their own. They have gone back to the history of ancient Rome for their warrant. It is written, they say, of old—no doubt in one of the Sybilline books destroyed after the first refusals of Numa Pompilius, to listen to the ravings of the Sybil—that two sons of Italy shall be the first to write and talk across space by means invisible, both of whose names shall be of the same letters all but one. Of course these are Marconi and Majorana, which are very much nearer together than anything that ever came out of Grimm's law in the matter of philology; so what more can you want? This Signor has been working for five years by means of a hydraulic microphone, and has done wonderfully, the Italian nation declares, though he has not gone more than three miles across space with his invisibly produced talk. But what is mere distance? And, besides, was not the Signor Majorana talking without wires five years ago, before that spurious batch of pretenders and imitators got their unholy ears in touch with the Bay of Biscay and the Mediterranean, which they have the characteristic impudence to call a French lake? Moreover, if the Italian Government had only been as prodigal of the national funds as these reckless, boasting Frenchmen, there is no saying how far the Signor would not have been sending his far more melodious voice in this year of grace. But what would you? At all events, the Signor was the first in the field, if not quite the farthest out. Which shows the correctness of the old Sybil, who did so much for the best King the Romans ever had. Again, has not the Signor said that his instruments are very much better adapted for long distances than those of De Forest, who has kept ahead of these Gallic boasters at any rate? He admits that the De Forest mechanism is similar, but his is the better for all that, being better adapted to great things. His instruments, we know at the same time of our own knowledge, culled from the Italian press, which is, as every one is aware who is aware of anything, the best in the world, are in use in the Italian fleet, the officers of which are able to communicate with each other quite as readily, as are the Americans, who rely for their fleet communications on the De Forest, and the English, who, to give them their due, have some merits of their own, rely on Marconi.

The Parsons & Law Method of Regulating Dynamo Electric Machinery

(Specially Contributed by the Hon. Chas. A. Parsons.)

In dynamo electric machinery (both continuous and alternating) it has been found that on account of armature reaction and ohmic loss the excitation has to be increased as the external load is increased. This is usually done by compound winding, or by alteration of the field rheostat.

Further, it has been found that when iron forming part of a magnetic circuit is subjected to an alternating flux superimposed on a continuous flux, the latter is reduced, that is, the magnetic resistance is apparently increased.

According to the following method of regulation there are provided means for the regulation of dynamo electric machinery, utilising the latter principle in a new manner

The method of regulation consists in the use of a leakage path provided between the poles of a magnet, which path can be subjected to an alternating magneto motive, whereby the amount of leakage can be regulated at will by varying the current producing such alternating force.

I have repeatedly on examining cars in for repair been able to lift off the connecting link after removing the leather grease bags, and on one or two occasions the link has actually dropped off, and the rest of the car has been in much the same condition. I also know instances where the nut has jumped the threads on the shell, with disastrous results. An example of this came under my notice, the distorted condition of the screw threads being clearly seen, and to an observant eye the cause was at once apparent on a further glance The joint became detached when the car was coasting down a long hill. This involved serious injuries to all in the car. It was evident that whoever had put this joint up had forgotten to insert the lynch pin or it had dropped out, which is not at all likely; but, notwithstanding this, the nut was hard up to its work—a rather remarkable thing when one takes into consideration the vibration it would have to endure.

The car had previously given trouble with the steering gear, and in each case the cause was identical; the joints had been adjusted up till the back and front halves of the cup were in contact with each other, thus partially encircling the ball, which was also worn, when, of course, no further adjustment was possible, and they should have been taken out and replaced by new ones at an earlier stage.

It is obvious that in this case the halves of the cup, being of gunmetal, would wear rapidly, and to such an extent as to allow the ball to come out, and this is precisely what had occurred, and, to make matters worse, the sides of the shell also bulged out for the reason already noted.

From the foregoing it will be evident that for a ball joint to be satisfactory it should be constructed rather more heavily than is generally the case, and I have found the following proportions successful in practice: The thickness of the shell should not be less than one eighth the diameter of the ball, and the clearance between the ball and the inside of the shell should not exceed 1-32nd in for balls of 1in. in diameter, and correspondingly less for smaller sizes, whilst it is advisable, and is now a general practice, to make the halves of the cup of some hard material, case hardened steel for preference.. The depth (inside) of the cap nut varies considerably, but a suitable proportion is three-fifths the diameter of the ball.

