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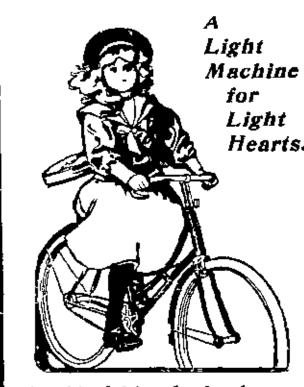

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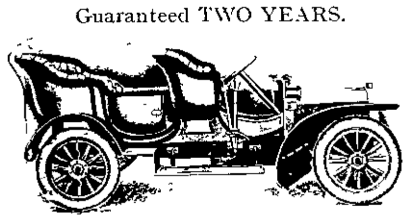

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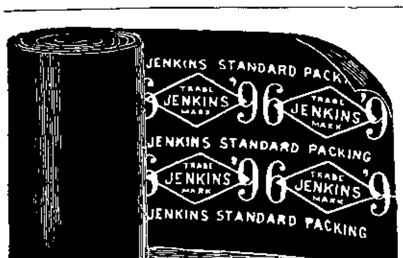

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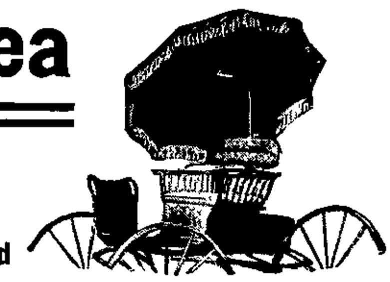

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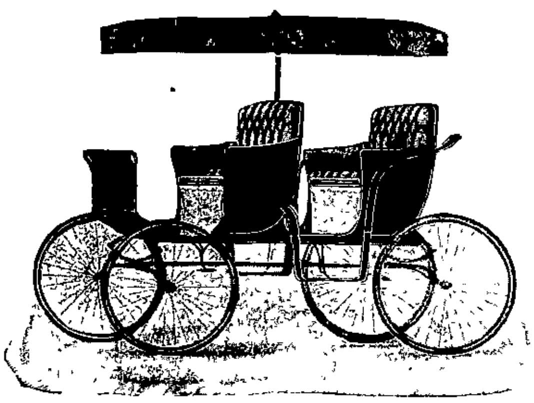

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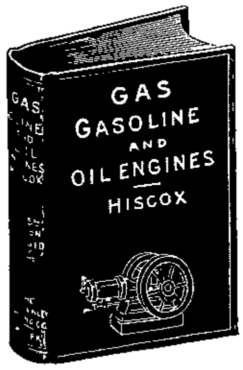

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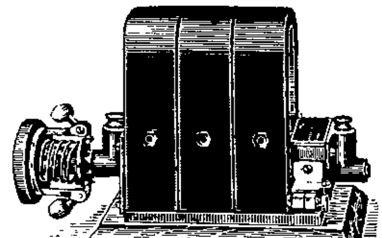

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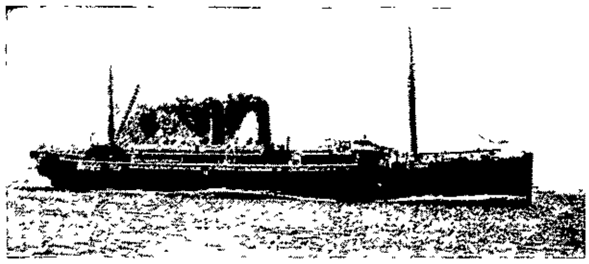

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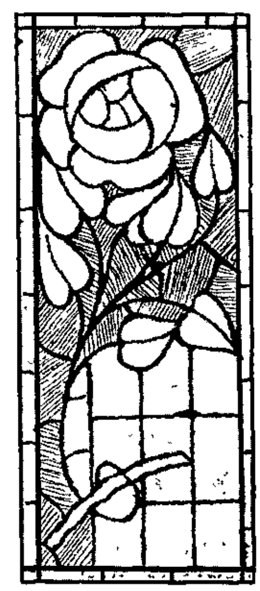

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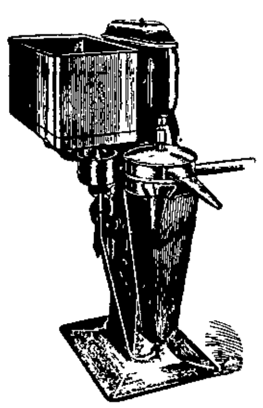

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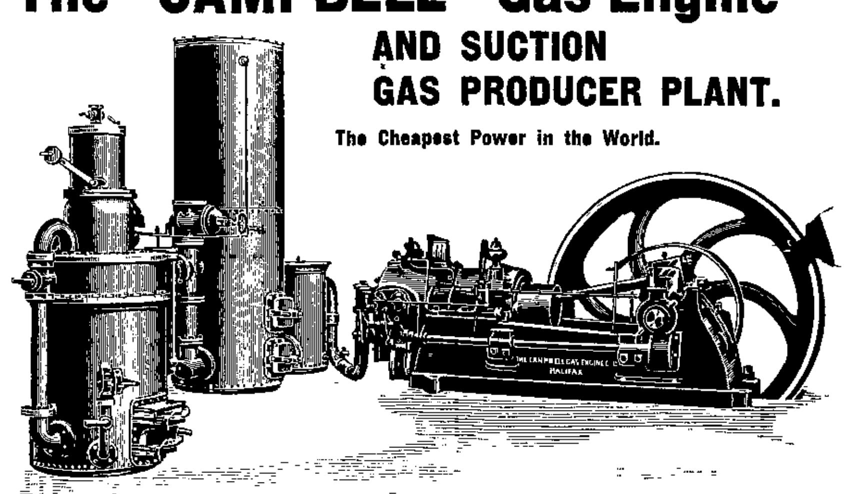

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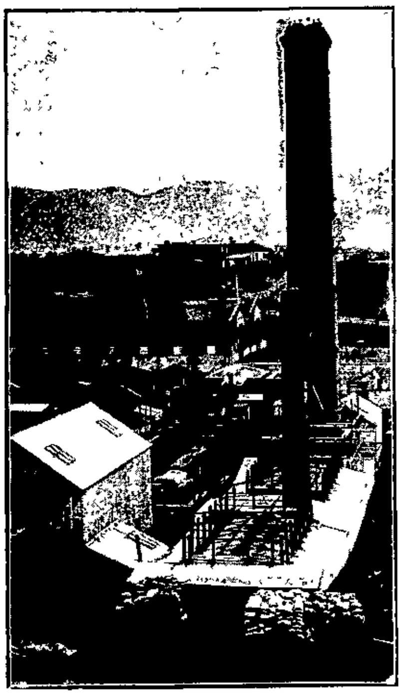

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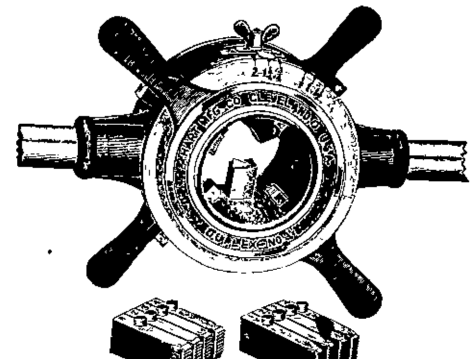

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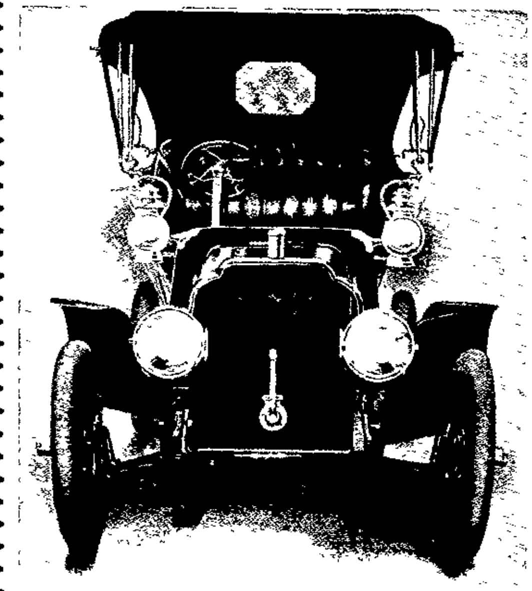

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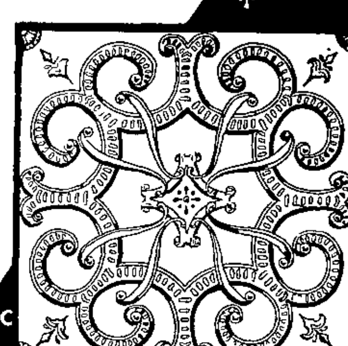

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PROGRESS

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THE SCIENTIFIC NEW ZEALANDER.

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The Editor invites contributions (which must bear name and address of sender, not necessarily for publication) dealing with progress made in any process or method directly or indirectly connected with mechanical, industrial or commercial work. In no case can rejected copy be returned unless accompanied by addressed envelope bearing half-penny stamp; neither can the Editor enter into correspondence concerning rejected contributions.

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EDITORIAL COMMENT.

The Anti-Trust Fuel.

Although the world has been slow to adopt spirit engines for commercial use yet there can be no doubt that this method of motive power has great possibilities, and is rapidly coming into use upon the Continent of Europe and in the United States. With regard to this last named country, a step in the right direction has been taken by the passing in the United States of the Denaturised Alcohol Bill by both Houses of Congress, placing that description of alcohol on the free list. Any farmer can now, it is said, make alcohol at from five to eight cents per gallon from the refuse on his farm. A farmer with a large quantity of rotten potatoes, bad apples, half-rotten vegetables and water soaked corn or maize could not previously dispose of this garbage except as food for hogs. Under the new American law it will be more profitable for the farmer to turn his waste produce into alcohol, for he can erect a distillery at a cost of from £10 to £20, and with that plant he can make alcohol enough to yield profit on large portions of crops which formerly went to waste. It seems that at present users of gasoline are having to pay as much as from 18 to 22 cents per gallon, or equal in English money to from about 9d. to 11d. per gallon, and it does not create as much power as alcohol The United States have been late in the day in adopting this form of spirit engines because of the tax (just repealed) amounting to 4s. 5d. per gallon upon all grain alcohol, and, indeed, upon all alcohol made from anything but wood Meanwhile, some of the European countries have been using alcohol for fuel in large quantities and with great success, and it naturally occurs to us that what can be done in this respect on the Continent and in America ought to be possible elsewhere We learn from an interesting article on the subject in a recent issue of *The American Manufacturer* that the passing of the before-mentioned measure is likely to effect in the United States quite a revolution in certain economic conditions Its intense heating power makes alcohol serviceable as a fuel of the highest order, and it would be invaluable as a power generator for motors

Failure of Shafts.

A circular letter of very great interest and importance to marine, and, indeed, to all engineers, was issued recently by Lloyd's Register of British and Foreign Shipping to superintending engineers and others, who might be able, from their experience to express opinions, and offer suggestions on the subject of the failure of shafts. The large number of shafts which break while at work, added to those which are just caught in time to prevent disaster, by close examination and scrutiny, certainly warrant such a letter being issued, and, as no doubt many of our readers have met with experiences which would help to throw light on the subject, and add to the information which the Committee of Lloyd's is desirous of obtaining, in order to lessen the number of shaft failures and reduce the risk of broken shafts, those who have had opportunities of inspecting fractured shafts are invited to give the benefit of their observations for the general good The points stated by the Committee for special observation are.—Ingot steel, scrap iron, and scrap steel, as material for the construction of shafts The first named is, perhaps, considered preferable for shafts up to 15 in. diameter, but for propeller shafts, good iron, well forged, is looked upon by a large number of engineers as preferable to steel The difficulty of obtaining scrap iron perfectly free from steel renders the position one of doubt in respect to the perfect homogeneity of the forging, and it is probable that the difficulty of selection has resulted in many bad shafts due to portions of steel being mixed with scrap iron used for the forging It is pointed out in the circular letter that repairing workshops stock heavy forgings for shafts to be ready for emergencies, and that these may be turned down abnormally if a smaller shaft is wanted than the diameter of the finished forging may have been intended for, the strongest part is thus removed in the outer skin

The Cure of Cancer.

MR JOHN BEARD, lecturer in Comparative Embryology in the University of Edinburgh, is reported to have found a substance that will cure cancer by digesting its cells An important article on the subject by Dr C W Saleeby appeared in the August number of *McClure's Magazine* Authorities are agreed that the disease is not the result of an infection. The cells of a malignant tumour are naturally native to the body which they ultimately destroy. Dr. Beard believes that the parent cancer cell has always been in the body, but not of it. His theory of treatment is based upon what is known to embryologists as the alternation of generations. In the case of the skate and the chick there is found to be an asexual larval stage upon which the embryo proper develops. Dr. Beard has discovered what he calls a "critical period," which marks the beginning of the disappearance of this transitory larval generation that had hitherto been growing. The characteristic tissue of which this structure is composed is designated by the name of "trophoblast." Dr. Beard classifies cancerous tissue as "irresponsible trophoblasts." According to him, all malignant tumours are products of aberrant germ cells, so that a death from cancer is, so to speak, a case of fratricide, since the individual and the tumour which kills him are both derived alike from one parent cell. There are a host of instances in the lower animals, if not also in man, of the development of these aberrant germ cells into tumours which show distinct signs of the attempt to produce a second individual. Of these extraordinary cases Dr. Beard (says his interpreter) seems to have provided an explanation. But far more commonly such an aberrant germ cell does not give rise to any such tumour, but passes on to the asexual stage or generation producing the trophoblastic tissue of which we have already heard. In a word, a cancer results from the attempt of an aberrant germ cell to continue its life cycle, the attempt having ended merely in the indefinite production of larval, asexual, or trophoblastic tissue. "If this theory be correct, the conditions which lead to the destruction, digestion, and complete absorption of the normal trophoblastic tissue that begins to vanish at the 'critical period' should have similar effects upon 'irresponsible trophoblast.' In a word, trypsin should cure cancer by digesting its cells The rest of the pancreatic secretion should destroy and dispose of the products of this digestion."

Dr. Saleeby, on the question of actual cures, says he has personally watched, from the first, the treatment of a case of cancer in an outlying district of London. "The diagnosis was beyond dispute and had been independently confirmed at two hospitals—one of them world-famous. The growth was visible and evidently full of vitality. The surgeons had pronounced the case inoperable, and the patient was evidently sinking. Writing two days less than four weeks after the tentative and partial commencement of treatment by trypsin, I am able to report that, so far as all the indications go (and they are abundant), the tumour has already been killed outright."

We hope to hear that this seemingly marvellous discovery has made rapid progress towards the amelioration of a disease which causes more than one in forty of all deaths.

New Zealand International Exhibition, 1906.

"PROGRESS" PRIZE ESSAYS.

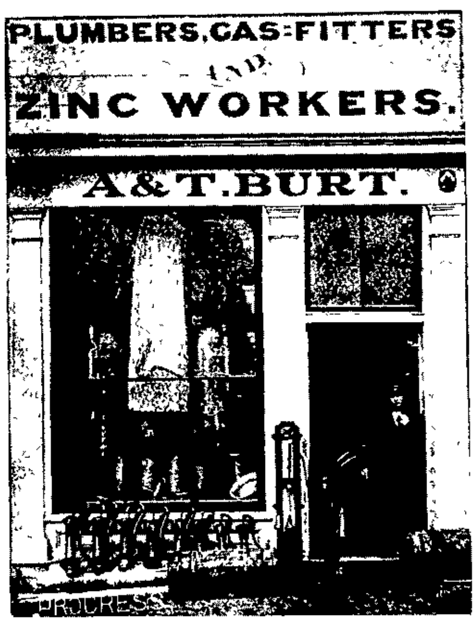
Particulars of the above, which are to be conducted on novel lines, may be had on application. Address Editor, "Progress," Wellington.

Our Industries: No. 9. A. & T. BURT, Ltd.

The iron-working and kindred trades of New Zealand are closely allied with the trend of events which has brought our colony into the front rank of Britain's oversea possessions. Prominently placed amongst the enterprising firms which have lent individual weight to our progress is the business of Messrs. A. & T. Burt, Ltd., whose head office is at Dunedin, and the following account of this large establishment cannot fail to be of interest to our readers.

Mr. A. Burt and his late brother started business in 1862 as plumbers and gasfitters, in the Octagon, Dunedin. Their shop then was only 18' x 12 , and as Dunedin grew larger, so in proportion grew Messrs. Burt Brothers' business After enlarging their small shop several times, until it became a matter of impossibility to properly transact the increasing business, the old firm decided to buy another section in 1866 and build a foundry thereon. The site chosen was in Princes street, where the office of the *Evening Star* now stands. From this time, up to 1871, many new industries were added to the business and at the end of the latter year the pioneers' name for good work had spread not only in Otago, but to all parts of New Zealand—even as far north as Auckland. In 1871 several important contracts were taken by the firm, and they again found it necessary to enlarge their premises. They managed to secure a piece of the late Mr. George Matthews's garden at the rear of their own foundry, and on this site large additions were made to the workshops, and the firm took its place amongst the leading iron and brass workers of the Australasian colonies. Whilst Messrs. Burt were occupying the premises in Princes street and Moray place, they were entrusted with several important contracts, notably the whole of the plant for the New Zealand Distillery, as well as machinery for several large meat-preserving works.

In 1875 the business had so increased that it was again necessary to look out for fresh quarters. This time a site was found between Cumberland and Castle streets, half an acre was secured, and in a very short time the whole of this ground was covered with the foundry and workshops. For a little while longer the old premises in Princes street were used as a warehouse, but in 1877 they were found to be too small for the necessary requirements; so a three-story brick warehouse, covering a quarter of an acre of ground, was built at the corner of Stuart and Cumberland streets.



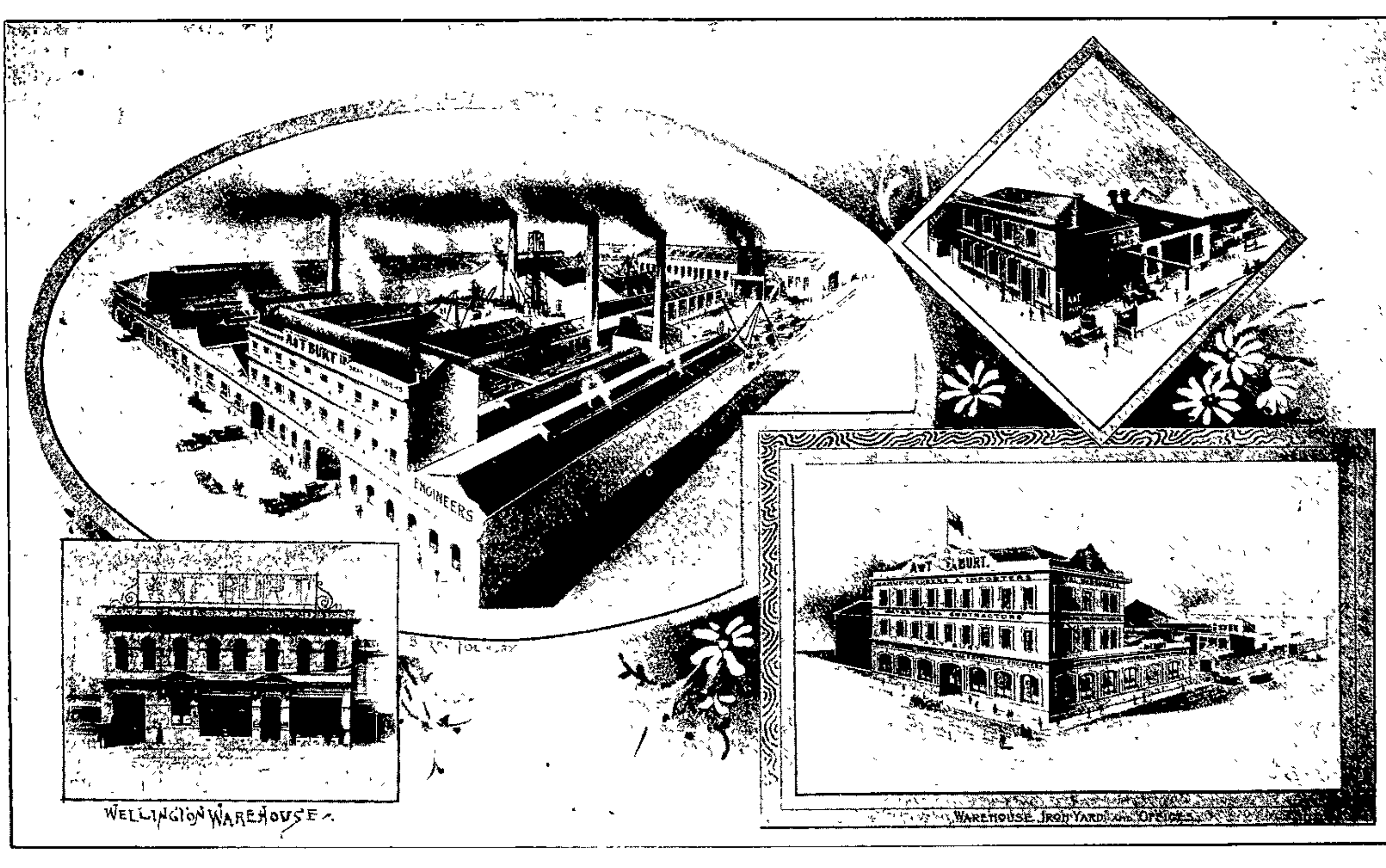
A. AND T. BURT'S FIRST OFFICE AND WORKS IN DUNEDIN IN THE "SIXTIES."

Close by, in less than twenty-three years, one of the largest of the Australasian foundries has sprung up from a little wooden shop. Of course, all these additions and improvements were not made for show, and the work has had to keep pace with the size of the buildings. From time to time the various branches of the business have increased in dimensions, and as soon as any important labour-saving machinery appeared on the market, it was at once adopted.

The business, at one period carried on by the Otago Foundry Co., in Cumberland street, has been acquired by Messrs. Burt, who also occupy the premises formerly used by the Dunedin Engineering Co , Castle street. Additional ground was in due course purchased opposite the works, where the plumbing and coppersmith business is now carried on exclusively, so that, altogether, the works and warehouse premises now occupy five acres in Dunedin. In 1897 the firm was registered as a limited liability company, and nominally a private company, which has since carried on the business under the title of A. & T. Burt, Limited, and it further enlarged its sphere of operations by opening extensive branches in Wellington, Christchurch, and Invercargill. In 1903 still further addition was made to the Company's business by the purchase of the foundry and warehouse of Dunn, Smith & Co., situated in Custom street, Auckland. This portion of the business is carried on under the management of Mr. Alexander Burt, junr., and the Company undertakes ship repairs and manufacturing work on a similar, though smaller, scale than the present works in Dunedin.

At the Dunedin works Messrs. Burt carry on some sixteen different branches of the metal manufacturing trades, and turn out about 75% of the goods stocked at their Dunedin warehouse and other branches.

The main entrance is from Stuart street, and the visitor at once enters the selling-department. Here most of the shelf goods are kept, and an efficient staff looks after the requirements of clients. Along the Cumberland street side is the main office accommodation. The three flats are connected with a hydraulic lift, which was manufactured and erected by the workshop staff. On the second flat mostly gas fittings and rubber goods are stored in bulk. Half of this



A. AND T. BURT'S DUNEDIN AND WELLINGTON ESTABLISHMENTS TO-DAY.

GROUP OF OVER 400 EMPLOYEES AT A. AND T. BURT'S FOUNDRY, DUNEDIN.

flat is set aside for show-room purposes. We understand it is the firm's intention to shift this show room to the ground floor in the near future so that the great variety of up-to-date gas fittings, gas heating appliances and sanitary fittings may be seen to better advantage. On the top floor a miscellaneous stock is stored mostly in bulk.

Passing through swing doors on the ground floor one enters the packing and bulk store at the rear of the warehouse. Here all the goods are packed and despatched to the various branches and customers. Passing across the yard the visitor comes to the new iron store recently erected. This store has a cart entrance to Cumberland street, and a travelling crane runs the whole length, and it has been designed with a view of keeping the various sizes of plates, bars, etc., in their proper places, so that prompt delivery can be given.

Attached to the warehouse is an electrical department under the supervision of Mr. J. P. Nelson. The firm are the New Zealand agents for Crompton & Co., and large stocks of electrical apparatus are kept both at Dunedin and the various branches.

Moving from the Dunedin warehouse into the works proper the visitor first touches the plumbing, tinsmithing and coppersmiths' departments, all in a separate building. Through the plumbing department the firm has carried out some of the largest jobs in and around Dunedin. In fact, this department carried out in recent years, amongst other works, the contracts for the high-pressure water supply of Palmerston South, and Alexandria South.

In the coppersmiths' and tinsmiths' departments all classes of copper and tinsmiths' work can be seen in course of construction. In the former department a speciality is made of copper washing boilers, high-pressure copper circulating tanks, and heavy copper steam pipes. Some of the largest brewery and sugar boiling plants used in the colony have been turned out of this department. Here the branches of the trades mentioned are carried on, and from thence one is conducted to the main workshop. Leaving the store and offices, where all manufactured goods are carefully checked, weighed and entered, the engineering department is next visited. Here we see, in the course of manufacture, sluicing and mining plant, dairy engines, dredging material, flax strippers, etc, etc. Some little time ago this department fitted and erected three large dredges for Siberia, and they are now working in the Czar's dominions, testifying to the good workmanship put into them at Burt's foundry. In this department also Crosbie's patent flax stripper is erected and sent out ready for use under the supervision of the patentee. Passing from the engineering department one is now shown through the blacksmith's shop where the wrought iron and steel work in connection with the various manufactures is carried out. In the iron-moulding department, which is next visited, the stranger is struck with the varied work in course of manufacture, this is one of the most important departments of a manufacturing firm such as Burts'. The brass moulding is inspected in turn, and here we see in the moulds all classes of plumbing and engineer's requirements. Brass-work has always been a speciality with this enterprising firm, and even at the present time most of the necessary brass-work used in the repair of large steamers all over the colony comes from their foundry. There is positively no kind of brass and copper work that Messrs A. & T Burt cannot execute, and, added to this, their price is invariably below that of the imported article.

Ever since the inception of the firm the iron and brass moulding departments have cast every working-day. In the brass-moulders' department several girls are employed in core making.

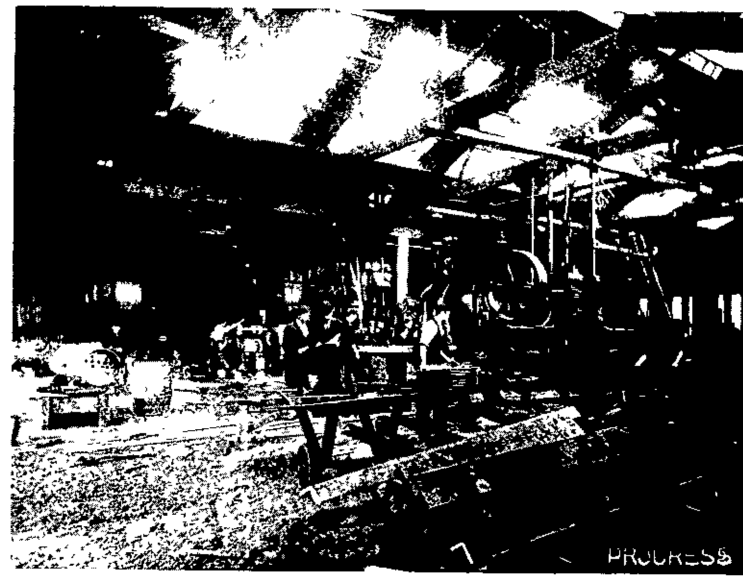
Now we come to one of the largest departments in Messrs Burt's business—the boiler-makers', dredge and bridge-building yards. Here we find in the course of construction the steel girders for the Manuherikia Junction bridge, also dairy boilers, sluicing plant etc., etc. Most of the large fluming supplied to the sluicing companies throughout New Zealand has also come from this department.

Leaving the ground floor of the works one is conducted up a cast spiral stair-case, manufactured on the premises, to the brass-founders' department. Here the rough castings are turned, polished and fitted together in readiness for despatch to the various warehouses for distribution in all parts of New Zealand. In the manufacture of steam and waterworks brass-work the firm can compete successfully with the imported article. Girls are also employed in this department fitting the lighter brass-work together. Attached to the brass shop is the electro and nickel-plating department, where all metal goods are made equal to new at a low price. The pattern-makers' shop is a very interesting department, and one sees how accurately the hands have to work. On their efforts depend the true casting and the finished article. Connected to this shop is a large three-story, fire-proof brick building, where all the patterns are stored and classified.

THE WELLINGTON STAFF OF A. AND T. BURT LTD.

