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PROGRESS

With which is Incorporated

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Progress

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EDITORIAL COMMENT.

A New Year.

WITH the present issue this Journal enters upon its third year. From a humble beginning, in point of columnar space, PROGRESS has gradually expanded in scope until, at the present moment, there are contained in its pages upwards of 50,000 words composing those articles in the various causes which originally prompted its institution. The circulation of PROGRESS has also increased in similar proportion to its bulk; this directly resulting from an improved literary and typographical standard. Consequently, its force as an advertising medium has come to be fully recognised by firms whose professions or lines of business require publicity in its columns As the organ of the Dominion's and the world's progress in science and invention. PROGRESS hopes to continue to merit the many hundreds of good opinions that have reached the editorial office from time to time.

The New Patent Law of Great Britain.

BEFORE the Legislature was prorogued the other day it passed the new Patent Act. This measure, of 30 clauses, provides:—(1) For somewhat extending the scope of the official search: (2) For refusing the grant of a patent altogether in lieu of requiring a specific reference, if entirely anticipated by one patent. (3) For post-dating an application in case of disconformity between the provisional and complete specifications: (4) For revoking a patent or registered design, if the patented article or process is not manufactured or carried on to an adequate extent within the United Kingdom within four years of the date of the patent, or one year from the date of the registered design; (5) For restoring patents which have been unintentionally allowed to lapse by non-payment of renewal fee: (6) For patents of addition carrying no renewal fees; (7) For extending the grounds for opposition and granting power to award costs; (8) For extension of the term of design registrations for a second term of five years, and for a third term of five years; (9) For giving any person who would have been entitled to oppose the grant of a patent, power to apply to the Comptroller-General within two years of its date to revoke a patent on certain grounds; (10) For giving power to the Court to extend the term of a patent for a further term of seven or even fourteen years; (11) For enabling two or more provisonal specifications for cognate inventions, to be completed under one complete specification, and for a single patent to be granted thereon: (12) For the filing of specimens of chemical inventions.

The new Act will apply to patents granted, designs registered, and applications made, before as well as after the commencement of the Act, except where otherwise expressly provided.

A full analysis of the chief points will be found in our Engineering Column, from the pen of Mr. Croydon Marks, M.P., specially contributed to PROGRESS.

The Brennan Mono-rail.

FROM Mr. Black's pen, in an article on "Light Railways" in our Engineering Column, we have to-day the first pronouncement on the exciting, suggestive, and most interesting invention of the famous Australian. Three things stand out in Mr. Black's paper, They are: first, it is fair to conclude that every Brennan truck must have its own separate gyroscope; secondly, that the possibilities enclosed in the chamber where these machines make their fearful number of revolutions are such as to make one think seriously; thirdly, that if the new invention is ever a success in the working stage, it will be more conspicuous as a temporary expedient than as a permanent railway traffic factor. Mr. Black's last conclusion is not likely to find a single dissentient. It is that the best course for the Dominion in this matter, is to leave the experimenting necessary for the development of the Brennan invention to the engineers and workshops of Great Britain. That will be better for the Dominion, and better for the invention.

The New Airships.

WITHOUT information as to the trials at Jamestown, it is not possible to arrive at any very definite conclusion as to the progress attained to-day in the flying art. The fact is that, while enthusiasts are gloating over predicted results—Mr. Stead, for instance, says that successful construction of airships will destroy war quicker than the Hague Conference, and General Baden-Powell agrees with him to almost the whole extent of his contention—practical men are rather coming to grief with their newest ventures. For example, Mr. Wellman's dirigible balloon and the military balloons La Patrie and Nulli Secundus—the first the work of the War Department of France, the second the fruit of years of experimenting by the military balloon department of the British army—are evidently the prize individuals of the balloon flotilla of the world. The great dirigible developed from the designs of Count Zeppelin for the German army, and known as Parseval, is of the same type of "assured" successes, and the Russians have announced another. Now Mr. Wellman's dirigible and the English War Department balloons were both smashed to pieces the other day by a hurricane. In plain English their discomfiture has demonstrated that these craft are not what at sea would be termed seaworthy. They are built stiffer than the first of their kind, and they carry more power, thanks to the inventions of the period that has elapsed since the first demonstration. But they are no whit better for practical purposes than the dirigible of Captain Renard, of the French army, which made such a sensation in the year 1885 by achieving a flight of 21 miles an hour, half of it against a head wind. The others have carried prime ministers and explorers, but they have none of them done more than the dirigible of Captain Renard. In the dirigible class the problem of constructing a craft that shall keep the air in all weathers has yet to be solved. It is of course nearer solution than it was twenty-two years ago, but the distance from practical dependability still represents, apparently, a vast gulf. On the other hand the champion of the aeroplanes, M. Santos Dumont, who flew last year so well in Paris has again taken up the dirigible and confessed to a deplorable failure of his aeroplane, and is at present hidden under the shadow of a promise to do something. The brothers Wright, at the same time from whom so much was expected and who have been the centre of much prophetic devotion in the United States, have not been heard from. The Dominion, in the person of a Dunedin citizen has added to the hopes of the world its mite, with a machine of which not even the journalist who described it has the faintest idea. For the present then the outlook in the matter of the mastery of the air by enterprising man is not of the best. Some balloons during the present year flew some hundreds of miles. But their round unsteerable predecessors did the same thing a century ago. How reliable they were as guides was discovered by the unfortunate Andre in 1897, in his attempt on the Pole.

Ship Fires.

A SHORT time ago the insurance companies maintained an inspection of cargo during stowage. There were then no fires. Now there is no inspection of cargo, during stowage; and fires rage. They are on the up grade for size and destructiveness, and they have reached present high-water mark with the disaster on the Turakina. No one can say how many lives and how many thousands worth of property they will go on to destroy. The plain moral is that the sooner we get back to the inspection the better. Who is to do it, and who is to pay for it? That is another question. But if fires are to cease at sea, there must be an inspection. On the other hand, if there is no inspection fires will not cease at sea. The Royal Commission of last year had a deal to say about spontaneous combustion and similar matter; but the main moral of its report was the imperative need for inspection.

Electricity

NOTES.

There has been a considerable drop in the receipts of the Christchurch Tramways during the last three months, which must be due in a large measure to the exceptionally dry season the Canterbury capital has experienced during the winter, a state of things which has enabled other means of locomotion to be followed by the population.

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The pumps for the new Ross Flat Gold Mining Company will be of the electrical turbine type, similar to those installed for the Kelburne (Wellington) water supply. The sinking pump, however, will be of the vertical type, and each unit will be capable of driving 10,000 gallons a minute, which should be ample, considering that the Ross United had only about 120 h.p. at their disposal with a power capacity of about 650 gallons per minute.

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A poll was to have been taken at Wanganui on the 28th ult. for the purpose of raising £5,000 in order to proceed with the amended electrical tramways scheme for that borough. Sleeper construction on a ballast foundation has been selected for the Wanganui track with overhead feeders, wooden poles, and span construction with centre running trolly. A single trolly wire of 2/0 B & S gauge, with double trolly wire at passing places, will be used. The gauge of the track will be the standard. The machinery will be of the Electrical Construction Company's well-known type, and will consist of two 75 k.w. generators direct coupled to two suction gas engines.

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Cheap power would prove an important factor in the reduction of freight charges from Lyttelton to Christchurch. To this end the electrification of that section of the railway should be seriously considered by the Government. Water turbines could be utilised for generating current at the Waimakariri, and by this means fully 6,000 h.p. would be immediately available.

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An ingenious system that will materially reduce the cost of cabling is about to be instituted in the Dominion. It is known as the "N.M." system, for which Mr. Clement Newton holds patent rights for the Southern Hemisphere. Mr. Newton is the Australian manager for the British Insulated and Helsby Cable Company, and has studied for years past the question of economy in regard to cable communication. In a future issue of PROGRESS we hope to publish full details of this splendid invention. Let it suffice here to state that the inventor claims that where it costs 3s per word to cable to London at the present day, the cost under the 'N.M.' will be reduced by 50%. We understand that the system will be used in conjunction with any code book and also with any private codes, provided that the code words are all numbered.

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We have long been accustomed to the central station in electrical matters, but it was scarcely to be expected, even in this age of progress, that music would some day be retailed to the consumer in the same manner as lighting or power. In Dr. Thaddeus Cahill's marvellous electrical invention for producing what might be called scientifically accurate harmony, lies the solution of the problem of perfect representation of music at nominal cost to the householder. Dr. Cahill calls his invention the "Dynamophone" and although it is impossible here to describe the tortuous and difficult pathway of his progress, or to tell of the obstacles which he was compelled to surmount, it will be sufficient to explain, simply—for it is really simple—how he finally solved the problem.

Electricity like sound, travels in waves or vibrations, electricity in the ether, and sound in the air. Why should there not be a way, argued Dr. Cahill, for producing the various vibrations corresponding to the pitch of a musical note by electricity and then changing them into sound vibrations? This was the problem he studied and he finally hit upon the use of electric dynamos. Each dynamo was so built that it gave out alternating currents which vibrated at a certain rate. Each dynamo produced vibrations representing a single pure musical note, or a single one of Helmholtz's tuning forks. Other dynamos or alternators were used to represent other pure tones, until in the present machine Dr. Cahill has no fewer than 145 such alternators. They are placed upon great steel shafts, and operated by power machinery. Each alternator is connected by wires with the playing keyboard in another room. When one key is pressed one alternator gives off its vibrations; when two are pressed, two alternators come into play. Let us suppose, now, that the player wishes to produce the peculiar sweet note of an A string (open) upon the violin. The ground tone of an A string has 435 vibrations a second. One key, controlling one alternator, will produce this ground tone, but it will sound more like a flute note than a violin note. Harmonics must be added—exactly as Helmholtz built up a tone with his tuning forks. Stops are drawn producing the first harmonic, 870 vibrations, the second harmonic, 1,305 vibrations and so on, until the approximate note of the violin is reached. In other words, the player, by using the proper keys and stops can construct the tones of any instrument he wishes. He can have the clear note of the flute, the heavy burr of the 'cello, or the squeal of the fife. The qualities of all instruments—the vivacity of the piano, the emotion of the violin, the purity of the clarinet, are thus within instant reach of the player upon a machine of this type. The present instrument with 145 alternators, while producing the most extraordinary results, will not reach all of the combinations necessary, let us say, to produce the marvellous complex music of an orchestra but the inventor is already planning a much larger machine, with hundreds of alternators, upon which eight or ten musicians may perform together, making possible heights of musical harmony never before imagined.

Telephonic attachments are provided for the "delivery" of Dynamophone music hundreds of miles away from the generating centre, thus it will be possible to hear cheaply either the most popular or best music of the day.

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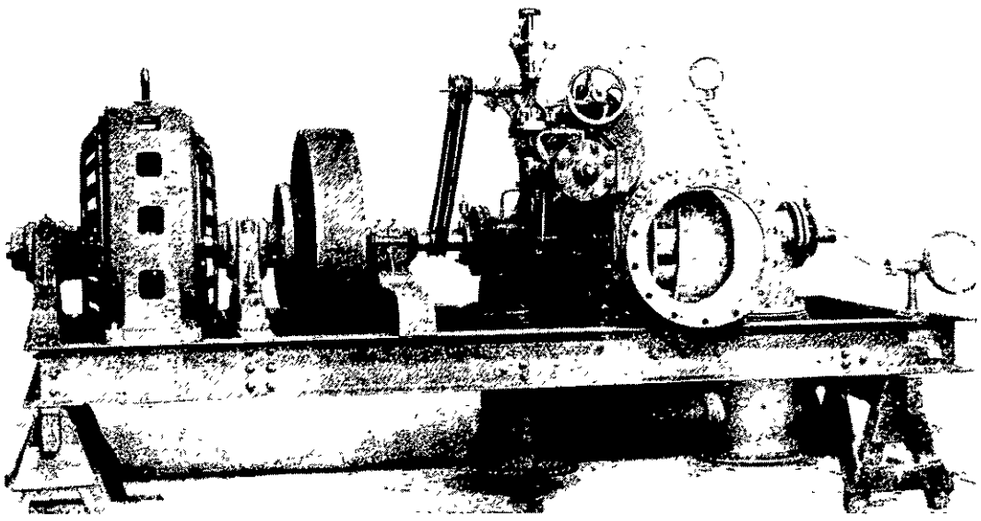
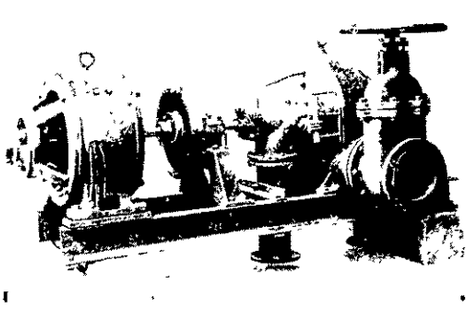
Since Dunedin acquired a public and cheap electrical supply from the Waipori a demand for electric lifts has arisen. A. & T. Burt Ltd. have just installed one of these lifts for Messrs. Herbert Haynes & Co. Ltd., and it has a capacity of 20 cwt., which it will handle at a speed of 80 feet per minute through a space of 45 feet. The energy is supplied from the Corporation mains. A 5 b.h.p. induction motor drives the lift, the motor being manufactured by Crompton & Co., London. The motor, by means of a belt, transmits its drive to a countershaft, which is fitted with a long cylinder, from which two belts, one straight and one crossed, drive another shaft on which three pulleys are fixed, two being loose and the centre one fast. This shaft is elongated and terminates in a worm engaging a worm wheel, on the shaft of which the winding drum is carried. In order to operate the lift, the motor is started running; and by means of a striking gear, which is actuated by a hand rope going to the bottom of the well either the straight crossed belt can be brought over the fast pulley and the lift cage either made to ascend or descend. There are several small improvements which have been specially designed by A. & T. Burt, Limited, in all cases the function of these being for safety. One particular appliance is a lever engaging the hand rope to be used as an emergency stop, in the event of the lift attendant, in travelling up or down, requiring to stop suddenly, all he has to do is to pull the lever and the belts are thrown into the off position. Another feature is the automatic arrangement for operating the gates. These gates are always closed when the lift is away from the floor, as the lift ascends, it opens the gate, which is opened wide simultaneously with the cage floor coming to the level of the warehouse floor, as the lift passes this floor, the gate is released and falls back into the shut position. The idea of this is to prevent the gates guarding the well being carelessly left open. The lift is also provided with automatic lift gear, which comes into operation immediately the rope breaks or slacks. In order to take power, the rope, after taking several turns round the winding drum, terminates in one end of the cage and the other on a counterweight, which is weighted to the weight of the cage plus half the maximum load. To minimise friction, the worm runs in a bath of oil, and all bearings are of the self-oiling type. Messrs. Burt have the honour of installing the first electric lift in operation worked from Waipori.



NEW PLYMOUTH LIGHTING. 90 k.w. alternating-current generator, single-phase, direct-coupled to 152 b.h.p. Carrick and Ritchie high-pressure 27in. double-discharge turbine; set running at 500 r.p.m.



NEW PLYMOUTH LIGHTING.

12 k.w. direct-current shunt-wound generator, coupled to a Carrick and Ritchie 12in. high-pressure double-discharge turbine; set running at 1100 r.p.m.

Electric Lighting at New Plymouth.

The electric lighting undertaken by the New Plymouth Borough Council has been an unqualified success under the guidance of Mr. H. Black their hard-working engineer.

Last year the corporation decided to install a 90 k.w. turbo-alternator direct-coupled set, and under keen competition the contract was secured by Messrs. Turnbull and Jones, Ltd., of Wellington, Dunedin, Christchurch and Auckland, whose price for the complete plant was the lowest received.

The specification, which very ably described the requirements of the Corporation, was drawn up by their electrical engineer, and the new plant consists of one 90 k.w. turbo-alternator running at a speed of 500 revolutions per minute. The 152 b.h.p. turbine is by Messrs Carrick and Ritchie Ltd. of London and Edinburgh, being of their high-pressure double-discharge type, with 27" wheel. The alternator is by the British Westinghouse Electric and Manufacturing Co., Ltd., of London and Manchester, and is capable

of generating current at a pressure of 2300 volts, the periodicity being 50. This set is shown in Fig. 1. Fig. 2 shows the exciter set, consisting of a Carrick and Ritchie 12" high-pressure double-discharge turbine, direct-coupled to a 12 k.w. Westinghouse direct-current shunt-wound generator, the voltage, at 1100 r.p.m. being 125.

The alternator, having the same voltage and periodicity, is capable of being synchronised with the old Brush alternators, and is of equivalent capacity to the whole of the original plant.

The switchboard supplied with the plant consists of highly polished slabs of the finest Sicilian marble, fitted with all necessary instruments, and arranged by the contractors, and the complete plant is of the very latest design, embodying all the newest developments of electrical and mechanical engineering.

Notes on Water Turbines.

[By H. S. KING, A.I.E.E.]

The study of hydraulics is by no means so restricted as is generally understood, and although turbines formerly only included horizontal types, yet the term is now applied to all water wheels in which a relative movement of the water to the wheel causes reaction. The earliest form of turbine was the reaction wheel, being a turbine without guide blades. In this type a hollow wheel or casing revolved on a hollow spindle, the spindle was drilled where it lay inside the wheel, and formed the passage through which the water entered, the casing had tangential nozzles through which the water left, the reaction of the water on the casing causing motion.

If the best velocity, that due to head, be employed, an efficiency of .6 is attainable with this type of turbine, but otherwise there is a considerable waste of energy.

This fact led to the introduction of guide blades and curved vanes, and the invention by Messrs Carrick and Ritchie, of London and Edinburgh, of the true turbine. In designing and constructing the vanes, care is taken to avoid unnecessary friction or resistance the surfaces of the vanes are kept as smooth as practicable, and the ends carefully tapered and rounded off when the water enters. Wrought-iron or steel vanes are preferable from a theoretical point of view, as they offer less resistance to the passage of the water, but it is found in practice that vanes cast in one with the rest of the wheel are more substantial and less liable to rust and are almost invariably adopted.

The method of measuring the horse-power obtainable from a waterfall is so well known that a description thereof in a short article like this is unnecessary.

The first turbines to be used in this country for electric lighting and power purposes were four 50 h.p. vortex turbines, operating on a fall of 276', supplied by Messrs. Gilkes and Co., of Kendal for the late Electric Lighting Syndicate, Wellington. The chief trouble with turbines required to run steadily used to be, and still is, to a smaller extent the governing, especially is this the case with low falls, where the large volume of water to be promptly handled calls for considerable power to actuate the regulating gates, and when the friction arising from large movements of massive regulating machinery gives rise to very violent "hunting." It may be taken as a general rule that the higher the fall, the better the governing, and of recent years so many improvements have been made in this direction, that there are now governors on the market which will give very satisfactory results when used with properly constructed turbines.