Apart from all other considerations, however, the difficulties attending the lubrication of this type of joint are serious, and I have yet to find a ball joint which is entirely satisfactory in this respect.

It also consists in the method of applying this device to alternators coupled in parallel to multipolar machines, and to polyphase machines.

According to one form there is provided for example in the pole piece of a dynamo or alternator a ring, preferably of laminated iron, concentric with the armature. In such an arrangement the E.M.F. derived from the armature will be that from the lines of force crossing the ring. This ring is wound with a winding through which an alternating current is passed, whereby the leakage due to the ring is reduced, and thus more lines of force will pass through the armature, and the voltage will be increased and compensation for armature reaction thus effected. Instead of adding a single ring, a series of such rings connected to two or more of the pole pieces may be employed, or only part of a ring may be used, the main magnets acting as the remainder. The windings on the ring or rings may be in a number of sections suited to the number of phases of the alternating current. It is not necessary that the rings entirely surround the armature, but they may form or be attached to projections from the pole pieces, or in any other way, provided that they act as a leakage path, carrying a certain proportion of the flux which does not pass through the armature. One form of this is well known, in which the pole pieces are provided with projections, between which the leakage path is situated, carrying a winding to which an alternating current is applied.

The rings may be provided with an air gap, which may further be varied, and thus effect an adjustment to meet different working conditions. In an alternator either the exciter magnets or the main magnets or both may be provided with a ring or rings, and the main current or a portion of the same, which may or may not be transformed, passed round them. As the load rises, therefore, the magnetic resistance of these rings is increased, whereby more lines of force are driven through the armature, and thus even with a low-power factor the voltage can be maintained or even increased automatically. Either the main magnets or the exciter magnets may be provided with this device, but the latter is preferred, as the inductive loss of voltage in the leakage path winding is smaller.

In the case of several alternators running in parallel, equalising wires—similar to those known in conjunction with compound dynamo electric machines—may be provided to connect the various slip rings of the alternators on the various leakage paths; or the leakage paths of the various machines may be excited either with or without subdivision or transformation by the sum of the currents of the coupled machines, that is to say, the leakage path may be inserted in the main leads away from the power station or in a transformer circuit connected to the same. In this latter case equalising wires may be applied to the transformed circuits.

It will be obvious that the use of a leakage path composed of a ring or part of a ring is not essential, as any suitable bar of iron or any other more or less "magnetic" material connecting the pole pieces may be used.

Further, the leakage path may be divided up into portions; also the leakage path may join the main magnetic circuit between the poles and the yoke of the field magnet, thus bridging a portion of the magnetic circuit upon which the main magnetomotive force is impressed.

The Parsons and Law method of regulation further relates to the regulation of alternators, dynamos, and the like, with the object to improve the regulation of voltage of two or more phase machines, and also rotary convertors, that is machines for converting from one, two, or more phases to continuous current, and to provide means for easy adjustment of the apparatus to meet different working conditions.

According to the method described above it has been found that in alternations with two or more phases the insertion of a leakage path winding in one phase only, causes an inequality of the phases, and for many reasons this inequality may prove objectionable.

In the following arrangements, therefore, separate leakage paths are provided governed by all or part of the phases. For instance, in a 3-phase alternator there may be three leakage paths, one connected to each phase. There may also be, in cases where a wire is led from the star connection, another leakage path in that, if desired.

Leakage paths to rotary convertors for the purpose of regulation are also described.

The leakage paths may be placed, as described above, on one side of the pole pieces, or may be distributed, some between one pair of pole horns and some between the other, or leakage paths may be placed on both polar horns in series or in parallel with one another, and in the case of multipolar machines the leakage paths may be either all in series or all in parallels, or some poles may have leakage paths connected to one phase and some to another phase. In fact, the distribution of these leakage paths may be as universal as possible but it is preferable to have approximately equal amount of leakage path between each pair of poles on the exciter or main magnets, so as to equalise the effect on the field as much as possible, and also to have equal amounts on each phase. The amount of compounding given by these leakage paths can be varied by varying the number of the leakage paths For instance, in some cases, if a three-phase plant be run on non-inductive load only, the windings on one or two leakage paths may be used, and the others are then short-circuited or otherwise rendered inoperative; for a power factor of 90 per cent. two may be used, and for a power factor of 80 per cent. all three may be in use.