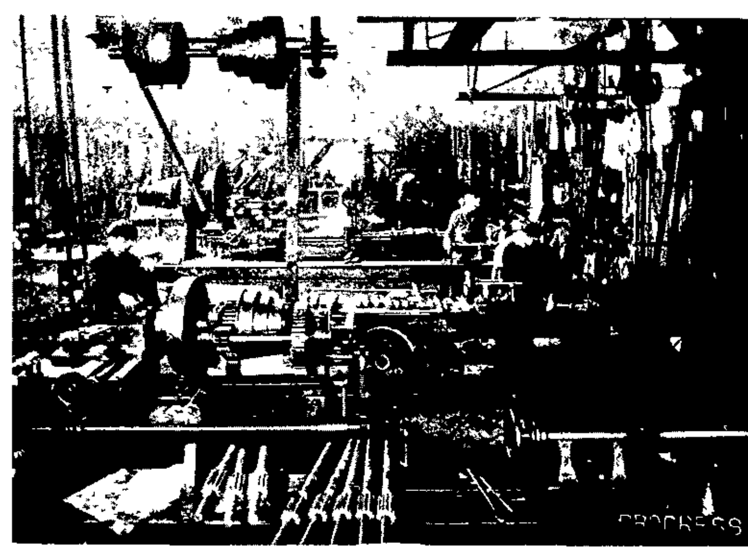
Interior Views, A. & T. Burt's Foundry, Dunedin.

HEAVY DRESSING-YARD.



BOILERMAKERS MACHINE AND FLUMING DEPARTMENT.

BRIDGE BUILDING YARD NO. 2 · SHOWING MANUHERIKIA CROSSING NO. 3 BRIDGE UNDER CONSTRUCTION.



ENGINEERS' MACHINE SHOP.

BRASS FINISHERS' DEPARTMENT.

GENERAL OFFICE.

The last place visited is the lead and compound gas-pipe manufacturing shop. The machine used for this purpose is driven by special hydraulic engines, and all sizes of lead pipes for plumbers' and ships' use, together with composition gas pipes are made. As there are a number of organ builders in the colony the firm took up, some time ago, the manufacture of special organ composition pipes.

The Wellington business of the firm of Messrs. Burt, like that of the head-quarters in Dunedin, progresses very rapidly—so rapidly that it was found necessary some time ago to transfer the Wellington branch into new and more extensive premises. This is a suitable building, of two stories in the front portion, with a frontage of 72 feet to Courtenay place by a depth of 42 feet, the depth of the section being 132 feet. The ground floor is devoted to the shop and spacious show-room, and to office accommodation, part of the space having been cut off for a cartway leading to the back of the building, where there is a large store, 80 feet long by 26 feet wide, supplied with a travelling crane, and used for the storing of pipes and heavy goods. The first floor is laid out as one large room, divided for the storing of the firm's extensive and varied stock. The new building, of which Mr. Wm. Turnbull was the architect, is so constructed that the foundations will be able to carry a third story, should this be added at some future time. The front is surmounted by a lettered grille bearing the name of the firm, and running the whole length of the parapet; the letters, which are on a large and striking scale, are in wire netting, this material having been chosen because of the reduced wind resistance

It is a far cry from Messrs. Burt's first office in Wellington to the large and spacious building which is now occupied in Courtenay place, for the first office was a diminutive gabled structure near the Theatre Royal, apparently of one room.

In this modest way the Wellington branch was established in 1895 by the late Mr. Simpkins. Later on the shop in Manners street was opened, but with the steady growth of the business, co-incidently with the prosperity of Wellington, this place was soon found to be too small, and hence the firm has built the new premises in Courtenay place; and under the direction of Mr. Robt. Johnson, the Wellington manager, the business is increasing very rapidly

The Christchurch branch of the firm is situated at 211 Tuam street, and is under the managership of Mr. J. Corbett. Here the firm stocks a general assortment of the commodities held at the larger warehouses, for prompt delivery in and around Christchurch.

Invercargill branch is situated in Tay street, and is under the charge of Mr. S. G. Remington. A large show room was opened some little time ago, and here the firm's numerous customers can be shown samples of the various lines manufactured and stocked.

The firm also has a Marine branch established at Port Chalmers under the charge of Mr. W. T. Ross. Here all classes of ship work and repairs are undertaken. A full coppersmith's plant and several lathes are in readiness for the completion of any urgent orders.

Mirror Serves as Lighthouse.

The most extraordinary of all British lighthouses is to be found on Arnish Rock, Stornoway bay—a rock which is separated from the island of Lewis by a channel over 500 feet wide. On this rock a conical beacon is erected, and on its summit a lantern is fixed, from which, night after night, shines a light which is seen by the fishermen far and wide. The way in which this lighthouse is illuminated is this: On the island of Lewis is a lighthouse, and from a window in the tower a stream of light is projected on to a mirror in the lantern on the summit of Arnish Rock.

NOTICE TO ADVERTISERS.

Change Advertisements for next issue should reach "Progress" Office not later than the 10th inst., otherwise they will have to be held over.

FERRO-CONCRETE WORK IN NEW ZEALAND.

MR. Samuel Brown, of Wellington, read an interesting paper before the Wellington Industrial Association recently explaining to members what is being done in Auckland and other places with regard to re-inforced concrete. There is no difficulty in driving the piles for the new wharves at Auckland. The piles are made long enough to come to about low-water mark. A frame is then made, and the pile made up with steel and concrete to the height required in the same manner as the pile itself Temporary staging is then made and the whole boarded over. The longitudinal girders have framing of deep boxes. In these boxes are placed mild steel frames, about three in each box. These frames, where they rest upon the pile, are about 6ft. deep at each end, and taper off to about 2ft., the middle of the girder being about 2ft. deep and somewhat the same as the ordinary beam with brackets underneath at each end. The bottom chord, which gives the shape to the beam, is 1½in. round mild steel. The top one is small section, and between the top and bottom chords are upright rods of steel, about ½in. thick and about 6in. apart. The whole is wired together with steel wire. Wherever a cross girder meets a longitudinal girder there are three steel bars 1½in. bent over so as to tie both together, that is to say, the cross girders to the longitudinal girders. These boxes are filled with concrete rammed in a similar manner to the piles

A. AND T. BURT, LTD.: THE DIRECTORATE.

FRONT ROW JAS. A. BURT, A BURT (MANAGING DIRECTOR), W C. BURT. BACK ROW: T. R. BURT, A. T. BLYTH (SECRETARY).

Mr. Brown also minutely described the deck-work being carried out on the contract. In Auckland they have built a very large wharf, and are spending altogether about £250,000. In addition there is a wharf and foundation for a crane at the Calliope Dock, costing about £40,000. The first process is making the piles. Four rods of 1½in. round mild steel are formed into a square 2in. smaller than the pile, so that there is 2in. concrete outside; that is to say, if the pile was 14in. square when finished, the square of steel rods would be 12in. These rods are made into a square by having light cast frames fixed at certain distances apart. They are bound together by steel wire every few inches right round, also diagonally. The ends of the four steel rods are bent at the end in the same shape as a pile when it is pointed. This frame is placed in a box, which is 2in. larger every way, so that when it is filled there is 2in. of concrete outside of the steel frame. There is also the ordinary pile shoe placed in the box and the whole filled with concrete. This concrete is well rammed with iron rammers, the concrete being made pretty fine—no stones larger than a walnut. The result of careful ramming is that when the frame is taken off, the pile is as smooth as if it had been plastered over. Extra long piles, say 40ft., have hollow pieces of wood placed in the centre; these are about 6in. diameter and are placed about 1ft apart. This is to lighten the pile, and is claimed by the engineer to be equally as strong.

"It would seem," said Mr. Brown, "that in San Francisco steel frame buildings stood the earthquake well. These, as far as can be gathered, were frame structures with the panels filled in with brick, stone, or marble. Although the frames stood well, it would seem that the panels in cases came out. The difference between this and the system that I have been trying to describe is that in one a whole panel may be shaken out, but the other is a complete network of steel interwoven in the concrete and which adheres to the steel so closely that it never rusts. It is said that reinforced beams for floors are now made for spans of 100ft. In addition to being the best style of construction to resist earthquakes, it is said to be also equally valuable as a fire-proof construction. The personal opinion I have formed of it is that in Wellington it would be as safe as a wooden building for earthquakes and more fire-proof than any other mode of construction."

Great Britain's Wealth.

£1,548,183,918 FOR THE EXCHEQUER IN FIFTEEN YEARS.

The total sum paid by the inhabitants of the United Kingdom into the Exchequer during the last fifteen years reaches the enormous amount of £1,548,183,918.

The Exchequer received as revenue in 1891–92 the sum of £79,125,686. The speed at which Britain increases its wealth may be gathered from the fact that this year the Exchequer will receive £126,870,474. The expenditure in the same years was £78,058,673 and £123,404,854 respectively.

The following table of incomes will show how the annual payments into the Exchequer are increasing —

1894–95	£82,551,191 ..	1901–2	£127,152,614
1898–99	£94,301,391 ..	1902–3	£135 372,762

There has been a deficit in the Exchequer six times in the last fifteen years, and the largest was in 1900–01, when it amounted to £53,207,580.

The cost of the sea and land forces of Britain has almost doubled since 1891, when the amount under the naval and military expenditure was £33,162,789. This year the figures are £60,302 477.

In 1900-01 the naval and military expenditure was £121,767,790, the next year it had increased by nearly nine millions, and the following year—the last of the Boer war—it was £110,844,488.

The total revenue derived from taxes this year is estimated at £119,875,000, an increase of £34,759,000 since 1891.

The Best Form of Windmill.

Sourensen, the Danish builder of windmills, recently discovered, through an accident, a form of windmill which tests show to develop more power than any other form heretofore tested. He had been running an old mill bearing ten wooden vanes. In a storm, four of these vanes were carried away, when, to the wonder of its proprietor, the old mill worked better than before. Inspired by this demonstration, he made some further experiments, and perfected a wind motor of conical form, having six vanes, the ends of which curved toward the summit of the cone. Prof. P. LaCour, who has established, by authority of the Danish Government, an observatory for the study of wind power, showed that the new conical aero-motor developed more power by nearly five per cent. than that of the "Ventocrat" type, whose surface is seven times as great; and thirty-one per cent. more than the "Rose of the Winds" type, with a surface three times as great; and twenty-nine per cent more than that of the old Sourensen type. It is predicted that the discovery of this new form of wind engine will go far towards making wind power, which is now largely lost, available for general use.

The Handcross Disaster.

The verdict at the inquiry into the Vanguard disaster, by which ten men lost their lives at Handcross, Eng., on July 12, was returned as follows: The jury found that the accident was caused by a breakage of the machinery brought on by the efforts of the driver to check the speed of the omnibus when he found that it was going too fast.

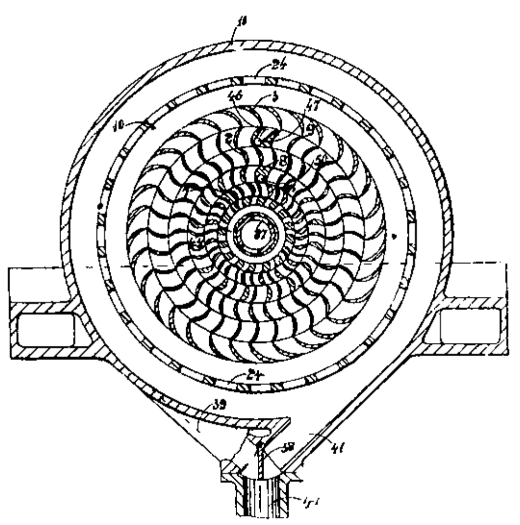
They considered that the driver committed an error of judgment in allowing the omnibus to go at too high a speed.

They held no one criminally responsible, but were strongly of opinion that this type of omnibus was unsuitable for use on country roads.

Inventions.

Falvey's Steam Turbine.

The steam turbine, as a high-speed motor, has reached a very high degree of efficiency, but there are many engineers who consider that it is still capable of great improvement, and that in its present form it is only what may be reasonably considered the pioneer in the art of steam-motor construction. Our illustrations show longitudinal and transverse sections respectively of a new turbine invented by Mr. Thos. Falvey, engineer, of Wellington, of which a model has recently been exhibited. According to Mr. Falvey's invention a revolvable disc has, projecting from its face, a large number of inclined vanes arranged in concentric circles. These vanes enter annular spaces provided between concentric circles of fixed vanes, upon the casing of the turbine, and are inclined in a direction reverse to the movable vanes. Steam is admitted to the inner circles of fixed vanes and passing through the outer circles is expanded and finally exhausted into a condenser or to the atmosphere. Annular partitions, forming a disc, divide the vanes into two sets or series—the direction of the vanes of one set being the reverse of those of the other set. The invention will be understood by referring to the illustrations. It will be seen that the circles of vanes, 1, 2 and 3, are fixed to a main disc, 4, which is mounted upon a shaft, 5, revolving in bearings, 6. The circles of vanes, 7, 8 and 9 are fixed to the back of the casing, 10, in which the disc, 4, and its vanes are adapted to revolve, the circles of moving vanes on the disc alternating with the circles of vanes fixed to the casing, 10.



FALVEY'S STEAM TURBINE, FIG. I.

The direction of the inclination of the moving vanes is the reverse of the direction of the fixed vanes.

The vanes of the disc, 4, are provided with annular partitions, 14, and 15, and the vanes of the casing, 10, are provided with similar partitions, 16 and 17, so that when the disc is in operative position the partitions, 14, 15, 16 and 17, form two continuous discs dividing the vanes lengthwise into sets or series.

Steam is admitted to the turbine through a passage, 25, and finds its way to the interior of the circular inlet valve, 26, which is provided with ports, 27, 28, 29 and 30.

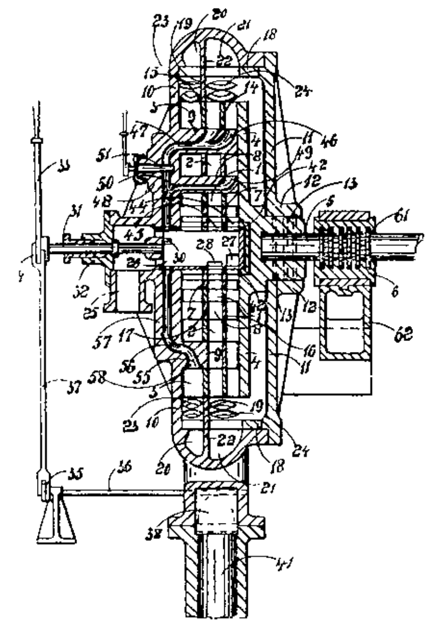
An exhaust valve, 38, is mounted upon the end of the shaft, 36, at the junction of two passages, 39 and 40, (Figure 1) through which exhaust steam passes to the exhaust pipe, 41.

The steam from the ports, 42, passes into an annular space, 44, surrounding the valve casing, and thence finds its way through the fixed circle of vanes, 7, and is thereby deflected on to the circle of movable vanes, 1, by which it is again deflected on to the vanes, 8, and so on until it finds its escape outside the vanes and through the holes, 24, into the recess, 21, and thence to the exhaust passage, 40, and the exhaust pipe, 41, the valve, 38, being open as shown in Figure 1

When more power is required the valve, 26, is turned by the lever, 33, until the ports 28 are brought into correspondence with ports, 45 in the casing, 43.

Steam continues to pass through the ports, 27 and 42, and also passes through the ports, 28 and 45, and between the partitions, 16 and 17, whereby increased area of the vanes is subjected to the action of the steam.

It is understood that Mr. Falvey will have a model of the invention working in the International Exhibition, and visitors who are interested in the subject will no doubt take an opportunity of seeing it at work.



FALVEY'S STEAM TURBINE, FIG 2

Vehicle Springs.

Herr Heinrich Bussing, of Brunswick, Germany, has devised a method of mounting the springs of vehicles, with the object of rendering them practically frictionless Each end of the spring is jointed to a slide capable of reciprocating in a guide secured to the under side of the frame of the vehicle. The bearing surface in the guide is formed by an inserted hardened plate, and the slide is provided with a series of rollers, bearing on the hardened plate and held in position by a projecting edge or shoulder.

An Aerial Bicycle.

Mr. Richard Allen, a retired constable of the Bradford Police Force, is constructing a flying machine to be worked by his bicycle, by means of which he hopes to be able to pedal through the air.

The framework of the machine is constructed of bamboo, and the working of the pedals of the bicycle causes the wings on either side to flap These are 33ft. from tip to tip, and automatically close when taking the upward stroke, and open out when coming down. An overhead apparatus provides for the steering.

Submarine Signalling.

The Admiralty have decided to make experiments with an American system of submarine signalling, and the cruiser Antrim is to be fitted with the apparatus at Chatham under the direction of Mr J. D Millet, an official of the Submarine Signalling Company, of Boston, America

By means of this system submerged bells can be heard by large vessels at a distance of from twelve to eighteen miles, and it is possible to communicate messages as well as to warn shipping of coast dangers in case of fog

New Motor Speed Sign.

A new speed indicator for motor omnibuses and cars has been put on the market The apparatus is arranged so that one dial faces the driver and another much larger one is displayed on the front of the vehicle On each the speed is indicated, while an auxiliary hand registers the maximum speed attained

It is claimed that the danger to the public will be greatly decreased if the police are able to see at a glance at what speed the vehicle is travelling

Road Motor Vehicles.

Mr. H. Livesey, of 14 South place, Finsbury-pavement, London, instead of arranging the engine cylinders in a motor car side by side in the usual manner, arranges each pair of cylinders in tandem. The pistons of each tandem pair are provided with projecting lugs or flanges to which external slide rods are connected that are fixed to the pistons and pass through slots in opposite portions of the walls of the cylinders. That piston of each tandem pair which is nearest to the crank shaft is connected to it by a connecting rod in the usual way. Thus, there are only two cranks to four cylinders, and the whole of the engine will be placed under the body of the car.

Marine Gas Engines.

Herr Emil Capitaine, of Reisholz, near Dusseldorf, explains in his specification, No. 22,594 (Eng.) of 1905, his method of utilising the waste heat of marine gas engines for the production of steam from sea water for feeding gas generators. The employment of gas engines and producers for sea vessels necessitates the production of a large quantity of steam for decomposition in the generator. The tubular boiler for the supply of steam is heated by the exhaust gases from the gas engine or by the hot gases from the producer. The boiler is constructed with a coil surrounding it, to which the sea water is first admitted, so that the heat of the discharging and only slightly concentrated sea water is, with the aid of a regenerator, given off to the cold incoming sea water.

Teaching Pronunciation by Machinery.

Two ingenious Frenchmen have recently perfected several mechanical devices which are used in teaching French pronunciation to foreigners. One of them is a small instrument called a "larynx-signal," which is held to the side of the throat when the diphthong "ou" is being pronounced. If the pupil is successful in getting the correct French pronunciation a small bell attached to the larynx-signal will notify him of his success by ringing. If the bell is silent, he may know that he has not given the word the correct pronunciation. Other machines are used for getting the correct pronunciation of various vowel sounds.

To Cool Refrigerator Cars with Liquid Air.

Armour & Company, of Chicago, have arranged with the inventors of a liquid-air producing process to erect a small experimental plant in Chicago for the purpose of testing the value of liquid air for the refrigerating of perishable goods in refrigerator cars. It is claimed by the inventors that liquid air can be made in quantities at a cost of about one cent per gallon, and that it can be kept in refrigerator cars for a period of approximately thirty days, with an evaporation of not over three per cent per day unless it is forced. The result of these experiments is looked forward to with great interest.

It is often difficult to ascertain who was the first inventor of a process in general use. It often happens that several minds have been at work on the same problem and have arrived independently at similar conclusions. Such, apparently, was the case in regard to reinforced concrete construction. Joseph Monier, who died recently, if not the sole inventor of reinforced concrete construction was, at any rate, one of its earliest exponents, his first patent having been brought out in 1867. An Englishman patented, two years earlier, a system of concrete building which seems to contain the germ of the many systems of ferro concrete or reinforced concrete construction which have since attained such extensive vogue Mr Joseph Tall was the inventor in question,

More than half the total miners of the world were in 1905 engaged in getting coal Great Britain employing over 833 000, the United States 594,000, Germany 543,000, France 171,000, Belgium 138,000, Austria 119,000, and India nearly 93 000. The total output of coal was 886 000,000 tons, of the estimated value of more than 295,000,000.

HYDRO-ELECTRIC DEVELOPMENT.

BY FREDK. BLACK, A.M. INST E E.
(Engineer, Waihi Water-Power Scheme)

IT has become almost an article of faith with the majority of people that, given a waterfall or swiftly flowing river in any part of the country, it must necessarily be of great value for power purposes. The wonders and marvels of electricity have been so expounded in popular form to the public that there is a danger of overlooking the fact that electrical undertakings must be governed by commercial considerations. To nearly all of the hydro-electric propositions that have received serious discussion of late in the colony, Napoleon's trite saying applies: "It is magnificent, but —— it is not war." I have to admit, with regret, that for this state of affairs some electrical engineers are, in a large measure, responsible. One, an American who visited the chief water powers, framed a report of the most eulogistic nature, but carefully avoided saying anything at all as to the price at which energy could be delivered to the consumer. Another assumed that all the installations would sell all the energy they could transmit at the same price, which he fixed in an arbitary way. Theories of this kind, embodied as they are in Government reports, are largely responsible for the totally erroneous ideas current on the subject. It cannot be too highly emphasised that a water power is absolutely worthless, no matter how many horse power are in it, unless it has an adequate market to sell its energy in, and can undersell energy derived from coal or other fuel. The essential condition of success may, in fact, be summed up in the word *market*, for if energy from fuel cannot be undersold, there won't be a market. It does not in every case necessarily follow that a possible market for the energy should be ready waiting for the installation; occasionally the market is created by the power supply when a new industry can be introduced, as occurred, for instance, in one of the earlier Niagara schemes, when the manufacture of calcium carbide and carborundum was established, or in the more recent example of Swedish and American production of nitrates from the air by electrical means. But cases of this kind are few and far between.

As so many hydro-electric undertakings are now in operation, not only in the United States and Switzerland, but in Canada, Mexico, India, Burmah, and practically every European country, including Great Britain, comparison plays a great part in the arguments advanced on behalf of every scheme mooted in New Zealand. Unfortunately many advocates know insufficient of the subject to understand that comparisons are most misleading when not made thoroughly complete. It has been asserted that because a 200-mile transmission is operating in California (or was prior to the earthquake of last April) and earning a dividend, therefore a similar transmission plant in this colony would be successful also. Again, because certain railways in Canada, the United States and Italy are worked by electric power derived from hydro-electric installations, that New Zealand should harness up some of its rivers and scrap-heap its locos. without delay But what about the conditions ruling in these cases and with us? The 200-mile transmission in Mexico or California is practicable because the climate there is excessively dry, so that the enormously high voltages essential to these distances can be employed without constant breakdowns, and it earns a dividend because it has sufficient customers to take a large proportion of the maximum energy it can supply—customers who cannot get that energy equally cheap from coal or any other source. In fact, in the districts served by 100 and 200 mile transmissions coal is either inferior and tremendously expensive, or is entirely unobtainable.

The electric railways which are the sole mainstay of hydro-electric installations are rare and always will be rare. Most railways require populations at intervals along their routes; given the populations you have markets for power in a score of forms. If fuel be dear or unobtainable while waterfalls are somewhere within reach, the populations will be the mainstay of the hydro plant, and the railway, even though the largest individual power user, will become a customer of second-rate importance. The reason for this is that the railway takes its energy in heavy draughts and intermittently, thus necessitating large works and generating plant, which are only employed to their full capacity at a few times each day. As capital charges on the cost of the installation are not modified by the amount of energy supplied, but go on at a fixed rate continuously, customers who require large plant to be kept ready for them, and use it to its full capacity only now and again, make the cost of supply higher than if they kept the plant uniformly loaded. If a general supply for industrial purposes can be added to the railway supply, the total load tends to more uniformity, and the cost per horse-power hour becomes lower. The Italian, Canadian and other railways referred to are worked hydro-electrically because, notwithstanding any drawback, the energy is cheaper than what could be obtained from the dear fuel available.

In the case of New Zealand railways, or any other, the problem to be solved is just the same—what is the cheapest source?

A study of the conditions that will affect hydro-electric transmission plants in New Zealand, is too extensive for treatment in a single article, but I may point out certain features. The climate in the majority of districts is damp, this increases the difficulty of maintaining a good insulation, so that it is extremely unlikely that we shall ever be able to successfully adopt the extra high voltages essential to very long transmissions—say for 200 miles and over. In many cases the country to be traversed by the transmission lines is rough and mountainous to the last degree, densely wooded and intersected by treacherous rivers, these obstacles may not be insuperable, but they run the cost up, and increase the maintenance. In every power-using district good qualities of coal are available, and modern fuel plants of great efficiency are coming into wide use; the hydro-electric supply must beat them or go bankrupt The number, size, and importance from a power-supply standpoint, of towns or districts to be fed by a transmission plant must be critically noted; price of coal, extent of steam, gas and oil plants in use, scope of industries, financial prospects for introducing electric tramways or supplying the energy to existing ones, are all points to be studied. The conditions surrounding the supply for railway main-line operation are a whole and complex subject in themselves, as the following brief treatment will show: Consider any one of the busiest lines in the colony with two daily express trains and six or eight goods and local trains, according to the existing schedules, split up into two, three or four car trains according to electric traction schedules, with say an hourly headway; the maximum load would come on the generating station probably not more than twenty times a day, and only for a few minutes or even seconds on each occasion. If the normal load averaged 1000 h p. this occasional maximum load could easily be 3000 h.p. or more, according to the physical conditions of the line. The practical bearing of this is that the expense of an installation able to deliver 3000 h p must be incurred to supply a load that for nineteen twentieths of its time does not exceed 1000 h p Storage batteries would be serviceable in reducing the disparity in cases where a frequent train service was run, but they are quite inapplicable to such a case as the one I am considering. As already pointed out, the only salvation from a high annual cost on this installation is to be got by extending the supply, and securing a more diverse and, therefore, paradoxical as it sounds, more even load. The installation may then need to have a capacity of perhaps 5,000 h p. but the ratio of normal to maximum loads will have risen from the former 1 to 3 to possibly 2 to 3. This brings us back to the chief factor in the whole problem: Can energy produced under these conditions compete with energy derived from fuel, and find a sufficient market?

In a concluding article I shall deal with the cost of the water to the owners of the transmission plant, the cost of the plant itself, the influence of distance of transmission and other factors upon the cost of the energy to the consumer, and discuss what constitutes a market.

(To be continued)

Our readers will regret to learn that Mr. and Mrs. Templin were laid up in Bangkok with fever at the time the last mail left. Mr. Templin proceeded there from Christchurch to superintend the erection of two Curtis steam turbines for the General Electric Co.

The Wellington City Council have ordered thirty more arc lamps for street-lighting purposes. The whole of the tramway routes, therefore, will soon be brilliantly lighted

The Christchurch City Council have appointed Mr. Scott as their engineer. Mr Scott was recently in charge of the Gore Electric Light Works.

The Wellington Electric Light & Power Co. intend to install a new steam turbine at an early date, and engineers will look forward with interest to the operations of this engine, which is the first of its kind to be erected in Wellington

INTERNAL COMBUSTION ENGINES.

AT the Royal Institution on August 5 Professor Bertram Hopkinson delivered the final lecture of his series on this subject. Professor Hopkinson said that in previous lectures he had described methods of regulation which were not satisfactory, but good regulation could be obtained by reducing the fuel supply if matters could be arranged so that the explosive mixture in the cylinder was stratified, consisting of practically pure air in one end of the cylinder and a strong mixture at the other. He would show by experiment what took place in the cylinder in these two cases, but he should point out that there was a practical difficulty with regard to this method of regulation because in the ordinary charging stroke of the gas engine the velocity of the entering gases was something like 60 miles per hour. It had, however, been successfully accomplished in the case of large engines, and there was reason to hope that it would be possible to work in this way with small engines. Apart from successful regulation there was this further advantage of obtaining stratification, that the piston remained cooler than under ordinary circumstances, and he need not say that the cooling problem in the case of larger engines was a very serious practical question. Reference has already been made to the improved efficiency of the gas engine over the steam engine, and the economy of the gas engine could be improved by the adoption of any method which economised the loss of heat to the cylinder walls and that carried away in the exhaust. It was not possible to effect economies in regard to the loss of heat to the cylinder walls, except by making the engine larger, and therefore it was necessary to concentrate attention upon the heat carried away by the exhaust gases. To improve the efficiency of the gas engine in this connection it was necessary to secure a greater ratio of expansion which was accomplished by employing greater compression, the two things being, of course, definitely related to each other. In theory it was possible to reduce the temperature of the gases when they left the engine to any degree, but in practice there were definite limits to the extent to which gases could be compressed by reason of the danger of pre-ignition. There were means, however, of preventing pre-ignition; for instance, water might be sprayed into the cylinder, and in that case the presence of the steam in all probability acted in preventing the gases from being prematurely ignited. By employing that and other devices it was possible to compress the gas to a volume as small as one-ninth of its original volume, and the economy of the engine could be improved to a point where over 30 per cent. of the total heat of the fuel was converted into mechanical work. The question as to whether the Otto or the two-cycle engine was the gas engine of the future had not yet been definitely settled, and he hesitated to prophesy.