The testing of a water-power plant, as regards its efficiency of working, may be divided into two classes:—

(1) The testing of the out-works, such as the races, sluices, etc., and

(2) The testing of the turbine itself.

The main supply pipe and regulator sluices may be tested, as to the loss of head, by means of a pressure gauge. From a measurement of the quantity of water flowing, the velocity of the water flowing, the velocity of the water in the pipe may be calculated. This will give the head due to velocity in the pipe. Similarly by means of a vacuum gauge the efficiency of a suction pipe may be ascertained.

On the Continent and in America the utilisation of water-power for electrical purposes has been successfully carried out in individual places on a gigantic scale. I have been unable to do more than briefly indicate a faint outline of this interesting subject, but if the great resources of this Dominion, with its waterfalls developing so many thousands of horse power, were harnessed, a great lift would be given to many industries, and our commerce would be greatly enhanced.

Comparative Efficiency of Various Electric Lights.

Comparative tests have been made between Moore tubes, Nernst lamps and the usual type of incandescent electric lamps, says the *Electrical World*. The Moore tube used was 179 feet long and 1¾ inches in diameter. It was located 17 inches below the ceiling, which latter was 10 feet 11 inches from the floor. There were seven six-glower Nernst lamps, with opalescent globes of a bluish tint. The incandescents were 113 in number, 88 being of 8 candle power each, and 25 of 16 candle power. All were wired to moulding on the ceiling, excepting 20 of the larger ones, which were used with opaque reflectors and had very little effect on the ultimate results. Measurements of illumination were made by means of a Weber photometer located successively at seven different points throughout the large room, and uniformly 34 inches above the floor.

The unit of illumination used was the lux, which is the illumination produced on a plane surface by a source of 1 candle power at a distance of one metre, the rays striking the surface perpendicularly. The periodicity of the current was 60 cycles. The average voltage during the test was 243 for the Moore tubes, 244 for the Nernst lamps and 177 for the incandescents. The illuminants were located above the plane of illumination at different distances, being 6 feet 8 inches for the Moore, 6 feet for the Nernst and 7 feet 10 inches for the incandescents. The current consumption in kilowatts was 3.15 for the Moore, 3.92 for the Nernst and 4.13 for the incandescents. The average intensity of horizontal illumination was 63 for the Moore, 44 for the Nernst and 15 for the incandescents. This made, per unit of power an average of 20 luces for the Moore 11.2 for the Nernst and 3.6 for the incandescents. To bring the illumination from the two latter up to the standard of the former, without altering the heights of the illuminants, would have required an output of 7 kilowatts for the Nernst lamps and 23 for the incandescents as compared with 3.15 for the Moore. Placing all illuminants at the elevation of the Moore tubes and obtaining equivalent illumination from all the required output would be 3.15 kilowatts for the Moore, 8.65 for the Nernst and 16.65 for the incandescents.

Trouble Caused by a Wireless Station.

The quarterly fire report, No. 3, of the electrical bureau of the National Board of Fire Underwriters (U.S.A.), makes note as follows of a very interesting and, it would seem, unusual occurrence.

The sending station apparatus of a wireless telegraph system was supplied by a 3kw. 2080-115-volt pole transformer on a three-phase system. This transformer broke down because of high voltage reactions caused by the wireless apparatus, and was replaced twice by other 3kw. transformers in parallel, all of which failed. A 7½kw. transformer was finally installed and operated satisfactorily.

In transmitting signals the secondary voltage (115) was raised to about 20 000 volts, which was impressed on the aerial conductors on the mast. It was found that this equipment when in use produced several breakdowns in lighting and small motor circuits in the neighbourhood supplied by other transformers of the same system.

In a doctor's office diagonally across the street from the wireless station were incandescent lamps and small motors supplied from a transformer, whose secondary line paralleled the secondary leading to the wireless apparatus. The reactions in the system caused by the sending apparatus of the wireless station caused the Edison plug fuses in the service entrance box to be blown violently, and destroyed the windings of a small motor. It is reported that these breakdowns were accompanied by flashes of flame about the apparatus in the office. Removing the doctor's service line to a position, where it no longer paralleled the wireless secondary circuit, corrected the trouble in this office. The wireless company also improved the contact of their ground connection, but it does not clearly appear how much this had to do with preventing further troubles. One of two other installations in the neighbourhood, a closely built-up city block, were affected to less degree. A number of telephones were rendered useless during sending of wireless messages, the code signals being loudly heard in the receivers. This was remedied by the insertion of suitable capacities in the telephone service circuits.—*Electrical World.*

Mining at Ross Flat.

[By J W.F.]

The company which was recently formed for working Ross Flat has a capital of £70,000, that amount being over-subscribed; consequently, there is little doubt that the undertaking is destined for success.

In August 1865, this goldfield was first opened, the workings being confined to the shallow ground of Jones Creek, but gold was afterwards traced into Jones Flat, which was worked on a paying basis for a considerable time on the first bottom, varying down to 80 feet. Subsequently, it was found that auriferous layers existed below this depth, and thus, at the end of 1866, several companies, such as "The Morning Star," "Prince of Wales," "Scandinavia," etc., worked ground at deeper levels. In 1868 the New Zealand Parliament passed the "Goldfields Drainage Bill, which created a Drainage Board with rating power. Under this Act a drainage company was formed with a capital of £6000, and this concern commenced pumping in January, 1870. The appliances of the company effectually drained the workable ground for about nine months, but the rating power of the Drainage Board having failed to provide for the heavy expenditure surrounding the maintenance of the steam pumping machinery of the drainage company, the latter ceased operations. This had the effect of stopping all underground mining in the district, excepting the "Cassius" claim, which, not being connected with Jones' Flat workings, carried operations on until the accidental tapping of other claims flooded it also.

During the 32½ weeks that the "Cassius," "Morning Star," and "Excelsior" companies were in full working they produced 11,543 ounces of gold, and the other companies, of which there is no record, probably yielded as much more. From the time the drainage company ceased pumping until 1882, all mining on the Flat stopped, leases being cancelled. In that year the Ross Goldmining Company, Limited, was formed with a capital of £30,000, to drain and work the ground by hydraulic power. An expensive shaft was sunk and heavy hydraulic engines and pumping plant were purchased from Messrs. A. and G. Price, of the Thames. The depth of the main shaft was 392 feet, cutting through eight distinct layers of payable washdirt.

After encountering difficulties in opening up claims at the deepest level, the company worked for six weeks, taking out 640 ounces of gold—results which compared favourably with those of previous mines. At the end of that time, however, they had worked too near to the old workings, which were, as a consequence, flooded out, and the water eventually broke through and completely flooded the new mine.

It is the intention of the Ross Company to clean out the old United Ross shaft, use it for pumping purposes, and sink a working shaft in the vicinity of the old "Cassius" workings. There it is expected rich gold will be struck as it is on record that the "Cassius" claim yielded 56 ounces on the last day before shutting down.

The failure of previous companies has been due to the fact that insufficient power has been available for pumping. Bearing this in mind, the new company, as has already been reported in PROGRESS, has allowed for every contingency by providing a modern electric power house situated at Kanieri Forks, where some forty or fifty Government heads of water, with a fall of about 270 feet, are available. This will give, approximately, 1000 h.p., 900 of which should be available for pumping, winding, etc.

For the two weeks ending 24th September, the wages bill of the Wellington City Council totalled £3524.

Building & Architecture.

The Architectural Editor will be glad to receive illustrations or matter from those interested in this section. Address: Architectural Editor, PROGRESS, 71 Lambton quay, Wellington.

NOTES.

Alterations and additions to five houses in Christchurch are now being proceeded with. Architect, W. V. Wilson.

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A contract has been let for two residences, North land. Architect, James Bennie; A. F. Riggs, contractor.

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A contract has been let for the fitting of fire-escapes at the Empire hotel, Wellington. Architect John S. Swan.

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Tenders are shortly to be called for the erection of a new vicarage at Mornington, Dunedin. Architect, B. B. Hooper.

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The contract for three villas has been let in Woolston, Canterbury. Architect, W. V. Wilson; contractors, Ingram and Kidd.

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A villa residence in Fitzgerald avenue, Christchurch is in course of erection. Architect, W. V. Wilson; contractor, W. J. Tindall.

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The tender of John Moffatt, which has been accepted for the erection of the new chimney stack for the Wellington destructor, is £1325.

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A superior eight-roomed residence is being erected in Mount street, Wellington, from designs prepared by James Bennie, architect. A. F. Riggs, contractor.

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A villa residence is in course of completion for Mrs. Restieaux, at Linwood, Christchurch. Architect, W. V. Wilson; contractor, J. Brunt.

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A residence of brick and stone for Mr. J. Orr, is in course of erection in Sydenham, Christchurch. Architect, W. V. Wilson; contractor, C. H. Cox.

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A very handsome residence of seven rooms is being completed in Central terrace, Kelburne. James Bennie, archi ect; O. Maisinson, contractor.

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A villa residence is in course of erection at Linwood, Christchurch, for Mrs. L. Symonds, of Lyttelton. Architect, W. V. Wilson; contractors, Ingram and Kidd.

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A handsome two-storey residence has just been completed in Victoria avenue, Wanganui, for Madame Briggs. Architect and contractor, A. M. McLeod.

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Two two-storey brick and stone residences are in course of erection in Madras street, Christchurch, for Mr. James Wilson. Architect, W. V. Wilson, contractor, F. E. Shaw.

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Tenders will shortly be invited for the erection of a two-storey block of offices in Hastings street, Napier, for Messrs. Dalgety and Co., Ltd. Architect, C. Tilleard Natusch.

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A large villa residence is to be erected for Mr. Todd, on the River Bank road, Wanganui This building will set forth up-to-date ideas of architecture. Contractor, Andrew Thompson.

* * * * * *

Gonville and Balgownie, the new suburbs of Wanganui, have been selected for the sites of several new residences which are now in course of erection. These buildings are all of modern architecture.

A three-storey brick building is about to be erected for Messrs. James Thain and Co., iron merchants, at the corner of Taupo quay, and Victoria avenue, Wanganui. The building will be a welcome addition, taking the place of the present old buildings, shortly to be removed. Architect, T. H. James; contractor, N. Meuli.

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The tender of Muir and Rose, at £9021, has been accepted for the extension of the Wellington College in accordance with the plans of Penty and Blake. The new building will be brick, two storeys high.

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It was decided at a recent meeting of the City Council to call for tenders for the erection of additions to the Newtown Public Library. In answer to a councillor, the Mayor said the proposed work would cost £7000.

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The contractor has been instructed to proceed with the repairs, alterations, etc., to the Home of Compassion, Island Bay, Wellington. The building was built from plans and under the supervision of Jas. O'Dea. Architect for repairs, etc. John S. Swan.

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The contract has been signed for a Gospel hall, in King Edward road, Dunedin. The building will have a seating capacity for 200, besides two large cloak rooms, ante room for small meetings, kitchen, and offices, etc. Architect, B. B. Hooper, contractor, W. Henderson.

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A handsome memorial pulpit is to be erected to the memory of the late Very Rev. Father Lewis, at the Basilica, Hill street, Wellington. The columns will be of white marble, and the balance of masonry of Oamaru stone. The pulpit will be approached by a stone stair with wrought-iron balustrade. Architect, John S. Swan, contractors, Hickmott Bros.

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Extensive alterations are being made to Foster's hotel, Taupo quay, Wanganui. The architects have designed a third storey which is nearly complete, and, when finished, will add greatly to the appearance of this old-established and favourite hotel. The interior of the new portion of the building, comprising some twenty odd rooms, is to be finished in an artistic and up-to-date style. Architects, Atkins and Bacon; contractors, Russell and Bignell.

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A contract has been let for the erection of a modern two-storey private residence, at Kilbirnie, Wellington, for Mr. M. F. Burke, and will consist of large drawing and dining rooms, breakfast and sewing rooms, and domestic apartments on the ground floor, with six bed and dressing rooms, together with bath room, linen closets, etc., on the upper floor. The kitchen, scullery, and bath room, etc., are well provided with cupboards, and all conveniences. The hall, drawing, and dining room ceilings are to be finished with stamped metal, while the ceilings of the other main rooms will be finished with heart of rimu, which timber, oiled, is to be used for finishings throughout the house. Architect, C. Tilleard Natusch.

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Our illustration on the next page depicts the first fire-proof electro-glazed dome to be erected in the Dominion. Electro-glazing is the process of mounting and uniting glass by copper electrically deposited Glass so treated is recognised in England as a fire deterrent by the insurance companies, municipal authorities, and fire-prevention committees. It prevents the leaping of fire from building to building, will resist heat until the glass begins to melt, and will remain in position until the sash is burned away The other features of this glazing, which is known as "Luxfer," are its neatness, durability and strength, due to the intimate contact of the copper and glass; while artistic effects are possible with it to an extent hitherto unknown. Our illustration was supplied through the courtesy of Messrs. Henry Brooks & Co., Wellington.

Ferro-Concrete Construction in Auckland.

[BY OUR AUCKLAND CORRESPONDENT.]

Ferro-concrete, reinforced, or armoured concrete, which are one and the same thing under different appellations, has come to take its place amongst the leading methods and material adopted in structural works in New Zealand, more especially in Auckland, where it was first used in a comprehensive manner.

Although iron and steel have been used to strengthen or fortify concretes in various forms for many years, in a sort of haphazard manner, it was not until Mr Hamer, engineer to the Auckland Harbour Board, recommended the use of reinforced concrete in the construction of the new wharves that people began to be alive to the possibilties of the material. Needless to say, this supposed new fad met with strenuous opposition from those who, from want of knowledge or prejudice, or whose vested interests were threatened, saw nothing but disaster in its adoption. These, however, had to succumb to the evidences of accomplished works which were fast accumulating on every hand, until to-day they stand unchallenged as the typical embodiment of strength and durability, resisting successfully the forces of nature and elemental war which have proved so disastrous to other methods and materials of constructon.

The Ferro-Concrete Company of Australasia have the distinction, under the management of Mr. Robertson, with Mr Moor, as engineer in-chief, of being the first to undertake the construction and erection, under the Hennebique system, of reinforced structures in the Dominion, and as their work is marked by technical knowledge, great care is exercised in seeing that even the most minor details of construction are faithfully carried out. Many other firms have followed suit, so that to-day some of the largest and important works, including wharves, warehouses, banks, shops, office buildings private dwellings, tanks, reservoirs, many bridges, including the Cemetery bridge in Auckland, are being carried out on this principle.

Among the more important works now being done in ferro-concrete in Auckland are, first, the railway wharf now nearing completion, Queen street wharf, and ferry service wharf, also Admiralty jetty and foundations for 100-ton crane at Calliope dock. These works impress the beholder with a sense of great structural strength and durability, and, when completed, Auckland will be one of the most up-to-date ports in the southern hemisphere. These works are being constructed at a cost of over £230,000.

Next in importance is the Cemetery gully bridge just started, and to be completed in two years at a cost of over £30,000. The total length of the bridge is 910 feet, the central arch will have a single span of 320 feet, and the depth, from parapet to bottom of gully, is 147 feet. Provision is made for a carriageway 24 feet wide, with a six-foot path on either side, and it will absorb 1,400 tons of Portland cement.

Next in importance are the two five-storey buildings being built simultaneously, the one for a granary for the Northern Roller Milling Company and the adjacent block for Lichtenstein; these buildings are built on reclaimed ground on ferro-concrete piles, 50 feet long, driven into the rock, the only woodwork in the structures being the doors and window frames, and their leading feature is the lightness of the walls. There is also a block of office buildings being erected for Mr. Mackay, in Swanson street, a block of shops for Mr. Dudley, in Queen street, and a private dwelling at Remuera is being erected of monolithic concrete.

The lady architect we have heard of, and the lady decorator is quite established in America. As a rule, however, when women concern themselves with buildings from the business point of view it is on the more artistic side. In America, however, there is at least one lady who practises as engineer, or, as she calls herself a specialising architect. Nor is her business a merely nominal one. She is already responsible for some very important works. It is stated that the whole of the steelwork of the Broad Exchange building in New York, which is twenty-eight storeys high, and houses 8,000 brokers,

INTERIOR OF NATIONAL BANK, WELLINGTON. [*John S. Swan Architect.*]

bankers, and Corporation officers, was designed by her. In addition to this she has designed the steelwork of the Astoria half of the Waldorf hotel. The Whitehall building, another giant of Lower Broadway, and a score or more of other big structures have been designed by this gifted lady.