An adjustable air gap between the leakage paths and the poles for adjusting the amount of compounding has been referred to above. Similarly, an adjustable air gap may be provided in one or both limbs of the leakage paths themselves, or a separate winding may be placed on the leakage paths, having an adjustable resistance or induction or condenser in circuit with it; by altering this resistance or induction or condenser the magnetic flux through the leakage paths can be varied, if desired. Similarly, a resistance or choking coil or condenser can be put in shunt across the leakage paths, which choking coil or resistance or condenser can be made adjustable. In cases where the current for the leakage paths is supplied from a transformer or transformers, these transformers may be made adjustable in any well-known manner.

In one example, a transformer supplied with primary current may supply secondary current to the leakage path. The adjustment of the compounding may in this case be effected by shunting either the primary current or the secondary current. A variable inductance resistance or condenser may be placed in the shunt if desired. Also the transformers may be used for cutting out the leakage paths as and for the purposes described above.

Arrangements of current transformers and leakage paths in a three-phase system, in which each phase has one current transformer controlling a single phase leakage path, each phase winding of the alternator is connected to a common bar or lead, after it has passed through the primary winding of its transformers. This bar also forms the neutral of the alternator. The leakage paths, which are in practice arranged behind one another on the pole pieces of the exciter in this form, are excited by the secondary transformer windings, one end of each of which is connected to a common bar, and the other end to another common bar, the arrangement being such that the secondaries of the transformers and the leakage paths are encircled in series between the two bars

In some cases it is preferable to combine two or more phases on one or more transformers, and supply one or more leakage paths from these transformers; for instance, in a three-phase machine the transformer or transformers will convert from three-phase into single-phase, the transformers being so arranged that each circuit of the three-phase current gives a portion of its effect to the single-phase, and this single-phase current may then be wound round one or more leakage paths.

The whole of the above devices can be applied to alternators of one or more phases, rotaries, motor generators, or motor convertors, and, in fact, to any alternating current machinery where there are poles excited by continuous current between which leakage paths can be put.

Messrs. L. C. Knight and Co., 50 Cuba street, have secured the contract for supplying and erecting the large storage battery for the Eketahuna Borough Council. This will consist of 120 Fritchett and Golds cells of the seven-plate type, with a guaranteed discharge of 45 amperes for three hours. This is a similar battery to that ordered for the Christchurch abattoirs by the same firm, and speaks well for this accumulator, which is recognised as one of the heaviest type of cell on the market The same firm also have the order for the booster and switchboards. The latter will consist of four special polished panels, and will be made up in their workshops to meet the exact requirements of the Eketahuna Borough Council. Mr H. A. Smith will personally supervise the above work.

* * * * *

The tallest lighthouse on British coasts is the Skerryvore, off Argyllshire. It is 240ft. high. It contains 4308 tons of masonry, and cost £90,268.

Portland Cement.

(To the Editor PROGRESS.)

Limestone Island,

October 12, 1908.

SIR,—I have read with much interest in your October issue an article by Mr. Longley on "Portland Cement." While I quite agree with most of his statements, there are two to which I beg to take exception very strongly, as I believe them to be not in keeping with the best practice among Portland cement users, and one of which would be certain to cause your readers much trouble if accepted by them.

The first is " . . . it being of the utmost importance that the pieces of the various materials should be angular and not round." Admitting that a few authorities have expressed the opinion that angular stone makes stronger concrete than rounded pebbles, it will be found that they do not attach much importance to the matter. And in practice I have never known a large contractor to pass over a good, clean gravel for a crushed stone of equal cost. My own experience has indicated that a clean gravel is usually the best material, being stronger than any aggregate but trap rock or granite, and I have just completed several foundations and pedestals for very heavy machinery in which some 25 tons of gravel were used. The house in which I live is built almost entirely of concrete made with local cement ("Crown" brand) and shingle in which it would be practically impossible to find a single angular stone

But the statement to which I most strongly object is that cracks in concrete work are caused by "laying one coat on another before the lower one has properly set." This is in direct contradiction to the generally accepted idea that a perfect bond can be obtained only by putting on the top coat before the under one has set, and should, if intended to be taken seriously, be accompanied by convincing proof. I will not say that letting the under coat set hard causes the top one to crack, but I have investigated case after case where the falling away of the top coat was due solely to having let the bottom layer set hard before applying the top one.