Reinforced Concrete.

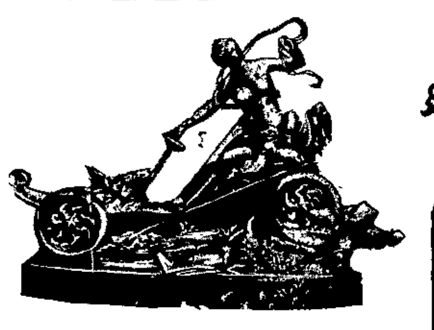
A correspondent writes that the Patent Indented Steel Bar Company (Limited), of Queen Anne's Chambers, Westminster, has been formed for supplying a bar of special section for reinforced concrete construction. The principal feature of the bar is stated to be great adhesion to the concrete owing to the mechanical bond formed by its indented surface.

Mr. A. E. Brown, the well-known Christchurch electrician, has disposed of his business to Messrs. Scott Bros., and is now acting as manager of their electrical department.

The new building in Wellington for Messrs. J. Nathan & Co. will require 10,000 feet of conduit, for electric lighting purposes.

The General Electric Co. have just landed six G.E. 67 railway motor equipments for the Wellington Tramways. These motors are 40 h.p. each, as against the 25 h.p. motors that have been in use on all cars since the system was opened up for traffic.

In Germany goat's milk is particularly esteemed for the reason that tuberculosis is extremely rare among goats, their almost complete immunity being due, it is suggested, to the life the animals lead on the hillsides in the open air. In the kingdom of Saxony in 1894 it was reported that out of 1562 goats slaughtered only 10 were found to be tuberculous.



The ....Motor.

24-30 H.P. "Brown" Car.

OUR illustration depicts the new four-cylinder 24-30 h.p. "Brown" car made by Messrs. Brown Bros., Ltd., London. The following particulars of this fine machine have reached us from Messrs. Jenkinson & Co., Wellington —

The four-cylinder engine (bore: 100 m/m, stroke · 120 m/m.) embodies all the latest improvements, while the materials used in its construction are of the highest grade. The crank-shaft is made of nickel steel, the bearings are long and a special bronze is used in their manufacture. The valves are mechanically operated, the inlet valves being fitted with variable lift. The gears driving the magneto, water pump and the special pump for forcing the lubricating oil up to the drip rack on the dashboard, are all enclosed. The water pump is placed in an easily accessible position. Compression taps are provided in the top of each cylinder.

Both magneto and high-tension ignition are fitted. The magneto is a Lacoste high tension driven by a small cardan shaft. The contact breaker for the accumulator ignition is run off a spindle just above. The accumulator ignition is by an E.I.C. controller coil with volt meter fixed to the dashboard and two 40 amp hr. accumulators. Two sparking plugs are fitted to each cylinder so that both ignitions can be used if necessary.

The carburetter is a float feed of improved design, is very efficient, and gives most satisfactory results.

The water circulation is by a gear-driven pump attached to the front of the engine, the radiator being of the honey-comb pattern.

The steering mechanism is of an improved type built very strongly, and the connecting rod to the front wheel is placed at the rear of the front axle, where it is less likely to be damaged.

The levers controlling the advance spark and the variable lift to the inlet valves are on an a quadrant on top of the steering wheel The joints are large and fitted with hardened pins The brake and change-speed levers are so arranged that all the connecting rods are inside the chassis, making it very convenient to fit side-entrance bodies. A curved metal dash affords great protection to the front passengers and also to the various fittings on the dashboard Two cupboards, in which maps, gloves, etc, can be kept, are provided. The exhaust box, which is exceedingly effective, is placed at the rear of the chassis, and without affecting the power of the motor, effectually silences it. Mud-guards are fitted from end to end of the chassis, and a box is provided on each side, one for accumulators and one for tools.

The back axle is of the very latest design, the road wheels being carried on two self-contained ball bearings attached to the outer case, thus relieving the live, or driving, axle of all weight. In order to absorb the shock of starting a special stay is fitted, running from the rear axle to one of the cross members of the frame. The bevel gears are large and carefully hardened and the driving pinion is well supported on three self-contained ball bearings. For the lubrication of the axle a door in the aluminium casing is provided through which to pour the oil. The lubricant used should consist of a good grease, such as "Brito" motor grease mixed with "Brito" gear oil. All the bearings are self-contained and, therefore, need no attention. The lubrication of the wheels is effected by filling the wheel caps with oil.

The gear box is fitted with three speeds forward and a reverse, and is of the sliding pinion type. The top speed is a direct drive obtained by sliding the second speed pinion inside the direct drive gear wheel All shafts are carried on ball bearings of ample size, and the lubrication is automatic. At the rear end of the gear box is a powerful brake drum to which is fixed a universal joint to take cardan shaft. The front end of the gear box is fitted with a coupling that takes a square shaft upon which the clutch slides, thus making it an easy matter to remove the clutch, if necessary. The shafts carrying the gear wheels are arranged side by side, thus permitting a full inspection on removing the aluminium cover of the gear box. The clutch is of the internal type with self-contained spring taking all thrust off the engine bearings, and is connected with the mechanism operating the variable lift to the inlet valves. A sprag is fitted and acts on a ratchet toothed ring attached to the brake drum

This car, together with others of the same make, will be seen in Christchurch during the Exhibition.

30 H.P. Cadillac.

THE picture on the opposite page represents the four-cylinder 30-h p car (Model H) turned out by the Cadillac Motor Car Co, of Detroit which recently passed through Wellington under the care of Mr Crozier, of Messrs Dexter & Crozier, on its way to the Exhibition As the most important feature of a car lies naturally in the motive power, the following notes relating to the Cadillac engine will be found of special interest.

There are four cylinders of the four-cycle type, 4⅜" bore by 5" piston stroke They are cast individually, and not in pairs or all together. The cylinder heads containing the valve chambers and combustion chambers are also cast separately and attached to the cylinders by right and left threaded nipples The Cadillac system of copper water jacketing is original with the Company, and the fact that it has been widely copied shows how highly its efficiency is appreciated by other makers This construction having the cylinder, cylinder heads and water jackets made separately has several distinct advantages The cheap method, ordinarily used, is to cast the cylinder and jacket together, coring to make the space between them. This usually does not produce a combination with a uniform space between the two for water circulation The maker cannot detect the fault because of inaccessibility, but it will not be long before the innocent purchaser awakens to the results of its imperfection. It will be readily understood that with the thickness of the cylinder wall not uniform, it cannot be cooled evenly throughout its entire surface, the result being that the motor cannot develop the power which it otherwise might, for the reason that the expansion or contraction will not be uniform, in consequence of which the piston will bind at some points of its travel and be too loose at others, thereby losing compression.

Another valuable feature in the Cadillac method of making cylinders, cylinder heads and water jackets separately is, that in case of damage to one part, it is necessary to replace only that particular part. The cylinders are cast from a special grade of metal after the Company's own formula and possess remarkable strength. The pistons and piston rings are also made in the same painstaking manner, and, like the cylinders, are turned out according to the Cadillac system of limit gauges. The piston connecting rods, are steel drop forgings of "H" section. The crank-shaft is also a steel drop forging and undergoes a special tempering process to give it strength and toughness, the bearing surfaces being carefully ground. The crank-shaft bearings are of large surface, made of babbit and backed by bronze. As these bearings are "halved" it permits of their being removed and replaced without the necessity of disturbing the shaft.

A very important feature to be noted in the Cadillac is the fact that the crank-shaft, pistons and rod bearings are easily accessible by removing the covers from the opening in the crank base, and the other characteristics which are peculiar to Cadillac engines may be summed up as follows —

The force-feed lubricator enables all working parts of the motor to be adequately lubricated and ensures even distribution of oil, the cooling system and carburetter are on approved systems, and the automatic governor is a feature that will tend to make this car especially popular; it is a new balanced ring-type governor, a device which is proving itself most efficient and of the greatest importance to a motor car. With this type of governor it is possible to maintain practically a steady speed with but little variation regardless of grades, up or down, or road conditions, the action being entirely automatic.

In the average motor car, particularly those of the four-cylinder class, a large percentage of the power developed by the motor is consumed by friction—lost—wasted. In some cases this has been demonstrated to be as high as 30 to 40 per cent. In order that the greatest possible amount of power may be actually utilised, that is, "delivered to the ground," the model "H" is equipped at the most vital points with the genuine Hess-Bright ball bearings, using ten in all, viz., two in each front wheel, one in each rear wheel, two on rear of main drive shaft and two on the transmission shaft Between the balls are steel coil springs packed with felt. The latter, after being saturated with oil, will lubricate the bearings sufficiently for months without further attention.

THE "LORDS" DISCUSSING THE NEW 24-30 H P CAR BUILT BY BROWN BROS LONDON.

Some Notes on Force and Power.

THE modern petrol car is a modified road locomotive; but, whereas the range of mean effective pressure in the cylinders of the railroad locomotive is considerable, varying from 160 to 60 pounds to the square inch, the range of pressure, even in a multi-cylinder petrol engine, is comparatively limited.

Why a Change-Speed Gear is Needed.

It is true that this mean pressure can be reduced by throttling (at the expense of economy), and that it is somewhat increased when the engine is running slowly with a heavy load and the throttle full open; but the useful range of pressure is certainly fifty per cent. less than in the case of the steam engine with boiler pressure at 200 pounds. For this reason, it is essential for the petrol engine to maintain a certain speed in order to develop its maximum power; and to effect this, and at the same time make it possible for the tractive force to be varied, the change-speed gear is introduced between the engine and the wheels.

To overcome the inertia of the car and accelerate its motion from rest, it is usual, and in most cases necessary, to start on the low gear, and this is because the maximum available tractive force is required. As soon as the vehicle is in motion, and has begun to store kinetic energy, a less tractive force is sufficient to propel the car with increasing velocity, and so the other gears are passed through in succession until the top gear is reached. But whatever gear the car is working on, the work done in unit time or power developed is the same, provided the engine runs at a practically constant number of revolutions per minute and the throttle remains unaltered.

Tractive Force Available.

The maximum tractive force available at the surface of the driving tyres of a 20 h.p. four-cylinder car is about 14 cwts., when on its lowest gear, assuming 20 as the limit of power the engine is capable of developing. On its top gear, this force would measure about 4 cwts., but the figure, of course, depends upon the ratio of the gears.

The practice of starting a multi-cylinder car from rest with a full load, on the top gear, is to treat the engine with little consideration. The tractive force available would only be one-sixth of that available on the low gear, as it would be necessary to run the engine at far below its normal speed at the time of letting in the clutch.

In summing up the foregoing remarks, it may be stated that the petrol automobile, like the railroad locomotive, varies its tractive effort from a maximum when starting with full load and ascending inclines, to a minimum when travelling its fastest on the level; but, unlike the locomotive, the horse power developed by its engine remains practically constant under varying conditions of car speed and road surface.

Strengths of Shafts and Axles.

Shafts and axles used in the construction of petrol cars are not designed entirely with reference to the horse power they have to transmit. For instance, the crankshaft of a 20 h p. four-cylinder engine does not require to be larger diameter than that of a 10 h p. two-cylinder engine, because the maximum twisting moment to which the former shaft is subjected is no greater than that transmitted by the 10 h.p. shaft.

The twisting moment to which a shaft is subjected and is called upon to transmit is measured by the product of the tangential force in pounds weight and the distance in inches from the centre of the shaft at which the force acts. It is therefore measured in inch pounds, and represents work done when in action.

A little consideration will show that the 10 h.p. shaft receives two impulses during two revolutions, while the 20 h.p. shaft receives four impulses during a like period; but the measure of each impulse in both cases may be approximately equal, the difference being that in the case of the 20 h.p. shaft the impulses are more frequent.

The discussion of twisting moments with reference to the transmission gear of automobiles suggests the consideration of the effects of different sized sprockets for chain-driven cars.

Effect of Changing Gear Ratios.

It frequently happens that the owner of a petrol car desires to fit slightly larger sprockets to his differential shaft, as he is anxious to increase the speed of the car on all gears, or, at any rate to reduce the revolutions of the engine for given speeds of the vehicle itself.

When this alteration is effected, it is well to remember that the whole transmission system is subjected, under ordinary working conditions, to greater twisting moments on all gears.

To illustrate this fact let us suppose that a car is capable of ascending a long incline (with full load of passengers) on the second gear, and that the engine is developing maximum power at 1,200 revolutions per minute

The same car is afterwards fitted with larger sprockets, and on ascending the same incline under exactly similar conditions it is found that the engine speed is reduced to 900 revolutions per minute, and that the speed of the car itself is the same as before. This, of course, means that the power developed and transmitted to the road wheels is the same as in the first instance, and, since the revolutions of the engine have decreased, the mean pressure on the pistons must have increased, otherwise the power developed would be less. This increase in pressure would be a natural result, owing to greater compression at lower engine speeds.

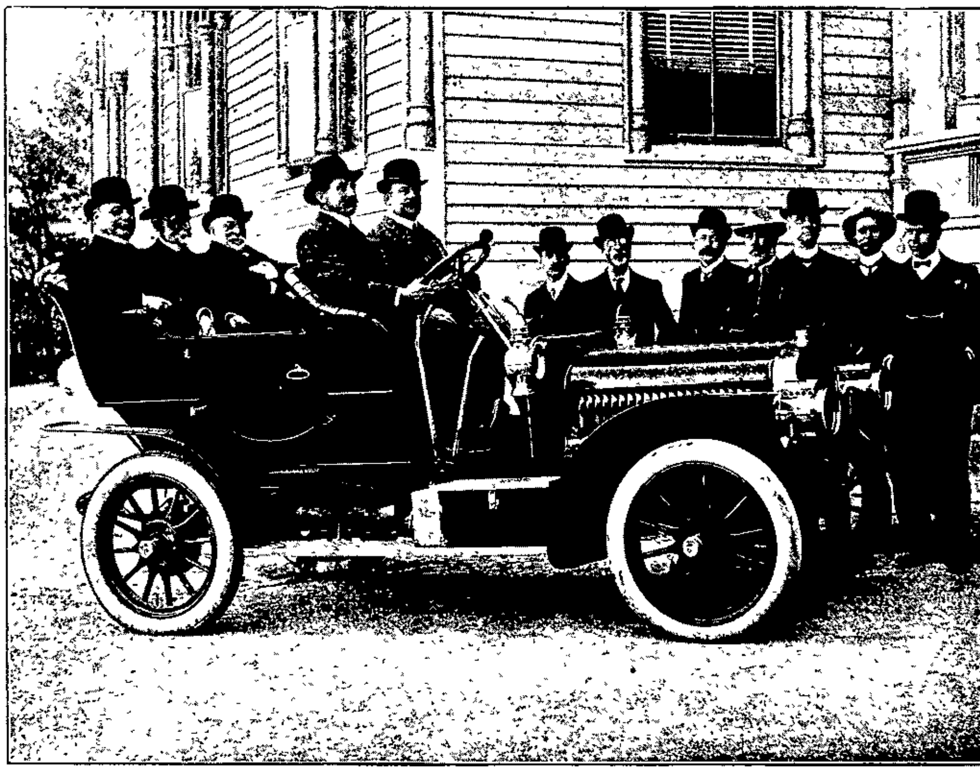
And so it follows that the twisting moment transmitted by the crankshaft and gears to the differential case and shaft is augmented, although the power transmitted remains the same

If the problem is approached from the other end of the transmission system, it will be seen that the pull on the chains in pounds weight is the same as when the smaller sprockets are in use; and as this pull is acting on the differential shaft at a longer radius (with the large sprockets), the twisting moment to which the shaft is subjected must be greater

It may be urged that the car will travel slower in the second instance when ascending the incline, and the engine speed be reduced to 750 revolutions, which means that less power will be transmitted until the driver changes down to the first gear; but the tendency under these circumstances is for the driver to keep the ignition hard up to its work and obtain all the power out of the engine that he can before changing down

But, in any case, the fact remains that the actual torsional stresses to which the transmission system is subjected are greater for given speeds of the car than when the smaller sprockets were in use, and it is more than likely that trouble will result unless due care is taken to change down earlier than formerly.

Unless a motorist uses his car in an essentially flat district, he is wise to retain the sprockets originally fitted by the makers —John O. Crombie, in *Autocar*.



30-H P 4-CYLINDER CADILLAC TOURING CAR, WITH THE PREMIER (SIR J G. WARD) AND PARTY.

Useful Hints.

By "Accumulator"

Unless the brakes are water-cooled, care must be taken that they are used alternately on a long hill, otherwise they are likely to fire and become useless

Before trying to fit new piston rings make sure they will enter the cylinder

Great care should be taken that no grease or oil be allowed to get on the tyres as it will cause the rubber to perish

Should the front tyres show abnormal wear, the front wheels should be looked to, as possibly they are out of alignment Shortening or lengthening the tie rods may be necessary

The best place to store petrol is in a metal drum underground, it takes up no valuable space, and is quite safe from fire.

Occasionally drench the cylinders with paraffin; it will free the piston rings and improve the compression. This is best done when the engine is warm.

To learn to change gears properly is the ambition of all motorists, and a very good way of obtaining practice is to lift the back axle so that the back wheels are some two inches from the ground. This must be done very carefully, so that there may be no risk of the car jumping down; then, if the engine is started and throttled down a fair amount of practice can be obtained.

A car should always be kept perfectly clean, the body work should always be washed before it is put away. The engine should be cleaned externally with paraffin and a stiff brush.

The exhaust pipe should be looked at if any overheating occurs that cannot be located. A stone may have been thrown up and made a dent and this causes back pressure.

Always keep a fair quantity of French chalk between the cover and the tube; it acts as a lubricant and so saves friction and consequent heat and wear. If too much chalk is used it is liable to form into hard lumps on the cover and to increase friction thereby.

To clean out the radiators and pipes thoroughly, empty out the water, and fill with boiling water and a little washing soda; this will be found to remove scale and grease if it is left in for a few hours.

The universal joint of the cardan shaft should have a protection of some sort to keep it quite clean and properly lubricated. A good plan is to cover it with a glove of pliant leather of ample size. First thoroughly wash the joint with paraffin, then cover thickly with grease, then put the glove on. A suitable glove can be made by a handy chauffeur or any saddler.

The best water to put in tank and radiator is filtered rain-water. Many cases of overheating can be traced to the deposit of mineral matter from hard water.

Should a grease pipe require cleaning out, the best way is to push a stiff wire down the pipe. After making a path through it, lay the pipe in petrol till all the grease is dissolved. Warming it over a flame effects the same purpose.

The tyre valve should always have a cap on, otherwise grit may get in, and this will be nearly certain to cause a leakage. If a cap is lost when on the road, a piece of rag should be tied over the valve and well secured.

To test a valve for a leak, turn the wheel so that the valve is at the top, then place the valve in a glass of water.

Should it be thought that the back-wheel tyres are wearing too quickly, the cause may be attributed to using the brake too harshly. When approaching traffic, or a corner, take the clutch out in plenty of time and apply brakes gently.

The Motor Omnibus on Trial.

GROWING POPULARITY IN SPITE OF FAULTS.

360,000 PEOPLE CARRIED DAILY IN LONDON.

THE motor omnibus of to-day, speedy, cheap convenient, the supplanter of the old horse omnibus and the tramway car, the serious rival of the suburban train, is on trial for incidental faults before its tens of thousands of admirers

People go on using it while they criticise, but they ask that its lessening noise shall entirely disappear, that its evil smelling vapours shall be seen and smelt no more that its comparative safety shall be made safer. The motor omnibus has in a little more than one year made itself indispensable to London ; London now asks that it shall make itself agreeable as well as swift and cheap.

The terrible disaster to the motor omnibus on Handcross Hill recently shook the nerves of Londoners a little, and for a few days there were fewer passengers on the motor omnibuses in the streets. But an isolated accident, shocking as it may be, was not sufficient to frighten permanently the people who have found the vehicles of such value. A striking effect of the Handcross tragedy has been the caution and exceeding care which the drivers of the motor omnibuses have since been showing.

ACTION BY THE POLICE.

Noise and smell are two of the complaints against the motor omnibus which the Chief Commissioner of Police is giving his immediate attention, and a Select Committee of the House of Commons is considering regulations which he has drawn up. Meanwhile, the authorities are well aware that the manufacturers fully appreciate the shortcomings of the present type of omnibus, and will be able before long to place in the streets vehicles much less noisy and better fitted in all respects for traffic.

Despite these incidental evils it is agreed on all sides that the motor omnibus is destined to play a large part in the evolution of London.

The new London will be an ever-widening circle, stretching far into the country, the central parts being reserved more and more for the day work of the hundreds of thousands who live on the fringes, and travel backwards and forwards night and morning. The quicker and the cheaper the means of locomotion between the suburbs and the working centre of London the better it will be for the workers They will be able to live further afield in fresher air, will have better houses, and will pay less for them.

SUBURBS NEARER.

Some of the outlying suburbs have hitherto been almost impossible as places of residence for thousands of workers, because of inaccessibility. The daily fares by train were also often a heavy item in a humble household Now, however, the handicap of time and expense is being minimised by the motor omnibus "The new vehicle," said Mr Duff, the manager of the Road Car Company, "will add two miles to the London omnibus radius" That is to say that, assuming the present omnibus radius from Charing Cross to be roughly from four to five miles, it will become by the use of the motor omnibus a radius of from six to seven miles. It is obvious that new, swift and cheap locomotion to and from this vast outlying circle of London must not only afford conveniences of residence to armies of workers, but must also greatly increase the value of all property tapped by the omnibus.

360,000 PASSENGERS DAILY

But these are only indications of the benefits to be conferred on outer London. At present it is calculated that the 400 motor omnibuses in London carry 360,000 passengers daily The number of vehicles will be greatly increased in the next few months.

The motor-omnibus companies and the drivers seem to have been put on their mettle by the criticisms which are being directed against them, and a very determined effort is being made to improve matters. The men are in effect driving "on honour"

In reply to a question by Mr Channing the Home Secretary gave the following list of motor-omnibus accidents in the metropolitan police district in May and June :—

	May.	June
Accidents caused by motor omnibuses	400	390
Number of accidents causing personal injury	62 ..	80
Number of accidents which .. proved fatal	2 ..	3

Motor 'Buses v. Tramcars.

BY A. J. WILSON IN *Autocar*

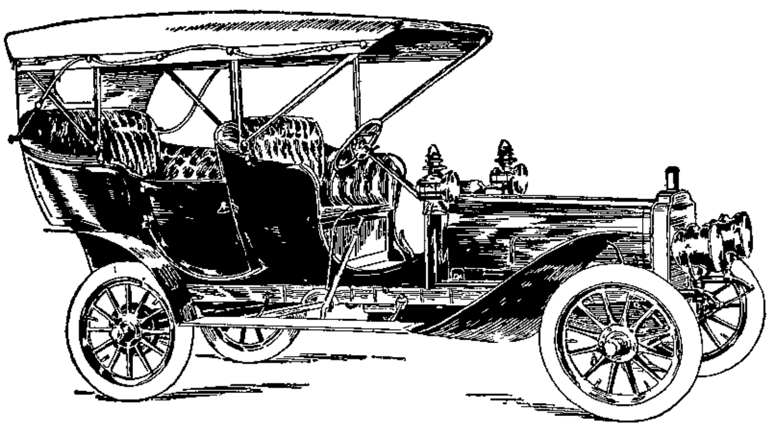
THE epoch-marking discussion aroused by Mr Manville's address to the London Automobile Club, which we recently printed, appeared to me to miss two points of great importance, both of which tell in favour of the motor 'bus Firstly, not a word was said about the frightful dislocation of traffic occasioned by the laying of a tramway, especially a conduit tramway such as those which have been during recent years and are now being laid in and around London. Even a short length of line such as that from the Angel at Islington to Southampton Row, where the line dives underground to Aldwych, had the effect of upsetting and diverting traffic in the district for nearly a twelvemonth. While Rosebery Avenue and Theobald's Road were impassable, Holborn and the Strand were shockingly congested for many months, and business men found it actually quicker to walk than to drive in any kind of vehicle Motor 'buses do not entail such inconvenience The other point is common to all tram lines, whether horsed or electric in perpetuity, and in my own experience the Angel at Islington, again is an object lesson, since I pass this spot every morning and evening on my way into and out of town A number of omnibus routes as well as three tramway routes are squeezed into this neck of street, and the public vehicles proceeding away from the city all stop at the Angel itself There are generally from two to seven omnibuses drawn up in a line at the kerb setting down and picking up passengers, and seldom less than three tramcars alongside them There is no space between 'buses and tramcars so that all other traffic has to crawl and stop behind the tramcars, and not only the tramcars coming in the opposite direction, but also the omnibuses (which will keep to the middle of the road instead of keeping to their left) interfere with this occasional possibility So the road is clogged, and the ratepayers employ extra policemen to regulate the traffic Do away with the tram lines and substitute motor 'buses and the congestion will be abolished , the motor 'buses will pull up at the kerb, passengers will not be compelled to dodge into the middle of the road to board the tramcar, and all other traffic will be free to pass along without incommoding anyone Moreover, the abolition of the horsed omnibus will do away with the vicious practice of such vehicles pursuing their course along the centre of the road. The horse-omnibus driver keeps to the middle of the road, in utter unconcern of faster traffic, because he likes to run his iron-tyred wheels on the smooth tram lines, and thus save his horse power , but with tram lines absent and with an abundance of surplus power the motor 'busman will obey the rule of the road by keeping to the left, thus leaving the centre of the road free for faster traffic

A Comfortable Solid Tyre.

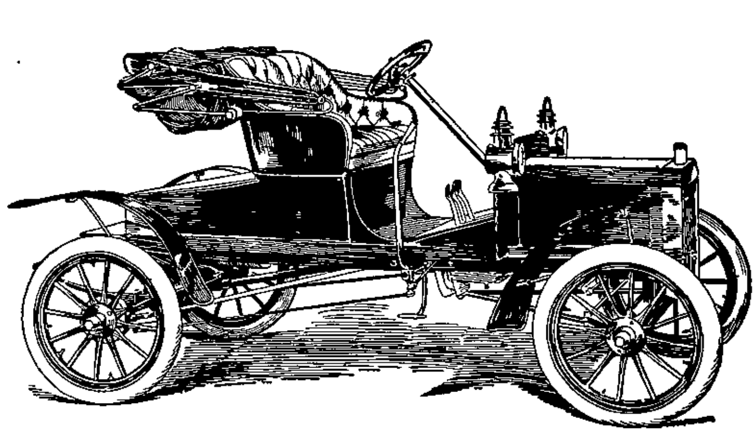
The maker of nearly every rubber tyre is only too ready to persuade a likely purchaser that his tyre is equal to a pneumatic Though we would not for a moment suggest that any solid tyre is equal to the pneumatic, we must admit that the Swinehart solid tyre goes very near the mark During a twenty miles spin (part of it being over granite sets) which we had recently, the comfort and lack of vibration was a very pleasing feature. The height of the rubber and its resilience will commend it to anyone who has a knowledge of this material —*The Motor.*

A Bid for French Trade.

M. Henric Fournier is establishing a series of International garages and repair shops in London, Rome, New York, Berlin, Cannes, and Nice to link up the Paris establishment with other leading capitals Cars, spares, and accessories of all sorts will be sold at these various centres at a uniform price, and the motor tourist will be welcomed with open and helpful arms at any of these International garages.



THE FORD 6-CYLINDER TOURING CAR, MODEL "K."



THE FORD 4-CYLINDER TOURING CAR, MODEL "N."

Do You Want a Motor Car ?

READERS of PROGRESS who are in the market to buy motor cars find the expert advice given by this journal invaluable.

Any reader who wishes information and advice can obtain it from us by writing his questions and enclosing a stamped and addressed envelope. He will receive a reply by post.

The proprietors of PROGRESS have no financial interest in the sale of cars. In several cases where readers have bought cars upon our advice, the manufacturers have offered to us the usual trade commission, which, of course, was refused.

A Surfeit of Cups and Trophies.

The Continent suffered last season from a surfeit of automobile competitions on land, on sea and in the air Motorists are becoming tired of competing for twenty to fifty-guinea cups, which to win outright is almost an impossibility. The rules specify that the holder must win twice in succession or three times in all To do this a competitor is obliged to enter for interminable competitions and at the end of much hard work he may have the good luck to become possessed of the trophy Many of the cups are put up merely to satisfy the vanity of the giver, or to advertise his particular merchandise

Owners of light American runabouts, with leather-faced fly-wheel clutches, should be careful not to let the car stand out in the rain with the clutch out, as it will get wet and the leather become hard , a fierce clutch will then be the result

A Comparison of the New and Old.