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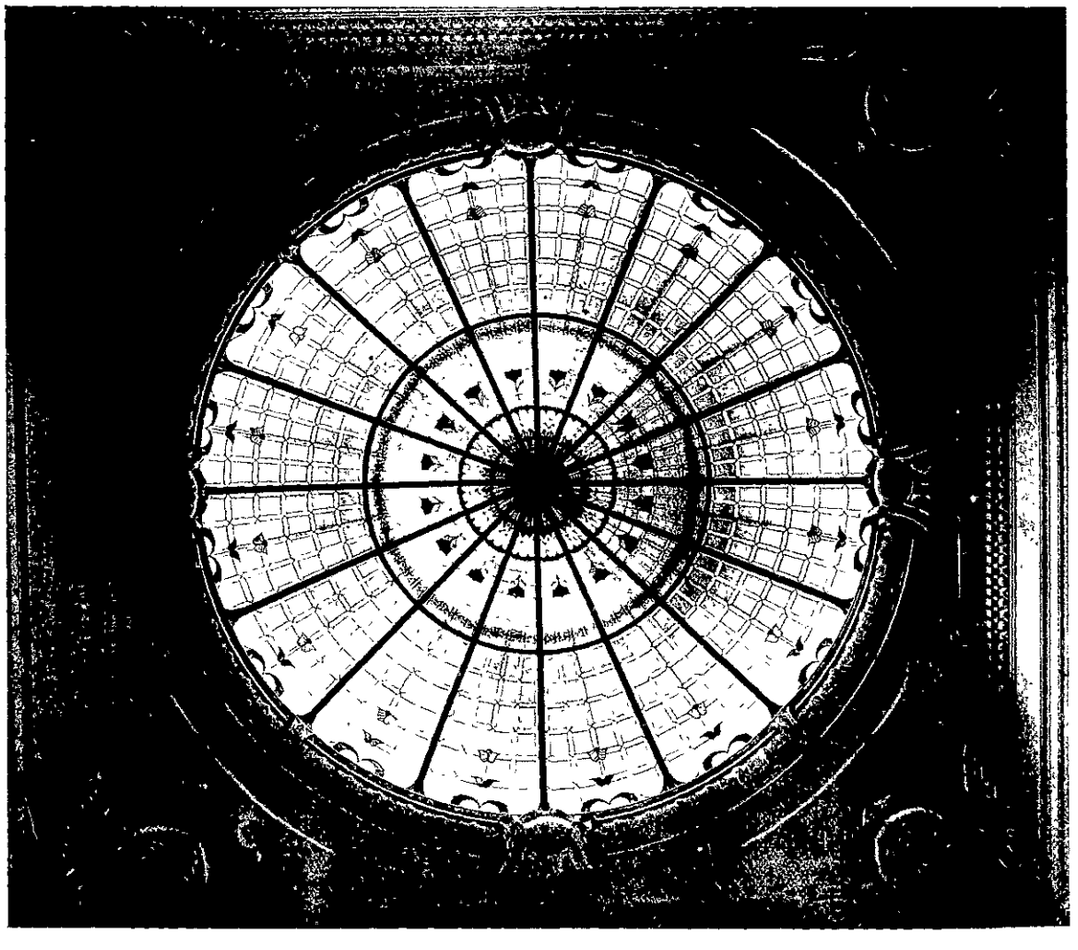
The practical value of concrete blocks for building has now been fairly established, but the artistic possibilitiesof this method of construction are still open to some doubt. An American engineer has patented a method of treatment of the concrete which seems to promise excellent results from an artistic point of view, allowing a great variety of surface finish. Instead of obtaining a smooth grey surface by means of cement, the aggregates are allowed to constitute the surface. The method, as described by the *Engineering World*, consists in using near the surface an aggregate of whatever finish is desired, and by removing the cement film from the concrete when the moulds are removed, this aggregate is brought out in relief, giving an artistic appearance. A very successful method for producing this finish consists in applying a solution of the concrete after it is hard and dry, which removes the cement, exposing the aggregate, and by careful washing a surface is obtained that is practically everlasting,



THE "LUXFER" DOME OF NATIONAL BANK.

OLD-WORLD ARCHITECTURE.

IV.

Our two illustrations of to-day show characteristic types of the architecture of Alsace and Lorraine, the provinces which fell to Germany as the prizes of the great war of 1870-1. They have been the living object, ever since that date, of the "revanche," the policy which has remained dear to the French heart, though it has ceased to dictate the national policy of the republic. In fact, the whirligig of time is doing for the Germans what it did for the French in former days. These are, of course, German countries absolutely; and before the end of the seventeenth century they were part of the German Empire. At that time Louis XIV. of France, in a time of profound peace, captured the city of Strasbourg by a stratagem, and after the long war that ensued, he obtained by treaty of peace confirmation of his right to the proceeds of his robbery, taking both provinces. Frontiers in those days were regarded as not dependent on questions of morality. A further portion was added by the French Republic during the wars of the revolution, the territory of a portion of the Swiss republic lying round about Mulhouse and over against Bale, completing the security of the French frontier by adding a Helvetic corner. But for Russia, which refused stoutly to support the demand of Germany and Switzerland for the return of these territories to their rightful owners, the provinces would have reverted after the peace of Paris in 1915 to their original sovereignty. By that time, however, they had become thoroughly French in spirit, and had given to France some of the most illustrious of her soldiers and sailors. Marshal Saxe, for example, was an Alsatian; so was General Kleber whom Napoleon left in command in Egypt; and so was General Rapp the heroic defender of Dantzic at the close of the Moscow campaign; so was the celebrated Admiral Brouat and many another famous patriotic defender of "La Patrie." By the time of the second Empire the people had become more French than ever. But the Germans had never abandoned their idea of La Revanche, and when they got their opportunity at the peace of Versailles, they took the fullest advantage of it

Thus these provinces passed back to their original German allegiance, and the years that have elapsed have made them a great deal more German than they were when so many thousands abandoned their country on the borders of the Rhine, in 1871-72, rather than submit to the German yoke.

The cities from which we draw to-day's illustrations are far more interesting for their German past than their French. For instance, the town of Obernai, of which our illustration shows the Market House, is one of the old cities of the German Empire, with houses dating back, many of them to the fourteenth century, and ramparts quaintly towered and bastioned, pierced with extraordinary old gates, of a date it is hard to determine beyond the fact that they are probably much older This old town, now of some 5,000 inhabitants, is in the heart of the Vosges country some fifty miles west of Strasbourg, right among the ancient castles peeping from every commanding position, and the cities with their small populations and their long eventful histories, all in a wonderful setting of woodland and mountain peak rising tier above tier. Here there is an old Gothic church of the simplest, severest type, picturesque with age and stately with dignity of perfect proportion; there is a beautiful chapel with a wonderful tower of the Renaissance order; and there is the Market House of our illustration; as complete a piece of architectural harmony as one could see in a day's march, even in that country so full of masterpieces of the past. The stork's nest on one of the chimneys reminds one that Obernai is a famous breeding place of the stork, a bird much respected as a scavenger in the old cities of the continent, living, therefore, in the security of a strong friendship with the inhabitants, who have protected him by law against molestation.

MARKET HOUSE, OBERNAI. [*Original photo by Mr. C. Dillworth Fox.*]

Thann is further to the south, and nearer the Rhine, occupying a commanding position overlooking the Vosges country, on the outskirts of which it is situated. This is a manufacturing town of some 8,000 inhabitants—a wonderful place for cotton prints—and of course with vineyards galore in the neighbourhood, presenting the same differences as all the Alsatian vineyards do, as between the "wines of the mountain" and the "wines of the river," the former of the effervescing variety largely. Our illustration shows the

church of St. Theobald—a magnificent Gothic structure, begun in 1455, with a spire of delicate open work nearly 300 feet high, dating from the year 1516. The doorways, highly enriched with sculptures, representing saints and scriptural subjects, are of very good execution, and the whole church is said to be in some degree a miniature of the great cathedral of Strasbourg. There is not, of course, the magnificent facade of the Rhine cathedral, nor is there the marvellous effect of the netting of detached arcades and pillars thrown over the solid masses of stone, which give its unique beauty to Strasbourg cathedral, an effect in places as of a veil of cast-iron of most delicate tracery. Indeed, of that effect one authority says thatthecathedral, being seen as it were behind a rich open screen, or in a case of woven stone, the effect is very gorgeous, but with a sacrifice of distinctness from the multiplicity and intersections of the lines. In some degree, the open work of the tower of the church of St. Theobald at Thann, together with the lattice work and the flying buttresses, goes in the direction indicated. Hence, no doubt, the legend of the miniature. Moreover, the cathedral of Strasbourg is admitted on all hands to be one of the noblest Gothic edifices existing. St. Theobald's is clearly, therefore, well in the front rank of Gothic art.

CHURCH OF ST. THEOBALD, THANN. [*Original photo by Mr. C. Dillworth Fox.*]

The Dulac System of Concrete Pile Foundations.

One of the most interesting of the newer methods of establishing firm foundations for buildings in soft ground was invented by the French engineer, Dulac, and was first used on a large scale in the construction of the buildings of the Paris Exposition of 1900, where much time and money were saved by the employment of this novel system.

The compression and stiffening of the ground, which are effected by wooden, piling are caused by the lateral displacement of earth as the piles are driven in. Dulac produces the same result by omitting the wooden pile and allowing a conical weight, raised by the pile driver, to fall directly on the earth in which it makes a vertical cylindrical hole, which is deepened by each successive impact of the weight. After the desired depth has been reached the hole is filled with concrete which is rammed very tightly.

The concrete piling thus formed possesses the great advantage of being independent of the height of the ground water. Wooden piles, on the other hand, must be driven entirely below the lowest water level in order to prevent decay.

The Dulac apparatus consists of a pile driver of the usual construction, 30 or 40 feet high, and three weights of a horizontal diameter of about 30 inches. The weight used in the beginning of the operation is conical, sharply pointed, and weighs two tons. When a hole has attained a depth of a few yards, a weight of parabolic, or sugar-loaf, form, also weighing two tons, is substituted and used until the desired depth is reached. The entrance of water can be prevented by throwing into the hole a quantity of clay which is plastered on the side of the hole by the falling weight. The diameter of the hole, before it is filled with concrete, is only a few inches greater than that of the weights. Holes nearly forty feet deep have been made by this method.

The filling is commenced by throwing in a quantity of stones and ramming them down with the third weight, which is flat on the bottom, and weighs one ton. The effect of the ramming is to broaden as well as solidify the successive layers, and thus form a very firm base for the concrete filler. The concrete is then introduced in small portions, each of which is well rammed with both the flat bottomed and the round-bottomed weights, and the process is continued until no more concrete can be forced into the hole. The compression and lateral distension effected by this method are so great, that the volume of stones and concrete employed is about five times the cubic capacity of the original hole. Thus, two desirable results are produced. In the first place a number of very strong concrete pillars are formed; and in the second, the soil between these pillars is compressed very forcibly so that it becomes capable of aiding materially in the support of the building.

In the new Gospel hall in Dunedin, which is being erected from the plans of Basil B. Hooper, special attention had to be paid to the foundations, which are four feet wide, with expanded metal embedded in the concrete footings. The whole design is carried out in brickwork without cement facings of any kind

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Two two-storey buildings of very neat design are in course of erection in Victoria avenue, Wanganui; also several cottages have been erected at Carlton, near the late residence of Mr. A. Atkins, C.E., Wanganui.

Modern American Hotels.

Modern hotels are not, as a rule, models of excellence either from an architectural or a decorative point of view A writer in the *New Age* has been telling his readers how modern hotels are built, and, as he says, these conditions explain much that is disappointing in hotel building:—It is necessary to impress the public with the fact that the scheme has behind it some go-ahead men. The scheme must accordingly be rushed at a tremendous rate. A building which in the ordinary course of things would take four or five years to build, is put up in a twelvemonth. Money is wasted wholesale in the rush; but that doesn't matter The thing is to impress the public. If that can be done the money will be subscribed. If not, who knows what will happen? These schemes are invariably undertaken in a hurry. A furnishing firm is running short of orders. They have a huge factory to keep going. Something must be done immediately. A hotel scheme is decided upon. An architect is called in and the foundations are laid before there is time to look round. In many of these schemes only very rough drawings are out when the work is commenced; just sufficient to pass the local body. And so from start to finish men are working one on top of the other. Mistakes are made wholesale. That doesn't matter. Get it finished. That is the only thing of consequence"

"Needless to say, all this hustle impresses itself on the architecture. A hotel must be designed according to the terms of the hustle. In a really fine piece of architecture the interior and exterior treatment will be organic; but in work of this kind all such treatment is out of the question. Exterior and interior must be designed separately, for the structure will be well on the way before there will be time to consider the interior. If an initial error has been made, then make the best of it. It is too late to change. The interior decorations will be such as can be put into position in the shortest time. It is the last lap. The hotel has been advertised to open on a certain date, and there are endless rooms to finish. Modelling in position is out of the question; only applied work may be used. In a word, anything that can be done in a hurry is done. That is the recipe for hotel decoration." There is a good deal of truth in all this. But happily these melancholy conditions do not universally apply in England, however, it may be in America.

The Finest Building in Europe.

Which is the finest building in Europe? We are not starting a prize competition on the subject, but the question is suggested by a curious note which appeared in the *Scotsman*. According to our contemporary the finest public building in Europe is (what does the reader think?) the new block of Government offices in Whitehall! Such, we are told, is the declaration of competent architects. We should much like to see that declaration. That the late Mr. Brydon's building is well adapted for its purpose, and has some fine architectual features, we readily admit—but the finest in Europe! When one thinks of the Parthenon, Santa Sophia, Chartres Cathedral, and St. Paul's, one can only conclude that our contemporary—or one of the competent architects who is its authority—has been indulging in an unrestrained use of superlatives which are a trifle ridiculous.

Fire-proof Insulating Material.

An insulating material which is stated to possess high dielectric strength, to be fireproof and non-shrinkable, is the subject of an American patent by George Kelley. The material first formed consists of five parts, by weight, of pontianak gum and ninety-five parts of liquid glass; that is, silicate of sodium or silicate of potassium. The liquid glass acts as a solvent for the gum, the resultant combination having excellent adhesive qualities. Sufficient mineral wool is moistened with the above combination to make a stiff but plastic body. The material is formed into sheets or moulded articles which are subsequently vulcanised under pressure until the desired degree of hardness is attained. It is stated that the article thus obtained is suitable in every way for insulating purposes.

Extensive additions and alterations are to be carried out to a residence at Whare Rata, Palmerston North, for Mrs. Arthur Russell. Included in the additions is a new wing containing handsome ball-room 30 feet long, with a six-angle window across the full width of one end, and a large inglenook, with fireplace finished in small pressed bricks, and having a tiled floor. On either side of inglenook, cosy ingle seats will be provided. The ceiling finishing of this room is to consist of two heavy beams running across the room, two smaller beams at inglenook and recessed window, the remainder being cut up into panels with heart of rimu battens. The upper floor, above the ball-room, will be occupied by three new bed-rooms. A deep window to the dining-room, and large alcove to the drawing-room, both of which are to be finished with fine heart of rimu finishings, are also among the alterations, which include new bath-room, conservatory, verandah and porch, as well as several minor alterations necessitated by the carrying out of the work. The exterior treatment of the building is to be in the Old English style, the upper walls of the new wing being covered with asbestos sheets, with battens to cover joints cutting the surface up into wide panels, and giving a picturesque appearance to the whole residence. Architect, C. Tilleard Natusch; contractor, J. McChesney, Marton.

Ship Subsidies and the Cost of Speed.

There was something more than the company speech and the company outlook, says *The Mariner*, in the admirable address which Mr. Owen Philipps, M.P., gave before the shareholders of the Royal Mail Steam Packet Company at their annual meeting recently. The chequered relations of his company with the Government over the West Indies Mail contributions raise the whole question of mail and ship subsidies, when right and when wrong, and we are glad to have the opinion of Mr. Owen Philipps on subsidies thus clearly expressed:—

"It is doubtful if any country gains by paying a subsidy to shipowners except for services actually rendered. If the payments for all mails were based on the poundage of mails actually carried, like any other form of excessively valuable cargo, and the rate of poundage was settled in each case with some regard to the nature and value of the services performed, I believe that it would, in the long run, be to the advantage of all concerned.

And although this statement is subsequently qualified by another which exempts from the generalisation any service "maintained solely on National and Imperial grounds, and where (as in the intercolonial service in the West Indies) there is no trade to justify any service at all on a commercial basis," the speaker was careful to add that it does apply to all cases where there is enough trade to pay a passenger service, provided the speed of the steamers is somewhat modified.

Here we touch the fringe of a correlative subject which is too often neglected. Better than subsidies, says Mr. Philipps, would it be if the money saved were spent in improving and cheapening cable communications. If that were done, he contends that the necessity for very fast mail steamers would disappear, "as very fast steamers are not as comfortable for passengers as large steamers of more moderate speed." As a general proposition this is undeniably true, although it is only right to add that the introduction of the turbine bids fair to combine high speed with the maximum of comfort. In fact, the favour with which the turbine has been received is in some measure due to this recommendation; but it is also due, and in a much greater degree, to the claim advanced for it that it is more economical at a high speed than the reciprocating engine. Ultimately the whole problem resolves itself into one of cost. Steamers, generally speaking, are run on business lines, and only Governments can afford to run them as a matter of policy. Let there be no mistake about this. The cost of speed, as speed increases, becomes so excessive that we may say under two conditions only can it be paid for. First, by the aid of a heavy Government subsidy, which will meet the financial losses. Second, by a private company strongly financed, which may run three or four high-speed vessels between points where there is a large and well-to-do first-class passenger or specialised traffic. Moreover, both of these conditions are limited by considerations of distance. What we mean is simply that the Atlantic greyhound, speeding between Europe and the United States at 23 knots, could not carry the coal to cross the Pacific from, say, Vancouver to Australia, at the same rate of speed. The problem of high speed is already sufficiently difficult on the Atlantic, and the reason why the broader waters of the Southern Hemisphere are left alone by high speed vessels is entirely due to primary economic and engineering obstacles. And yet, perhaps, it may be difficult to persuade Mr. Deakin and Sir Joseph Ward of this truth; but none the less, we profoundly doubt whether any Government, after looking into the question, would risk the impossible and waste money over a long distance high-speed "All-Red" route.

What exactly is the cost of speed? What relation does the expense of it bear to the increase in efficiency? Briefly, let us quote Froude's deduction which states that 1 per cent. increase of speed requires 2 per cent. increase in length, 6 per cent. increase in tonnage and bunker coal, and 7 per cent. increase in horse-power, boiler capacity, and engine-room crew. These conclusions, of course, are now subject to some modification since the introduction of the turbine, and it is possible that the coming of internal combustion machinery may still further upset the basis of the calculation; but meanwhile it holds good for the great majority of steam-propelled vessels. There is no necessity to labour the point; it is conclusive that for every additional knot of speed the cost increases enormously, and for a 23-knot line of steamers, such as we have seen suggested, the subsidy they would require on any ocean "lane," longer and less frequented by passengers than that between Europe and New York, would be simply appalling.

Harnessing the Waipori.

By W. G T. GOODMAN, A M I.E.E.

Part I.

One cannot travel through New Zealand without being impressed with the fact that Nature has been extremely beneficent in her endowments of natural resources The magnficent lakes, rugged mountains with their everlasting covering of snow, extensive glaciers, and swift-flowing rivers, are a great attraction to visitors from all parts of the world. New Zealand has many rivers, some carrying large volumes of water with low heads, and others carrying smaller volumes with extraordinarily high and easily developed heads. The natural resources of New Zealand in the direction of valuable rivers that can be harnessed, have received the attention of the New Zealand Government during the last few years, with a prospect of development and utilisation for electrical purposes.

The late Mr. P. S. Hay, M.Inst. C.E. who held the position of Engineer-in-Chief to the Public Works Department of New Zealand, submitted a most valuable and instructive report to the New Zealand Government in September, 1904, in which he dealt exhaustively with the valuable resources available for hydro-electric development, and after making due allowance for all loss of head in races, conduits, and pipes, and allowing an 80 per cent. efficiency for all water motors, he showed that the enormous amount of 3,700,000, horse-power can be obtained, 500,000 horse-power being available from the rivers of the North Island, and 3,200 000 horse-power from the South Island rivers When one realises the true import of these figures it can be seen that New Zealand has been liberally treated with natural hydraulic resources.