Hoping that in the interests of concrete you will consider this of sufficient importance to put before your readers.

—Yours, etc.,

D. M. GREER,

B.A., Ch.E., M.Am.Ch.Soc.

Roller and other Bearings.

(By Geo. B. Woodruff.)

Paper read before the Institute of Marine Engineeers on Jan. 13, 1908.

(Continued)

Flexibility of roller ensures full line of contact as compared with series of points, with either solid roller or ball, consequently a uniform distribution of load is obtained, and no tendency to destroy the surface of a journal, entirely eliminating the necessity of hardened and ground steel sleeves, any reasonable steel surface being entirely satisfactory. Rollers act as oil reservoirs, and right and left spirals as oil carriers. Less co-efficient of friction, hence higher efficiency than any other design. Less cost of installation due to elimination of special surfaces.

As will be seen from the previous discussion, the flexible roller bearing, from the very principle on which it is designed, has many points of superiority, and in order to prove my contention in the matter, I propose to refer to a number of tests, which have been made in the past by people whose authority cannot well be questioned. In order to obtain experimental information showing the difference between the flexible rollers and the ordinary solid rollers, a series of experiments were made under several conditions by the Franklyn Institute of Philadelphia, and the results of these experiments, which involved considerable time in the execution, are condensed in the following:—4 Hyatt flexible rollers, and 4 solid steel rollers, all uniformly ¾in. diameter, and 10in. long, were used in the test. The Hyatt rollers were formed of strips of steel ½in. wide and ⅛in. thick. These rollers were placed between three plates as shown in the sketch. The whole was placed between the plates of a testing machine and vertical pressure applied. Whilst under this pressure in a testing machine, a horizontal pull was applied to the middle plate, which we will call B, and the resistance to rolling accurately measured by

its reaction on the platform of a scale. The faces of the upper and lower plates, A and a, were planed, and in one series of experiments both faces of the middle plate B. In other series, both faces of plate B were left just as they were received from the rolling mill, that being a very decent surface, comparatively smooth and flat. Increasing vertical pressures were applied up to a maximum of 550lb. per lineal inch of roller. The apparatus employed would not permit of a higher pressure, owing to the resistance to motion of plate B when solid rollers were applied, but under the same conditions with spiral rollers it was possible to place a pressure per lineal inch of 700lb. As these experiments were all made between rigid plates on a machine in which the pressure was applied by screws, and registered on a scale beam, it was suspected that the rigidity might be more favourable to the spiral than to the solid rollers. Therefore, an experiment was made in which the pressure was applied by weight acting on a lever and due to gravity only, with the following result —

Total Pressure Applied. Resistance to motion of Plate B :—

	With Spiral Rollers.	With Solid Rollers.
2,000 lb. ...	9 lb ...	26 lb.
3,000 lb. ...	17 lb. ...	34 lb.

These results corresponded closely to the first experiment, and prove that the method of applying pressure was not the cause of the difference in the resistance to rolling. It will be observed by the figures as given above, that the resistance to motion was much less with the spiral than with the solid rollers under both pressures employed. The reduction of rolling resistance varies in the various tests from 10 to 66 per cent., and averages 51 per cent. less with the smooth centre plate, and 23 per cent, less with the rough centre plate where the flexible rollers were used in the place of the solid one. Observations were likewise made to ascertain the thoroughness of the bearing contact between the plates and the rollers. With the so-called rough plates, the incomplete bearing of the solid roller showed indications of grooving at the points of contact, which is the usual manner of failure of anti-friction rollers. On the contrary, under the same conditions the spiral rollers showed complete bearing throughout their entire length the elasticity of the roller permitting it to follow the sinuosities of the rough plate, and maintain contact. The pressures employed in the experiments were about as high as good practice tolerates with the slowest motion, and very much higher than is permissible with the velocities in ordinary shafting. The high pressure borne by the spiral roller without permanent deformation, its low resistance to motion as compared to the solid rollers, and its elastic adaptation to inequalities of surface, were clearly exhibited by the experiments. Another experiment which was described in the "Engineering Review" of February, 1906, is very interesting. A special friction-testing machine of particular design was employed for determining the co-efficient of friction of the flexible roller bearings, as compared with the solid roller bearings and plain bearings. The machine was fitted with a pendulum suspended from the bearing in such a way that the same could be weighed. The force necessary to keep the pendulum in vertical position was measured by putting weights in a scale pan attached to a cord passing over a pulley. The shaft or journal was of ordinary machinery steel, and rotated by means of a belt and pulley. In beginning an experiment, a pointer on the lower end of the pendulum was brought to a zero mark exactly beneath the centre of the shaft by means of adjusting screws in the yoke holding the bearing. After the shaft began to revolve, the pointer was held to the zero mark by putting weights on the scale pan. The product of the force thus supplied, to the pendulum, by distance of the point of application from the centre of the shaft, gave the moment of friction, and dividing this by the radius of the journal, gave the friction at the surface of the journal. Dividing this, again, by the total weight on the journal, gave the co-efficient of friction. A long series of tests of this kind were made with each one of the four different sizes of shaft, viz., 2in., 2¼in., 2½in., and 3in., and the result of the entire test condensed averages, shows the average co-efficient of friction on the four sizes for the three different kinds of bearings to be as follows:—