Fig 1 represents an old hand crane used by the Wellington Harbour Board for many years, and which is still capable of lifting 30 cwt It is, however, now used only by carpenters' gangs for wharf repairs.

Fig 2 shows the new 20-ton hydraulic crane erected at the end of the railway wharf This splendid machine has a vertical lift of 100 ft while the jib head is 90 ft. above the mean-tide level. The jib derricks have a maximum rake of 50 ft. (33 ft. over edge of wharf) into a minimum of 16 ft. rake. The jib rotates all round and the crane is treble power, having lifted on test 2¼ tons with one ram, 11¼ tons with two rams and 20 tons with three rams (net load) The foundations consist of four concrete piers resting on

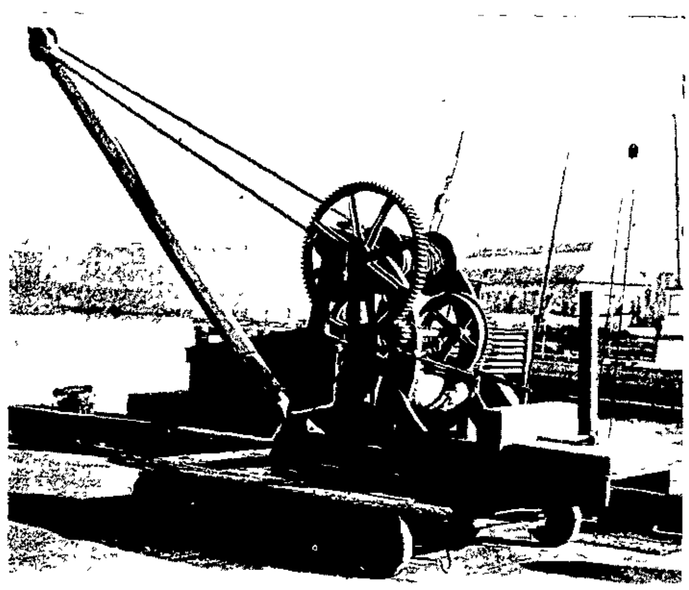


FIG. 1 —30-CWT CRANE THAT HAS BEEN USED BY THE WELLINGTON HARBOUR BOARD FOR MANY YEARS PAST

a concrete bed 36 ft below mean-tide level The total cost, including foundations, crane, freight, erection and testing, was £5,350, and the makers of the crane are Messrs Tannett, Walker & Co., Ltd., Leeds.

The Wellington-Manawatu Company's engine No. 19, which we illustrate herewith, is a passenger locomotive built by the Baldwin Locomotive Works, of Philadelphia, U.S A., and is used for hauling the mail train between Paekakariki and Longburn. It is a 10-wheeled locomotive having three pairs of coupled wheels and a 4-wheeled truck, with cylinders 17″ diameter and 22″ stroke The valves are inside-admission piston valves worked by Stephenson link motion The diameter of driving wheels is 58″ The driving wheel centres are cast steel and the front and back drivers are flanged, the middle drivers being plain. The boiler pressure is 180 lbs per square inch The boiler is lagged with magnesia sectional lagging and is covered with a Russian iron jacket. The diameter of boiler is 51″, and the tubes are of solid drawn brass 1¾″ diameter, the fire box being of copper with copper stays. The boiler has a heating surface of 1,100 square feet, and the grate area is 17 square feet The head light is of copper Leach's air sanding apparatus acts on the front and back drivers The tender is carried on two 4-wheeled trucks, having wheels of 30″ diameter. The tank capacity is 2,000 gallons, and that of the coal bunkers 4½ tons The Westinghouse brake engages all driving and tender wheels, and there is a hand brake on tender Total weight of engine and tender 58 tons

WELLINGTON–MANAWATU RAILWAY CO 'S EXPRESS ENGINE NO. 19.

Star Pictures.

At the annual meeting of the Philosophical Society the secretary (Mr T King) explained and exhibited certain stereographic star pictures drawn by Mr T. E. Heath, of Cardiff, author of "A Road-book to the Stars" Mr King explained how objects sufficiently near to the eye appeared solid through the combination of the images presented to the right and left eyes such images being seen from different points of view, and therefore, in slightly different perspective Scientific use of this fact had been made in the beautiful invention of the stereoscope about half a century ago, and that instrument, at first a scientific curiosity, had since done valuable service Its first astronomical application was to the moon, which for stereoscopic purposes had to be photographed at intervals of time, during the same phase, but in varying libration; the result being that the two pictures, united by the stereoscope, showed her as a spheroid. For the moon herself to be so seen at the distance of the earth, one would require a pair of eyes 66 000 miles apart At the Yerkes Observatory in the United States comets had been stereographically photographed, and, what was still more remarkable, meteor-tracks on two separate occasions. Some of these were shown, and the effect of the light gauzy mass, standing out solidly against the background of a black sky sprinkled with stars, was very striking and beautiful But no stereographic photographs of star-groups could be taken, the whole orbit of the earth being as a point compared with their vast distances Light travelled rather more than 185,000 miles a second, and took over eight minutes to reach us from the sun, but the nearest star was three "light-years" away, and there were stars visible to the eye whose light was two hundred years in reaching us, while the telescope revealed luminaries thousands of light-years away It was a curious fact that on a scale representing the solar distance as one inch a light year would equal a mile Mr Heath, with elaborate calculation and great pains, had drawn a great number of stereoscopic projections of stars of the greater magnitudes, and many of these were shown—one representing the familiar South Polar group, which never set in this region. The stereoscopic effect was very striking and beautiful the comparative degrees of distance being wonderfully brought out Mr. King explained that these views of the constellations were such as would be given by a pair of eyes 107 light-years apart In the discussion following, the chairman and other members described methods of combining stereographic pictures by the eyes alone, without the aid of an instrument.

Longest Span in the World.

A REMARKABLE BRIDGE

ONE of the most remarkable bridges in the world, not only from the engineering point of view, but also from its relations as a link in transcontinental traffic will be that now under construction across the St Lawrence river about 6 miles above the city of Quebec and 170 miles below Montreal.

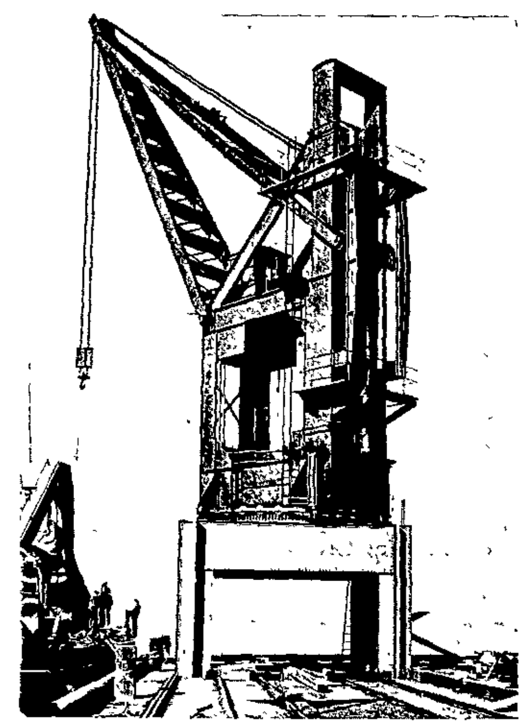


FIG. 2 —20-TON CRANE RECENTLY ERECTED BY THE WELLINGTON HARBOUR BOARD.

It will contain the longest span in the world, and will be the link that will render possible another all-Canadian transcontinental railway. The structure, it is supposed will be built in two years. All railways will be entitled to its use. In order to avoid obstruction to ocean-going craft, the bridge is not built on a series of piers extending across the stream, but consists technically of two great cantilevers carrying a huge central expanded span having a total length in the clear—that is, between the towers at either side—of 1,800 feet which is 90 feet longer than each of the two spans of the famous bridge over the Firth of Forth near Edinburgh Scotland

The approaches to the central span of the Quebec bridge are each 214 feet long extending from the shores to the supporting piers. All parts of the structure are of huge proportions, and consist mainly of built-up steel girders and other shapes, not a single casting being used The weight of each girder is 278 tons The anchor arms are 500 feet long The bridge has a very large capacity, the floor having a total width of 75feet It is designed to carry two lines of steam railroad, two trolley lines two carriage highways, and two sidewalks, the last-named being placed outside, and the rest of the traffic between the trusses, which are 67 feet apart, centre to centre The clear headway above water is 150 feet.

It is only in recent years that the construction of such a bridge has been rendered possible, through the development in the manufacture of steel shapes The steel mills are now furnishing rolled, rectangular steel in sizes that were not obtainable at the time the Firth of Forth bridge was built. As a consequence, the Quebec bridge is constructed with its cantilever towers in vertical planes. It will have built-up lattice chords and posts and 18-inch I-beams The result will be a structure lighter in weight, cheaper in cost and the most graceful in appearance among the bridges of the world For purposes of comparison, it may be interesting to note that the span of the Williamsburg suspension bridge at New York is 1,600 feet, that of the famous Brooklyn Bridge, 1,595 feet, and that of the new Manhattan bridge, 1,470 feet.

North Island Main Trunk Line.

A NATIONAL UNDERTAKING.

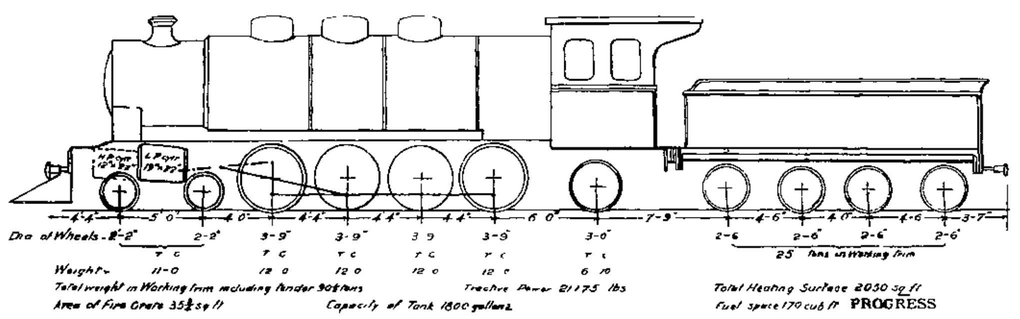
By Our Special Commissioner

PART II.

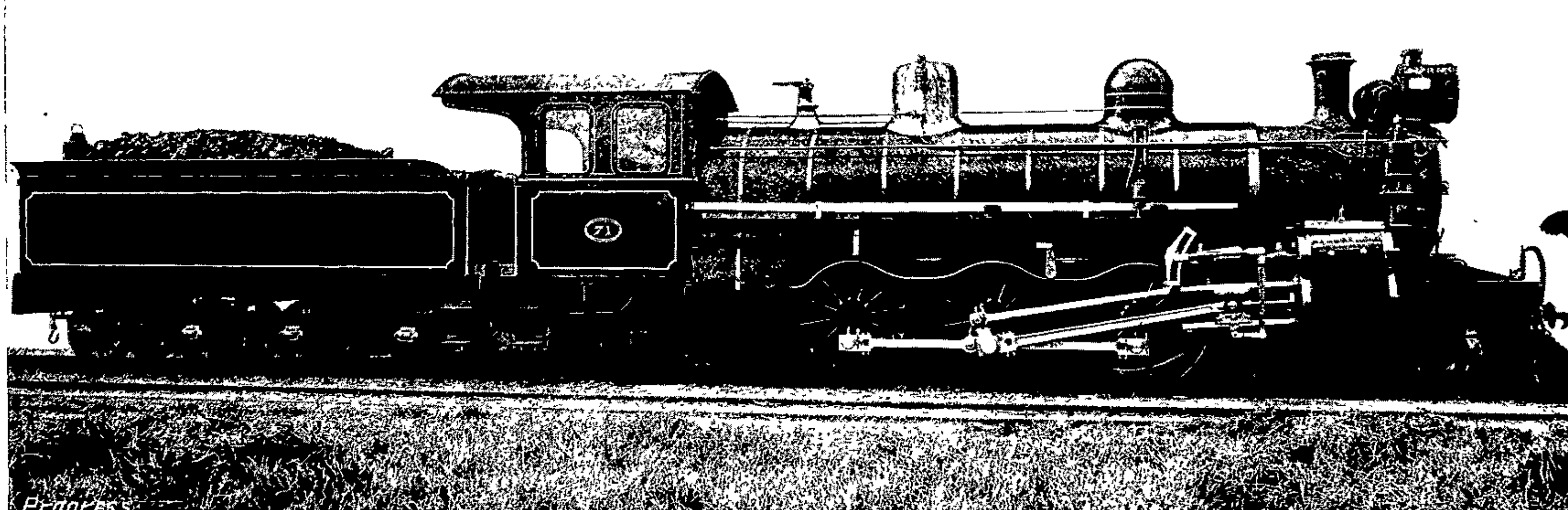
Description of the Works and Route.

Properly speaking, the Main Trunk Railway begins at Auckland and ends at Wellington, but the portion of the line to Te Awamutu having been so long in use, and the southern section being in the hands of a company, the popular mind has come to look upon the portion from Te Awamutu to Marton, on the Wellington-New Plymouth railway, as constituting the Main Trunk Line. As the northern and southern sections are now well known to travellers we will attempt only a description of the less widely known section of the railway connecting them. Te Awamutu is a neat little town 100 miles south of Auckland. Thence to the native town of Te Kuiti, a distance of twenty-five miles, the construction works are of an easy nature. At the latter point, however, the Line commences to rise by a succession of 1 in 70 grades. Up to this point we have been travelling in the drainage area of the great Waikato river, the waters generally flowing north to empty themselves into the sea at the Waikato heads. We now ascend the divide between the Waikato and the Mokau basins, and cross it a mile or two before reaching Puketutu station. Here the waters flow to the west, towards Taranaki. A little later we rise to the main summit at the Poro-o-tarao tunnel, where we enter the drainage area of the Wanganui river. From this point all the waters flow southwards to Cook straits. For about twenty miles on the section of line referred to the works are somewhat heavy, consisting of rock cuttings and banks, with occasional short bridges and one large viaduct at Waiteti—the first of many to be met with on the Line. The country from Te Kuiti to this point is not very inviting for settlement, but the Maoris keep a few cattle and manage to grow sufficient for their own needs. The tunnel through the dividing ridge at Poro-o-tarao was a heavy piece of work, being 63 chains in length, through papa rock From the tunnel southwards comparatively easy works of an average character carry the Line past the old Maori village of Taumarunui, picturesquely situated on a triangular flat at the confluence of the Wanganui and its large tributary, the Ongarue. This was a place of some importance in the old days, being on the highway from Wanganui to Taupo on the east, and the Waikato on the north, and at a later date was a safe and widely used fording place for horse traffic across the Wanganui. At present it is the terminus of the railway, and also of the steamer navigation on the Wanganui river. From here the steam-boat can be taken for Pipiriki and Wanganui. On the south side of the river no great engineering difficulties are met with till Piriaka is reached, if we except the tendency of the treacherous papa slopes to slip and block the Line without giving the engineers much warning.

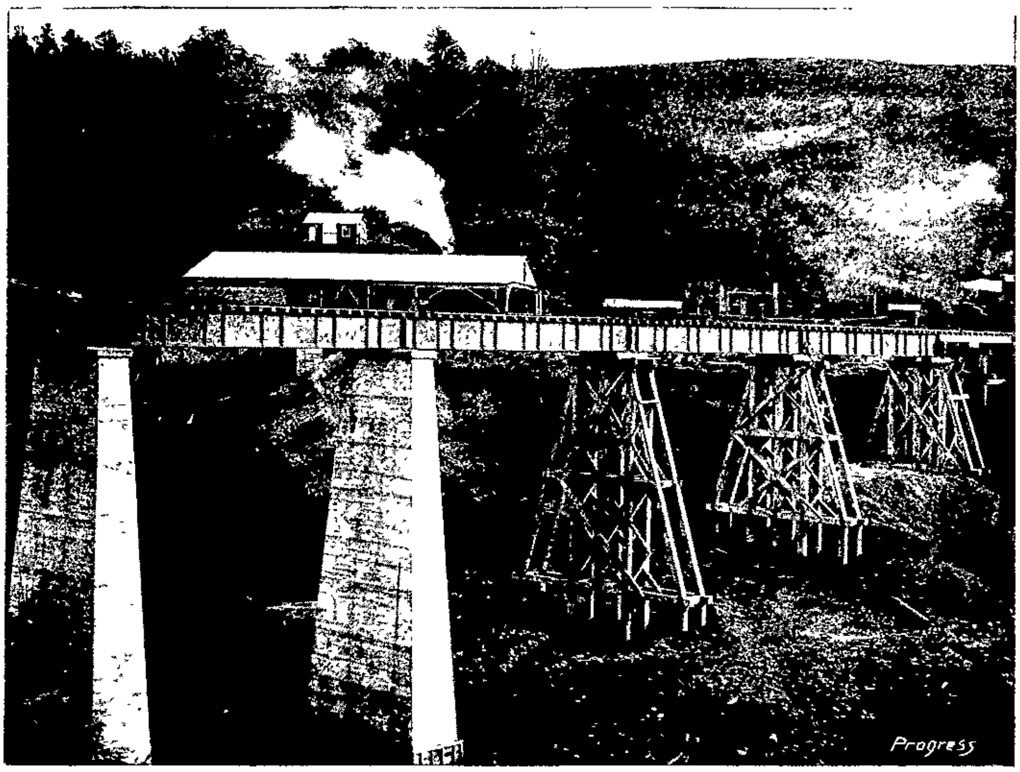
At Piriaka the Line commences to climb up to the Waimarino tableland, a rise of 2,000 feet having to be negotiated at a workable grade. The country hereabouts is mountainous and broken, and in consequence the construction works have been heavy and costly, particularly along the banks of the Whakapapa and Piopiotea rivers. At Kakahi, beyond Piriaka, the Government has established a sawmill in the totara forest, where sleepers and timber for bridges, culverts, station buildings and other works are cut, and dressed. A large proportion of the timber in this part of the forest is totara of excellent quality attaining a marvellous growth in the pumice which covers the flat land and gullies to a depth of several feet. On the hills the soil is fair, and much of the land has been disposed of to settlers for grazing purposes after the timber has been cut out. The large proportion of totara on the fringe of the bush at this point gave the impression that the Waimarino forest was nearly all totara, but more thorough investigation shows that the proportion of totara diminishes as the forest is penetrated, although the other timber which grows in abundance is not inferior in size or quality, and is of considerable value. It consists of *rimu*, *matai*, and *kaiwaka* on the flat and undulating land, and runs off into birch and scrub on the slopes of the higher mountains. Cuttings, banks, bridges and viaducts are met with on the twenty miles of the Line southwards of Piriaka, which continues through heavy bush country on a steady ascending grade, but the sharp natural rise in the country prevented effect being given to the original decision to have a maximum grade of 1 in 70. At Raurimu, the centre of activity on the northern section just now, where the majority of the nine hundred workmen are to be found, considerable difficulty was experienced by the engineers in obtaining sufficient length of line to be able to adhere even to the modified grade of 1 in 50, and it became necessary to adopt one or two expedients to get the necessary distance. One of these is unique in railway construction schemes in this colony.



PROPOSED 4-CYLINDER BALANCED COMPOUND LOCOMOTIVE FOR USE ON THE MAIN TRUNK LINE BETWEEN TAIHAPE AND TAUMARUNUI. WEIGHT, WITH TENDER, 90 TONS.



LOCOMOTIVE, CLASS "A," WHICH IS INTENDED FOR EXPRESS SERVICE ON THE MAIN TRUNK LINE BETWEEN PALMERSTON N. AND TAIHAPE, AND TAUMARUNUI AND AUCKLAND. WEIGHT, WITH TENDER, 72 TONS.



KAKAHI BRIDGE. THE SAWMILL ON THE LEFT IS WORKED BY THE PUBLIC WORKS DEPARTMENT.

At the Raurimu hill the Line passes under itself by means of a short tunnel, the difference in elevation at the crossing point being about 70 feet.

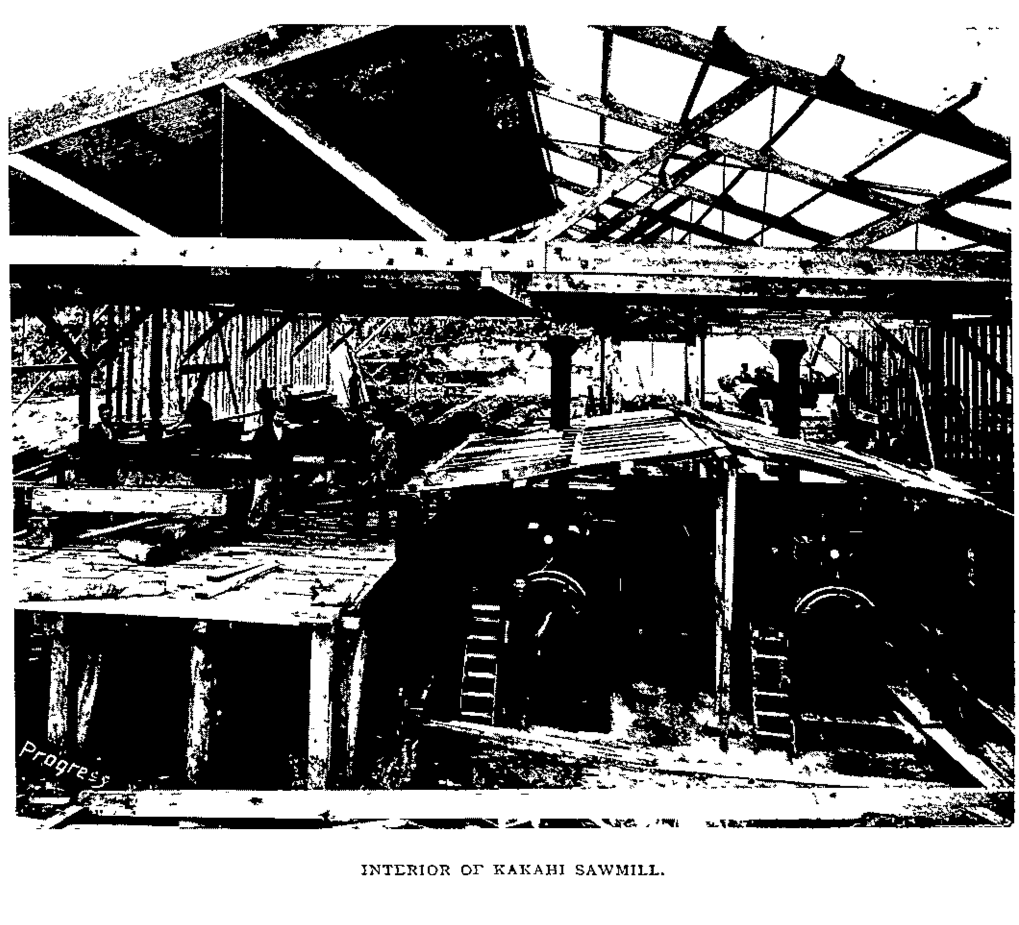
For another five miles the Line continues through heavy forest till it emerges suddenly on the open tussock plains in full view of Tongariro, Ngauruhoe and Ruapehu—the latter, as is well known, being the highest mountain in the North Island, attaining an elevation of 9,175 feet. For about eight miles the Line continues on the plain, and at Waimarino, near the stream of the same name, it attains the first summit at an elevation of about 2,600 feet above sea level. The plains are spoilt for grass growing by the heavy deposit of pumice with which they are covered, and on account of their high elevation are hardly a congenial place in winter, but the ponderous mass of the three great mountains, with the ever-steaming crater of Ngauruhoe and the steam-cloud which hangs over Ruapehu, make an awe-inspiring picture to the traveller who looks upon them for the first time. This should be a popular place to linger for the tourist who is not pressed for time, and who finds any pleasure in the contemplation at close quarters of the mighty works of Nature.

Continuing southwards the Line soon leaves the plain and again enters forest country of much the same nature as that on the northern side of the open country. In the comparatively short distance of eleven miles three ravines have to be crossed on huge steel viaducts, namely at Makatote, Manganui-o-te-ao and Mangaturuturu. These ravines have been formed by comparatively small rivers, having their sources on the mountain sides cutting down channels in the plateau. At the crossing place the Makatote gorge is about 300 feet deep, with sides almost perpendicular in places, covered with a luxuriant growth of evergreen vegetation, which presents a glorious spectacle from the road bridge which crosses it, at a lower elevation, less than a mile below the railway crossing. The Makatote viaduct will be the highest and longest in New Zealand, but being simpler in design and easier of construction, is hardly such an engineering achievement as the similar structure at Makohine in the Rangitikei valley, at the southern end of the Line. It is to be 265 feet high, 891 feet long, built of steel in ten spans, on five piers each 36 feet wide. It is being erected by Messrs. Anderson, of Christchurch, and will cost nearly £60,000. The Manganui-o-te-ao gorge is 120 feet deep, but not very wide. Lower down this stream was a favourite retreat of the Wanganui Maoris in the troublous early times, and traces of their cultivations can yet be found. A peculiar stream is the Mangaturuturu which is crossed by a viaduct about 50 feet high. Its waters contain a strong mixture of sulphur, alum and other disagreeable elements picked up on its course down the side of Ruapehu, and at different times present various shades of yellow and blue colour, alternating with a delusive clearness which gives an unpleasant surprise to the unwary traveller who helps himself to a drink from it. The same effect is noticed to an even greater extent in the Wangaehu river lower down, which also has its source in the same mountain.

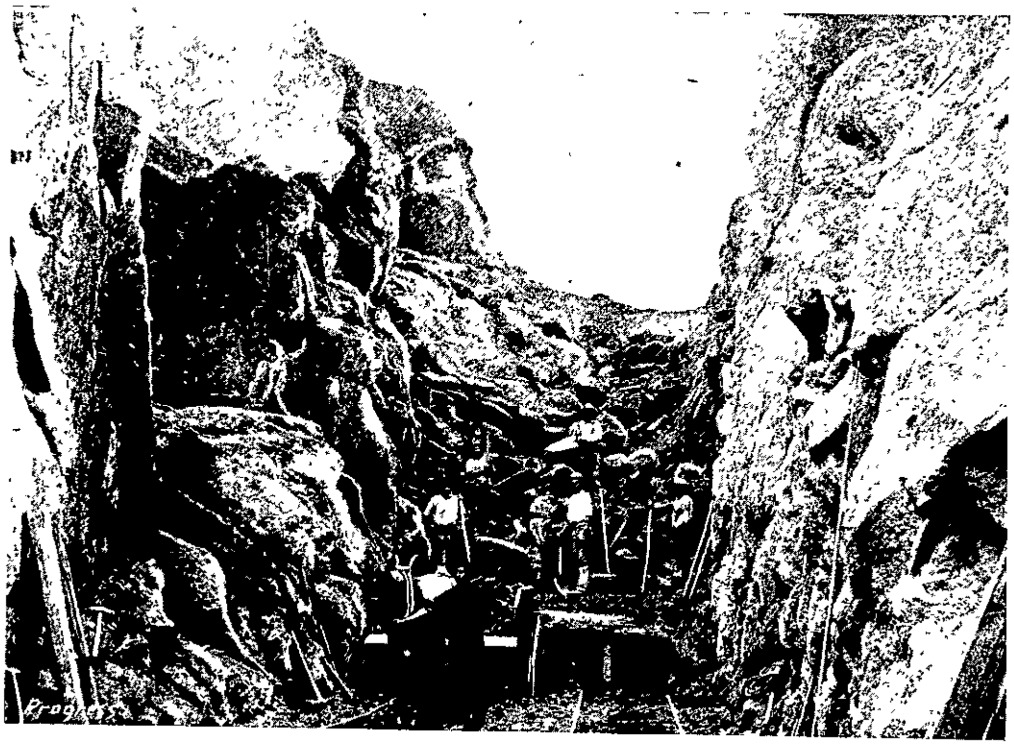
After leaving Waimarino the level of the railway falls to the crossing of the Makatote, and then rises a little to the Manganui-o-te-ao, where it commences to fall by steep grades down to the crossing of the Mangawhero river. Here a station is being located for the benefit of the old settlement of Ohakune, some miles off the track of the Line. On this section there are two viaducts—one at Toanui, and a long one at Hapuawhenua, but the latter cannot compare for height or difficulty of construction with either Makohine or Makatote, though it is still nearly 150 feet above the bed of the stream. The Toanui structure is short and of moderate height; both are to be built of steel. The formation works are again heavy, the Line having left the lofty plateau, and making a descent on the steep country at its edge. Heavy timber on the slopes of Ruapehu still continues, but a fair amount of settlement has taken place on the lower lands. Dairying is carried on to some extent, there being a dairy factory at Raetihi and a creamery at Ohakune, both of which townships are on the overland tourist road from Pipiriki to Tokaanu, but are several miles distant from the railway. Sawmilling is also carried on to a limited extent, but may be expected to increase when an outlet by rail is available.