There are several small streams which have been used for generating electric energy in various parts of the country. It has been the good fortune of the author to carry out the development of an important hydro-electric scheme contiguous to the city of Dunedin, and the object of this article is to present a description of the installation.

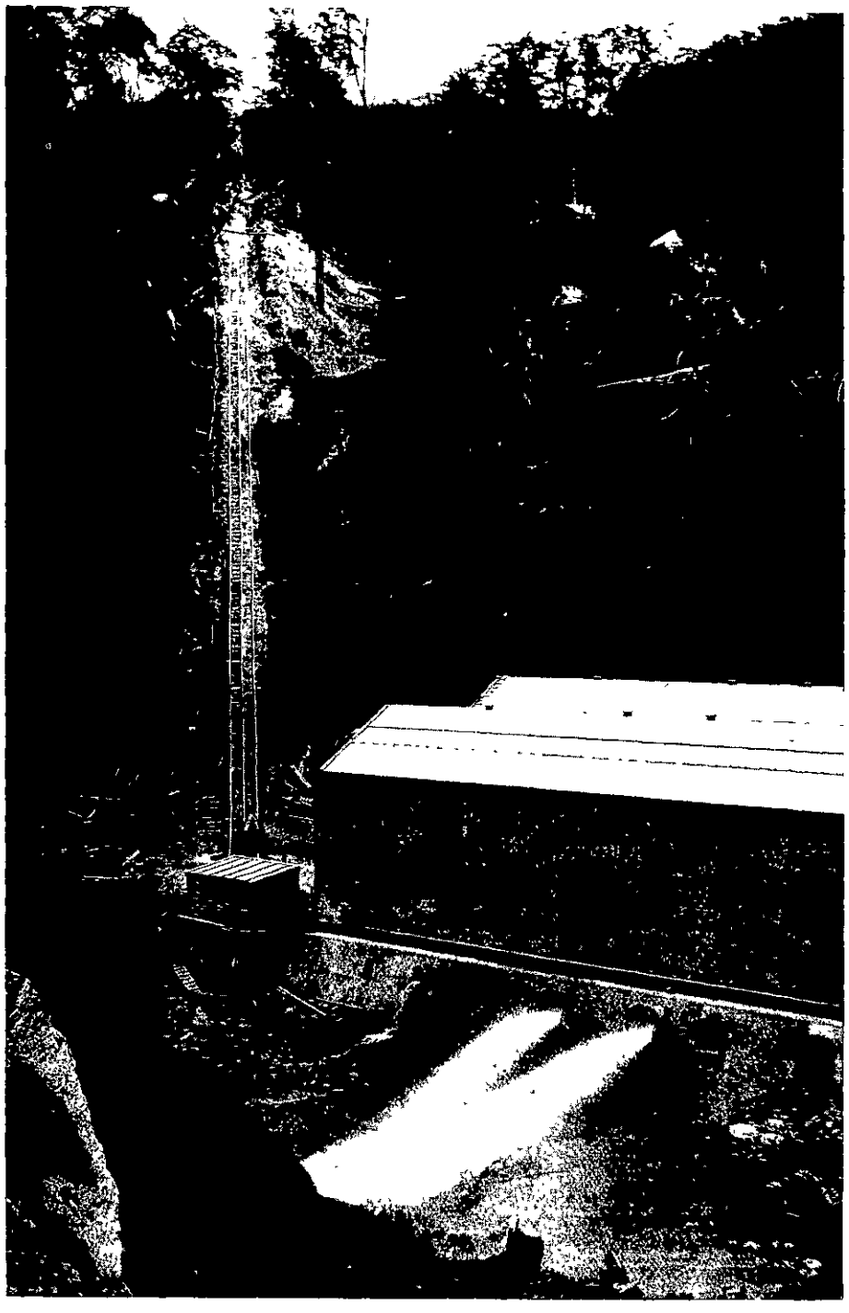
The Waipori river is situated in the province of Otago, and has become noteworthy, because from it power is being obtained for the development of electrical energy on a scale hitherto not attempted in the Australasian colonies. It is typical of many rivers of New Zealand, rushing down the steep slopes of the mountain ranges meandering through a comparatively level plateau; again rushing through a rocky gorge, and subsequently forming a confluence with the Taieri river some five miles from the sea. The translation of the Maori word "Waipori" is "muddy water" and, as the name indicates, the water is of a dirty colour, caused by the mining operations in and along its banks and tributaries. It is the receptacle of "tailings" from hydraulic sluicing and elevating.

Perhaps one may be excused for reciting, *inter alia*, a brief history of the circumstances leading to the hydro-electric development of the river. Seven years ago the author on behalf of the firm he then represented, was invited by the City Council to report on the electrification of the Dunedin tramways and recommend a system for generation of power, the latter consideration to be with the view of supplying the tramways and city and suburbs with the electricity for lighting and motive power. In this report consideration was given to alternatives of generating by gas, steam, and water-power. In connection with the hydraulic considerations, three propositions were reviewed, namely —The Taieri river, with a head of 70 feet, the Lee stream, with a head of 700 feet; the Waipori, with a head of 800 feet. The power station on the Taieri river for the Lee stream scheme would have only been 12 miles from the city of Dunedin, the power station for Waipori scheme in the location suggested by the author would have been 26 miles from Dunedin After consideration, the City Council decided to adopt the Taieri river scheme, but subsequently this proposition had to be abandoned as Parliament would not grant the Council power to erect a dam 30 feet high across the river. The Corporation then adopted the Lee stream scheme, by the advice of a firm of consulting hydraulic engineers. This scheme involved the construction of a tunnel 1½ miles long, which was proceeded with and constructed for about two-thirds of its length.

In August, 1902, a company was formed to exploit the Waipori river scheme. This company immediately proceeded with the construction of a portion of the hydraulic works, and in April, 1904, contracted for the necessary Pelton wheels, generators, and transformers for the power station. Their prospectus stated that they proposed to utilise the energy to be obtained from the Waipori river, to supply power on the Taieri plains, and in the city and suburbs of Dunedin. When they had proceeded thus far they applied to Parliament for the necessary Enabling Act. The Council realised that if the company secured powers to reticulate in the city of Dunedin, and suburbs, such powers would jeopardise the prospects of the Corporation undertaking, and in October, 1904, they bought out the rights for £12,500 and took over the liabilities of the Waipori Company, and abandoned the Lee stream scheme, on which they (the Corporation) had already spent the sum of £18,000 on the tunnel works.

Negotiations necessary for the completion of the purchase occupied several months, and in March, 1905, Messrs. Noyes Brothers were instructed to proceed with the designing and construction of the electric portion of the undertaking. At the time of the purchase by the Council, the company had constructed the weir and 82 chains of the flume, and, as previously mentioned, had let contracts for a portion of the generating plant The proposals of the Corporation were of a much wider range than those of the Company, and, with the view to meeting the requirements of such proposals, the scheme as designed by the Company was very materially altered and amplified in order to guarantee as far as possible permanent operation, and provide every possible means of eliminating risk of stoppage in supply.

At the point where the Waipori river leaves its last elevated plateau and commences its final rush towards the sea, the site of the intake has been chosen, the height above sea level being 1125 feet. From this point the river rushes in numerous cascades through a vertical height of 700 feet, in less than two miles. The source of the river is in the Lammerlaw Mountains, a range running from 4000 to 6000 feet above the sea level. The length of the river above the intake is 22 miles, and the catchment area of the watershed is about 95 square miles. From careful observations taken during the last three years the discharge at point of intake has varied from a maximum of 50 cubic feet per square mile, to a minimum of 0 4 cubic feet per square mile. The information at hand shows the fluctuation in the river discharge October, 1904, to 31st May, 1907.



VIEW OF POWER STATION FROM OPPOSITE SIDE OF RIVER

In this view may be seen the discharge from the Pelton wheels. On the left of the picture is the gravitation tramway, by means of which the machinery and material for the power station were taken from the top of the hill.

ANOTHER VIEW OF POWER STATION FROM OPPOSITE SIDE OF RIVER.

The location of intake was well chosen, and advantage was taken of a projecting spur of rock through which a tunnel 22 feet in length was cut. This tunnel leads into the wooden flume. On the opposite side of the river a similar spur formed an excellent key to the weir. Nature thus assisted the construction of the intake, as these rocks present practical immunity from damage by flood, and provide an easy method of handling the head-gates. The tunnel is rectangular in section, 8 feet by 4 feet at intake, tapering to 6 feet by 4 feet at the junction with the flume. The two head-gates are each 4 feet by 4 feet, and are operated by rack, pinion and pawl with ratchet levers.

The weir is constructed of rock-filled crib-work, 76 feet long at the crest, 15 feet in depth, with a top width of 10 feet, and a bottom width of 32 feet. The timber used was obtained in the vicinity, and none of the logs are less than 8 inches in diameter at the small end. The first bay of logs was run longitudinally with the current, and fastened to the bed rock by iron dowels run in with neat cement. The next tier was run at right angles to the first bay, and attached to it by thin manuka trenails, the logs being adzed to present a neat seat at each intersection. The space was then filled with hand-packed rubble as large as could be conveniently placed in the structure. A spillway has been constructed on the opposite side to the intake, which tends to divert the current clear of the head-works during heavy floods, and an 18-inch scour pipe has been provided in order to draw off silt accumulations. The object of the weir was to cause the deposit of material carried in suspension, the material thus deposited to form a water-tight structure and to reduce the pressure on the crib-work to a minimum. The results anticipated have been obtained, and a permanent wall of gravel, etc., now extends some 600 feet up stream.

The conduit for the water embraces all the features usually met with in an undertaking of this class, viz., earthworks, tunnels and pipes, and the total length from intake to water wheels is 2 miles 14 chains.

The country along which the flume is laid is mostly of micaceous schist formation easily affected by weather, and shortly before the author left, some five tons of rock fell and carried away 12 feet of the flume. There is not likely to be any further trouble in this direction, as the rock is well benched back.

The whole of the conduit from the intake to the penstock is wooden rectangular fluming, except where it passes through the tunnels, built upon a bench 10 feet wide, mostly excavated out of solid rock. Where the flume crosses creeks and gullies, it is carried on masonry piers. It is 6 feet by 4 feet in the clear, and has a uniform gradient of 8 feet to the mile. The joints in the longitudinals are butted and covered by battens 3in by ½in. under which is placed a 3in. strip of tarred felt, the joint having received a coat of tar applied hot, and all butt joints were run in with boiling pitch. The length of wooden fluming is 136 chains and the six tunnels aggregate 11 chains, total 147 chains. Four spillways are provided in this distance, these are for the purpose of facilitating repairs to the flume. The flume is constructed of mountain birch, an abundance of which exists in the locality. A saw-mill was erected in the vicinity and worked by an impulse wheel, under a head of 120 feet, located on the bank of the river, and the sawn timber was hauled 3,170 feet by cable tramway, rising 1 100 feet in that length. Four miles of wooden tramway were laid through the bush, on which the logs were hauled by horses to the mill. Nearly 1,000,000 super feet of timber was used in the flume construction, and 400,000 super. feet of sapwood was turned out and cut into suitable sizes for building purposes.

The life of the flume is estimated at from 10 to 12 years, but before the expiration of that time, no doubt, a tunnel will be constructed, about 5,000 feet long, through the hill, to conduct the water to the penstock.

The following table shows the discharge for every 6in. of water in the flume the calculations being based on Ganguillet and Kutter's formula using the co-efficient of rugosity of N 0 017 —

Depth ft in	Area sq ft	Hydraulic Mean Depth Feet.	Velocity in Feet	Cub. Ft Per Sec.
0 6	3	4285	1 795	5 4
1 0	6	.75	2.729	16 4
1 6	9	1 0	3 358	30 2
2 0	12	1.2	3 821	45 8
2 6	15	1 36	4 170	62 5
3 0	18	1 5	4 463	80 3
3 6	21	1 61	4.683	98.3
4 0	24	1 714	4 888	117 3

The tunnels, which are cut through the various spurs, vary in length from 295 feet to 20 feet, and they are made slightly larger than the flume. One novel feature in the construction of the tunnels consists in increasing their capacity by dropping the invert lever 7½in. at the inlet, and rising correspondingly at the outlet. It was found that owing to the decrease of fractional surface the discharge was increased by this means nearly 15 per cent.

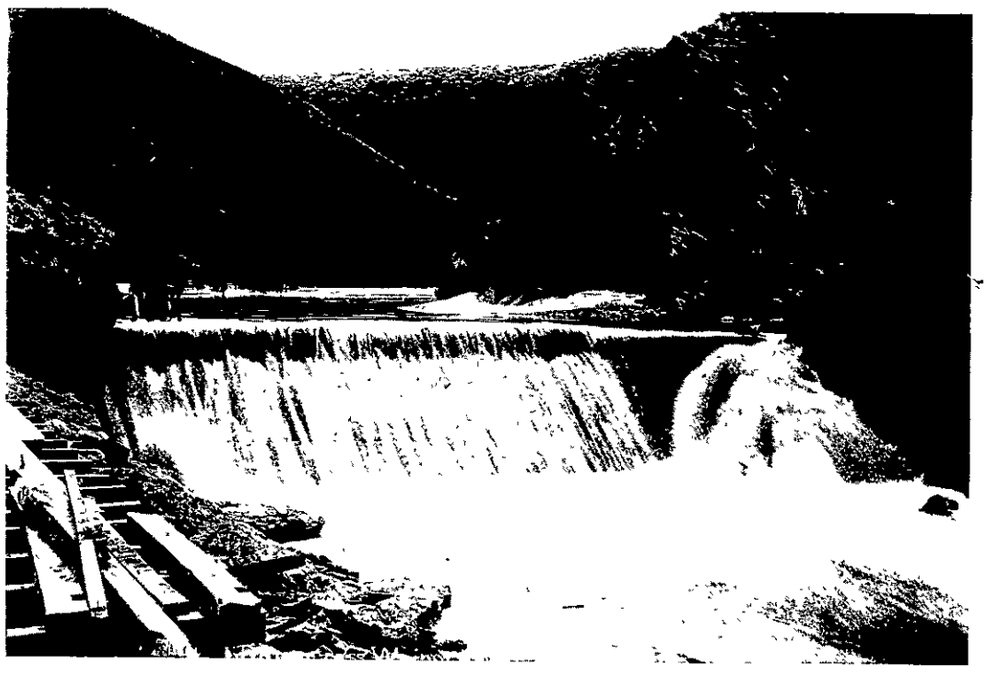
Three spillways are operated by rack, pinion and pawl; while a fourth, from which all water discharged into the pipe line is regulated, is operated by a revolving screw, the nut being firmly fixed in a yoke piece which has two long arms with a cast-iron ball weighing 30lbs. at each end. As the planes of the gates are at right angles, one leading to the spillway and the other leading to the penstock, the race man is able to stand in a position so as to operate both gates simultaneously with the assistance of the centrifugal force obtained by the cast-iron balls.

In order to free the water of all materials carried in suspension, two catchment basins, to intercept stones, etc., have been constructed, each having a capacity of 53 cubic yards of silt. The flume terminates at the penstock, which is constructed of concrete, and is 13 feet long by 9 feet wide, and 10 feet deep below the sill of the flume. By this depth sufficient velocity was obtained in the falling water to overcome the head lost at the pipe entrance. Two pipes are built into the penstock, each 42in. in diameter and provided with 6in. air-vent pipes, located on the pipe side of the main gates. Before the water enters the penstock, it passes through two gratings, twenty feet apart, one formed by wrought-iron bars, 1½in. apart, lying at an angle of 45 degrees, and the other of galvanised wire netting, 1½in. mesh, at an angle of 60 degrees. The author found it necessary to fix the latter grating, as on one occasion trouble was caused by two rabbits' feet becoming jammed between the needle and nozzle.

The pipe line presents some features of interest on account of the deviation from the usual practice. The steel pipes run from 42in. to 36in. internal diameter, alternate outside and inside courses, and vary in thickness from ⅛in at the penstock to ¼in. at the power station end, and the length of the pipe line is 1,776 feet. The following table gives the details of construction :—

Thickness of plate, inches						
⅛	3-16	¼	5-16	⅜	7-16	½
Diameter of rivet, inches						
5-16	⅜	½	11-16	¾	13-16	⅞
Pitch double rivetted seams						
1.⅛	1.½	1.⅞	2 ¼	2 ⅝	2 ⅞	2 ⅞
Pitch single rivetted seams						
1	1 1-16	1.⅜	2	2	2	2
Distance between rows, D.R seams						
11-16	⅞	1 ⅛	1 ½	1.½	1 ½	1 ½
Lap, centre of rivet to edge of plate						
9-16	21-32	¾	1.⅛	1.¼	1 5-16	1 ¾

The pipes are manufactured from "soft open hearth" steel plates, with a tensile strength of between 52,000 and 56,000 pounds per square inch. The rivets were of similar quality, with a tensile strength of between 44,000 and 50,000 pounds per square inch, all materials being submitted to the usual bending, punching and cold hammering tests



THE DAM ACROSS THE WAIPORI RIVER.

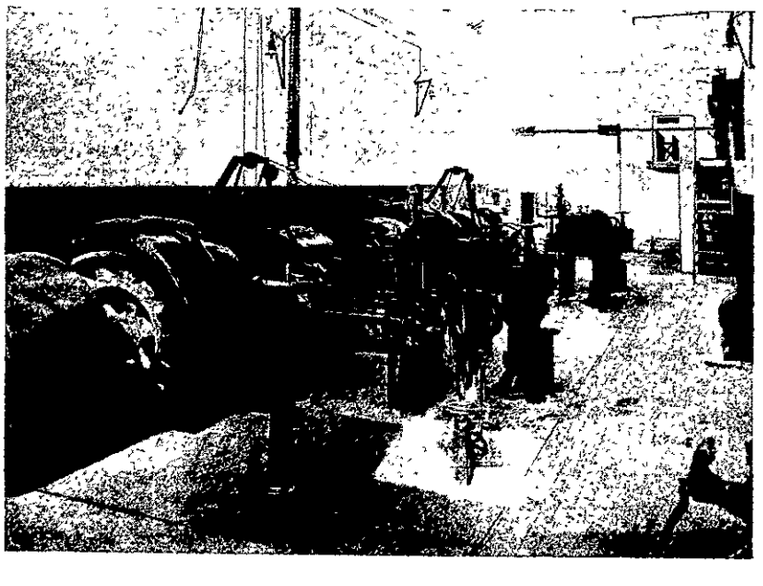
The following table gives the various lengths of each size of pipe, maximum head, loss of head by friction, and velocity of water when carrying 40 cubic feet of water per second —

Diameter.	M'xm'm Head.	Thickness of Steel	Length feet	Loss Feet	V'lc'ty ft. p r S'cond
inches	feet	inch.	258	48	4.16
42	140	1/8	136	.33	4.58
40	226	3/16	58	..	5.66
36	254	3/16	333	.	..
36	329	1/4	328		
36	440	5/16	256		
36	500	3/8	221		
36	600	7/16	186	5 53	5.66
36	670	1/2			
..	670	..	776	6 39	5.66

The pipes were made in 20 feet lengths in the shop, and were subjected to a test 15 per cent. in excess of that given in the foregoing tables, after which they were cleaned by sand blast, then heated to a temperature of 300° Fah., and dipped for 15 minutes in a bath of asphaltum mixture, containing 1½ per cent. of pure linseed oil.