For the flexible roller bearing co-efficient of friction	.019
For the solid roller bearings	.0233
For the plain bearings . .	082

There have been many tests of different characters made at different times to obtain the co-efficient of friction in bearings of various types, and we have often seen co-efficient of friction in a bearing given as low as .003, or sometimes lower, but the method of arriving at these figures is manifestly different from that employed in this case under question. The comparison between three averages is really what is most interesting. You will note that the difference in the co-efficient of friction as given in the results of these tests between the flexible roller and the solid roller is .0043, which shows a difference of 23 per cent. in favour of the flexible roller. The difference in the co-efficient or friction between the roller and the plain bearings seems to obviously call for further reference. It may be said that the friction of roller bearings is shown to be one-fifth to one-third of the plain bearing. It is also shown in these tests that co-efficient of friction in the roller bearings decreases as the load increases. Many other laboratory tests have been made, all showing the same general result. One or two practical tests may be of interest. I might describe briefly a test which was made in one of the plants belonging to the United Shoe Machinery Co. The line shaft which was tested is 152 feet long, 3 inches diameter, and is supported by 20 bearings. It is belt driven at one end from a head shaft. Belted from this shaft are counters of eighty-eight machine tools. No changes were allowed in the countershafts or belts during the progress of the tests. The tests extended over a period of about one month, and were carried out to the minutest details. The summary of results, however, which is what we are most interested in, is as follows:—

First the average frictional load of the shaft, with the 88 counters constantly running in white metal bearings.

Main shaft in white metal bearing, 8.85 H.P.
Main shaft in flexible roller bearing, 6.36 H.P.
Per cent. of saving by flexible roller bearing 16.7 per cent.
Second, average frictional load on main shaft only: all counter belts thrown off—
In white metal bearings, 2.28 H.P.
In flexible roller bearings, .80 H.P.
Per cent. of saving by flexible roller bearings, 64.9 per cent.

Another test which may be interesting was made on an overloaded shaft, 2in. diameter, and the object was, if possible, to avoid the fixing of a larger motor. There were thirty bearings in use on this line of shaft, and the results were as follows, as shown by the voltmeters and ammeters:—

	Volts.	Amps.	Watts
With white metal bearings ...	224	36	8064
With flexible roller bearings	222	30	6660
Motor (running free) ...	223	4	892

Rated capacity of motor was 15 H P.
Saving shown.
Percentage saving by Hyatt roller bearings, 17.4 per cent.
Indicated H.P. saved by Hyatt roller bearings (30.2 in.), 2.4 H.P.
Cost of 30 2-in. flexible roller bearings, £30.
Net profit on investment after paying interest and depreciation, 28 per cent.
Time required for saving to repay investment, 2½ years.
Time required, assuming flexible rollers bearings had been originally fixed, 1¼ years.