From Ohakune to the crossing of the Waitaike near Karioi the Line passes over comparatively easy country on moderate grades, but at Nimia, on the Wangaehu river, a gradual rise to its second summit at Waiouru is commenced. For six miles the route is over the cheerless Murimutu plains—poor tussock land, incapable of growing much—where, however, the work of making the Line is easy, but heavy cuttings and fillings are again encountered on the last four miles before Waiouru is reached. This is the point of termination of the first day's journey of the present Tokaanu-Taihape and Tokaanu-Pipiriki coach service, and after the opening of the railway will be the changing place for passengers desirous of proceeding to either Tokaanu or Pipiriki. It is rather a dreary locality, however, with hardly any timber or other vegetation, except tussock, in sight. The level of the Line at this summit is almost the same as at the highest point on the Waimarino, forty miles away, but between these two points the Line has dipped down to a level about 600 feet below the summit elevation.

From Waiouru the Line commences to descend by easy grades over ten miles of rolling country, little removed from desert as regards fertility, and entirely devoid of timber or any growth but tussock, till forest is again encountered at Turangarere, and a decided improvement in the quality of the land is immediately noticeable. Turangarere was at one time an important pah belonging to the Maniapoto tribe, and many natives still have their homes there. The sawmilling industry is also in full swing, and from this point southwards to Marton, there is an abundance



INTERIOR OF KAKAHI SAWMILL.



NORTH ISLAND MAIN TRUNK RAILWAY: OHINEMOA SECTION—A RHYOLITE ROCK CUTTING.

of timber, although sawmills have been at work at various points along the Line for years. From Turangarere to Taihape, sixteen miles distant, the works are of a very heavy nature, including two tunnels, and troublesome cuttings and fillings along the banks of the Hautapu river, a tributary of the Rangitikei. As at Raurimu, the country falls away too fast to allow of the Line being constructed on the proper grade without adopting expedients to gain distance A detour had therefore to be made to Mataroa to gain about a mile and a half of extra length of line so that the grade might be maintained. Taihape is a lively settlement which has for some time been the terminus of the Line at the south end, and is also the centre of a considerable sawmilling business, besides being the distributing point of supplies and produce for the numerous settlers who have recently taken up land in the neighbourhood It has grown rapidly in the last few years, and possesses some presentable public and private buildings.

Southwards from Taihape, if we except two tunnels, one on the railway, and the other for the diversion of the Taihape creek under the Line the country is fairly easy as far as the Toetoe creek, which is spanned by a steel bridge at a great height, but between this point and Mangaweka construction works are again of a very heavy nature, a number of tunnels having been necessary to carry the Line past the steep cliffs of the Rangitikei river. A long and high viaduct just outside Mangaweka was also necessary, but a comparatively simple design was possible, and the work of erection was, therefore, not difficult Mangaweka was for some time a township of importance, but the progress of the works into the interior, and the advance of the terminus to Taihape, have deprived it of some of its glory.

Southwards of Mangaweka, right through to the point of junction with the Wellington–New Plymouth line at Marton, the formation works are of a moderate character, with the exception of a short length of heavy work near Mangaonoho On this section one of the most remarkable engineering efforts on the whole Line is met with, namely, the mighty viaduct spanning the Makohine ravine at a height of 238 feet. Though not quite so high nor so long as the viaduct under construction at Makatote, higher up on the Line, this was much more difficult work from an engineering point of view, owing to the treacherous nature of the sides of the ravine and the faulty foundations. These circumstances necessitated a structure with only two intermediate piers so as to avoid having to construct foundations on the sloping hillside. These piers had to be of extraordinary strength to carry the concentrated loads, and the girders also had to be much deeper than would otherwise have been necessary The centre span is 176 feet long flanked on either side with two spans of 247 feet and 38½ feet respectively The 247 feet spans are made up of cantilevers 38 feet long being extensions of the centre span, and a 209 feet span hinged to the end of the cantilever at one end while the other end rests on a concrete pier. The girders of the 209-feet spans are 22 feet deep, and those of the central span 25 feet. There are 12,000 tons of concrete, 1,252 tons of steel and iron, and 26,560 superficial feet of timber in the structure, which cost £72,000.

Settlement and Roads

When the Line was started there was no settlement between Silverhope (Rangitikei) at the south end, and Te Awamutu at the north, nor were there any roads or other means of communication through the Rangitikei Valley and the country beyond, except an extremely rough native track. Since the construction of the Line commenced townships have sprung up in several places along its route, particularly at Hunterville, Ohingaiti, Mangaweka, Taihape, Raetihi, Taumarunui, Te Kuiti and Otorohanga. In connection with the railway a great many miles of roads through the adjoining country have been constructed for the purpose of giving access to the railway stations, and a service road, for use during the construction of the Line, has also been formed throughout its entire length This road, during the coming summer, will be placed in sufficiently good order for coach and buggy traffic, so that it will be possible to drive from Auckland to Wellington by the route of the railway. This has never been practicable hitherto.

Up to Turangarere, at the south end, the country has now all been settled by Europeans, the farms for the most part being small, so that there is a somewhat considerable population along this part of the route.

From Marton right through to Turangarere the country was originally heavily timbered, and much of it is so still, though sawmills have been planted at intervals as the rail-head advanced, and a steadily increasing volume of business done in timber for export, as well as for local consumption and the Wellington market. Although the annual output is enormous, the visible supply is sufficient to keep the millers occupied for many years to come, and the value of the country is, if anything, rather enhanced when the timber has been cut down, for the soil is capable of supporting a population of dairy, sheep and cattle farmers. One pleasing feature about the progress of the Line is that many of the men who put in periods of work on its construction have invested their savings in acquiring a home and means of earning an independent livelihood by taking up land along the route and they are now on the way to make a comfortable living without troubling the labour market, while some still struggling selectors are glad to avail themselves of the opportunity of earning a little ready money by undertaking work on the Line

Present Position and Prospects.

The rail-head at the northern end is at Oio at present, but in a month or two will have reached Raurimu, where it will probably remain for some little time. The works from there to Makatote are actively in hand and being pushed on as rapidly as possible. In the tunnels and more important cuttings the men are divided into "shifts" and artificial light provided, so that the work goes on continuously throughout the whole 24 hours, except on Sundays. The Makatote viaduct is also under construction by a reliable firm of contractors, the stipulated date for its completion being 15th June next. By the time the viaduct is completed the intervening length of formation between it and Raurimu will also be finished and the rails laid, so that the rail-head can be immediately advanced over it and on to Manganui-o-te-ao. The contract for the Manganui viaduct is also in Messrs Anderson's hands, the agreed date for completion being 7th February, 1908.

The rail-head at the south end has just reached Turangarere and comparatively easy work lies ahead till the first summit of the Line at Waiouru is reached. The workmen are already thickly spread over the whole of this length, and a rapid advance of the rails may be expected. They are certain to reach Waiouru before the close of the coming summer. With the rail-heads at Raurimu and Waiouru at either end there will remain a gap of 40 miles, half of which is easy country, and more or less work has been done over practically the whole of it.

Last year a staff of engineers and workmen were started on a new section of the Line between

NORTH ISLAND MAIN TRUNK RAILWAY: MANGAWEKA SECTION—A PAPA CUTTING.

the north and south ends, with headquarters at Ohakune, and, though working under great difficulties on account of the deplorable condition of the roads during the winter season, very fair progress has been made The Mangaturnturu, Toanui and, Hapuawhenua viaducts are of this section. The two latter are to be erected by the Public Works Department's own workmen, the iron and steel work being already in course of preparation at the Mangaonoho workshops, and the former by Messrs. Anderson, the contract date for its completion being 7th February, 1908, the same as for the Manganui viaduct

At the present time there are approximately 2,700 men employed on the three sections in hand, the respective numbers being about as follows — North end, 900; central section, 600; south end, 1,200.

The present position may be summed up thus —

Total distance, Auckland to Wellington	426	miles
Already constructed and open for daily passenger traffic ..	335	"
Rails laid on a further	34	"
Formation practically complete on a further	10	"
And in hand on a further ..	32	"
Untouched	15	"
Total	426	"

The untouched portion is left so merely because the works upon it are of an easy and unimportant character and can readily be finished by the time the heavier work now in hand is done

Probably all the earthworks will be finished as soon as the large viaducts are ready, so that on the completion of those structures really depends the date of the opening of the railway for through traffic. It seems quite probable, therefore, that the prediction of the Minister for Public Works and Railways that through trains will be run by about the end of 1908 will be realised It will also clearly be possible to take the through journey during this coming summer, by coaching from Raurimu to Waiouru. A coach already runs from Raurimu to Makatote, and will doubtless run on to Raetihi as soon as the road is in sufficiently good order for vehicular traffic At Raetihi connection can be made with the Pipiriki-Waiouru coach.

The Men in Charge

The construction of the Main Trunk Railway has occupied the attention of a succession of Ministers for Public Works but the Hon Wm Hall-Jones, the present Minister for Public Works, and Railways, has had the principal control of the undertaking for a longer period than any other Minister—namely, from March, 1896, to the present date The practical work of construction has also claimed the efforts of many engineers. The work is being carried out at present under the direction of Mr. P. S. Hay, Engineer-in-Chief of the colony, who is also entitled to the credit of designing all the fine steel viaducts as well as most of the bridges along the Line. The works at the northern end are under the general control of Mr. C. R Vickerman, District Engineer at Auckland, with Mr. J D. Louch Resident Engineer, at Raurimu in the immediate local charge. Mr J. J Hay, Resident Engineer, Ohakune, is in charge of the works on the central section, and the construction at the southern end is under the supervision of Mr F W Furkert, Resident Engineer, Taihape, who recently succeeded Mr. G. L. Cook in that capacity These officers are assisted by a large staff of assistant engineers, overseers, timekeepers, and other minor officials The general administrative work is under the control of the Under-Secretary for Public Works, Mr. H J H Blow

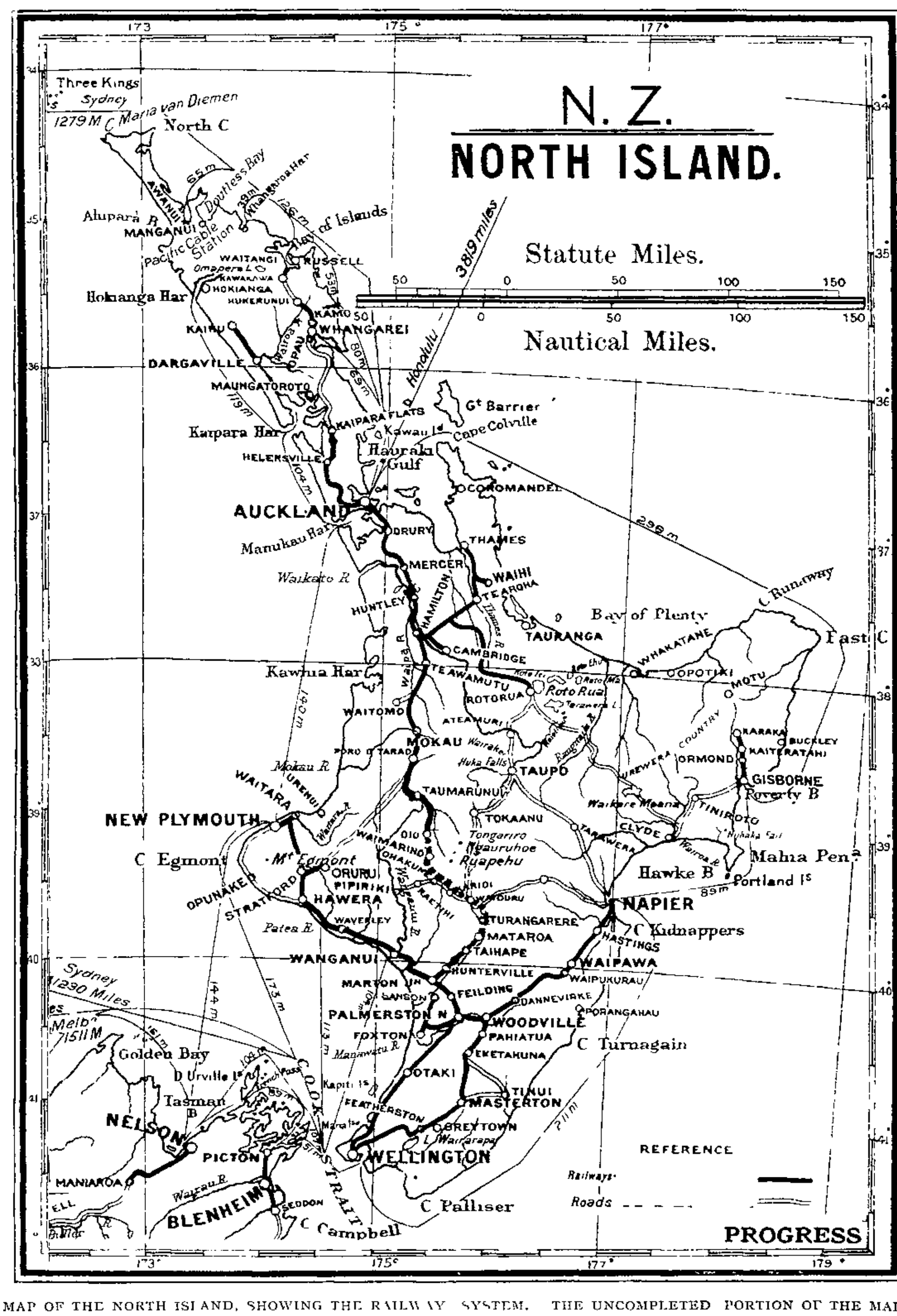
The Probable Train Service

The completion of the railway being within measurable distance, interest, of course, attaches to the probable nature of the train service to be run over the Line By the time through trains are run it is expected the Union Steamship Company will have one, or possibly two, fast turbine steamers in the ferry service between Lyttelton and Wellington, and the time-table arrangement will probably be made with a view of securing a rapid mail and passenger service from one end of the colony to the other Already we have a train leaving Invercargill in the morning and reaching Christchurch the same night A fast steamer could await the arrival of this train at Lyttelton and still deliver mails and passengers at Wellington by 9 or 10 o'clock the following morning As already stated the distance between Wellington and Auckland is approximately 426 miles, and taking into consideration the rough nature of much of the country traversed and the extent of comparatively new track, as well as the great height to rise to the interior plateau, it is expected that the through journey will occupy about 20 hours. A train leaving Wellington for Auckland about noon would be convenient for the arrivals by the southern steamer, and would give Wellington commercial men two or three hours of the business portion of the day to despatch their correspondence This train could reach Auckland by 8 a m the following morning in time for letters to be distributed by the letter-carriers' first delivery This would give a 48-hour through passenger and mail service between Auckland and Invercargill The express on the return journey would probably leave Auckland in the evening and reach Wellington about 4 p m the next day, thus allowing passengers to connect at leisure with the southern steamer leaving three or four hours later This steamer would be timed to reach Lyttelton so as to connect with the first express, which leaves Christchurch at 8 a m. and runs through to Invercargill

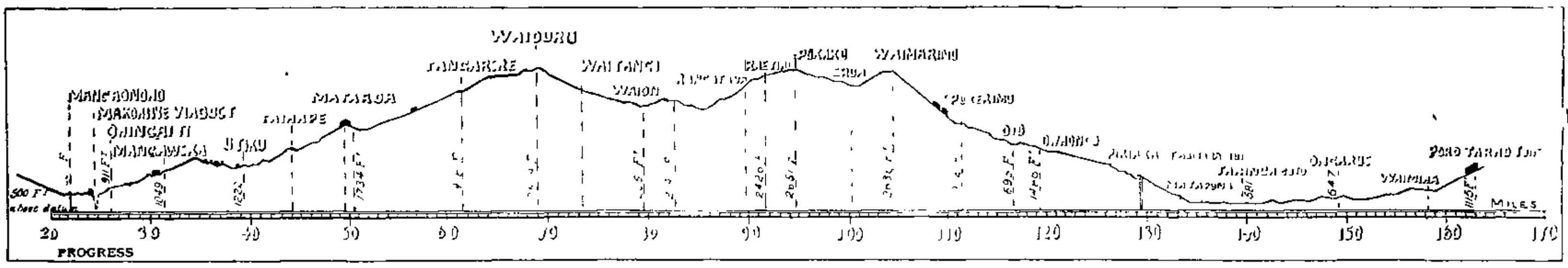
Special rolling-stock is to be constructed for the Auckland-Wellington mail trains The engines for the run between Palmerston and Taihape (or between Wellington and Taihape should the Government purchase the Wellington–Manawatu Railway) will be of the new Class A type shown in our illustration A similar engine would run between Taumarunui and Auckland, but for the heavy section and steep grades between Taumarunui and Taihape a special locomotive will be used, of a stronger and heavier type than any hitherto in use on the N Z Railways It will be of the four-cylinder balanced compound type, capable of hauling a loaded train up a grade of 1 in 50 at an average speed of 20 miles an hour, and will weigh, with tender, over 90 tons. An outline drawing of this engine appears in this issue. All the engines will be furnished with tenders so as to provide ample coal and water accommodation and enable them to run long distances without stopping.

The cars will be of two classes, the first-class of the standard saloon type in use on the New Zealand Railways 47 ft. 6 in long with verandah at each end, height from floor to ceiling 7 ft. 8 in., containing a roomy lavatory and furnished with a plentiful supply of drinking water The seats will be of the popular single, reversible back type, arranged two on one side of the central aisle and one on the other Each seat will be numbered, and any passenger desiring to do so will be able to obtain from the guard a ticket reserving any one seat for his sole use for the whole or any part of the journey The carriages will be lighted by gas, stored at high pressure in reservoirs fixed to the under frame of the car, each lamp giving a light equal to 25 or 30 c p. Each car will accommodate 32 passengers The second-class cars will be of the same size and type, with similar lavatory conveniences. The seating accommodation will provide for 52 passengers, arranged on the standard longitudinal system, and the seats will be provided with cushions.

A dining-car will be attached to each train, similar in size and exterior appearance to the passenger cars, and will be fitted with a large gas-cooking range, dresser, cupboards and all



MAP OF THE NORTH ISLAND, SHOWING THE RAILWAY SYSTEM. THE UNCOMPLETED PORTION OF THE MAIN TRUNK RAILWAY IS SHOWN BY A DOTTED LINE.



NORTH ISLAND MAIN TRUNK RAILWAY: LONGITUDINAL SECTION OF THE PORTION OF THE LINE BETWEEN PORO-O-TARAO AND MANGAONOHO, SHOWING THE HEIGHTS OF THE PRINCIPAL STATIONS ABOVE SEA LEVEL.

necessary appliances for expeditiously dealing with the various wants of passengers, including ice chests and cold-storage cupboards. The dining saloon will accommodate twenty-one passengers at a sitting, four at each table on one side of the aisle, and two at each table on the other side

As a considerable portion of the journey will be made during the night, sleeping cars will also be attached to each train.

On such a journey the saving of time is, of course, an important consideration, consequently stopping places for the express train are likely to be fewer than we have hitherto been accustomed to. The details of the time-table have not yet been settled, of course, but the following has been suggested as probably suitable..—

NORTH.		SOUTH.	
Wellington	12 30 p.m.	Auckland ..	8.30 p.m.
Palmerston	4.15 p.m.	Frankton ..	11.45 p m.
Marton ..	5.45 p.m.	Taumarunui	4.0 a.m.
Taihape	8.0 p.m.	Taihape ..	9.0 a m.
Taumarunui	1.0 a.m.	Marton ..	11.0 a.m.
Frankton	5.15 a.m.	Palmerston	12.30 p.m.
Auckland	8.30 a.m.	Wellington	4.0 p.m.

There will also be a daylight train each way between Taumarunui and Taihape.

Obviously, therefore, as the central portion of the route will be traversed during the night by the up-express, the traveller from Wellington, who wishes to enjoy the magnificent mountain panorama and the gorgeous bush scenery along the route, should leave the train at Taihape and make his way by the slower mixed goods and passenger train across the central section, and connect with the fast train again at Taumarunui later in the evening. Taihape will be a suitable place to stop over, and good hotel accommodation can be obtained there. Probably suitable accommodation will also be obtainable on the Waimarino plateau, close to the mountain group, by the time the through trains are running.

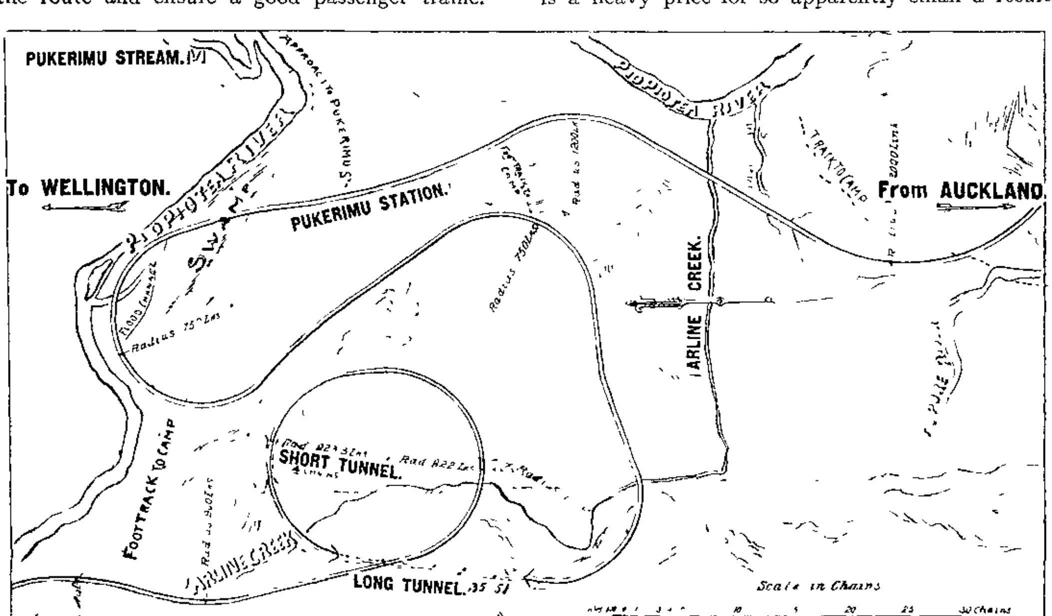
Overland Fares.

A welcome feature in connection with the opening of the line will be a reduction in the cost of the through journey, compared with present conditions. Calculating on the basis now in force, which is not likely to be increased, the ordinary fares should work out somewhat as follows —

Wellington to Auckland —

	1st. Class.	2nd. Class.
Ordinary Single ..	40/- ..	.. 21/-
Ordinary Return	80/- ..	. 42/-
Excursion Return	71/- ..	.. 35/6

These fares should certainly serve to popularise the route and ensure a good passenger traffic.



NORTH ISLAND MAIN TRUNK RAILWAY: DIAGRAM SHOWING THE "SPIRAL" AT RAURIMU (PUKERIMU).

THE NEW CUNARDERS.

A DESCRIPTION OF THE NEW 25-KNOT TURBINE PROPELLED EXPRESS CUNARD LINERS—THE LARGEST VESSELS IN THE WORLD—TRIUMPHS OF ENGINEERING

In last issue we described the turbines of these magnificent vessels, and, before proceeding to a detailed description of the steamers themselves, it will be found interesting to make a comparison of the largest vessels since Brunel's leviathan, the *Great Eastern*.

Vessel	Length over all	Beam	Depth.	Displacement in Tons.	Horse power.	Speed knots per hour.
	ft.	ft.	ft.			
Great Eastern	692	83	57½	27,000	8,000	14.25
Lucania	625	65	42	19,000	30,000	22.01
Oceanic	704	68	49	28,500	28,000	19.50
Deutschland	686	67	42	23,000	37,500	23.5
Baltic	725	75	49	40,000	18,000	16.25
Kaiser Wilhelm II.	706	72	52½	30,000	40,000	23 5
New Cunarders	800	88	60	43,000	80,000	25

The new vessels, it will be seen, are the first to exceed in beam that of the *Great Eastern*, which has always been regarded as the standard of measurement in this particular. Recently the *Baltic* was the longest vessel afloat, yet it will be exceeded by no less than 60 ft.; the *Kaiser Wilhelm II* has the most powerful machine propulsion, yet it will be doubled. The foregoing table also affords striking testimony in regard to the price of speed, for whereas the *Great Eastern* with its 27,000 tons displacement and machinery developing 8000 horse power attained 14.25 knots per hour, in order to obtain less than twice the speed, ten times the horse power is employed, while to gain one and a half knots above the speed of the *Kaiser Wilhelm II*, twice the horse power of the latter vessel is required It will be admitted that this is a heavy price for so apparently small a result.

With the ordinary types of propelling machinery such tremendous horse power would be absolutely out of the question if the vessel were to pay its own way, owing to the enormous space required to contain it, while the coal bill and other incidental expenses would be so appalling that even the wealthiest steamship company would shrink from embarking upon such an enterprise. But the success of the Hon. C A. Parsons' invention has facilitated the difficulties of both the constructor and the owners, since the machinery is exceptionally economical both as regards space occupied, weight and fuel consumption, at a given speed. High horse power, moreover, was imperative since the contract with the Government stipulated that the minimum average sea speed should be 24½ knots per hour, and to maintain this average under all conditions of weather necessitated an ample reserve of power. And as experience of the turbine so far, both from naval and mercantile vessels, shows that when a given speed is stipulated the ultimate results are in excess of the contract, it is by no means unlikely that when the mammoth Cunarders settle down to their work the speed will be nearer 26 knots than 25.

The vessels have been christened the *Mauritania* and *Lusitania* respectively, the former being constructed at the well-known Clydebank works of Messrs. John Brown and Company, Limited, who have been responsible for many of the finest vessels in the Cunard fleet, while the latter is being built upon the Tyne at the Wallsend shipyards of Messrs. Swan, Hunter, and Wigham Richardson, Limited, one of the most prominent shipbuilding firms on the east coast. The designs represent the result of many months' careful consideration and experiments with models in the testing tank.