The transport of the pipes and placing in position entailed a large amount of labour and risk to men and horses, owing to the inaccessibility of the country. After being placed in position in the trenches the pipes were jointed and hand rivetted, afterwards being caulked both inside and out, they were then covered with soil to a depth of 2 feet 6 inches, to prevent them being exposed to sun temperature, and thereby to dispense with expansive joints. The variation in temperature of the water between summer and winter is not more than 15 degrees Fahr., and the expansion due to this difference will not be more than 2 inches, which will be taken care of by the vertical angles in the pipe line. Six anchorages prevent the line from creeping, four of which are solid concrete blocks, 6 feet x 4 feet x 6 feet Five air valves of the triple-cluster type are provided with shut-off gate and extension pieces to allow the influx and efflux of air, the balls being of hard wood with rubber seats. Five manholes are placed in the line to facilitate field rivetting and inspection.

Owing to the physical features of the country it was found impossible to select a line wholly below the mean hydraulic gradient, and recourse had to be made to a tunnel at the lower end, in order not to rise above it This tunnel is 187 feet in length, with a gradient of 1 in 3½, and large enough for three pipe lines, thus providing for future extension At the mouth of the lower end of the tunnel the last section of ½-inch plate pipe is attached to a cast iron "Y" branch piece, dividing the water into two 22in. cast iron pipes each to carry 20 cubic feet of water per second, one branch for each unit. On each end of the branch of the "V" a main 22in. gate is placed with a 4in. by-pass. The valves are enclosed in a tower, as they are operated by fine thread spindles which require 2500 turns of the hand-wheel to open or close them; a motor is installed to operate these. The balance of the pipe line is of cast iron, each leg of the 22-inch branch being 80 feet long, bifurcating by a cast iron "Y" piece into two 14-inch branches, each leading to the nozzle of the impulse wheel Each 14-inch branch is controlled by a 14-inch gate valve with by-pass The cast iron pipes were made of best grey iron, having a tensile strength of not less than 18,000 pounds, and were cast vertically in 6ft 6in. lengths, weighing 25cwt.



ENGINE ROOM OF POWER STATION, WAIPORI.

The Pelton wheels of electrical generators are here shown, each of 1500 h.p

VIEW OF FLUME FROM JUST BELOW THE INTAKE

It was of course necessary to erect the foundations for the engine beds before the pipes were laid, and considerable difficulty was met with in having to connect rigidly with two fixed points in the pipe line The closures were made ¼in short, and the final joints were run in with lead caulked against a wrought steel band shrunk over the flanges In the terminal pipe two extension pipes were placed, one being a 6-inch branch to operate the exciter units, and the other a 4-inch branch leading to the air receiver.

The exciter pipe line is so arranged that any two of the three exciters may be operated in parallel with the same hydraulic head, this object being obtained with a system of "Y" branches and valves.

All cast iron pipes were tested hydrostatically to a pressure of 450lb per square inch and the valves to 500lb per square inch. The joints are made with round rubber high pressure gaskets, the flanges being rebated for that purpose.

Generally the whole lay-out of the pipe system is a departure from that usually adopted, more particularly in respect of the entire absence of receivers at the back of the power house. The deviation of water is made by the "Y" branches It will be seen that the water has thus been put into train with a minimum amount of obstruction and friction, and the results obtained from the efficiency tests are ample proof of the advantage of this system over that of water receivers. The weight of the column of water in the pipes is about 470 tons, which at full bore moves with a velocity of 5·66 feet per second, and in order to provide against accident due to shock from water hammer, an air receiver has been installed which consists of a shell 30 feet long by 36 inches in diameter. The air pressure is maintained equal to that in the pipe line by an air compressor operated by a 10 h.p motor, and the water is covered with a layer of oil to prevent aeration of the former. The capacity of the receiver was calculated to absorb the sudden stoppage of flow from an angle of 26 degrees from the one jet of the four main pipes, in six seconds at full bore, the standard working pressure being 288lb per square inch The receiver reclines at horizontal, and is provided with an automatic float which operates the controller of the compressor motor.

The receiver was placed at the end of the malleable line because it was impossible to place it nearer the nozzles; the cast-iron pipes had, therefore, to be made sufficiently strong to resist the shock arising from water hammer.

As previously mentioned, the main supply of water carries a large amount of sludge in suspension, which renders it unsuitable for the operation of the hydraulic governors A supply of clear water was obtained from a small creek giving a hydraulic head of 400 feet at the power station. A small concrete weir 8 feet high to the sill of the spillway was constructed across the bed of the creek, and the water conveyed by a 4-inch pipe-line 1807 feet in length, to the governor. This pipe line is provided with the necessary air valves, gate valves, and stop-cocks, and is buried and securely anchored. It is tapped at a height of 250 feet above the power station to supply the engineers' residences and fire hydrants for same, and in addition to supplying the governors the water is also used for cooling the transformers.

The maintenance and operation of the flume is done by one man, who has been provided with a small cottage located near the penstock It is this man's duty to record the water passing through the flume and over the weir and to patrol the whole length of the flume twice per diem. His residence is connected by telephone to the power station, and there are also telephone stations along the flume to each spillway, and one at the intake! and the race-man reports to the power station from each point.

When making the efficiency test the water was measured by passing it through a square orifice. The head and aperture were accurately measured, and the co efficient of discharge used was 0.619, and the results agreed with the measurements of the water over a weir. The amount of water used during the experiments was 29 cubic feet per second, and allowing for frictional losses, etc., the total theoretical h.p. at the power house was 2185 This included the water for the main unit and exciter. The spouting velocity at the nozzles was 12 360 feet per minute, the peripheral speed of the water wheels being 5945 feet per minute.

An ideal site for the power station was selected on the bank of the Waipori river. The building is constructed of concrete re-inforced with steel rods; the metal, gravel, and sand for the concrete were obtained from the opposite bank of the river and consequently only the cement and re-inforcing rods had to be transported from Dunedin.

The power station building is 100 feet long by 64 feet in width (internal dimensions), and a temporary wall has been constructed at the down stream end to allow of future extensions Before commencing the work of clearing the site for the foundations the author deemed it advisable to clear the bed of the river in front of the power station of the large rocks and boulders, so as to provide a clear channel for the water in flood time This dangerous and arduous work took several months to complete, and the bed of the river was cleared for a length of 8 chains, the result being that the normal level of the water was reduced 6 feet, thereby considerably reducing the cost of the power station foundations, as the floor level would have been 6 feet higher if this work had not been carried out.

Concurrently with the work of clearing the river bed, the construction of a training wall at the up-stream end of the power station was proceeded with,

to divert the flood waters from the power station site and to form a permanent protection to the foundations from erosion during time of floods.

The foundation for the wall of the building on the river front was taken down to the rock bottom 16 feet below the bed of the river, and is 8 feet wide at the base, tapering to 4 feet wide at the engine room floor level, which is 6 feet above the highest known flood level.

The power station is divided into two portions. The front portion forms the engine room and is 100 feet long by 30 feet wide; the back portion is 100 feet long by 29 feet wide, and has two floors. On the ground floor adjacent to the engine room, is the L.T. bus bar corridor, which runs the whole length of the building, and is 7 feet 6 inches in width. At the rear of this is the transformer room, which is 63 feet long by 12 feet wide, and at the rear of the transformer room is the H.T. bus bar corridor, which runs the whole length of the building and is 9 feet wide. These compartments are divided from each other by concrete walls, which also form the support for the floor of the oil switch room above, which contains the H. and L.T. remote control oil switches, the L.T. in this case being 2400 volts. The whole of the walls and floor of the oil switch room are constructed of re-inforced concrete, the floor being calculated to carry a distributed load of 40 tons. At the down stream end of the building, in the rear of the H.T. bus bar corridor, is the lightning arrester annex, which is 29 feet long by 5 feet 6 inches wide.

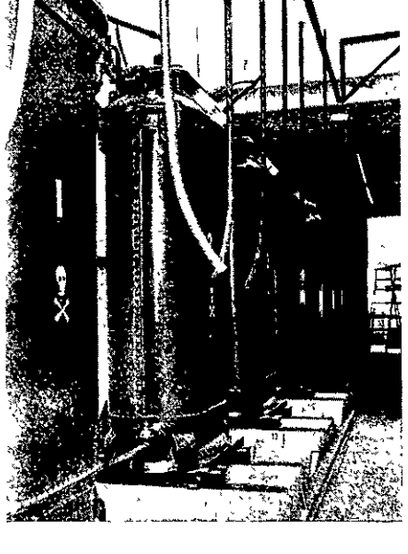
INTERIOR VIEW OF THE OIL SWITCH ROOM.

The main walls of the engine room carry the 15-ton Krupp traveling crane which runs the whole length of the building on concrete girders, which are re-inforced with steel rods and partly supported on concrete corbels. The roof is constructed with framed iron principals at 12 feet 6 inch centres, and is sarked, felted and covered with galvanised iron. The engine room and the oil switch room are lighted by means of skylights which run the full length of the building, and there are also large windows at the up-stream end. The foundations for the machinery are carried down to bed-rock; they are constructed of solid concrete and are entirely independent of the main building. The cast-iron pipes conveying the water to the engines are carried right through the building on independent foundations.

There are two main generating units, each unit consisting of one General Electric 1000 K.W. 2400 volt 50-cycle three-phase generator, revolving field type, with 14 poles running at 429 r.p.m. The regulation at full load and 100 per cent. P.F. is 7 per cent., and with 1000 K.V.A. and 75 per cent. P.F. 15 per cent. The efficiency is 95.25 per cent. at full load. The generator is driven by two Pelton wheels each 4 feet 6 inches diameter, one at each end of the shaft, and on each Pelton wheel there are 15 buckets and the wheels are out-hung. Leading to each water and on each Pelton wheel there are 25 buckets and the wheels are out-hung. Leading to each water wheel is the 14in. pipe, so designed as to increase the velocity at the nozzles. The flow of water is controlled by the main 14in. gate valves on each branch, which, under operating conditions, are left wide open, and the regulation is adjusted by means of movable needles within the nozzles. The needles are of bronze and operated by worm gear and hand wheels, so that the quantity of water flowing through the nozzles varies according to the area of the concentric aperture between needle and nozzle tip, which is 5½in. internal diameter. When operating at full load the radial space is ⅜in. The needles are provided with heavy re-action springs to ease the effort required to increase the annular opening.

Under full load conditions the nozzles are at the top position and the jet impinges on the centre of the buckets. At no load the jet is quite clear of the buckets and impinges against a heavy iron baffle plate which deflects the water into the bottom of the tail race. The jets discharge right across the river and strike the opposite bank. They act as an ejector, and special inducts are led into the water eductes to admit air. The whole of the solid casting forming the nozzles is attached to the main pipe by a ball and socket joint, and is free to move in a vertical plane through an angle of four degrees. The nozzles are raised and deflected by means of a system of levers, cut gearing and rack shaft operated by the hydraulic governors, which are Lombard type "E." The deflecting portion of the nozzles is counterbalanced by hydraulic pressure, so that quick action can be secured from the governor on account of the absence of inertia in heavy counterbalanced weights.

The governors are provided with electric control motors operated from the table switchboard, which admit of instantaneous control of the speed of the water wheels. This control is of great advantage when synchronising. The regulation of the governors is exceedingly sensitive and does not vary more than 4 per cent. from no load to full load, and from full load to no load. When the load is thrown off, the jets are deflected clear of the buckets.



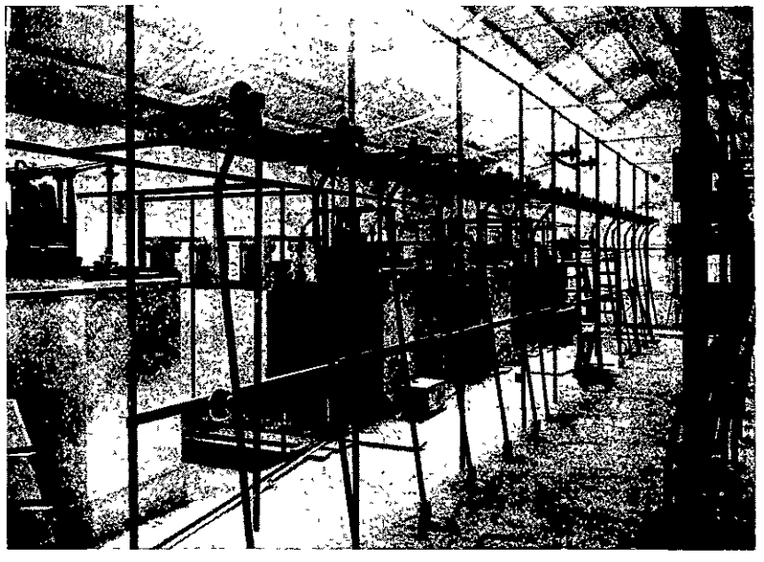
TRANSFORMER ROOM.

This shows the seven 350 kilowatt transformers, which raise the voltage from 2400 to 34,700. These transformers weigh from five tons each, and are eleven feet high.

The Pelton wheels are capable of driving the generators at 50 per cent. overload, but they are designed to give the best efficiency at full load. The buckets are made of the highest grade cast semi-steel, and the wheels are guaranteed to safely withstand the highest run-away speed attainable under the effective head of 665 ft. without damage, with the nozzle adjusted to give the maximum stream. The nozzles are pivoted on heavy trunnion pins and the ball joints are leather packed with oak tanned leather laid in tallow.

A re-action strut is provided for relieving the fulcrum bolts from thrusts, which are taken up on an independent journal in line with the axis of the joints.

The Pelton wheels are guaranteed to develop an efficiency of 80 per cent. of the theoretical energy in the water delivered to each wheel at full rated load, 75 per cent. at three-quarters load and 70 per cent. at half load. In the tests made by the author the efficiency obtained at full load was 83 per cent.



ANOTHER VIEW IN THE OIL SWITCH ROOM (here are shown the high-tension oil switches, which are operated from the switchboard in the engine room.)

The main generating units are spaced 24ft. 4in. apart, centre to centre.

At the down-stream end of the engine room are located two exciter units, foundations being provided for a third. Each unit consists of a G.E. 40 K.W. 6 pole D.C. 125 volts, 725 r.p.m. generator, coupled to a 60 h.p. Pelton wheel, coupled at the other end of the Pelton wheel is a 60 h.p. induction motor, the object of the latter being to act as a regulator for the exciter, the position of the adjustable needles in the deflecting nozzles being fixed to take care of the normal load on the exciters.

At the rear of the exciter units is the switchboard gallery, the floor of which is 8ft. above the engine room floor level. The centre of the gallery will be the ultimate centre of the power station when the plant is duplicated. On the switchboard gallery is located the main controlling switchboard, consisting of four generator panels, two exciter panels, one motor panel, one transformer panel, one regulating switch panel, and two line panels. In front of the gallery is a table switchboard inclined to a slight angle, on which are distributed the switches for controling the oil switches and Lombard governors. These switches are provided with red and green lamps which indicate whether the oil switches are open or closed, and the connections are engraved on the marble so that the attendant can see at a glance which line or bank of transformers he is operating.

On each generator panel there is an A.C. ammeter in one leg, field ammeter, volt meter, polyphase inductor recording Watt meter, field switch and field rheostat, one four-point receptacle for synchronising plug, and two hand-operated oil switches. On each exciter panel there is one ammeter, one field rheostat, one volt meter receptacle and one double pole main switch. On the induction motor panel there is one ammeter and one automatic oil switch. On each transmission line panel there are three ammeters, one in each leg, one overload time limit relay, one controlling switch with signal lamps for line oil switches.

The switchboard is of black enamelled slate, 18ft. 6in. long, supplied by the G.E. Company, and is a very handsome piece of work.

In the L.T. bus bar corridor are located the 2,400 volt bus bars, which lead from the hand operated oil switches and bus bars on the switchboard to the remote control oil switches controlling the L.T. side of the transformers.

In the transformer room there are 7 G.E. transformers, each having a rated capacity of 350 K.W., and arranged in two banks of three each, with the seventh as a spare. The transformer ratio is 2,400 to 20,000, and they are connected in "Delta" on the L.T. side, and in "Star" on the H.T. side, with neutral earthed giving a potential of 34,700 volts between places. The primary full load current is 146 amperes and the secondary full load current 17.5

amp. The transformers are oil insulated, water cooled, and each tank contains 350 gallons of oil. They are guaranteed not to exceed a temperature rise of 35 degrees C. after 24 hours' run at full load and 50 degrees C. after 2 hours' run at 25 per cent. overload, and the tests prove that these guarantees were fully conservative. The efficiency of the transformers at full load is 97 per cent., the regulation with non-inductive load 1.4 per cent., and at 90 per cent. P.F. 2.8 per cent. Each transformer is 11 feet high by 4 feet by 3 feet weighing 5 7 tons, and connected to a system of oil piping by means of which the oil can be drained from the transformer to a well, and a small electrically-driven rotary pump lifts the oil to tanks overhead, from where it gravitates back to the transformers, they are also connected up to a circulating water supply. Each transformer is mounted on a small trolly and can be shifted off its bed on to a traverser and wheeled into the engine room, so that it can be dissembled with the aid of the overhead travelling crane.

There are several small transformers in the power station for various purposes. Three 40 K.W. transformers for motors and lighting the potential being regulated by taps connecting to the dial switches on switchboard. Series transformers are in transmission lines for operating the overload relays and line ammeters

In the H.T. bus bar corridor at rear of transformer room are the bus bars connecting the oil switches on the H T. side of the transformers to the oil switches controlling the line bus bars This bus bar corridor is constructed on the cellular principle with concrete partitions, and all H.T. wires are kept at a minimum distance of 12 inches from earth.