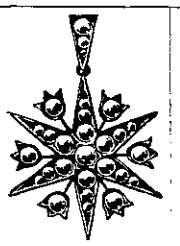
Tests with machinery of a heavy, slow-moving order have also been made, and very fine results in favour of the flexible bearings have been shown. For instance, the Wellman-Seaver-Morgan Company, or, as they have recently changed their name, the Wellman-Seaver-Head, Ltd., of 47 Victoria-street, have reported that on their Open Hearth Charging Machine (which machine weighs 19 tons without its load) that this machine, when tested, fitted with roller bearings, took 18 amperes at 450 volts to travel the machine along its rails, showing a current consumption at the rate of 10.9 H.P. The same machine, fitted with the ordinary brass journals, they calculate took 19.1 H.P. to travel at the same speed. It will be seen, therefore, that for slow moving machinery, and especially a machine of this kind, which is sometimes started a great many times during the day, the saving to be effected by the use of roller bearings is enormous. Another test has been reported from Wm. Beardmore's works in Parkhead concerning a roller table serving a pair of their heavy armour plate rolls. It is stated that this roller table, after it was refitted with flexible roller bearings, is being operated with 50 per cent. less power than what it required previously, when it was fitted with bearings of the ordinary type.

APPLICATIONS FOR PATENTS.

The following list of applications for Patents, filed in New Zealand during the month ending Oct. 29th, has been specially prepared for PROGRESS:—