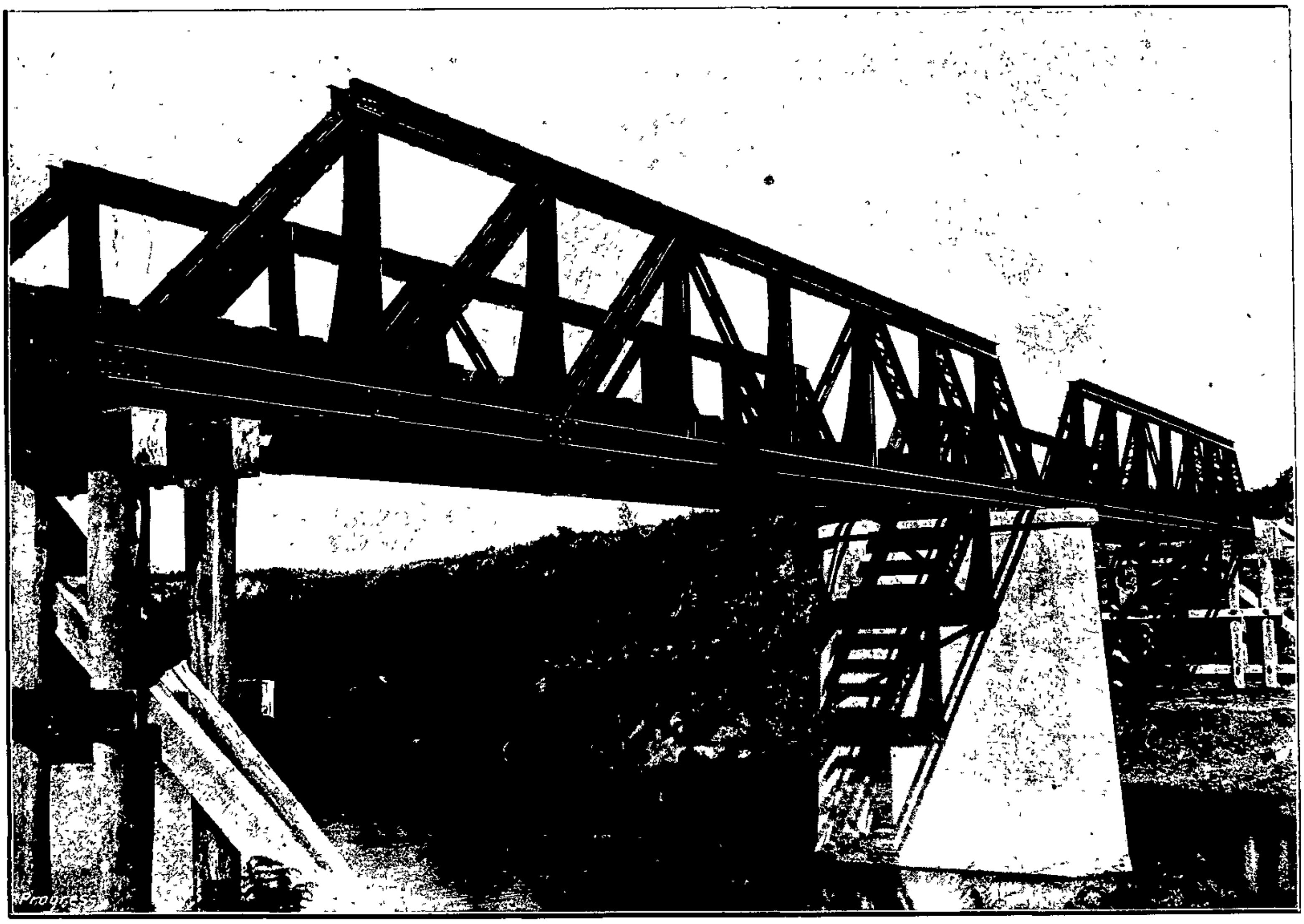
For example, originally the dimensions were somewhat more moderate, the length being about 700 ft Elaborate tests were carried out, and then the length was decided at 720 ft., which in turn was advanced to 800. Again, at the time the contract was signed with the Government, the turbine, though successful in smaller commercial vessels, had not been subjected to the severe tests incidental to an Atlantic liner. The builders and engineers were thus embarking upon unbroken ground, and under the circumstances it was a plucky step to forego the well-tried and reliable reciprocating type of engines for the comparatively unknown turbine The designers attacked the question in a most determined manner and erected experimental turbine plants Indeed the building of the new vessels has bristled with engineering difficulties Records in engineering work have been ruthlessly broken, and up to the present the various firms, though called upon to do work unprecedented in nature or proportions, have fulfilled their tasks with complete success. Owing to the enormous lengths of the vessels the building slips and facilities for handling the material have had to be completely overhauled and, in many instances special plants installed By a curious circumstance two different types of erecting berths have been tested The one at Wallsend is enclosed, that is to say, the slip is contained in a huge building, while that on the Clyde is quite open In the former case the roofing provides exceptional facilities for carrying overhead transporting plant in the form of electric cranes, which by travelling the full length of the slip can convey the material and the huge erecting tools from one point to another in the least possible time. The berth at this shipyard is one of the best equipped in the country. The slip is 740 ft. long, capable of extension to 900 ft., has a clear inside width of 100 ft., and is 144 ft. from the ground to the roof, so that the overhead equipment has ample clearing space over even the highest portions of the vessel. Five overhead electric cranes are employed, and work can thus be carried out at several points of the vessel simultaneously. The hydraulic riveters, which have a gap of 6 ft., are conveyed by light swinging cranes carried on the side columns supporting the overhead structure They are portable, and are moved about easily from one point to another by the overhead cranes

In the case of the vessel being built on the Clyde owing to its great height a special type of plant has had to be designed for raising the material from the ground to the upper works of the vessel The installation selected comprises a special derrick consisting of a single mast, the principal feature of which is its unusual height—about 120 ft. The jib is set at an angle of 45 degrees. At the outer end is fixed the usual pulley for carrying the lifting-rope. The derrick is electrically operated throughout. There is a cabin or crow's-nest 95 ft. above the ground at the point where the jib springs from the mast, accommodating the motor for actuating the slewing motion. The electric winch for hoisting the load is placed on the ground level. It is of 30 horse power, and is arranged for two lifting speeds of 90 ft. and 210 ft. per minute respectively. With this derrick a load of five tons can be lifted to a height of 120 ft. above the ground level. The material is brought alongside the berth on the railroad track, then lifted by means of the derrick, the load swung round and lowered to the desired point. With this plant the transportation of the constructional material can be carried out with facility and great celerity.

We have said the vessels mark a great advance in steamship design. The most important structural element is the double bottom, which is 5 ft. 6 in in depth between the outer and inner shells. There is a dead rise of 18 in. from the keel to the bilge, and the frames decrease from 5 ft. 6 in. at the keel to about 4 ft in depth where the curve of the bilge straightens into the sides. The hull is sheathed with plating 1½ in. thick, which on the lap gives a total thickness of 3 in on either side. The side plating is carried up to one deck higher than has hitherto been common, thereby giving about 10 ft more to the freeboard and permitting of three rows of port-holes Forward of the foremost smoke-stack the plating is carried up still another deck, the result being a flush forecastle deck from some distance aft of the bridge right up to the bow, so that when the vessel is ploughing through a heavy sea, there is no well forward which can be flooded, as is the case in most vessels.

The stern frames and brackets, which have been constructed by the Darlington Forge Company of Darlington, are the largest in the annals of shipbuilding For the stern frame alone, which is in one piece, 69 tons of molten metal were required, and the weight of this section in its finished state is 47 tons. The brackets were cast singly Each of the after brackets weighs 22½ tons, while the forward brackets weigh 24 tons apiece The height of the frame, which is 55 ft, was strikingly shown by comparison with the 6 ft. 9 in. driving-wheel of a locomotive which was placed beside it. The rudder weighs 70 tons complete and has a stock 26 in. in diameter. The total weight of the stern frame, brackets, and rudder is approximately 220 tons In transporting the frame from the foundry at Darlington to the water's edge at Middlesbrough the frame projected over the side of the special wagon to such an extent that three sets of rails were required The frame was bedded firmly upon the trolley with huge ingots of steel at the ends to keep it steady, while to prevent accident the car was sandwiched between two trolleys each carrying a powerful crane. Sunday was chosen for the journey, and the speed of the train was limited to three miles per hour. Portions of stations and signal-posts had to be temporarily removed to permit the load to pass, and to cover the short distance between Darlington and Middlesbrough six hours were required. On arrival at the quay the frame was lowered into the hold of a vessel, and thus it was carried round to Glasgow to be built into the hull.

The vessels are provided with eight decks. The first or orlop deck is just above the boiler rooms. Then comes the lower deck, which will be devoted chiefly to third-class passengers, whose comfort will be appreciably increased by the provision of separate state-rooms. The level of this deck will be the water-line of the boat, and it will be provided with port-holes the passengers at the same time being accommodated with side state-rooms. Above is the main deck occupied by first and second-class state-rooms, then follows the upper deck, on which are the dining-saloons—the first-class one a massive and gorgeous apartment, extending the full width of the ship, some 80 ft., about 125 ft. long and capable of seating 500 persons comfortably. This saloon is lighted from a huge dome extending up through the two decks above and crowned with a roof of cathedral glass The four remaining decks are the shelter, bridge, promenade, and boat decks respectively, the last being some 90 ft. above the keel, which is about the height of an ordinary eight-storied house. Each of these upper decks is to be replete with magnificently equipped state-rooms while the great breadth of the vessel ensures ample space for broad uninterrupted promenades. The ship will have accommodation for 500 first-class, 500 second-class, and some 1200 third-class passengers. The crew will number 800 so that with a full complement the vessel will become a floating hotel carrying 3000 souls. Accustomed though trans-Atlantic travellers are to luxury and convenience on the modern liner, the accommodation on the existing liners will pale before that provided on the Cunarders. By the system of lifts, passengers will be able to reach any deck quickly and easily.



NORTH ISLAND MAIN TRUNK RAILWAY

ONGARUE [RIVER BRIDGE (NO. 2 CROSSING). THREE 20 FT. AND TWO 80 FT. SPANS. HEIGHT FROM RIVER BED TO RAIL LEVEL, 37 FT.

Record Anchoring Cables.

Another interesting record that has been created has to do with the chain cables, which have been made for anchoring purposes by Messrs. Brown, Lenox, and Co., of Pontypridd, South Wales. They are the largest that have ever been made for ship's use, the previous record having been those made by this firm for the *Great Eastern*, in 1855. The cables for Brunel's mammoth vessel were made of iron 2⅞ in. in diameter, which at that time was an unheard-of size. In the case of the chains for the Cunarders, however, the diameter of the iron used in the link exceeds that used for the *Great Eastern* by ¾ in., being 3⅝ in. in thickness at the smallest part. Each link is about 22¼ in. long, and together with the crude cast-steel stud, weighs about 160 lbs. The total length of the main cable is about 2000 ft. and the total weight about 100 tons. The joining and anchor shackles represent a weight of 500 lbs. and 840 lbs respectively. The chain is forged throughout. This particular cable was made for Messrs. Swan, Hunter, and Wigham Richardson, and this firm gave instructions for three of the links used in the cable to be tested at Lloyd's Testing House. Three links were accordingly severed and sent to the proving-house at Netherton, Staffordshire, the testing machine installed there being one of the most powerful in the country and licensed by the Board of Trade Department for the testing of chains and anchors of the largest dimensons. The test was carried out before Mr Peskett, the naval architect to the Cunard Company. The sample was at first submitted to the proof strain established by the British Admiralty, which is of 189.8 tons. The result of the trial was nothing beyond a total elongation of the three links by almost ¼ in. The statutory breaking strain of 265.7 tons was next applied, but the chain successfully withstood the test, a further elongation of about ⅝ in. for the three links resulting. An attempt was then made to test the links to destruction, and notwithstanding the fact that the maximum capacity of the testing machine was applied, representing 350 tons—the actual tension applied was over 370 tons—the machine failed to break the links. They were then carefully examined but no sign of fracture or defect could be discovered although the strain applied was about 90 per cent. in excess of the breaking strain imposed bv the British Admiralty and is the greatest tensile strain that has ever been applied to a chain cable, the only result was an elongation of the three links by 6 in. above the length before submission to the tests.

Such is the latest word in British steamship construction. The eyes of the world will be upon the *Lusitania*, the first of the sisters launched, when she sets out on her first Atlantic voyage

GAS ENGINES FOR SHIP PROPULSION.

MR. J. E. Thornycroft recently read, before the Institution of Naval Architects, a paper entitled "Gas Engines for Ship Propulsion." He said that the majority of small gas engines worked on the "Otto" cycle, which had the advantage of requiring no special gas or air pumps, and that this was the only type of engine that had been as yet tried for marine work. The gas producer, which was generally used for moderate powers worked on what was known as the "suction" principle—*i.e.*, instead of the gas being generated by the combustion of fuel, by air and steam being forced through it under pressure, it was generated by the air being drawn through the producer, the whole of the apparatus working somewhat below atmospheric pressure The advantage of this system was that neither a steam boiler working under pressure, nor a gas container for holding the gas was required ; and the further very important advantage for marine work is that there was no danger from a leakage of gas from the producer—if leakage occurred, it was from the atmosphere into the producer itself.

The producers for moderate powers were usually worked with anthracite coal, and where vessels were to be used on fixed routes, and the same class of fuel could be obtained, anthracite or coke would be found to be the most suitable for moderate powers, it being too difficult to make a satisfactory small plant to work with bituminous coal

After the gas leaves the producer, it must first be cooled, and, as there would always be a certain amount of impurity, even when anthracite was used, it had to be thoroughly cleaned. This was usually done by passing the gas through a series of vessels, where it was "scrubbed" by its passage through layers of coke over which water was running. The large space occupied by the ordinary coke scrubbers prohibited their use for marine work, and to meet this difficulty Herr Capitaine had arranged his plant to clean the gas after it had been cooled, by the introduction of a very fine spray of water, which mixed with the small particles of dust and other impurities in the gas, and formed a sort of fog ; the gas in this stage was passed into a centrifugal apparatus, having a peripheral speed of 160ft. a second, which threw out the moisture and impurities, leaving a clean dry gas to be drawn out by the engine. The composition of this gas might be taken to be as follows. Carbon dioxide, 6 per cent. ; carbon monoxide, 25 per cent.,; CH_4 methane, 1 per cent., hydrogen, 14 per cent. ; nitrogen, 54 per cent

It would be realised that the size of the producer for a given power was comparatively small when it was known that the area of the firegrate necessary was only 0 05 square foot per h p, whereas the average amount for an ordinary natural-draught steam boiler, burning 15lb coal per square foot grate area, would be 0 2 square foot per h p.

In Messrs. Dowson's arrangement of suction producer designed for anthracite coal, which the majority of smaller suction producers resembled, a fire-brick lined steel casing was fitted with fire-bars and a closed ashpit, and in the upper part of the casing a conical hopper was placed, with the usual valves for opening and closing to admit fresh charges of fuel The gases came off the fuel at the base of the conical hopper, and passed through a stream generating pipe or vessel, and then away to the cooler and scrubber. The producer was fitted with an outer casing, in which the air was heated and mixed with the steam on its way to the ashpit. In the "Duff-Whitfield" producer, arranged for working with bituminous fuel, the tarry products which were evaporated from the new coal were caused to pass through the hottest part of the fire, and so were consumed before the gas passed away to the cooler. The "Boutillier" producer was arranged for working with bituminous fuel, in which the fuel was supplied by an under-type stoker to the hottest part of the fire, so that the tar was at once decomposed, and could not pass away with the gas. The principle upon which this producer worked seemed to be one of the best adapted for marine work. The "Jan" producer consisted of a series of producers which were arranged to work in sequence, the gases of one which had been newly charged passing through another which had been at work some time so that there were always some of the producers supplying tarry gas, the tar being consumed by one of the other producers in the later stages of the series. The heat efficiency, as given by Messrs. Dowson for their suction plant, was 90 per cent As the result of a great many tests, the late Mr. Bryan Donkin gave the average heat efficiency of steam boilers at 66 7 per cent.

In the "Capitaine' producer the gas was of a comparatively slow-burning nature, and might be described as poor gas, to distinguish it from town gas, and some of the other gases generated by pressure producers which had a larger proportion of hydrogen, such as water gas There was an advantage in this slow-burning gas, as it enabled the engine to work with a high compression, thus giving a larger range of expansion, and consequently, a high economy

The one great disadvantage of the internal combustion engine was the necessity of setting the engine in motion before it would run automatically. For powers less than 200 h.p it was preferable to employ a reversing gear, keeping the engine always running in the same direction, or to use a reversing propeller. Compressed air was being employed for starting up large engines, and when once the engine was fitted in this way the valve gear for running the engine in either direction did not amount to very much. For moderate powers, a single-acting engine with a trunk piston was found most convenient, as the piston did not require to be water-cooled, until one as much as about 2ft. in diameter was employed. A single cylinder of 20in. diameter and 2ft. stroke, running at 120 revolutions per minute, would give about 100 h p., taking the average working pressure at about 80, which was less than the figure often obtained For large powers fitted to vessels where steam capstans and steering gear were fitted, it was thought that the best plan would be to employ an auxiliary boiler, which could be heated by the gas when the whole plant was at work, and could be used independently to drive the various auxiliary and starting engines when the producer was not alight.

Professor Capper had stated that the theoretical maximum thermal efficiency of the steam engine was only 30 per cent., and only from 5 per cent to 20 per cent. of the heat generated was ever turned into useful work. In the case of the gas engine, the theoretical efficiency was about 80 per cent., and in practice 25 per cent. to 30 per cent. of heat developed in the cylinder was turned into useful work. For vessels fitted with small-powered compound-condensing engines of less than 100 h.p. the fuel consumption would be from 2lb to 3lb. per 1 h.p. For gas plants of this power the fuel consumption would be less than 1lb per 1 h.p ; but for larger powers of not less than 500 h.p. the economy would not be quite so marked.

The official report of the "reliability" trials in the Solent last summer showed that the Emil Capitaine of 16 tons displacement, ran at an average speed of ten miles per hour for ten hours, on a consumption of 412lbs. of anthracite coal. This consumption also included the fuel which was consumed by the producer during the previous 12 hours, when it was not in active operation, but simply smouldering and keeping itself alight, the producer having been filled the night before the trial. The amount of fuel consumed in this way was very little, but should be taken into account when making a consumption trial. For the purpose of comparison, tests were made on November 8, 1904, with the Gastug No. 1 and Elfriede, a steam tug of very nearly the same dimensions and power. The Gastug No. 1 was 44ft. 3in. long by 10ft. 6in. beam, and was fitted with one of the four-cylinder 70 h.p. suction gas plants. The Elfriede was 47ft. long by 12ft. beam, and was fitted with a triple-expansion steam engine developing 75 h p

At the towing meter the Gastug No. 1 attained a maximum pull of 2,140lbs., and the Elfriede a maximum of 2,020lb. A run from Hamburg to Kiel and back was made by these two boats, during very stormy weather, at a maintained speed of 8½ knots. The consumption of fuel was measured for a period of ten hours, and was as follows —For the Gastug No. 1, 530lbs. German anthracite ; for the Elfriede, 1,820lbs. steam coal. This shows an economy of 1 to 3.44 in favour of the gas plant.

To demonstrate the possibility of using gas plants for large powers, Messrs. William Beardmore and Co., who are joint owners with the author's firm of the British Capitaine patents, are constructing sets of engines of 500 and 1,000 h.p, to run at a speed of about 130 revolutions per minute.

There were many instances of gas engines running for stationary purposes for long periods on town gas without a stop of any sort ; and it appeared that there were several engines of 250 to 400 h p per cylinder running regularly every week from Monday morning to Saturday afternoon without a stop. The Premier Gas Engine Company gave an instance of an engine which had made a run of 51 days without a stop, the previous run being 49 days without a stop of any kind.

The King and an Inventor.

DISCOVERER OF MAUVE RECEIVES A KNIGHTHOOD.

The King has been graciously pleased to confer the honour of knighthood upon Mr. Edwin Thomas Ann, J P, Mayor of Derby, and Dr. William Henry Perkin, F R S.

Dr. Perkin was the discoverer of the dye-stuff "mauve," by which the foundation was laid of the coal-tar colour industry, and an official communication from the Prime Minister's residence states that at the international celebration of the coal-tar colour jubilee on July 26 Dr. Perkin received presentations and addresses from English and foreign societies

The story of Dr. Perkin's discovery is an interesting one. While acting as assistant in the research laboratory of the Royal College of Chemistry under Professor Hofmann in 1856, Dr Perkin attempted in his own laboratory to effect the synthesis of quinine with a view to preparing it artificially. In this he failed, but to study the products actually formed he selected a substance, aniline, which could be prepared from benzine, a constituent of coal-tar.

The aniline was treated with an oxidising agent, when a black precipitate was obtained which was found to contain a brilliant colouring matter since known as aniline purple, or mauve. Further investigation showed that the colouring matter had the properties of a dye. Dr. Perkin took out a patent, and in 1857, with his father and brother, set up works at Greenford Green, near Harrow In 1874 Dr. Perkin retired from business and devoted himself to scientific investigations.

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Architecture and Building.

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PROVINCIAL NOTES.

A seven-roomed residence is now being erected for Mr. McKay, at Northland, Wellington. Architect, James Bennie; contractor, A. C. Pearce.

* * * * * *

A twelve-roomed bungalow residence has been designed for Mr. W. J. Monaghan, J.P., at Karori, Wellington. The house will cover an area of 4,300 sq. ft., and the site chosen is a prominent one, 15 chains back from the main road and having an uninterrupted view of the surrounding country. Architect, C. F. B. Livesay; contractor, J. H. Fairhurst.

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A two-story residence is nearly completed for Mr. W. D. Duguid, Kelburne, Wellington. Architect Jas. Bennie; contractors, Cumberland Bros.

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A contract has just been let for a modern two-story residence for Mr. Robt. Pearson, Wellington. The residence will be up-to-date in every particular, and will make a pleasing addition to Wellington terrace Architect, James Bennie; contractor, Mr. James.

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"Matitiki," Mr. Robt. Malcolm's house at Opawa, Christchurch, has lately been completed. The building, views of which we give in this issue, has a well established garden for it occupies the site of the old house, and with its terraced lawns sloping down to the Heathcote river forms a beautiful setting for one of the most charming bungalow houses around Christchurch. It is roofed with small green Westmoreland slates, the gables being rough cast. All windows are casement hung and glazed with leaded squares. The accommodation comprises large living-hall, dining and drawing rooms, library, five bed rooms, toilet room, two bath rooms, kitchen, and necessary offices. Advantage has been taken of the space in roof to form a large and well-equipped billiard room. The living-hall has a panelled wainscot level with top of doors, and the beams and floor joists are exposed to view and are of figured rimu. The dining-room has an ingle-nook lined with small bricks, with open fireplace. This room has a wide plain picture rail, the wall space above same being strapped and giving a quaint half-timbered effect in walnut finish, while the floors are of polished jarrah. The drawing-room also contains an ingle-nook with built-in benches and handsome tiled interior grate with copper canopy. This room has a barrelled ceiling, and all the woodwork of the room is finished in China gloss. A special feature throughout has been made of the mantel-pieces which are of quaint and original design. Architects, Clarkson & Ballantyne.

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A very fine modern villa residence has just been completed for Mr. H. D. Ackland, Ashburton, into which some features quite new to the district have been introduced. The building is of brick with hollow walls, and is roofed with Marseilles tiles. The structure faces the north-west so as to throw as much sun as possible into the principal rooms. The wall spaces between the top of the bay windows and verandahs to the underside of oriel windows, and the gables above them are covered with octagonal wood shingles stained dark brown, which affords a very pleasing contrast to the red brickwork. The splayed arches over all openings also are a very fine feature, the whole of the bricks for them, as well as the moulded bricks for the sills and chimney tops, being specially made for the purpose by Messrs. Crum & Dyhrberg, Ashburton. Inside, also, there are open fireplaces in almost every room built of moulded bricks, and in the principal rooms the fireplace is set in an ingle-nook separated by wide archways from the main floor. These ingle-nooks are lined with panelled wainscotting to a height of 5ft. 6in., and two of them have little circular windows to afford opportunity of looking out without moving from the ingle-side. The hall and main staircase are panelled in dark wood, also the ceiling, which is domed. The staircase window is a very large one of stained glass and leaded lights. All the doors opening to the main hall are solid framed American oak. There are five panelled doors fitted with heavy antique bronze furniture, as are also all the windows and gas fittings to correspond.

The house contains seventeen rooms, and is replete with every modern convenience, including two bath rooms, etc., and a very complete hot-and-cold water service, the water being pumped by a small gas engine. Architect, H. E. Vincent, Ashburton

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"MATITIKI," MR. ROBT. MALCOLM'S RESIDENCE, OPAWA.
[Architects: Clarkson & Ballantyne.

Seven one-story brick shops are in course of erection for Mr. E. H. Tate, Colombo street, Christchurch, north of Dundas street. Contractors, Holbrook and Sons. Messrs. Holbrook & Sons have also just completed three one-story brick shops in Colombo street, south of Dundas street, Christchurch.

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Messrs. Barr & Shaw's tender of £300 has been accepted for the erection of a seaside cottage at Castlecliff. Architect, John S. Swan.

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Messrs. Crum Bros. & Dyhrberg have supplied the special pressed bricks for the High School at Ashburton Architects, England Bros.

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A two-story brick building is in course of erection for Mr. Richie, in Dundas street, Christchurch. Contractors, Ashton & White.

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A residence in brick and stone is in course of erection in Manchester street, Christchurch, for Mr. Zebulun Leigh, of that city. The building will be up-to-date in every particular—jarrah being used for all foundations, timber, and joists. A large dining-room with semi-octagonal bay windows faces west, and the drawing-room has triplet windows. The commodious hall is lighted by leaded glass; white tiles have been used extensively on the verandah floors, etc. Architect, W. V. Wilson.

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A one-story brick building roofed with wood, iron and glass, and 61 clear feet span, is in course of erection for Messrs. Leary & Macfarlane, fruit and produce salesmen, in Lichfield street, Christchurch. Architect, F. J. Barlow; contractor, F. E. Shaw.

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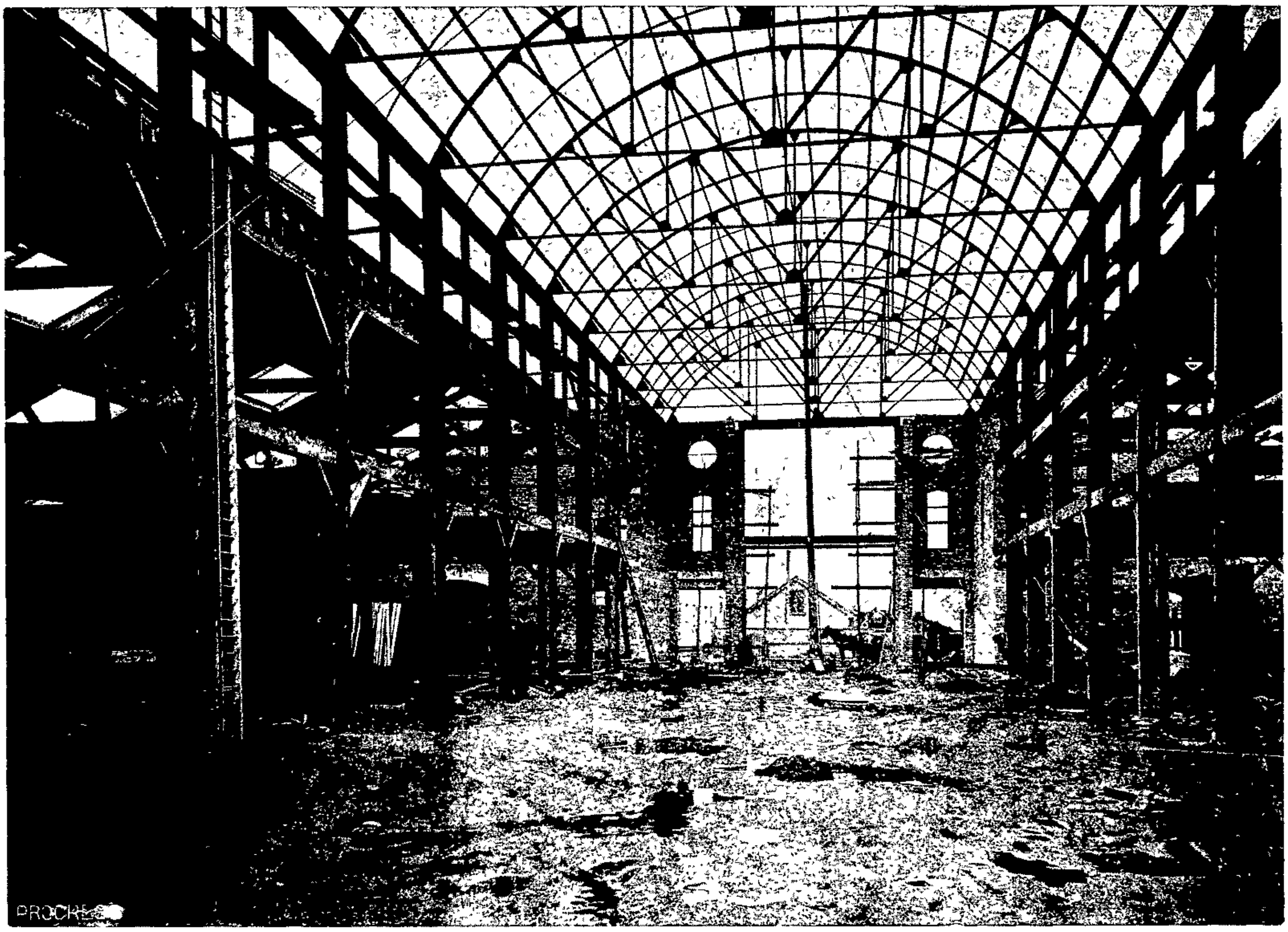
The plans have been prepared for a store and offices to be built in brick at Dannevirke for Messrs. Dalgety & Co., Ltd. Architect, C. Tilleard Natusch.

"MATITIKI". THE DRAWING-ROOM.

"MATITIKI": THE DINING-ROOM.



INTERIOR OF THE FARMERS' SALEYARDS BUILDING, CHRISTCHURCH.

The contract for the erection of a butcher's shop at Karori for Mr. W. G Garrett has been signed The contract price is about £500. Architect, John S. Swan, contractor, J A Fairhurst

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The alterations to Messrs D. W. Virtue's warehouse in Victoria street, Wellington, are being carried out from the plans, and under the supervision, of Mr. John S. Swan. Contractors, Menelaus & Rigg.