In the oil switch room above are located the remote control oil switches, which are of two types there are four of the Westinghouse solenoid operated type which connect 2400 volt bus bars to the L T side of the transformers, four G.E. motor operated type which connect the H.T. side of the transformers to the bus bars four of the Westinghouse solenoid type which connect the H T. bus bars to the 35,000 volt line bus bars and two G.E. motor operated type which control the two transmission lines They are built up on concrete walls separating each chamber, and the doors are hung from the top, so that they are free to fly outwards in the event of explosion in the oil cells.

The controlling circuits for motors, solenoids, and signal lights, are taken off the D.C. 125 V. exciter circuits, and the whole of the mechanism can be handled with safety. The switches can be opened or closed with hand levers in case of necessity and both types of oil switches are entirely satisfactory in operation.

All oil switches throughout the entire system have disconnecting knife switches on either side of each leg, and the greatest care has been exercised with the station wiring, which is with open bare conductors throughout, the only insulated cables being those which connect the generators to the switchboard bus bars, and both sides of the transformers to the disconnecting switches above.

It will be observed that the leads from the transformers are connected to double throw knife switches on the L.T. side and to plug switches on the H.T. side, in order to admit of the spare transformer being cut in to replace any one in service that may give out in either of the two tanks. The connections to the plug switches on the H.T. side are made by means of heavily insulated flexible cable to admit of safe handling with a potential of 20,000 volts to earth. The double throw switches and plug switches are all supported on an angle iron framework. On this framework are also carried the inter-connecting bus bars between the transformers and the oil switches on both sides.

The wiring of the power station is on the duplex system throughout, and admits of either generator being connected to either transmission line through either bank of transformers independently, or in parallel.

In the lightning arrester annex are six Westinghouse low equivalent lightning arresters, one set on each leg of the two transmission lines. Each arrester is of the standard type with a series of sparking gaps in series with a resistance between them and the ground. Oil insulated choke coils are connected between the lightning arresters and the line oil switches, to protect the transformers from damage due to surges.

The hissing of the brush discharge from the H.T conductors is very marked, and the latter is visible at night. The author found it advisable to have all insulators carefully cleaned with dry cloths at regular intervals. The operation of the plant is extremely simple, and the only electrical troubles the writer had was a puncture of an insulator on one of the selector switches and a burn out in one transformer, the latter due to a heavy surge on the line

The generators were put into operation on 3rd November, 1906, and have been running almost continually ever since; and though the water contains so much matter in suspension it is so fine that the paint is not even worn off the buckets.

The power was first sent through to Dunedin on 19th March, and after the necessary preliminary experiments, the whole scheme was put into permanent operation on 7th April, 1907.

The power station staff consists of three engineers, three switchboard attendants, and one spare man, who divide the shifts between them.

A gravitation tramway had to be constructed on the hillside to convey the material from a receiving shed at the foot of the practicable waggon road to the power station. The full truck descending hauls up the empty one. The horizontal length of the line is thirty chains and the total fall 722 feet, at an average grade of 24 feet to the chain the steepest pinch being 1 in 1.43 The tramway is constructed of birch rails laid on transverse sleepers

(To be continued)

THE MASTERY OF THE AIR.

SOME QUOTATIONS AND CRITICISMS.

[By PETER ELLIS.]

The following are quotations from the remarks of Rankine Kennedy, which appeared in last month's issue of PROGRESS, page 448.

"Of how much use would a steamship be even if it could go from here to New York in a straight line, if it would probably go to the bottom of the sea if the engines stopped or slowed down? That is what would happen to the aerial machine on aeroplane principles"

Three essential tests for a flying machine:

"*First*, it should be able to rise of its own power from the ground level and soar to a few hundred feet high."

"*Second*, it should be able to hover over any spot on the earth for any time desirable without any straight line movement."

"*Third*, it should come down to earth safely from any height when the engines are stopped."

"The aeroplane I have studied long, but have come to the conclusion that no successful flying machines will depend in any way upon aeroplanes for sustaining them in the air, and the results of all the recorded experiments with them amply confirm me in that conclusion"

The above quotations are from the remarks of an eminent authority in engineering, and should not be lightly passed over. Nevertheless, I make bold to differ from him and believe that the aeroplane principle will eventually prove the most successful, and will fulfil the first and third of Mr. Kennedy's essentials, and also the second one to a limited extent

Adverting to the first essential, the aeroplane will be able to rise of its own power, *but not vertically*; it will have to rise gradually at an angle, the resultant of horizontal effort and gravity. To rise vertically means enough power to overcome the total weight plus other resistances, to rise at a fair angle with the horizon requires very much less power. This is quite evident to competent engineers, and is the mode adopted by most winged creatures The third essential can be fulfilled by the aeroplane; it may descend safely from any height when the engine is stopped, *but not vertically*; the planes must be of the correct form and construction, and must be perfectly handled. In order to produce a resultant of sufficient angle with a vertical line, this is how most winged creatures descend.

The second essential cannot be fulfilled by the aeroplane in its entirety, because the principle upon which it mainly depends is *constant motion to a considerable extent*. It is true the feathered tribe can "hover" almost motionlessly, but man cannot hope to quite successfully emulate the birds, at least not in the immediate future. Referring back to my opening quotation, I suggest that the analogy of the steamships is somewhat unfortunate, for a steamship (unless a submarine) is not required to rise from the sea bottom as an airship is required to rise in the air, neither is it required to descend through the sea, as an airship from the heavens. Were it so required, there would be nothing absurd in its dive to the sea bottom, (but at a considerable angle with the vertical) when the engine is stopped. I hope to publish in a subsequent issue of PROGRESS my idea of what the future successful airship is likely to be. My spare moments are sometimes devoted to this problem, and I have a scheme in embryo which readers of PROGRESS may take at its worth. I am sorry to differ from such an authority as Mr. Rankine Kennedy, but it is a matter of history that engineers of equal eminence treated the locomotive engine as an absurd machine in its early infancy, but subsequent developments have proved them in error.

THE UPPER AIR.

There is an interesting account in a London weekly of the use to which the meteorologists put the kite in taking observations in the upper air. The vagaries of the air far above the earth's surface supply the meteorologist with most valuable data on which to base his predictions. The kite used is a box-shaped affair, and its equipment consists of a meteorograph, which records moisture, barometric pressure, temperature, and wind velocity. A height of four miles has been reached with such instruments, but the meteorologist generally confines his observations to a height of one mile. This height is the region of storm. Gales of 100 miles an hour are common, and clouds have been observed to travel at 174 miles an hour. The advent of a hot wave has been predicted six or eight hours in advance, owing to observations taken at this height. It is hoped that the kite will solve the problem of the origin of cyclones and anti-cyclones, which would be the crowning triumph of meteorology. Already our ideas of wind have had to be considerably modified. Wind is not a current of air moving horizontally and fairly uniformly, but it consists of many small currents buffeting each other, and finally mingling with each other. The component parts of breezes vary in speed and direction. Some go up and some go down; some forward and some back. A strong upward current is always found under the cumulus type of cloud—the cloud that resembles a puff of steam: and kites caught by this current are carried to a great height. It is supposed that the soaring bird knows of the upward current instinctively and makes use of it, and uses the contrary currents when flying against the wind. A kite has the advantage that it can go up in any weather but a calm, when a small balloon will take it to the region of wind. Even in the clearest weather electricity streams down the wire holding the kite, and shows itself by tiny sparks on the reel. When a kite is 12,000 feet high, or when a thunderstorm is at hand, the sparks become larger and more dangerous. Sometimes the electricity has to be earthed. But to gather the electricity from the upper air and make use of it, as often suggested, is said not to be worth while. "However intense atmospheric electricity may be, its quality is not sufficient to justify purpose."

Another French company is said to have purchased a colliery in the Swansea Valley, with the object of exporting large quantities of Welsh coal to France.

..Legal..

NOTES.

By H F. Von Haast, M.A., LL.B.

Passing Off. Trade Name. Confusion of Letters. The Birmingham Small Arms Company, Ltd. manufactures and sells cycle parts and accessories, bearing the letters B.S.A., the initials of the first three words in the Company's name, which have become widely known as indicating the Company's articles. On spanners the letters appeared with a trade mark consisting of three piled rifles. Webb and Co. also manufactured and sold spanners, which they marked and advertised as "B.A.S," meaning "Best All-round Spanners." The B.S.A. Company sued Webb and Co. for passing off their spanners as those of the B.S.A. Company. No actual deception or confusion, and no deliberate intention to deceive were proved.

Held by Parker, J., that the letters B.A.S. were likely to cause Webb and Co.'s spanners to be confused with those of the B.S.A. Co., and therefore an injunction was granted to restrain Webb and Co. from advertising and selling spanners marked B.A.S.—*Reports of Patent etc., Cases, Vol.* 24, *p.* 17.

Ferro-concrete Piles. Infringement. Novelty. Patent held Invalid.—In 1897 Francois Hennebique obtained a patent for improvements in piles, quays, and retaining walls or structures. His first claim was for piles formed of bars of iron embedded in concrete and cross-tied by clamps, and his third for a form of cap for use in ramming the piles. In his specification he referred to "solid uprights or standards" as well as to piles, and to the piles being either dropped or rammed into the ground, also to constructions of these uprights being raised above the level of water and their non-liability to alter in air or water. Prior to this time ferro-concrete, such as was used by Hennebique, was a well-known material and had been used for various purposes, but not for piles. Specifications of Brannan and Stempel, however, previously published, had described the construction of piles in cement with metallic framework. Hennebique discovered the fact that a ferro-concrete pile will resist percussion strains and could therefore be driven in. Hennebique and Mouchel (who was equitably interested in the patent) brought an action against Edmond Coignet and others for infringement. In argument Hennebique's leading counsel claimed that the specification should be given a broad construction to protect the invention of "a pile capable of being driven and of resisting bursting strain," while his junior counsel claimed a narrow construction protecting a pile constructed in a particular way only, and a pile to be driven.

Held by the Court of Appeal that the specification must be given a broad construction, that the first claim was not confined to piles capable of being driven and that the patent was invalid on the ground of anticipation; that even if the narrow view was adopted, the patent had not been infringed; and that Hennebique could not get a patent for his discovery that a ferro-concrete pile could be driven or rammed, because that was discovery and not invention. The only thing that a patent could be taken out for would be a pile of a particular form, so as to get the benefit of the truth thus discovered —*Reports of Patents, etc., Cases, Vol* 24, *p.* 229

Design or Method of Manufacture. Corsets. Charles Bayer, in 1905, registered a design for corsets. The application for registration contained the following: "Statement of nature of design, shape or configuration of corset. The novelty consists in a corset having the gores or gussets cut horizontally and from the front of the busk towards the back of the corset, as shown in the representations." The registered representation of the design showed a straight-fronted corset, in which the seams were not exactly horizontal, but the gussets tapered towards the front. Messrs. Symington and Co. applied for the removal of the design on the grounds (*inter alia*) that it was not novel and that it was not subject matter of registration, being a mode of manufacture.

Held by the Court of Appeal, that a registrable design must be something which must be altogether expressed to the eye, or must appeal to the eye, that what Mr. Bayer claimed was a corset with horizontal gores or gussets, and that the reference to the representation was not by way of limitation, but by way of illustration, that such corsets were not novel, and that what was claimed was not a design, but a *mode of manufacture* of a corset of establishing a particular length, and the like, insuring the lateral tension at the bottom of the bust which could give the straight front. An order was therefore made for the removal of the design from the register. —*Reports of Patent Cases, etc., Vol.* 24, *p.* 65.

Chattels Transfer.

PART II.

(By C. P. Skerrett, K.C., Barrister-at-Law)

The statute contains important provisions relating to future acquired property—*i.e.*, property of which the grantor has not the ownership at the time of the execution of the instrument, and which may not even be in existence at that time. The strict rule of the common law prevented an assignment or transfer of property not then in existence or not then owned by the grantor. The more modern system of equity allowed the assignment for value of future property, of possibilities and expectancies. It thus became possible for a man, apart from statutory restriction, to execute a mortgage over all his stock-in-trade in existence at the time of the execution of the mortgage, or which might be acquired by him afterwards during the subsistence of the mortgage in connection with a specified business. It also became competent for a man to assign by way of mortgage all book debts then owing or which might thereafter become owing to him in connection with a specified business. Until the new stock-in-trade or book debts was acquired the mortgage was regarded as a mere contract to grant the mortgage, but directly the event happened the mortgage effectually bound the new stock-in-trade or book debt so coming into existence. For a time the courts struggled against the full application of the above principle, and various distinctions and reasons were urged by judges refusing to apply these principles to particular cases. This tendency to compromise with a principle was put an end to by the House of Lords in *Tailby v. Official Receiver* (13 Ap. C. 543). There a man assigned by way of mortgage all book debts which should become owing to him, but not restricting the assignment to book debts to become owing to him in connection with a specified business. The assignment was treated as an assignment of all future book debts to become owing to the assignor. The county court judge held that the assignment was bad, and his judgment was promptly reversed in appeal in the Q.B. Division by Justices Hawkins and Matthew. This decision was reversed by the court of appeal and the judgment of the county court judge restored upon the ground that the book debts, not being restricted to those accruing in a particular business, the description in the assignment was too vague. The matter then went to the House of Lords, who unanimously reversed the decision of the Court of Appeal, and restored the judgment of the judges of the Queen's Bench Division, thus affirming to the fullest extent the principle which we have been considering.

While the House of Lords may in the case just referred to, have arrived at the true logical conclusion, their decision called attention to the necessity for legislation to restrict this wide power of assigning future acquired property. In our law this has been effected by treating book debts as "chattels" and by two separate provisions of the statute which practically have one and the same object in view.

Section 29 of the Act, 1889, provides that every instrument should contain a schedule containing an inventory of the chattels comprised in the instrument, and that the instrument should be void as to any chattels not comprised in the schedule as against the assignee in bankruptcy, the trustee under an assignment for the benefit of creditors and an execution creditor. The effect of this provision is to require the goods to be described as in an ordinary trade inventory, and to ensure that the description in the schedule will sufficiently identify the articles which are the subject of the security. The other provision to which I have referred is section 30, which provides that an instrument should be void in respect of any chattels of which the grantor was not the true owner at the time of executing the instrument. The general effect of these two provisions is to make it practically impossible to give a chattel security over a trader's stock-in-trade, because the stock-in-trade must be that which is described in the inventory, and the result is that the varying articles of stock-in-trade owned by a trader cannot be described in the schedule at the time of the execution of the instrument of security. This provision also makes it impossible to give an effective security over the future book debts of a trader. If such a security were possible, it would affect a great deal of the purpose of a security over future acquired chattels, because the stock of a trader is resolved into book debts, and if he could give a security over future book debts it would serve to some extent the purpose of a security over future acquired chattels. In this connection it should be noticed that these provisions do not apply to a mortgage of an incomplete article, for when the article is completed the security attaches to the completed article.

The legislature, however, felt it necessary to make certain exceptions to these rules, and accordingly three classes of exceptions were provided for, namely, (1) wool and crops; (2) fixtures, plant and trade machinery, where such fixtures, plant or trade machinery are used in, attached to, or brought upon any place in substitution for any of the like machinery plant or trade machinery described in the schedule to the instrument; (3) stock branded with the brand described in the schedule and the increase of the stock described in the schedule. To ensure identification of the stock, stock is only covered by the security if it is branded, or ought by a covenant in the instrument to be branded, with the brand specified in the instrument.

The statute requires all defeasances, conditions or declarations of trust, which form part of the transaction, whether the same are verbal or in writing, to be written on the same paper on which the instrument is written, otherwise the instrument will be absolutely void, except as to live stock, wool, crops, or substituted trade machinery. A defeasance is an instrument which defeats or qualifies some obligation created by deed; and that which in the same deed is called a condition in a separate deed may be defined as a defeasance. The case of *The Christchurch Finance Co* v. *Durant and Sons* (7 L.R., 619) is a striking illustration of what would amount to a defeasance. There a bill of sale was made payable on demand, and in default of payment a power was given to the mortgagee to seize and sell, but the mortgagee verbally agreed with the mortgagor that so long as he paid the interest due under the bill of sale no seizure would be made. It was held that such agreement was a condition of defeasance, and that the bill of sale was accordingly void even between the immediate parties to it.

With a view to shortening instruments under the statute certain covenants and powers are implied in the instrument which may be modified or varied by agreement of the parties, and in addition certain abbreviated expressions are provided for which, when used imply the compendious provisions which are fully expressed in the statute.

In securities over stock it should be noted that it is desirable to state where the lands are on which the stock are depasturing, and it is also necessary to describe stock by the brand or by the sex, age, name, colour or otherwise so as to be reasonably capable of identification, and to include substituted livestock and the increase of stock in instrument, it is necessary that a covenant should be contained providing that such substituted stock and increase of stock should be branded with a particular brand.

(To be continued.)

Blotting-paper is made of cotton rags boiled in soda.

Gas Manufacture and Supply.

[BY OUR LONDON CORRESPONDENT.]

Street lighting in the City of London and the metropolitan boroughs is now largely done by means of incandescent gas burners. Many systems of high-pressure gas supply have been adopted, and it is possible to secure equal or even more light with gas than electric arc lamps. In fact, in London and many cities electric lamps of large power are at present fast disappearing The flat-flame burners that ten years ago did duty for street lighting, burning 4½ to 5 cubic feet per hour, have almost entirely disappeared; the upright C. Welsbach or Nern burner having taken their place. With them it was possible, with a consumption of about 3½ft. per hour, to obtain a light of thirty candles or more. The last twelve months have, however, seen still greater advances; the inverted incandescent gas burner has now been adopted for street lighting.

In Edinburgh Mr. W. R. Herring, M. Inst. C.E., engineer of the corporation gasworks, has put up a very considerable number of street lanterns, and installed in them inverted burners which consume only an average of 2¾ feet of gas per hour, and give an illumination of 75 candle power. Mr. Herring's lead is being followed by others, at West Bromwich, Mr. Harold E. Capp, engineer of the gasworks, has introduced into street lanterns an inverted burner and double reflector. This arrangement is very similar to the Edinburgh lantern, and practically the illuminating effect is as good.

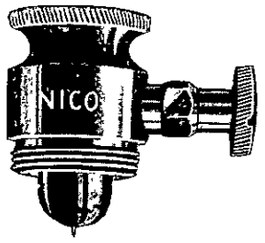
Much attention is being devoted to the adjustment of the gas supply to inverted burners. In the use of these burners Russia plays a considerable part, and it is generally admitted that the gas supply, or rather the pressure at which it is supplied, must be under control. The new inverted incandescent gas-lamp company have brought out what they term the "Nico" gas-regulator (see illustration). The regulator is constructed on such principles that a perfect jet issues into the burner tube and is in no way affected by the heat evolved. The gas passes in to a hollow, or crescent-shaped, form; this is said to be preferable to the solid stream of gas, and secures a more perfect mixture. A crank on the inside of the adjuster makes it impossible for the needle, which is really the active regulator, to become tight, but it is extremely sensitive. The "Nico" adjuster takes the place of the ordinary injector so that the burner is not much larger with it than without it.