25027—R. H. Gulleford and J. G. Harbottle, Christchurch: Flax-bleaching process.
25028—M. Siddall, Christchurch: Kettle.
25029—R. Gilkes, Wellington; Protecting shop front from dogs, etc.
25030—J. H. Grant, Wodonga, Vic: Rabbit-burrow fumigator.
25031—W. J. Love and F. W. Skelsey, Burnside: Cement-manufacture.
25032—W. J. Roebuck, Dunedin: Post-coupling.
25033—A. Jarrett, Glebe, N.S.W.: Kerosene-pump.
25034—W. Nelson, Auckland: Lamp ventilator, etc.
25035—T. McNab, Collingwood: Picture frame-making apparatus.
25036—A. W. Collett, Dannevirke: Friction-winch.
25037—H. G. Scott, Jamaica, U.S.A.: Dispensing stopper for liquid receptacles.
25038—W. Seifert, Takapau: Flax-treatment.
25039—F. W. May, Shannon: Ballast-truck.
25040—R. S. Irwin, Waikaka: Preventing marine engines from racing.
25041—J. S. McPherson, Wakefield: Broom, etc., bracket.
25042—J. A. Patterson, Wellington: Hydro-carbon-gas producer.
25043—H. Bentles and J. H. Dalton, Auckland: Bottle-stopper, etc.
25044—J. Baird, Hamilton: Earth-closet.
25045—G. L. Briggs and R. F. Bollard, Taupiri: Saw fence.
25046—J. E. C. Brown, Dunedin: Explosion engine.
25047—A. H. Wright, Dunedin: Hat-pin.
25048—A. H. Wright, Dunedin: Lock.
25049—A. H. Wright, Dunedin: Guard for playing table-games.
25050—A. H. Wright, Dunedin: Displaying telephone lists, etc.
25051—A. H. Wright, Dunedin: Cooker.
25052—T. W. Edlin, Waimate: Non-refillable bottle.
25053—J. Ford, Dunedin: Candle-saver.
25054—R. Paladini, Wellington: Fan.
25055—J. Worms, Auckland: Surveying peg.
25056—G. Hutchinson, Christchurch: Portable reading-stand.
25057—J. Mitchell, Auckland: Wall-construction.
25058—F. Castle, Auckland: Fire-alarm
25059—E. Bingham, Masterton: Cycle-horn, &c, actuator.
25060—R. J. McDonald, Auckland: Shoe.
25061—B. and W. Trewhella, Trentham, Vic.: Roller-grip for band-gearing.
25062—B. and W. Trewhella, Trentham, Vic.: Double-pinion toothed gearing.
25063—B. and W. Trewhella, Trentham, Vic.: Pawl and ratchet mechanism.
25064—R. Millis, Dunedin: Tire-protector.
25065—D. Laing, Dunedin: Cigarette.
25066—J. Gray, Dunedin: Wheel.
25067—R. R. Dunn and A. Whett, Eastbrook: Brick-making composition.
25068—G. M. Scott, Wellington: Illuminated advertising device.
25069—W. J. Parsons, Wellington: Step-ladder.
25070—J. Mitchell, Auckland: Wall-construction.
25071—J. Mitchell, Auckland: Building-plaster.
25072—H. Croft, Auckland: Roundabout.
25073—L. M. M. Monteath, New Plymouth: Flax preparation.
25074—W. J. Roebuck, Dunedin: Step-ladder.
25075—W. P. S. Macgregor, Wendonside, and E. C. Reid, Ravensbourne: Wire-strainer.
25076—H. Maighan, Dunedin: Raising venetian blinds.
25077—A. E. Styles, Wendon Valley: Dray-brake.
25078—T. Gare, New Brighton, Eng.: Manufacture of articles from waste rubber.
25079—E. V. Schou, Ealing, Eng: Soap manufacture.
25080—V. O'Donnell, Willaura, Vic.: Rope-making.
25081—C. W. Eccleston, Los Angeles, U.S.A.: Ore-concentrator.
25082—J. A. Powrie. Lower Hutt: Poultry and stock-feeding bin.
25083—J. A. Powrie, Lower Hutt: Water-strainer.
25084—E. Moss, Christchurch: Fire-alarm.
25085—W. G. Richardson, Auckland: Centrifugal machine.
25086—F. C. Brown, Waihi: Heating metal tools.
25087—E. Dahl, Palmerston North: Collapsible cot.
25088—M. Burns, Tokatoka: Wool-bale grip.
25089—C. B. M. Branson, Dunedin: Saddle-cover.
25090—C. Stott and T. W. Brownlee, Brisbane, Q.: Totalisator apparatus.
25091—C., C. E., C., and M. Thomson, Winton: Hat-pin.
25092—W. Murray, Mokoreta: Spanner.
25093—J. C. Oliver, Tauranga: Colander.
25094—J. M. Collins, J. Low, and A. Burges, Palmerston North: Flax-treating apparatus.
25095—J. M. Collins, J. Low, and A. Burges, Palmerston North: Flax-scutcher.
25096—J. M. Collins, J. Low, and A. Burges, Palmerston North: Flax-treating apparatus.
25097—F. Stubbs, Auckland: Cooking-range hot-water system.
25098—R. Meek and O. Elliott, Auckland: Billiard-table.
25099—W. Burrell, Melbourne, Vic.: Rabbit-crate.
25100—Oxychlorides (1907) Limited, London, Eng.: Sewage-treating method and apparatus.
25101—T. Edwards, Ballarat, Vic.: Rabble for ore-roasting furnace.
25102—P. R. Hughes, Geelong, Vic.: Bale-fastener.
25103—United Shoe Machinery Company, Paterson: Upper-conforming machine.
25104—United Shoe Machinery Company, Paterson, U.S.A.: Press.
25105—J. de Irabien, Buenos Ayres, Argentine: Air-current turbine.
25106—J. McMullen, Makuri: Mail-bag deliverer and receiver.
25107—E. W. Hursthouse, Wellington: Lamp-pillar.
25108—E. W. Hursthouse, Wellington: Steam-cooking apparatus.
25109—H. M. Keesing, Auckland: Air tank for gas manufacture.
25110—Henry Simon, Limited, Manchester, Eng. Flour milling and conditioning.
25111—F. D. McLeod, Grey Lynn: Corrosion-preventing solution.
25112—J. A. Harriss, New York, U.S.A.: Mail receiving and delivering apparatus.
25113—W. L. Imlay, Conestoga, U.S.A.: Filter.
25114—J. Sweeney, Coromandel, and J. Kidd, Auckland: Condenser.
25115—Auckland Sewing Machine Company, Limited, Auckland: Sewing-machine.
25116—A. Ferguson, Wellington: Waste-paper basket.
25117—National Cash Register Company, Dayton, U.S.A.: Cash and credit register.
25118—S. D. McMiken, Komata: Metallurgical furnace.
25119—P. H. Le Cornu, Adelaide, S.A.: Combination bedroom furniture.
25120—W. C. Bray, Adelaide, S.A.: Cart note-case.
25121—F. Oakden, Dunedin: Lime-burning process.
25122—F. Oakden, Dunedin: Lime-burning kiln.
25123—F. Torrington, Auckland: Plunger for regulating pressure of aerated waters.
25124—J G. O'Brien, Wanganui: Gas-stove boiler.
25125—W. H. Trengrove and H. E. Dovey, Wellington: Finger-protecting sewing-shield.
25126—J. Gray, Dunedin: Means for lubricating wheels.
25127—J. C. Koller, Doornfontein, Transvaal; Extraction of metals from ores.

Full particulars and copies of the drawings and specifications in connection with the above applications, which have been completed and accepted, can be obtained from Baldwin and Rayward, Patent Attorneys, Wellington, Auckland, Christchurch, Dunedin, etc.



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