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A two-story brick building, to be occupied by the Christchurch Cycling & Motor Club, is being erected in Gloucester street, Christchurch Architects, Collins & Harman, contractors, Riley & Farquhar

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H. E White building and engineering contractor, Christchurch, has just completed the following for which he was the designer and builder A two-story brick and cement building of four shops, boarding-house, dining-rooms, etc, in Colombo street, corner of Dundas street, Christchurch, for Mr. Bullock, the contract price for the whole being £2,000

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A contract has been let for the ventilation of the chapel at Nelson Convent to H W Davies & Co Smith & Smith, of Wellington, are to supply the leadlight windows for the same. Architect, John S Swan

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Messrs. Whitcombe & Tomb's new box factory and printing works, illustrated herewith, and situated in Colombo street, Christchurch, have just been completed. The contract price for this building is £10,000 Contractor. H E White

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Alterations and renovations to the Masonic hall, Harrison place, Wanganui, are in progress When completed this hall, so we are informed, will be second to none in New Zealand Architect, A. Atkins, F.R I B A, contractor, N. Meuli.

The new Café Continental, Sumner, is nearing completion. This building is of brick and concrete and is of four stories with flat roof The contract price is about £7,000 Contractor, H. E. White

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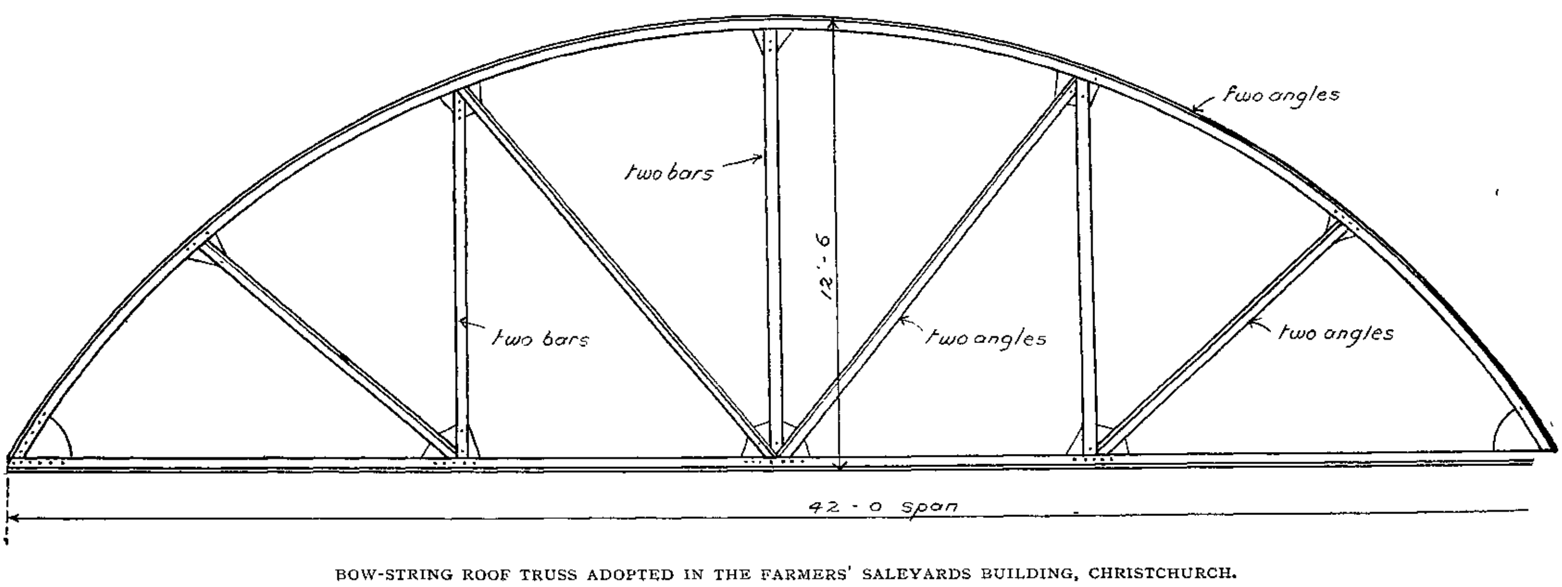
The new Southbridge hotel, at Southbridge, is in course of erection This hotel is a wooden building of two stories and the contract price is estimated to be about £1,000. Contractor, H. E. White.

* * * * * *

A contract has been let for a large store for Mr. J. Greaves, in Maraia place, Wanganui This building is to take the place of one of the old structures erected in 1848, and the contract price for the same is £1,048 Architect, T. Battle

* * * * * *

The new Commercial Travellers' Club house is being erected at the corner of Ridgway and St. Hill streets, Wanganui, and when finished it will prove a credit to the town. Architect, A. Atkins, F.R.I.B.A · contractors, Russell & Bignell.



BOW-STRING ROOF TRUSS ADOPTED IN THE FARMERS' SALEYARDS BUILDING, CHRISTCHURCH.

A new build ng has just been completed in St. Hill street, Wanganui, for Messrs. Horsley & Co., grain, wood and coal merchants.

* * * * * *

A new building for the Wanganui Meat Freezing Co., to be used as a butcher's shop, is nearing completion in Ridgway street, also a store adjoining these premises and belonging to Mr. C. Burnett, solicitor, Wanganui When finished these buildings will be a welcome addition to Ridgway street, taking the place of two very old buildings recently demolished. Contractor, G. Benge.

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Mr. W. S. Marshall's fine residence near Rata, in the Rangitikei district, built in the modernised Elizabethan style is nearly ready for occupation. It contains a hall 35 x 19 ft. with a staircase 5 ft. wide, large drawing-rooms, school room, smoking-room, billard room, ten bed rooms, two bath rooms and all the numerous domestic apartments necessary for a large country house Architect, C. Tilleard Natusch ; contractor, James Mc Chesney.

* * * * * *

A twelve-roomed residence is about to be erected for Mr. Tudor Baker at Ashley Clinton. Architect, C. Tilleard Natusch ; contractors, Coles Bros., Ongaonga. The architect has also plans in hand for a fourteen-roomed residence for Mr. O. H. Porritt, Palmerston North

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A two-story brick building to receive visitors at the Christchurch Exhibition is in course of erection. This building is to be completed by the 1st November, a period of eight weeks from commencement of operations. This will be an exceptionally speedy piece of work in the building line. Contractor, H. E. White.

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Two-story brick and cement additions to the British hotel, Lyttelton, are in course of erection The contract price is approximately £1,500

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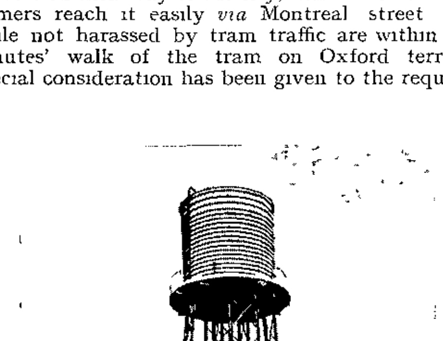
The following notes concerning the new premises for Messrs. W. H. Price & Sons, brass-founders Manchester street, Christchurch, have reached us from T. W. Bowring, the contractor :—

Two showrooms, each 38′ 10″ x 22′ 8″ = 1760-5-4 sq. ft. ; Machine shop, 63′ x 28′ 6″ = 1795-6-0 sq. ft. ; Moulding-shop, 39′ 3″ x 28′ 6″ = 555-4-0 sq. ft. ; Workshop, 29′ x 17′ 7″ = 509-11-0 sq. ft. ; Store, 47′ x 38′ = 1786-0-0 sq ft. ; Corn store, 7′ 6″ x 6′ — 45-0-0 sq. ft ; total, 6452-2-4 floor space ; with height of 14′ in the clear

Floors are of kauri on V D L. joist, that of machine shop being in two thicknesses, the first being 9 x 1½ hard-heart kauri laid diagonally ½″ apart and 4 x 1 square, jointed kauri laid straight on top, thus producing a strong floor, and any of the top boards can be replaced without damage to the next board (not being T. & G) The building is of brick on a concrete foundation, with cement front to Manchester street. All lintels are of concrete with 3 railway iron in each. The walls of the machine shop, moulding-shop, workshop, and store are whitewashed, this being done by one of Messrs. Price & Sons' patent spraying pumps at less cost than can be done by hand. The building is well lighted, there being in addition to the 18 windows equalling 374 sq. ft., 31 skylights 6′ x 4′ 6″ equalling 837 sq. ft., to say nothing of the show windows which run right across the building. The draught for the furnaces is supplied by a brick stack 40 ft. high. The head ventilation is procured by ventilating ridge capping running the full length of the machine and moulding shops, and this building is two stories in front.

* * * * * *

The high-pressure water-supply tower, illustrated herewith, was erected for the City Council at Sydenham to supply the Borough of Sydenham with water for house, street, and fire use. The contract was carried out by Messrs Lucas Bros , of Kilmore street, Christchurch (who make a speciality of this class of work), under the supervision of the designer, Mr A Dudley Dobson C E City Surveyor The height from the ground to top of tank is 125 feet. Seventy-eight tons of steel have been used in the structure A ladder runs up to the platform from which a magnificent outlook over surrounding district may be obtained. The top tank has a capacity of 40,000 galls., while the concrete tank below holds 56,000 galls. There are three pumps each capable of running 250 galls per minute, and two of these pumps will deliver the same quantity under a pressure of 150 lbs to the square inch A 12-inch wrought iron pipe runs down the centre of tower and feeds the mains. There are 12 legs, each consisting of 4 steel angle irons, 5 in x 5½in riveted every 5 ft. to form a solid lump, and with every 20 ft. there are horizontal brace and adjustable tie rods on the principle of the ordinary bicycle, combining lightness with great strength.



HIGH-PRESSURE WATER-SUPPLY TOWER ERECTED BY LUCAS BROS CHRISTCHURCH, FOR THE BOROUGH OF SYDENHAM

The Farmers' Saleyards Co.'s New Building.

The Farmers' Saleyards Co., Ltd has been floated in Christchurch for the purpose of establishing a large central market which is intended to take the place of the present scattered markets It is proposed to throw the new market open to all auctioneers on somewhat similar lines to the Addington market, and to let space as required by the different salesmen for special sales, etc.

The ownership of this market is in the hands of over 1,400 interested people, both producers and consumers, and such ownership carries with it the right to a voice in fixing rates of commission and entry fees, and is likely to result in the adoption of the best methods of conducting sales of stock, produce, etc.

The site is the best in Christchurch for the purpose, and the market building which covers over half an acre, fronts St. Asaph street, with a right-of-way 20 ft. wide to Tuam street, thus being of easy access to the southern and western farmers on their way to the city, whilst the northern farmers reach it easily *via* Montreal street and while not harassed by tram traffic are within two minutes' walk of the tram on Oxford terrace. Special consideration has been given to the requirements of ladies attending the market. There is a splendid supply of water from a well 327 ft. deep flowing 14 ft. above the surface, which will provide a safeguard against fire and will prove of the greatest assistance in keeping the premises thoroughly clean and sanitary. Large stable accommodation will be provided near by for farmers and others. It is calculated the market building will be ready for occupation this month, in time for the extra business created by the Exhibition, and when in full operation should be of great benefit to the citizens, an ornament and improvement to the city, and an asset of continually increasing value and convenience to producers and shareholders.

MESSRS. WHITCOMBE AND TOMBS' NEW BOX FACTORY, CHRISTCHURCH.
[*Contractor : Henry E. White.*

The building is of brick on a concrete foundation, with damp-course between, and is roofed with iron and glass ; 300 loads of clay were used on the ground floor. It has about 15,000 ft. of floor space, and about 5,500 ft. of loft space with fanlights in the top span. There are shops and offices in front, facing St. Asaph street, with meeting hall and commercial room above. About 4,400 ft. of the floor space is concreted, and contains movable pens for pigs, etc., while the portion set apart for fruit and produce is clay-dressed with boiling tar and grit.

The supporting posts are of jarrah, and the rest of the timber is heart of red pine. The jarrah posts consist of one piece 12 x 6 one way, with two pieces each 6 x 6 bolted on to each side giving great strength to the uprights. The posts rest on concrete blocks with a damp-course of asphalt between.

Other features of the building are the roof drains, which are carried across the beams and along the rafters above the lofts descending to the ground drains alongside the side walls. This idea will have the effect of keeping the intermediate space free from moisture and dampness in wet weather. A feature of the seating accommodation, which will slope up 12 or 14 ft., is that persons can leave the premises while horse sales are in progress, without having to go through the saleyards consequently, they will avoid the danger of being run over The saleyards, by the way, will be fully equipped with stalls, open yards, and loose boxes, and will be the most up-to-date market in New Zealand The structure will also contain commodious lavatories for both sexes. Provision has been made for possible future requirements in the way of extending the accommodation of the markets

The directors purpose dividing the revenue—one portion to be applied to payment of dividends on capital, and the other portion to rebates on commissions The promoter and chairman of directors is Mr. J. Brake , architects England Bros , contractors J & R Campbell , contractors for the brick work, Robinson & Sons , signwriters, Martin & Price.

The illustration on page 26 of the bow-string roof truss was supplied by Messrs. Andersons, Ltd , the makers It has a span of 42 ft., is 12 ft. 6 in high in the centre, and weighs about 25 cwt.

Mr. Brake was in Wellington on the 18th ulto for the purpose of interviewing the Premier, who promised to perform the opening ceremony during the first week in November.

Earthquake-proof Buildings.

That is what American architects and engineers are in search of just now Their technical press has been full of discussions lately on the best type of building to employ in the rebuilding of San Francisco, in order that there may be no possibility of a repetition of such a terrible calamity as lately befell the city. No one, of course, can guard against earthquake, but the Americans think it is quite possible to build a city which shall be, at any rate to a very great extent, earthquake proof. The *Scientific American*, for instance, declares that it will be within the power of the engineer and architect to build a second San Francisco, which, if called upon to do so, could pass through such another seismic disturbance without being completely overturned or utterly ravaged by fire.

The most hopeful promise for the future (the writer goes on to say) is found in the admirable manner in which the steel skeleton of the modern steel and masonry building has passed through the terrific shock and wrenching of the earthquake. Although this result has been a matter of surprise to the average layman, it is not so to the engineer. Modern structural steel is possessed of such elasticity and toughness that it will submit to the most severe and complicated stresses before it can be brought to the point of rupture

According to information at present available, it would seem that in buildings of this type at San Francisco the wreckage directly due to the earthquake was confined to the loosening, and in some cases throwing down, of the brick or stone facades with which the buildings were covered in. Probably, also, it will be found that the interior partitions and floors have in many cases suffered a similar fate. The loss of the walls or panelling, was due to the fact that they were not homogeneous with the steel frame, but were merely attached to it by methods which were never intended to resist the enormous inertia stresses that were set up when the old building was rocked by the earthquake. Evidently, if this disruption of the walls is to be prevented, they must either be bonded in more completely with the steel frame, or, better yet, they must be made homogeneous with the frame. Now, the last-named conditions are ideally present in the new form of concrete steel or armoured concrete construction, which has made such rapid strides of late years in structures of the larger and more important class. As the results of most elaborate engineering tests, concrete steel has been proved to possess in the highest degrees those qualities of elasticity, toughness, and homogeneous strength which, when combined in a monolithic mass present a structure as nearly earthquake-proof as our present methods and materials can make it.

Building Boom in America.

There is quite a building boom in the United States, as is shown in a report issued by the Government Geological Survey In forty-seven principal cities of the country 184,416 building permits were granted in 1905. The value of the structures erected was £128,111,000. This shows a large gain of nearly forty per cent. over the record of the prevous year.

The New Tyne Bridge.

The magnificent new bridge across the Tyne between Gateshead and Newcastle, which was lately opened by the King is looked upon as one of the greatest engineering triumphs of the day and as the finest specimen of bridge building in North Britain since the Forth bridge was constructed some fifteen years ago It takes the place of a bridge erected some fifty years ago by Robert Stephenson. There is a wide difference in the methods under which the two bridges have been constructed. Especially is this true of the foundations. The old bridge was built on simply piled foundations, for in Stephenson's time the Tyne was comparatively shallow, but the new structure has had to be erected in deep water, and the modern caisson system has been employed. the concrete filled supports being firmly fixed in the river bed. Three piers have been erected in this way, and with the approach from each bank there are thus four spans composed of steel girders The total length of these girders is over 300 yards, while the height of the underside of the centre of the bridge above high-water mark is 87ft sufficient to allow the passage of the largest steamers sailing on the Tyne.

... Correspondence ...

[Readers are directed to the rules set out in "Business Notices" on page 7]

Our Railways.

To the Editor

Sir,—I have read with interest your article in this month's paper on the Main Trunk Railway, and am waiting anxiously for the following number to complete it

In your maps etc, would you kindly show the Stratford-Toko branch and its proposed extension route in relation to the Main Trunk?

I would also be pleased to see you take up the Midland and Otago Central railways, as it is only by articles like these that we can understand what is going on around us —I am, etc,

Ashburton, 10/10/06. HERBERT GRESHAM

[The Stratford-Toko branch will be discussed, together with the Midland and Otago Central railways, in a future issue —Ed]

Union Co.'s Fleet.

To the Editor.

Sir —In your very interesting account of the Union Steam Ship Company's fleet, its origin, etc., I notice you do not mention the S.S. Alhambra (McMeckan, Blackwood, I think), a very interesting boat which was at one time in the P. & O. service, and one of the last ocean-going steamers with Mortice spur gear in connection with trunk engines which drove the propeller. An account of the above boat and what became of it will be of great interest. Apologising for troubling you —I am, etc,

Wellington, 1/10/06. JOHN WELSBY.

[Mr. Welsby's information is welcome, but no doubt he will readily understand that it is impossible, within the confines of a newspaper article such as that to which he alludes to treat of every ship or every steamer that has played a part in the history of our mercantile marine —Ed.]

The Whaler Chance.

To the Editor.

Sir,—I noticed in your very interesting article on the New Zealand Mercantile Marine that you made only a brief mention of the old whaler Chance This vessel was built at Salem, date not exactly known, but long before her New Zealand skipper was born in 1818. She was launched as a full-rigged ship, and was christened the Bengal. Her dimensions were 100 ft. long, 24 ft 6in. beam, and having a capacity of 285 tons While sailing as the Bengal she was ice-bound in the Sea of Okhotsk, along with some other whalers While the latter was crushed, she escaped and carried all her crew, some hundred men, to Honolulu. In 1874 the Chance, as she was called at that time, passed into the hands of Messrs. Nicol Bros., of the Bluff, who fitted her with all the necessary requirements for coast whaling Whales were very plentiful at this time about Foveaux strait, Solander island and the West Coast. The Otago provincial government offered a bonus for a vessel first fitted out and despatched from any port in the province The Chance received the bonus, and sailed under the command of Captain P Gilroy She was exceedingly successful, and it was at this stage that Mr F T Bullen made the acquaintance of Captain Paddy Gilroy and his wonderful barque. Mr. Bullen speaks of her as being vilely unkempt and dirty as to the hull and gear, but he could not pay too high a tribute to Paddy's wonderful seamanship, and that of his polyglot Maori, half-caste and white crew on the rugged southern coast —I am etc,

Wellington, 5/10/06 F G LAYTON.

High-speed v. Low-speed Engines.

To the Editor.

Sir,—I write to you on the above subject feeling sure that there are many people whom your paper will reach who are interested in it There is an immense amount of loss entailed by purchasers of different kinds of machinery simply because they are inadequately informed and accept without reserve every word in the catalogue of an engine which has taken their fancy. It is, of course, an understood thing that experience is the best teacher, but it charges the highest wages.

A marine engine is usually classed as high speed when its revolutions exceed 600 r.p.m., and as a low speed when below that amount, although the power of the engine has a good deal to do with this For instance, an engine developing 5 b h p. and running at, say, 550 r.p.m. would be a low-speed engine, although at the top of the low-speed rating; while an engine of 50 b.h.p. would be a decidedly high-speed engine if running at that speed, i.e. 550 r.p.m., provided it was constructed with no more than, say, four cylinders, otherwise the engine might be made up of 10 5-h p engines coupled up; in that case it would be within the low-speed limit. This is largely gauged however, by the piston speed per minute. Take an engine of 500 r p.m. and 15" stroke: this engine's piston will travel at 500 x 1.5" = 7500" per minute = 625 ft. per minute, this is high speed, especially for a heavy engine. Then again, take an engine at 500 r p.m. and stroke 7" = 3500 inches per minute = 291.8 ft. per minute, which is a fairly low speed This matter, however can be gauged at a glance at the makers catalogue by the revolutions and the weight. Now, what is the result when the different engines are put in commission? This, like the former, depends as to results, largely on conditions.

Take an engine of 20 h.p. and 800 r.p.m., and fit it into a light boat of narrow beam and little draught and the speed will be good because the small craft can move through the water and make way for the quick-revolving propeller, giving it plenty of clear unbroken water in which to do effectual work. Again, let us fit this engine in a serviceable sea-boat of say 50 ft. in length and 10 ft. beam and the result will be very poor—practically the same as putting a race-horse into a dray. The consequence is the boat cannot get away from the light quick-moving propeller and does little more than churn water, as the boat would be only moving at approximately from 6 to 7 miles per hour, and this only in calm water. Now, let us fit a 20 h.p. low-speed engine of, say, 325 r.p.m. with propeller, say, 30 in. diameter, into the light narrow-beam boat as before described, and it will sink it. This would be the table reversed—the draught-horse in the racing sulky. But let us fit this engine in the 50 ft. serviceable sea-boat 10 ft. beam, and we will find that on the first revolution of the propeller the boat will literally jump from its moorings, and instead of the miserable 6 or 7 miles an hour, we will have approximately 10 miles an hour. This speed will also be fairly well maintained in rough water, but why? Because of the slow-revolving propeller in which the amount of slip is reduced to a minimum. The propeller getting hold of the water does satisfactory service, owing to its large diameter and slow movement during which it does not get a chance to churn the water; this being a great deterrent to the successful propulsion of a boat, through the water. "But," says the novice, "we can increase the diameter of our high-speed propeller and so make it more efficient" This has been tried many times before and is a useless performance. The power of the high-speed engine is in its number of r.p.m., and if that is reduced to any appreciable extent, the power of the motor is thereby reduced and the engine is also working beyond its normal strain. In other words, if you want an efficient and serviceable propeller for a useful and serviceable boat you must buy a low-speed engine.

Then we come to durability · the unmechanical eye has only got to look to some of these light high-speed engines, to see that they are not designed for long-life service, and that their up-keep must, of necessity, be greater than an engine of the same weight moving at half the speed, the internal explosions of these engines also plays havoc with their cylinders and piston rings, to which the aforesaid applies.

In conclusion, the value of an engine is its first cost, plus its efficiency, plus its economy, plus its up-keep, plus its length of life, which is its durability The purchaser of an engine, if he wants to make a good bargain, must fully consider these items of which the second one, i e., efficiency, is an easy first —I am, etc,

San Francisco, 1/9/06 H C CHRISTIAN.

New Colonial Industry.

A new industry which promises to benefit the island greatly, has just been started in Barbadoes. A syndicate has been formed to make paper of the megass—sugar cane from which the juice has been pressed—which has hitherto been used as fuel. The syndicate is offering planters £1 per ton for the megass.

Applications for Patents.

THE following list of applications for Patents, filed in New Zealand during the month ending 15th October, has been specially prepared for PROGRESS.

21792—P. Klien Riga, Russia: Aluminates, etc., manufacture
21793—J. M. Rauhoff, Tinley Park, U.S.A. Rendering cement or concrete waterproof.
21794—Merrell (Soule Company), Syracuse, U.S.A.: Recovering solids of liquids.
21795—T. Southerland, Rangiora: Packing honey.
21796—G. Michalopoulos, Auckland: Stove for heating tailor's irons.
21797—J. R. Rusden, Perth, W.A.: Stamping hats, boats, etc.
21798—C. F. Boneskete, Shannon, U.S.A., and R. B. Rutherford, Aurelia U.S.A. Wire stretcher and splicer.
21799—G. R. Bonnard, London, Eng., G. W. Beynon Mortimer, Eng., and G C. Mackillop, Stratford-on-Avon, Eng.: Pulverising and crushing apparatus.
21800—G. Lee, Martinborough Cigarette roller.
21801—J. B. Poynter, Wellington. Fire lighter.
21802—J. Fenton, Auckland. Cock-box
21803—T. B. Sutton, Rongotea, and E. Toms, Palmerston North: Billiard-table attachment.
21804—The Hydraulic Hand Milker Company, Limited, Wellington: Milking machinery. (G. Hutchinson).
21805—G. T. Girdler, Auckland: Explosive-engine and air compressor.
21806—C. Marriott, Bairnsdale, Vic.: Puncture-stop composition for tyres.
21807—A. Just, F. Hanaman, and Vereingte Gluhlampen and Electricitats-Aktien-Gesellschaft, Budapest, Hungary, and I. Salzmann, Vienna, Austria: Incandescing filaments for electric lamps.
21808—E. W. Ackland, Dunedin: Conduits for electric cables and wires.
21809—A. Smaill, jun., Tomahawk: Teat-cup of milking machine.
21810—I. G. Macfarlane, Ngaruawahia: Spraying apparatus.
21811—R. W. E. MacIvor, London, Eng. Treatment of ores containing gold.
21812—The Imperial Fibres Syndicate, Limited, London, Eng.: Scutching, etc., hemp. (T. Burrows and W. H. Palmer).
21813—A. Beeby, Christchurch: Washing-compound.
21814—K Matthews, Wellington Ink, etc., bottle.
21815—C. G. Dickeson, Auckland Blackboard frame.
21816—G. F. Wight, Auckland. Pen or pencil attachment.
21817—C. B and G. W. Plummer, Auckland: Fibre-dressing process.
21818—W. Sim, Underwood Milking machine.
21819—J. D Smith and J. J. Scott, Dunedin: Railway-track door.
21820—A. A. Adams, T. Sears, and W. F. Fair, London, Eng. Dasher for churn
21821—A. Johnston, Wellington Desk-lid support.
21822—R. Hannah and Co., Limited, Wellington: Boot upper. (H Chambers).
21823—H. H. Reimers, Auckland Steamer for dairying purposes.
21824—T. Vivian, Auckland Egg-preserving process.
21825—S. Hanham, Auckland Self-countersinkering screw.
21826—V. S Aston, Gisborne Flax-treating solution.
21827—T. J. Wathew, Auckland Bath water-heater.
21828—Ozonair (Limited) London, Eng.: Ozonising atmospheric air (E. L Joseph)
21829—H. P. G. Steedman, London, Eng Match-making machine.
21830—H. P. G. Steedman, London, Eng Match.
21831—J. J. Macky, Auckland Connecting trolley-wheel to electric wire
21832—W. Middleton and H. N. G. Cobbe, Kalgoorlie, W.A: Grinding pan
21833—United Shoe Machinery Company, Boston, U.S.A.. Skiving-machine. (F. L. Alley and W. Pack)
21834—J. A. Linley, London Eng Food preservation (A. E. Sherman and J B Linley).
21835—United Shoe Machinery Company, Paterson, U.S.A. Machine for inserting fastenings. (T. Briggs).
21836—C. Reeve, Eketahuna Exterminating weeds by electricity.
21837—A. Lyell, Wellington Non-refillable bottle.
21838—H. M. Keesing, Auckland Securing carpets in position.
21839—C. F. Griffiths, Auckland Vibrating apparatus.
21840—W G Richardson, Auckland: Treatment of *Phormium tenax*.
21841—W. G. Richardson, Auckland Utilising waste flax for cattle food.
21842—C. A. Nielsen, Port Ahuriri, and R. S Alward, Wellington Trawling-net.
21843—W. J. Bell, Inaha, Horse controller.
21844—J. Anderson, Dunedin Pasteuriser or milk-heater
21845—J. Langford, Waihi Amalgamator.
21846—F. Bower, New Plymouth Chair-back protector.
21847—W. Morton, Dunedin Non-slipping shears,
21848—H G. Willims, A Broad, and C G Crolly, Dunedin Brush or broom making.
21849—J H. Hickman and J. Whitelaw, Wellington: Show case.
21850—J H Hickman and J. Whitelaw, Wellington Show case
21851—T. Dawson, Maraekakaho: Chock for steadying oil engines and vehicles, etc.
21852—E W Thurgar Auckland Pincer for removing rivets from jewellery, etc.,
21853—J. S Douglas, Dunedin Obtaining gold from river beds.
21854—T. S. James, London Internal combustion engines.
21855—J. H. Hickman and J Whitelaw, Wellington. Iron-sand separator.
21856—A. J. Edwards, Auckland: Trolley pole controller
21857—De Bokleosky, Chaterinbourg, Russia: Centrifugal amalgamator.
21858—P. McKay, G. Cather, A. Gerricke, and J. Hogan, Day Dawn, W.A.: Drill Chuck.
21859—W. W Mackie, Ealing, Eng: Dynamo electric machine and electric motor.
21860—N. C. J. Nightingall, Melbourne, Vic.: Filter for water taps
21861—J. Kimberley Horsham, Vic.: Drafting gates for stock sheep and cattle
21862—F. Jennings, Wellington: Ledger.
21863—C. F. K. H. Foot, Ashley Clinton: Gas lighter.
21864—A. Woods, Auckland Address holder.
21865—W. E. Murray, Edinburgh, Scotland: Steady foundations, for floating staunchions.
21866—C E. Bettany, Nelson Frying pan cover.
21867—R. Crawford and H. Tattersall, Auckland Hot-water system.
21868—W. Aggers, Auckand Easy chair
21869—W. E. Clayley, Alexander, Auckland:
21870—H J. Corter and N. R. Dike, Muniyan, Vic.
21871—T. F Macdonald, A. G. Smith, and A. E. Oppenheim Wellington: Cookery utensil.
21872—E. V. Moller, Meenyan, Vic: Adjusting and locking window sashes.
21873—W F Dugins, Kew, Vic.: Road cleaner or sweeper
21874—T M Breck, Karamea Gold saving.
21875—R Forrest, Auckland: Suspending saucepan, etc, lids
21876—F. Cotton, Hornsby, N S W. Removing sulphur arsenic, etc, from ores
21877—B F Boult Auckland Dumb bell
21878—J. M Craigie, Dunedin Boot.
21879—J Grant, Leichhardt, N S W. Prevention of fires by spontaneous combustion in baled goods
21880—C A Schauer, Wellington Fumigating apparatus
21881—H North Wellington Upholstering springs and supports
21882—J Cook, Wellington: Trolley head
21883—W E. Hughes Wellington J. F Sicely, and G Cummings, Marton Preventing combustion of baled goods
21884—W M Norrie Auckland Acetylene gas generator
21885—G Cummings, Marton Wool Press.
21886—W. B Curtis Auckland: Stripping and washing flax
21887—R Millar Dunedin Spraying machine
21888—C K. Cook Dunedin Truss
21889—T W Stoddart, Bristol Eng Liquid distributor for sewage
21890—C A Kidd Christchurch Vehicle tyre
21891—A Johnston Wellington Desk-lid bracket
21892—W E Hughes, Wellington, J F Sicely, and G Cummings, Marton Preventing spontaneous combustion in baled goods.
21893—J J and J B Salmon, Dunedin: Tyre cover.
21894—L H Gilmer, Christchurch Ensuring cleanness in boot etc polish
21895—B G. A Harkness Stratford Potato planter.
21896—A. Batty, Auckland: Envelope opener.
21897—A. Ridd, Waipuku: Milking machine.
21898—C. C. Woledge, Christchurch: Electric arc lamp
21899—W. E. Hughes, Wellington, and F. G. King, Redfern.
21900—J. Gordon, London, Eng.: Applying glass etc. tiles to walls
21901—A. A. Stephenson, C. P. Kelly, and J. B. Zander, Melbourne Incandescent lamp and burner.
21902—A. A. Stephenson, C. P Kelly, and J. B. Zander, Melbourne. Hydrocarbon vaporiser for lamps.
21903—C. Goldman, Wellington. Combination lounge and bed.
21904—G T Booth, Christchurch: Flax stripper.
21905—J Johnson, Invercargill H. H. C. Nicholls, Edendale Scaffolding bracket
21906—F. A. Rich, Auckland, and S. B. Christy, Berkeley, U S A. Electrodes for recovery of metals
21907—E W. Thurgar, Auckland: Pipe.
21908—W. J Bell, Inaha Link.
21909—A. Whitney, Melbourne Target.
21910—G. Gray, Dunedin. Coulter Clamp
21911—F. H. Burbush Auckland Butter cooler.
21912—J. Ramage, Balclutha. Milk strainer.
21913—E. W. Gawne Dunedin: Toothache cure.