Tested with a well-known No. 4 "Nico" inverted burner, with a consumption of 3.4 cubic feet the result obtained was a luminosity of 65.5 candles, or a duty of 19.26 candles per cubic foot of gas. With a No. 5 "Bijou" burner the readings were:—consumption 1.3 cubic feet; illuminating power, 30 5 candles; and a duty of 23 5 candles per cubic foot of gas consumed.

Although gasworks are now almost universal in all parts of the kingdom, there are uses for small gas-making installations. Recently, when on a visit to the Dublin Exhibition, we were interested in a small petrol gas plant operated under the Elwell-Smith patents. The well-known method of making gas by passing air over petroleum spirit of 650 degrees specific gravity, and so obtaining a mixture, which gives a rich gas for illuminating purposes, is the foundation of the manufacture of petrol safety-gas; in the Elwell-Smith process, the proportion of petrol and air are unvaried. The apparatus starts and stops automatically; the generator continues to operate until the demand for gas ceases, and then it stops until gas is again required. In isolated houses, institutions, churches etc., petrol safety-gas will be of great service.

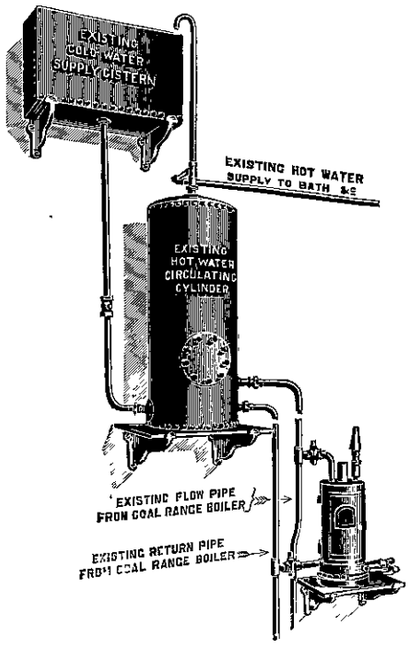
All the world over the name of the "Richmond" Gas Stove Company, of London and Warrington, is coupled with gas stoves; the firm are most enterprising, quite the most recent apparatus that they have placed upon the market is the "Neptune" water heater They tell us that with gas at 3s per 1000 cubic feet, for an expenditure of 3½d, it is possible to have 50 gallons of boiling water with one burner only of the heater The "Neptune" will provide hot water to any number of taps at the same time on differe it levels in any part of the house; the heater may be connected up to existing hot-water pipes and the circulating cistern is used for storage of the hot water. The gas burner is made to swing out clear of the boiler, and consists of two rings with separate taps The smaller ring at ten-tenths pressure consumes 8 cubic feet per hour, and we understand it is found to be ample to provide a sufficient supply for the ordinary domestic requirements and to maintain the cistern full of hot water at night. The "Neptune" is very compact, standing 25 inches high over-all and having a diameter of about 10 inches, prices range from a few pounds with cast-iron water circulators, and gun-metal chambers. They are made in two sizes. There is every probability of their being very generally fitted up in houses where the "gas range" is used for cooking and gas fires for heating. The "Neptune" appears to us to be far in advance of the bath "Geyser" as with it the hot-water supply to the house remains intact.

It has always been a vexed question as to whether it would be policy to test gas consumers' fittings and the internal pipes. The Britisher's house is his castle and he very vigorously defends it against all comers; he is always suspicious that the "gas man's one aim in life is to best him, to charge him for gas that he never consumed, and as generation after generation become gas consumers, still the gas man is very little more popular than he was fifty years ago. In most cities and towns, pipes and fittings for water supply are rigorously tested, and every effort made to detect and stop leakage, the loss by leakage having to be borne by the supplier. Water is paid for by rate levied in accordance with assessment of the house and not by measurement. Gas on the other hand, is paid for by measurement, and any leakage past the meter is a loss to the consumer and



THE NICO ADJUSTER.

not to the gas supplier. The Corporation of Liverpool have taken up the matter of testing gas pipes and fittings on consumer's premises for a normal sum, and their action is likely to prove highly beneficial to the public, both on economic and hygienic grounds. We are told that so far only some seventeen applications for tests have been reported; in five of these the fittings were found to be sound, in the remaining twelve there were escapes aggregating a rate of 25 97 cubic feet of gas per hour, or an annual money loss to the consumers of £29 10s 8d. These figures prove that such testing of consumers' pipes



THE NEPTUNE WATER HEATER.

and fittings is exceedingly desirable Much of the leakage of gas is due to the use of composition pipe, it has, however, now become almost universal to "run" wrought-iron pipe to all "points" and to have no soldered joints

Owing to the large quantities of tar that are produced by coke-oven plants the price has continued to fall, and gasworks tar has become almost a drug in the market. Much interest is therefore being taken in the proposals to use it on roads as a protection against dust, and already there is very considerable demand. The rapidly increasing motor traffic, and the abominable dust evolved, have rendered it absolutely imperative that something should be done to make the roads more suitable for motor running, and so far it appears that the coating or painting them with hot tar is the best and cheapest means of reaching the desired ends. Gas engineers are quite jubilant, and hope to secure the business and so find a new market for their tar.

The Gaslight and Coke Company, the premier gas undertaking of the world, having a capital of £27,000,000, an annual output of 22,963,382,000 cubic feet of gas, and no less than 492,910 consumers are bestirring themselves in every possible way to extend the use of gas, and to increase the day consumption. In this matter they are being greatly aided by the ability and untiring energy of their chief inspector, Mr. F. W. Goodenough, who has a staff of 200 officers, and more than 2000 workmen, engaged entirely at the "Commercial End" In addition, the company have lady demonstrators who wait on consumers and give practical lessions in the use of gas stoves, cookers etc., pointing out the special features of each apparatus and advising as to the most economical method of using them. Another new work being done by this and other gas companies is the maintenance and upkeep of incandescent gas burners and mantles The charge is purely nominal to the consumer, his fittings and burners are overhauled at regular intervals everything is kept "well found" and in working order. The maintenance cost per annum per burner, to the company, does not, in many cases exceed threepence The benefit to the public is very great, but still with it all they do not as a whole take kindly to the inspection, and often will suffer faulty burners, broken mantles, cracked chimneys and other ills, rather than have the periodical visit of the "gas man," as the public dub all and singular connected with gas supply.

Correspondence.

[TO THE EDITOR.]

SIR,—Some of your readers who are fond of figures may find the following matter interesting. I lately read in an American paper that some mathematician had announced the curious persistency, under multiplication, of the figures 142857, thus:—

142857	142857	142857
2	3	4
285714	428571	571428

142857	142857
5	6
714285	857142

The way in which the figures follow each other seems undisturbed, till multiplying by seven we get the extraordinary departure:—

142857
7
999999

Here, so far as my information went, the matter ended, apparently with the idea that the series was exhausted. Out of curosity I carried it further:—

142857	142857
8	9
1142856	1285713

Now, in these we have in each one figure too many to compare with the original number, but if we add it in we get the same series, *viz.*, 1142856—6 *plus* 1=7 so 142857; 1285713—3 *plus* 1=4, so 285714.

Of course 142857 *plus* 10=1428570 and the series begins again with outside figures added Multiplied by 35, or any other multiple of seven, the result is always in the 9 series, *viz.*, 499995 the 5 and 4 end figures making the full 9.—Yours faithfully,

EDW. TREGEAR.

Wellington, 4/10/07

Astronomy

Astronomical Photography.

(By Rev. Dr. Kennedy, Hawkes Bay.)

Astronomical telescopes are of two kinds, reflectors and refractors. A reflecting telescope consists essentially of a concave reflector usually made of silvered glass, which reflects the rays of light from the object observed so as to form an image of it in the principal focus of the mirror. In a refracting telescope the rays pass through a lens which refracts or bends them in such a way as to produce an image of the object in the principal focus of the lens. In both cases this primary image is magnified and observed by means of an eye-piece.

A very important difference between a reflector and a refractor, especially when used for photography, is that a reflector brings to the same focus the various coloured rays which make up white light: whereas an ordinary refractor does not bring the rays of all colours to the same focus, on account of the unequal refrangibility of the different coloured rays which constitute white light. An object glass which is intended for visual purposes is made to focus as many as possible of the bright rays which are most effective to the human eye, namely, the green, yellow and red rays. The blue and violet rays do not come to a focus at the same point as the green and yellow rays, and, consequently, there is usually a blue or purple halo round the image of a bright object when observed through an ordinary refracting telescope. Now, it happens that a photographic plate is more sensitive to the blue and violet rays, than to the green, yellow, and red rays, and on that account a lens which is intended for photographic purposes must be made to bring the blue and violet rays to the same focus. An object glass which is made for visual purposes is, therefore, not suitable for photography; and *vice versa*, an object glass which has been specially corrected for the photographic rays is not suitable for direct eye observation. Hence, many astronomers prefer to use a reflector which can be used for both purposes, and many of the best astronomical photographs, especially of nebulæ, have been taken with reflecting telescopes. But as a refractor has other advantages over a reflector, various plans have been devised to make a refractor equally available for the two kinds of work. One way is to separate the lenses of the object-glass a little, until the violet rays come to a focus. The object glass can be used further for eye observation by bringing the lenses together again. This plan has been adopted with great success by M Jannsen at Meudon, in France, for his photographs of the sun. Another method, which has been adopted at the Lick observatory, is to use a third lens which, when placed in front of the object glass, brings to a focus the photographic rays. The latest method is that employed by Messrs. Cooke and Sons, of York, who have succeeded in making an object glass which is as achromatic as a reflector, and can therefore be used for photographic as well as visual purposes, without any alteration in the lenses. This photo-visual objective, as it is called, consists of three lenses formed of three different kinds of glass, and it serves to illustrate the perfection which the optician's art has now attained. Six surfaces of glass are so accurately figured that every ray of light falling upon the objective passes through the finest pinhole, at a distance of seventeen or eighteen times the diameter of the lens. Objectives of this kind have been thoroughly tested by Sir Norman Lockyer, Sir. David Gill and other eminent astronomers, who speak of their performance in terms of the highest praise. A Cooke photo-visual objective, 9 inches in diameter and 12 feet 6 inches focal length, is in use at the Meanee observatory, and gives complete satisfaction, both as a visual and as a photographic telescope.

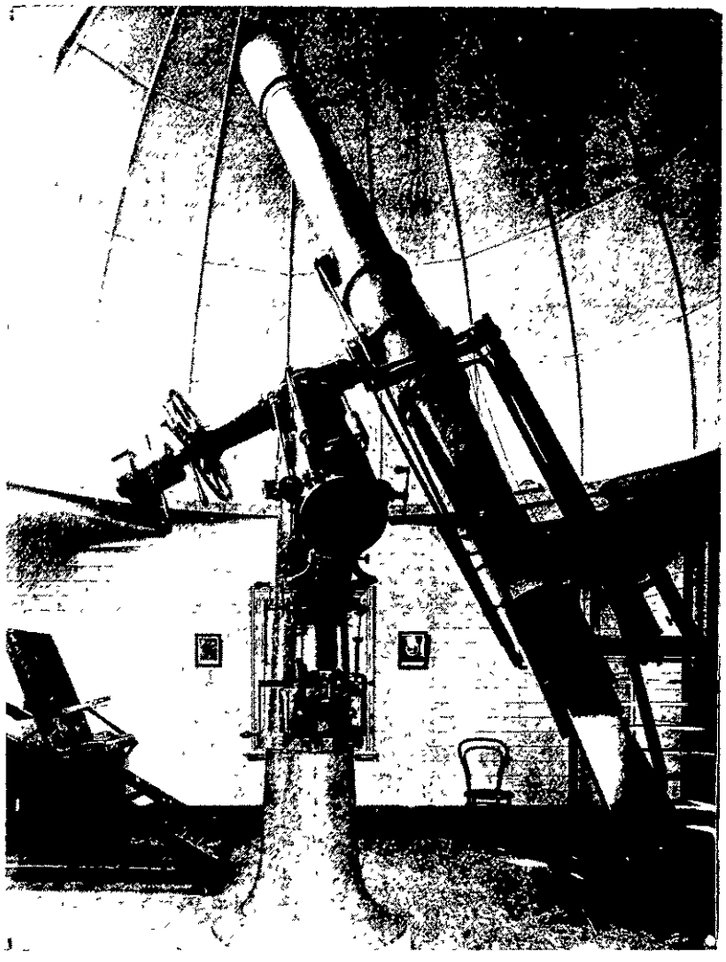


FIG I.—MEANEE OBSERVATORY TELESCOPE USED AS A PHOTO-HELIOGRAPH.

The first celestial object photographed with anything like a useful, practical result following from the picture, was the sun. As early as 1845 Fireau and Foucault succeeded in taking Daguerreotype photographs of the sun, and in 1851 Berowski photographed the solar prominences during a total solar eclipse. In 1857 De la Rue designed the Kew photo-heliograph, which consisted of a telescope with an object glass of 3½ inches aperture and about 5 feet focal length, and corrected for the photographic rays. The eye-end was furnished with a camera and enlarging lens, which magnified the image of the sun to about 4 inches. In 1873 the Kew photo-heliograph was transferred to the Royal observatory, Greenwich; but it has been since superseded by a photographic refractor of 9 inches aperture and nearly nine feet focal length. With this instrument a photograph of the sun 8 inches in diameter is taken every fine day at Greenwich.

Fig. 1 is a photograph of the Meanee observatory telescope used as a photo-heliograph. The image of the sun in the principal focus of the 9-inch photo-visual objective is 1½ inches in diameter. This is enlarged in the attached camera, by means of a magnifying lens, to 5½ inches in diameter. The full aperture of the object glass is not used when photographing the sun, but it is stopped down three or four inches. The light of the sun is so intense that a very slow photographic plate and a very rapid shutter have to be used. Generally, very slow lantern plates (whole-plate size) are used, and developed with hydroquinone. The shutter (see Fig. 2) consists of an aluminium disc 6 inches in diameter, with an adjustable slit, and rotating round a centre eccentric to the enlarging lens. When the shutter is released, the slit flies rapidly across the image of the sun at the principal focus, giving an exposure to the plate for a very small fraction of a second. It is possible to give with this shutter any exposure from one twentieth to one five-thousandth of a second. The duration of the exposure generally varies from one three-hundredth of a second in winter, to one three-thousandth of a second in summer, with a 3-inch stop, which is equivalent to working the lens at f/50.

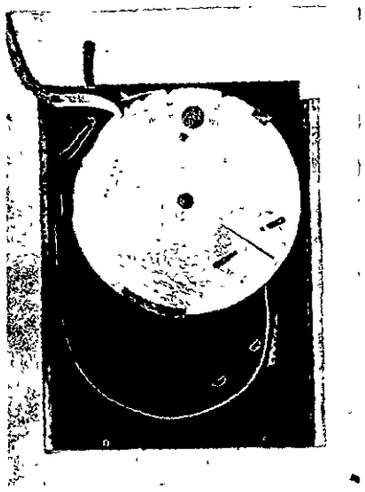
When the photograph of the sun has been taken it has to be measured, the four following particulars being determined for each spot: First, its distance from the centre of the sun; second, the angle between it and the north point; third, the size of the whole spot; and fourth, the size of the umbra of the spot, that is to say, of its dark central position. The area of a spot is measured by placing a thin piece of glass on which a number of cross lines have been ruled one hundredth of an inch apart, in contact with the negative. These cross lines make up a number of small squares, each the ten-thousandth part of a square inch in area. The negative is then examined with a magnifying glass, and the number of little squares covered by each spot is counted. Some idea of the gigantic size of the sun can be formed from the fact that a spot which would cover only one of these little squares would be 2½ million square miles in area, and yet would be only between two and three millionths of the visible hemisphere of the sun.

Fig. 3 is a photograph of a group of sun spots taken at the Meanee observatory last June, as seen through the measuring glass ruled into small squares. The area of the whole group is about 1000 million square miles. The size of the earth on the same scale would be the circle E in one corner of the square.

Fig. 4 is an enlarged photograph of a sun spot also taken in June. The length of the group is 120,000 miles, and the total area is 1250 million square miles.

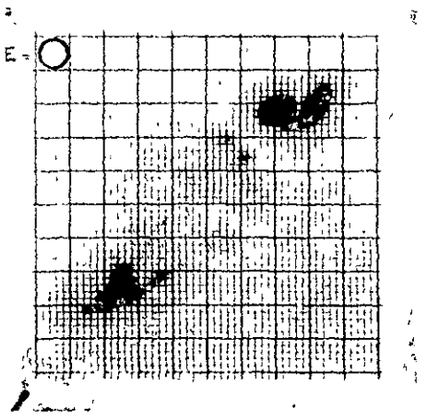
Fig. 5 is a photograph of the sun taken on the 17th July. The spots belong to the same group as that in Fig. 4, returning after a revolution of the sun. The large spot

which was becoming detached in Fig. 4 is completely separated from the rest of the group in Fig. 5. This detached spot is more than six times as large as the earth, and yet its area is not one two-thousandth part of the surface of the sun's visible hemisphere



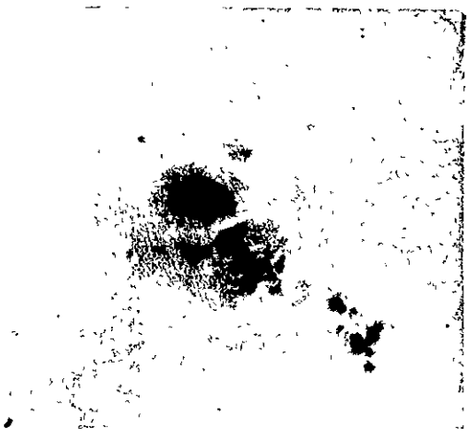
ASTRONOMICAL PHOTOGRAPHY—FIG. 2

The question of temperature is a grave one, for a very slight difference in the warmth of the air in one part of the tube will spoil the chances of successful observation. In the case of this new telescope, it is proposed to keep the observatory always at one constant mean temperature, as near as possible to that of the night.