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 & Rayward, Patent Attorneys, Wellington, Auckland, Christchurch, Dunedin, &c.

Colombo's Splendid Harbour.

Colombo harbour has been constructed at the expense, and under the direct supervision, of the Ceylon Government. The foundation stone of the famous south-west breakwater was laid by King Edward when, as Prince of Wales, he visited India in 1875. This breakwater, which is fourteen hundred yards long, was completed in 1885 at a cost of £700,000; but before it was finished designs were prepared for a further extension of the works, which were to include the construction of a north-east breakwater three hundred and thirty yards long, and a detached island breakwater nine hundred yards long, situated between the two others. While the work was in progress it was decided to construct a graving dock, the cost of which, including additions when complete, would amount to £348,700. The dock, which is eighty-five feet broad, and has a depth at high water of thirty-two feet, will, when finished at the end of this year, be larger than any of the docks at Bombay, Singapore, or Hong-kong, none of which exceeds five hundred feet. It will take the largest ship afloat in the Navy, not excluding the Dreadnought.

It may here be interesting to give a few facts indicative of the growing prosperity of the island under Crown Colony rule. A salient fact is the growth of the revenue, now amounting approximately to £2,100,000, which has increased more than a hundred per cent. during the past fifteen years by regularly maintained leaps and bounds. Although extensive public works have been undertaken by the Ceylon Government, including, besides the harbour works at Colombo, the construction of five hundred and sixty miles of State railways, the public debt of the colony does not exceed £5 000,000, and under existing arrangements this will be entirely extinguished in the year 1948 The debt works out at about £1 8s per head of the population, as compared with £54 11s in Australia, £68 10s. in New Zealand, and £13 11s. in Canada The unexampled rise in revenue, with the constantly recurring surplus of receipts over expenditure, is doubtless due to the thrifty system of administration of the Ceylon Government, which bears favourable comparison with the speculative policy of the self-governing Colonies, whose Governments are financially independent of Colonial Office control.

Mammoth German Liner.

It is reported in Belfast that the Hamburg-American Line after long consideration, have decided to build a vessel designed to eclipse the new mammoth Cunarders, both in size and speed.

No details of her construction have as yet been decided upon, and it is not determined whether she is to be driven by turbine or reciprocating engines

Messrs Harland and Wolff, it is understood, have booked the order for the construction of the vessel.

..Legal..

Contributed by H. F. Von Haast, M.A., LL.B.

RECENT DECISIONS.

Banker. Customer Drawing Cheque with Spaces which Facilitate Forgery.—Messrs. Marshall, Day & Myers, the executors of Ann Myers, opened an account with the Colonial Bank of Australasia (Limited) in Melbourne, against which cheques were drawn signed by the three executors. Myers, who alone resided in Melbourne, drew each cheque, sent it for signature first to Marshall, then to Day, and then added his own signature. He drew five cheques, three for £10 each, one for £50 and one for £2 6s. 4d., and wrote them out so as to leave a space between the left hand margin and the statement of the amounts in words and figures. Messrs. Marshall and Day signed the cheques in that condition. Then Myers filled in the vacant space so as to turn the three £10 cheques into cheques for £110 each, the £50 cheque into a cheque for £150, and the £2 6s. 4d. cheque into a cheque for £32 6s. 4d. The cheques so altered were presented to and paid by the Bank, which could not, by the exercise of ordinary care and caution, have avoided paying the cheques as altered. On discovery of the forgeries, the Bank debited the executors' account with the amounts of the cheques as altered, contending that Messrs. Marshall & Day were estopped by their negligence from alleging that the cheques as altered were not their cheques. Messrs. Marshall & Day sued the Bank to recover the difference between such amounts and the original amounts of the cheques. Held by the Judicial Committee of the Privy Council (affirming the decision of the High Court of Australia) that, whatever the duty of a customer towards his banker may be with reference to the drawing of cheques, the mere fact that the cheque is drawn with spaces such that a forger could utilise them for the purpose of forgery, is not by itself any violation of that obligation, for people are not supposed to commit forgery, and the protection against forgery is not the vigilance of parties excluding the possibility of committing forgery, but the law of the land. The Bank was therefore entitled to debit the executors' accounts with only the original amounts of the cheques. *The Colonial Bank of Australasia (Limited) v. Marshall.* 22 *Times L.R.* 746.

Promissory Note. Material Alteration not Apparent.—A promissory note was made in England by The Exhibit and Trading Company (Limited) payable to the order of The Goderich Organ Company, and sent out to Canada to The Goderich Organ Company, which had been turned into a limited company. Subsequently to the making of the note the word "Limited" was added after the words "The Goderich Organ Company" on the face of the note, and it was endorsed by the Goderich Organ Company (Limited) to the Bank of Montreal, which sued the Exhibit Company upon it. Held by Phillimore, J., that by the addition of the word "Limited" the note had been materially altered, that the alteration was not apparent, that, therefore, the note was set up according to its original tenor, viz.: as if it were payable to the Goderich Organ Company, that the endorsement, therefore, was not in order, without prejudice to a fresh action on a proper endorsement, and that the Bank could not recover. *Bank of Montreal v. Exhibit and Trading Company (Limited).* 22 *Times L.R.* 722.

Breaches Outside New Zealand of Award of the Arbitration Court. Seamen on New Zealand and Foreign Vessels. Jurisdiction.—The Arbitration Court made an award for the Wellington industrial district to which the U.S.S. Co., which is incorporated in and has its ships registered in N.Z., and the Huddart-Parker Co., which is incorporated in and has its ships registered in Victoria, were parties, fixing minimum rates of wages to be paid to members of The Wellington Cooks' and Stewards' Union, and the N.Z. Seamen's Union. The following questions were submitted for the consideration of the Court of Appeal in a case stated by the President of the Arbitration Court. (1) Could the award be enforced with respect to an alleged breach committed in Australian ports, or any port outside of New Zealand? (2) Was the breach committed when the watch was ordered to be kept or the holiday withheld, or when the men were paid without overtime payments being made? (3) To what extent does an award become the law of the ship? Held by the full Supreme Court that the Arbitration Court has no jurisdiction over foreign shipping companies, and therefore cannot enforce its award against the Huddart-Parker Co., except in the case of men engaged for a voyage beginning and terminating in New Zealand, but that it has jurisdiction over the U.S.S. Co. even outside New Zealand and therefore —(1) The Court can enforce its award with respect to a breach committed in an Australian port or any port outside New Zealand. (2) The breach is not committed when the watch is ordered to be kept, but when the company finally fails to pay for the service, and continues until the duty is performed. (3) The award binds the shipowner in New Zealand with respect to the whole of the round voyage, and his acts and omissions during that voyage. *Re The Wellington Cooks' and Stewards' Union. Supreme Court, October 15th,* 1906.

Interference with Trade. Trade Union Inducing Master to Dismiss Servant and not to Employ Him Further.—Mr. Heggie, who was employed as a shipwright in the service of the Queensland Government at one of its docks, was called upon by the Brisbane Shipwrights' Provident Union to join the Union and pay the entrance fee. The Union and its representatives at its direction told the Government that if Heggie were not dismissed the union shipwrights employed at the dock would be called out, and as long as Heggie's employment continued would not be allowed to resume work. The Government dismissed Heggie, who sued the Union and its representatives for damages. The jury awarded him £100 damages, finding that the officer of the Government was induced and coerced by these statements to dismiss Heggie, and that the Union and its representatives had combined and conspired together to procure his dismissal with the intention of injuring him and depriving him of the opportunity of earning his livelihood as a shipwright, until he should become a member of the Union. Held by the High Court of Australasia that these facts disclosed an actionable wrong and Heggie was entitled to recover. Quinn v. Leathem applied and Taff Vale Railway Co. v. Amalgamated Society of Railway Servants followed and the rules laid down applicable to such actions. *The Brisbane Shipwrights' Provident Union v. Heggie.* 3 *Commonwealth L.R.* 686.

Bankruptcy. Payment made to Trustee of Deed of Assignment for Benefit of Creditors.—Watson, a builder, on 5th June, 1903, executed a deed of assignment whereby he assigned all his property to Mr. Afford as trustee for the benefit of his creditors. Mrs. Petrie, who owed Watson £21, paid this amount to Afford on 12th June. Watson was adjudicated bankrupt on 20th August. Afford had received about £500 in respect of the bankrupt's estate and paid away various sums under the deed and on the request of the Official Receiver trustee in Watson's bankruptcy paid the receiver £100. The Official Receiver then sued Mrs. Petrie for the £21 which she owed Watson. Held by the Court of Appeal that the Official Receiver, by accepting the £100 had not elected to treat the deed as valid and the trustee under it as his agent to collect the debts due to the bankrupt's estate, that as Mrs. Petrie had paid the £21 with full knowledge that the deed was an act of bankruptcy, and that, as Watson was made bankrupt within three months of the act of bankruptcy, the deed was void, her payment was not protected and, as she was unable to show that any part of the £21 was included in the £100 received by the Official Receiver, she must pay this amount again. *Davis v. Petrie.* 22 *Times L.R.* 771.

Using House for Receiving Deposits with a View to Betting. Recovery of Money Deposited to Make Bets.—Mr. Mortimer, by arrangement with the owner or occupier of No. 51 Lexington street, London, used it in connection with his business as a turf commission agent, calling for and receiving his correspondence there. Mr. Vogt, who was a sport with a "system," remitted to Mortimer's Bank £100 odd for the purpose of making bets on his behalf. In due course Vogt's money disappeared in the losses resulting from his system, but he bethought himself of a nice sharp quillet of the law which would enable him both to have his cake and eat it. Accordingly he sued Mortimer for the deposit on the ground that by the section of the English Betting Act corresponding with section 15 of "The Gaming and Lotteries Act, 1881" (N.Z.) any money received by the owner or occupier of a betting house, or by any one using it for betting as a deposit on any bet, shall be deemed to have been received to the use of the person from whom it was received, and may be recovered accordingly. Held by Joyce, J. that this section of the Betting Act applied not only to the owner or occupier of the premises but to anyone using them and that Vogt although he had had a good "run for his money" was entitled to get his money back again. *Vogt v. Mortimer.* 22 *Times L.R.* 763.

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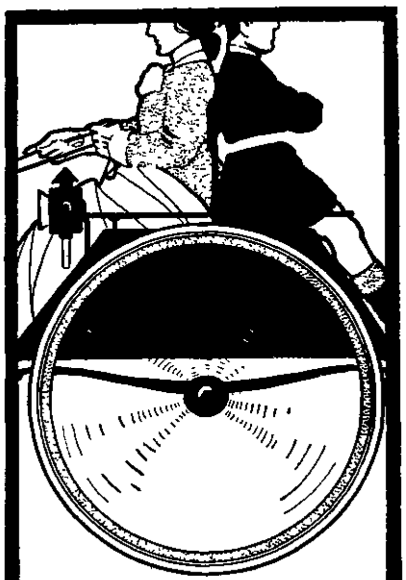

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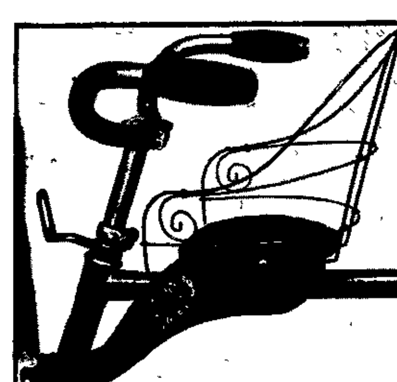

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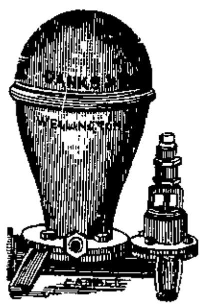

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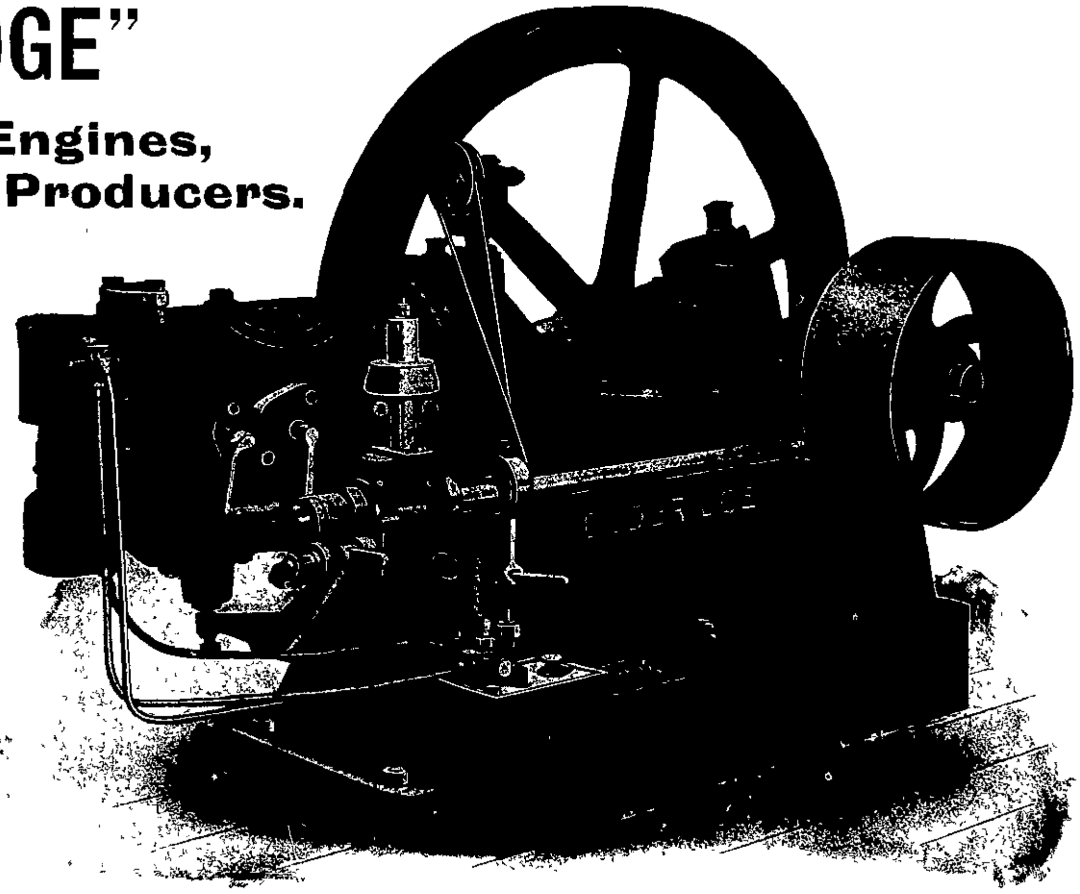

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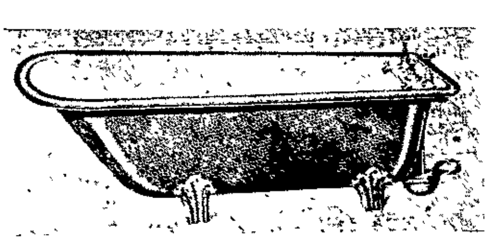

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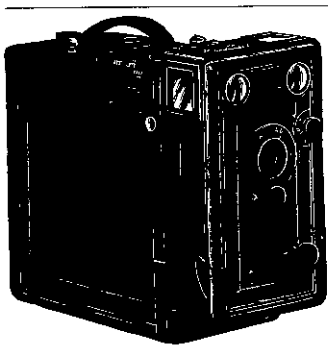

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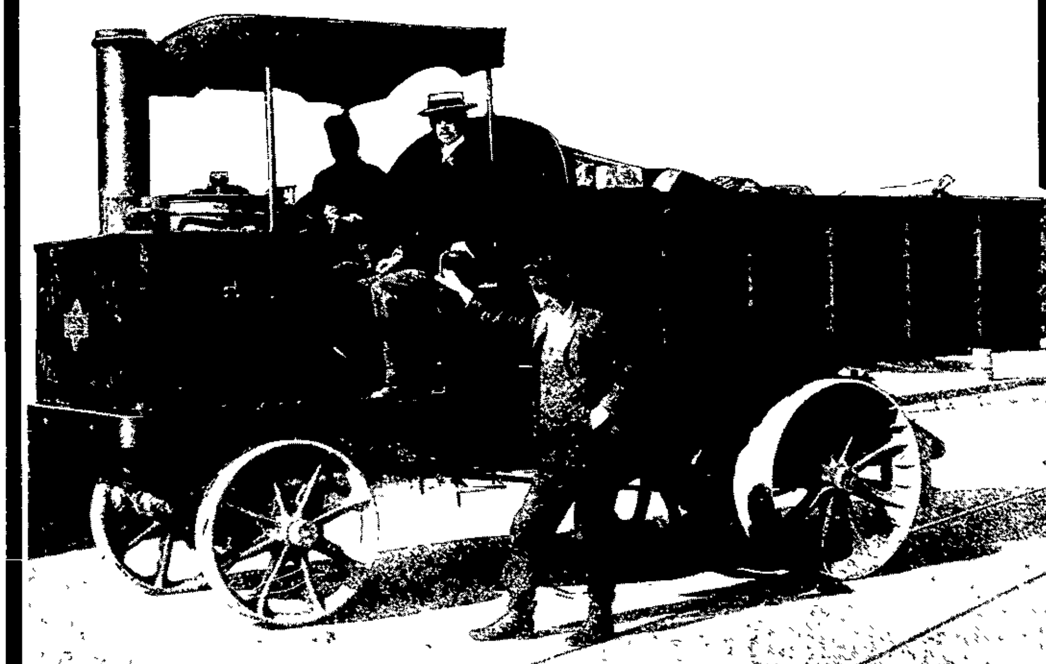

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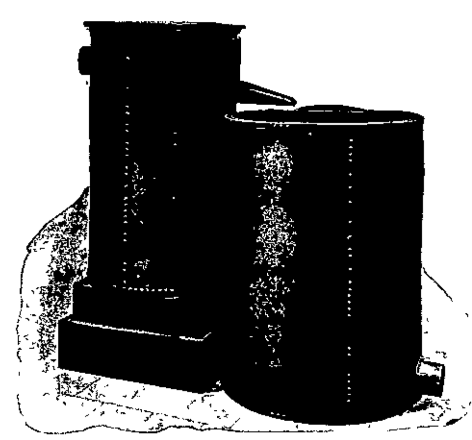

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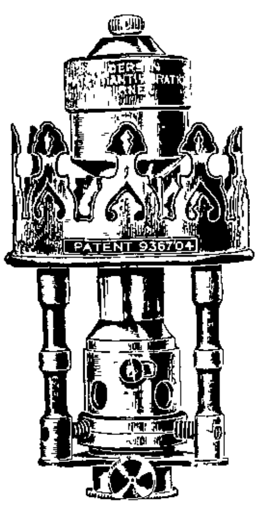

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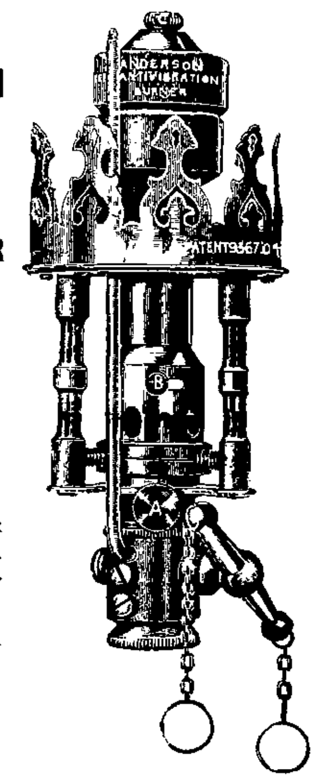
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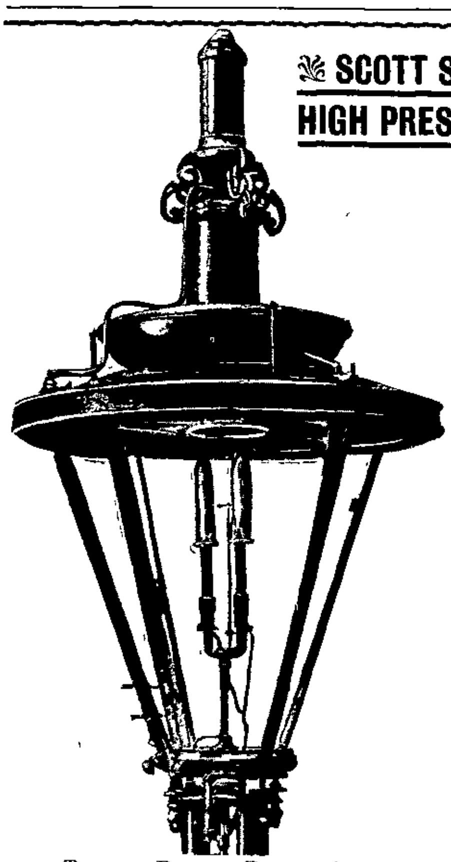
SCOTT SNELL HIGH PRESSURE Gas Lamp.


TYPE OF DOUBLE BURNER LAMP. 1,20) c.p. Consumes 28ft. per hour.

THIS Lamp has been scientifically tested in London, Paris, Berlin New York, Chicago, St. Louis, Boston, and various other British and Foreign towns. All tests show **Maximum Efficiency.**

It has been applied to Docks—over 200 installed in one Dock. It has been applied to streets too numerous to specify. A typical installation may be seen in Whitehall and Parliament Street Westminster, **saving over £100 a year** in cost, and **giving seven times the amount of light** of previous system.

It has been applied to various **Halls, Hotels, Shops, Railway Stations,** and various other establishments.

COMPARED WITH COMPRESSING SYSTEMS

WE AVOID **Expense of Special Service. Increased Leakage Losses. Expenditure for Power. Cost of upkeep of Compressing Plant. Dependence of whole service on working of Power Actuated Pumps,** and various minor drawbacks.

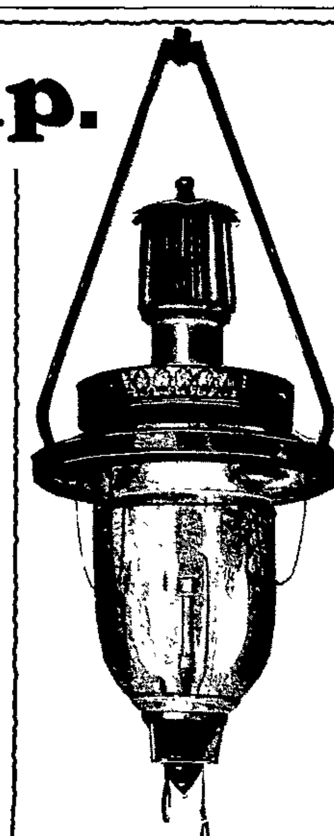
A street may be transformed in a single day by installing Scott Snell Lamps, **without disturbing street surface or traffic.**

Free of Cost, by means of **Waste Heat,** this Lamp provides itself with compressed air at nearly 2lb. per square inch pressure

COMPOSITE BODY LAMPS.

Specification—These Lamps are constructed with detachable reservoirs and cylinders, making any part replaceable in a few minutes. Adjustment is much simplified. Working parts operate on knife edges. Weight considerably reduced Working parts may be removed and replaced by spare section, and an examination or re-adjustment made at leisure.

Guaranteed gas consumption, 15ft per hour.


TYPE OF SUSPENSION CIRCULAR LAMP. Over-all height, 54in. Width 16in. without globe.

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Lighting Engineers and Contractors,

TELEGRAMS: "DACOLIGHT, LONDON." **73 Farringdon Road, LONDON, E.C.**

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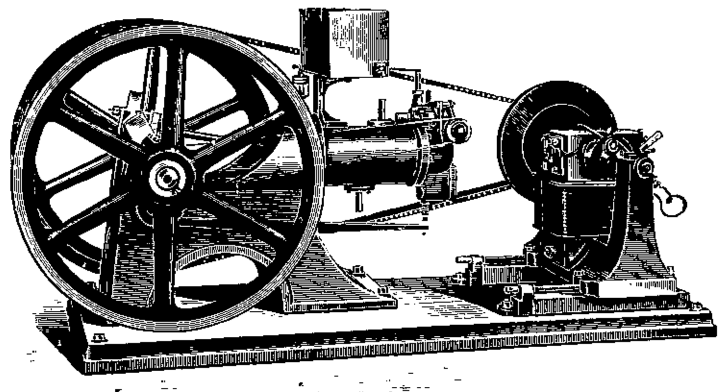

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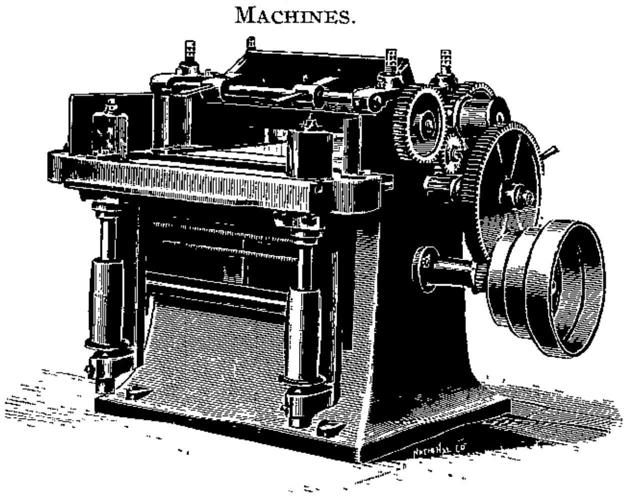

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