ASTRONOMICAL PHOTOGRAPHY—FIG 3.

when the sun gets there. They will be far away from the places they now occupy. Let us see how long it would require the sun to travel to the place where Arcturus now is. The parallax accepted for that star gives its distance such that light requires 160 years to come from us to him and that we should go to him will require nearly 2 500 000 years at the rate of 12 miles a second. In the light of such figures a period of 75,000 years becomes a mere point of time a watch in the night.



ASTRONOMICAL PHOTOGRAPHY—FIG 4

A Huge Telescope.

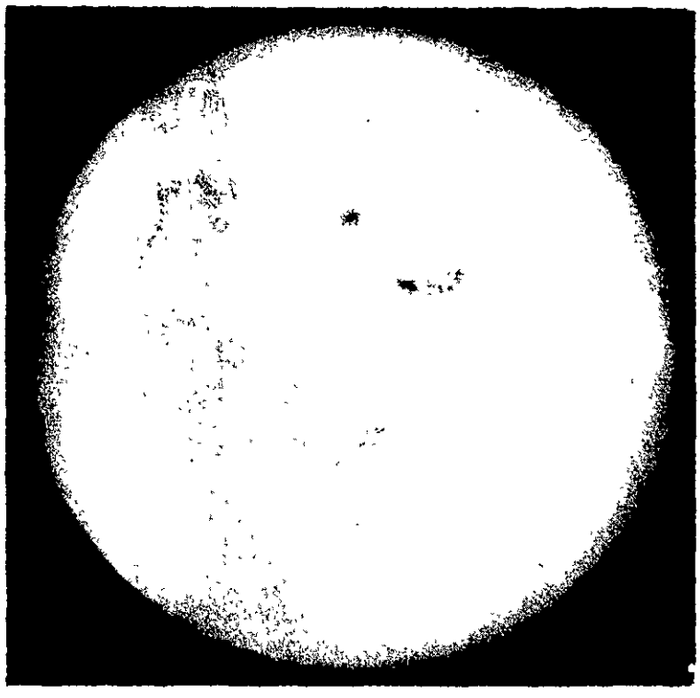
The huge telescope presented by the late Mr. Yerkes to the Williams Bay observatory is still the most powerful instrument of the kind extant, but a much larger telescope still is to be built for the solar observatory of the Carnegie Institution on Mount Wilson, in California. This telescope, for which the funds are being provided by Mr. John D. Hooker, of Los Angeles, is to be of the reflecting type; and some idea of the immense stride in telescopic construction, which will be made by this new addition to the astronomer's resources, may be gathered from some notes supplied to *Engineering* by Professor Hale, of the observatory on Mount Wilson. The largest reflector hitherto made has a 60in. diameter silvered-glass mirror, of which the glass has a thickness of 8in. and weighs one ton. In the proposed new telescope the mirror will be 100in. in diameter, necessitating a thickness of glass of 13in., and a weight of four and a half tons. The Herculean task of casting and annealing this huge mirror has been entrusted to the Plate Glass Company of St. Gobain. The equally formidable task of grinding, figuring and testing will be undertaken in the workshops of the observatory itself, under the direction of Professor Ritchey; and lastly, the mounting of the instrument is to be entrusted to the Union Iron-works Company, a firm which is well known as the builders of battleships and cruisers for the American Navy. It is estimated that the making and mounting of this telescope will take about four years. The question of its behaviour when finished will arouse considerable interest, for, undoubtedly, if its performance be satisfactory, it will be a great gain to astronomy. Its huge aperture, combined with comparatively short focal length, will make it extremely valuable for spectroscopic work of the fainter stars; but as telescopes of increasing size are taken into use very great difficulties are encountered.

The Orbit of the Sun and the Solar System.

Professor Peckham, of the Adelphi College, Brooklyn has descended heavily on the theory of the gentlemen who recently described the orbit of the sun and the solar system with a great display of interesting detail. Here is the pith of the Professor's refutation:—

"As to the speed of the sun in its path, astronomers are agreed that this is about 12 miles a second. At this velocity, which is a slow one as velocities go in the heavens, we go 1,036,800 miles a day, as any one can determine by multiplication, instead of 5,000,000 miles a year, as the writer states, and nearly 400,000,000 miles a year. Yet the stars are so remote that the sun will require 68,000 years to cross the space separating it from the nearest star at this enormous rate of motion. Again, astronomers are agreed that the sun is moving toward Vega and not Arcturus, and that it will require the sun 558,000 years to pass by Vega. But we shall never pass by Vega, although we are moving toward it, nor would we pass Arcturus, if we were at present moving toward that star, since these stars are themselves moving, and will not be where they are now when the sun gets there. They will be far away from the places they now occupy. Let us see how long it would require the sun to travel to the place where Arcturus now is. The parallax accepted for that star gives its distance such that light requires 160 years to come from us to him and that we should go to him will require nearly 2 500 000 years at the rate of 12 miles a second. In the light of such figures a period of 75,000 years becomes a mere point of time a watch in the night.

The determination of the point in the sky towards which the sun is moving is a matter of much interest to astronomers but it is one on which no more than a beginning of investigation has been made. Herschel, more than a hundred years ago, studied the proper motion of the stars, and located this point in the constellation Hercules. Many others of the highest repute including Struve and our own Newcomb, have followed Herschel, and have reached a slightly different result, although they do not remove the point very far from Hercules. It is now located near Vega in the constellation of Lyra, or by Campbell, at a spot 10 deg south of this star. The opposite point is near Sirius and not near Polaris. Any one who is interested in this investigation will find a statement upon it given in Milton's "Astronomy," the latest and best text book for students beginning the subject



ASTRONOMICAL PHOTOGRAPHY—FIG 5.

Engineering: Sea and Land

Light Railways for New Zealand.

[By FREDK. BLACK, A.M. INST. E.E.]

It cannot be denied that there exists in many parts of New Zealand at the present time a veritable railway hunger. During the past few months deputations of representative men have come literally from the east and from the west, the north and the south to impress upon the Minister for Railways the urgent need and superior claims to consideration of their respective districts for branch railways. It is not merely a twice, but a twenty times, told tale, and in spite of the practically uniform answer given to each body of applicants, the making of deputations still goes on. The Minister's reply on each occasion may be summarised thus:—

(*a*) The Government admits that the district would be greatly benefited by having a branch railway to it or through it, and it expresses no doubts as to the traffic possibilities, but

(*b*) The completion of the country's trunk lines is of paramount importance, and will require for the next few years the whole of the money that it is possible to obtain by the same borrowing policy

(*c*) And when the trunk lines are finished, branches will be duly considered, and some of them will be built.

So plainly, emphatically, and repeatedly, has the Government made these statements that its attitude ought to give pause to those committees which are preparing "to bring under the notice of the Minister the great natural resources and traffic prospects" etc. Neither the Minister, nor anyone personally acquainted with the districts concerned, questions either the resources or the present difficulties of marketing them, but the best of propositions cannot be carried out if money is lacking. As a matter of hard fact, however, a number of these desired branch lines are not payable propositions, and, if constructed, would throw a greater or lesser burden on that part of the railway system which does pay. Few people realise what a traffic should be, in volume and character, to justify the construction of a railway, and perhaps fewer still consider the matter very seriously, when it is a question of their district obtaining transport facilities without having to shoulder the whole of any loss resulting. While the unanswerable argument as to the concentration of the money on the trunk lines is available, the Minister has no need to discuss with deputations the probabilities of branches paying; but later on, when some money is available, not a few districts will be hard put to show prospects that will warrant railway construction on a business basis.

With a more general recognition of the really hopeless outlook for branch lines during the next few years, public attention will more readily turn to the building of light railway systems by local bodies, and it may be by private enterprise also. Already there are some County Councils giving this matter their earnest attention, and from 30 to 40 miles of track are now under consideration in districts where the burden of road transport and road maintenance is becoming too heavy to be borne. The light railway is not much understood by the general public in New Zealand, and perhaps on this account it is regarded as something a long way removed from the usefulness and permanence of the standard railways of the country. It may therefore surprise some people to learn that our main lines, as originally constructed, have been classed by more than one eminent authority as light railways. There is no hard-and fast division between light and ordinary or heavy railways but it is tolerably safe to assert that lines of 3′ 6″ gauge employing 60lb to 70lb rails, and built on land exclusively reserved for them, are not light railways, so that the main lines of to-day do not fall within this class. On the other hand, a 3′ 6″ or any lesser gauge line, with rails from 20lb to 40lb could under most circumstances be fairly described as such. The general significance of the term and the one I have in mind, is a railway of lighter and cheaper construction than the standard types adopted in this country. Such a system is, generally, though not invariably, of comparatively short length, not often exceeding 50 miles, and more commonly is from 10 to 20 miles only.

In many countries systems of this kind are in extensive use, and render the most valuable services more especially in agricultural districts. In Belgium there are 1100 miles of narrow gauge light lines and nearly as many in Italy. Both France and Germany (like Italy) have classified light railways into three or four grades, and possess many examples of each. Of other Continental countries Sweden and Holland have adopted them, and in Austria there is a considerable mileage. In England provision is made by law for grants of public money to private enterprise establishing these undertakings in certain classes of districts, but this State aid has not been so fruitful as the Government assistance given in Belgium and France, probably because the English agricultural industry is a dwindling one. Ireland, among its limited number of these lines, possesses at least one of special interest in the Bessbrook and Newry system, which was the world's first electric railway, as first built it was 3 miles long with a gauge of 3′ 0″ and the cars were run by hydro-electric power. It is some years since I visited it, and probably it is now—like another famous pioneer work in that country, the Port Rush to Giants' Causeway electric tramway, with its extraordinary third rail conductor—reconstructed on a modern design. In India there is a very large mileage of light railways with gauges of 2′ 0″ and upwards, and in Canada Mexico and most of the South American republics there are many examples. The gauges adopted are numerous ranging from the 1′ 11½″ of Festiniog (Wales) to the metre (3′ 3½″) which is a favourite one on the Continent where also the .75 metre (2′ 5½″) is largely used. In British countries 2′ 0″, 2′ 6″ and 3′ 0″ are almost exclusively used, though there are instances of light lines on the standard gauge (4′ 8½″), such as the Southwold line in Suffolk, now worked by the Great Eastern Railway Co., as a branch to its main system.

On the majority of these lines, steam locomotives are employed, and short trains of cars are hauled. Electric traction will in time be almost universally used where the traffic movement is not of insignificant amount, for infrequent traffic having small scope for development steam will always be the cheapest power.

Some reference will probably be expected to the latest idea in light railways of which a good deal has been heard during the last few months—the single rail Brennan system. So far, no actual installation has been carried out, and only a model has been built, therefore nothing is definitely known as to the limitations this invention will experience when tried on a practical or commercial basis, After gathering such information as is available, I am inclined to think that it will find its chief field of usefulness (if it proves able to find one at all) in service of a temporary nature, such as the transport of an army through new country, maintaining communications between a military base and the front, or piloting the way in an unroaded district for the construction of the more conventional class of railway. At present there is no evidence whatever as to its carrying capacity in relation to its cost, nor indeed as to either its first cost or working expenses. It is quite clear, however, that every car on the Brennan system must be equipped with the two gyroscopes and a motor, or engine, to rotate them—plain trailer cars will be out of the question—and it is a fair inference, therefore, that the labour and maintenance cost will not be small, and that the rolling stock will be expensive. High speed machinery demands close attention, particularly at bearings; and it is certain that if a bearing on a gyroscope shaft, which runs at several thousands of revolutions per minute started to seize, it wouldn't be many seconds before the shaft fractured and the gyroscope wrecked the car. It is not pleasant to contemplate the opportunities that would exist for this occurrence on a Brennan line laid over, say, a pumice plain in the North Island, or a nor-wester-swept district in Canterbury, when grit and dust were plentiful in the summer air. However until some experience of the system has been gained, judgment must be suspended, but I think it will be wise on the part of New Zealand to contentedly allow Home districts, which have the advantage of being within a few hours of the works manufacturing the plant, to undertake all the experimenting and perfecting of parts that is inseparable from any new system.

(To be continued)

Aluminium.

THE REGULATION OF PRICE.

The comparatively high price which prevails for the metal aluminium has continued for a year or two, and there is no immediate prospect of any reduction, notwithstanding the non-existence of the internationial syndicate which formerly controlled the price. It is probable, (says the *Mechanical World*) that if water power were not used on a large scale in connection with the electrical production of aluminium in different countries, the quotation for the metal would be higher than it is at the present time. The reason for the maintenance of the price at its present level is to be found in the large demand which is experienced for aluminium for numerous purposes, a demand which has increased in a greater proportion than the production.

Apparently a great deal of secrecy exists in respect of the actual output of aluminium in the United States, Great Britain, Switzerland, France, Germany, and Austria. It is known that the different works are equippen with plant representing 100,000 h.p., but the production of each is not specifically stated. It is estimated by expert metal statisticians that the output of aluminium throughout the world amounted to 14,500 tons in 1906, and representing an augmentation of 3,000 tons over the preceding year, and 5,000 tons as compared with 1904. These figures are, of course, estimates, and there are no means of testing their accuracy. At the same time, there is no reason for doubting that they are approximately correct. The future is to witness a large increase in the outturn of the metal, seeing that all the producers, including the British companies, have extensions of work in hand, and most of these are expected to be completed and in operation next year. The directors of the Neuhausen Company, which was one of the pioneers in the electrical production of aluminium, have expressed the opinion that when these developments have actually been completed, the considerably greater quantity of metal which will then be available will lead to a decline in price.

Such an event would be welcomed by consumers, but there is no certainty that the future will confirm this opinion. In the first place, it is highly probable that the consumption of aluminium will continue to increase, and if the augmentation equalises the advance in the production, there is little prospect of the price being reduced. On the other hand, if the output should become greater than the demand, the quotation may be lowered to promote the consumption. It is, however, far from certain that the producers would act in this manner, and for

that matter there is nothing in the way of a renewal of the international syndicate for the purpose of again regulating the price, in the course of the next year or so, when supplies of the metal become more plentiful.

The British as Inventors.

The details which we published lately of Mr. Brennan's wonderful "spinning-top railway," suggest that the world may be on the eve of a new revolution in the art of transport. The new balancing train has, it is true, yet to be tried on a large scale. but as a working model its success has been startling. The principle which it embodies is capable of the widest application. It may affect the future design of motor cars, and may even lead to a complete change in the method of working railways, though for obvious reasons any such transformation will be but slowly accomplished. In itself the gyroscopic railway is a miracle of ingenuity, and it is most satisfactory to reflect that it is the product of the British mind. The Britisher has often been reproached with a want of inventiveness. There is a strange want of humour in such a reproach, and a complete ignorance of the history of invention. For, as a matter of fact, almost all the great and fundamental inventions have been the work of British subjects. We have even heard a distinguished American authority assert that all the devices with which the ingenuity of the United States is commonly credited have been the achievement of Englishmen. Such a view is an overstatement and far from being absolutely correct, but it contains a measure of truth. Thus, the Northrop loom, of which so much has been heard, was patented first in the United States, but it was the invention of an Englishman. The pressed-steel car, the manufacture of which employs an enormous amount of capital and labour in the United States was of British origin. These examples could be multiplied almost indefinitely. It is no small tribute to the energy and persistence of the Englishman that he should be thus distinguished, when we remember that the State places every conceivable obstacle in his way. The English patent laws tax him unjustly, and penalise him for his very inventiveness. In the United States, on the other hand, very different treatment is accorded to the inventor. American statesmen have always borne in mind Washington's insistence on the importance of giving "effectual encouragement as well to the introduction of new and useful inventions from abroad, as to the exertions of skill and genius in producing them at home." At the same time the British policy of reserving for municipal monopolists the exploitation of electricial supply and electric traction has gravely affected the British inventor in the electrical industries. Here, again, the fundamental discoveries were made by Englishmen. Davy discovered the arc lamp; Faraday, Varley, and Wheatstone made the dynamo possible; Grove produced the first accumulator· Swan the earliest electric incandescent lamp; Hughes the microphone on which the modern telephone transmitting instrument is based. It was not for want of British originality that the electric industries were developed abroad, but because Englishmen were denied the opportunity of practical knowledge and experience in the years when the world was turning to the use of electricity. In other directions, passing over the great names of Stephenson, Watt, Arkwright, Brindley, and Smeaton, the pneumatic tyre, on which all mechanical road propulsion is now based, where speed is a matter of moment, was a British invention In maritime engineering the turbine is the product of British brains, and may rapidly supplant the older reciprocating engine. In naval engineering the originality that produced the *Dreadnought* shows that England has nothing to fear in any contest of skill. *Given better patent laws*, and more encouragement from the State to the inventor, given also a fair chance to new industries, with exemption from mandarin control, and there is every reason to think that England would surpass her former record. The country of Armstrong, Whitworth. Whithead, and Parsons has no cause to fear anything except its Government.

The New Patents and Designs Bill in England.

BY G. CROYDON MARKS, M.P.

The new Patents and Designs Bill, that has already passed through one of the standing committees of the House of Commons, is likely to have a very far-reaching effect on the future industries of Britain. One of the most valuable features of the new bill is that having reference to the power, which an inventor will possess, of filing additional patents of improvement that will run concurrently with the main or original patent with which the improvements are associated, but as to which additional patents no fees will be paid beyond those that are necessary for the ordinary application. It may thus well be that, in the future. an invention concerning which there are possibilities of improvement, may be covered by one patent and six subsequent patents of addition for details, and these seven separate patents would all be kept in force by the annual payments made after the fourth year of the original patent, instead of—as at the present time—requiring every patent granted to be covered by its own annual renewal fee In engineering devices, particularly, it is quite common for the patent—for example—covering a new type of pump, to have associated with it several subsequent patents for improvements in detail, suggested by the working of the main patent; and it has been the practice heretofore to require that separate and independent patents should be applied for for these improvements Hereafter a great saving will result to manufacturers and engineers in connection with machines upon which details and improvements can be very readily introduced without incurring the present annual costs for keeping each of such improvements in force.

Another feature of considerable interest is that which enables the applicant for a patent during his provisional period to file other provisional specifications, and then, at the end, to get one complete patent combining all that has been shown in the several provisional patents deposited during the period of provisional protection. One of the difficulties in the matter of litgation in the past has been due to the disconformity between provisional and complete specifications. Hereafter it will not be possible for any person to attack a patent on the ground of disconformity between the provisional and complete specifications.

The tribunal before which patent actions will be tried will probably hereafter resolve itself in one court. and, with a view to bringing everything into line, it is decided that the appeals from the patent office decisions, that are at present heard by the law officer, shall hereafter be heard by the judge, from whom, however, no further appeal will be possible.

Owing to the manner in which unfair licenses have been granted by some patentees in the past, grave troubles have arisen concerning the harass under which certain industries have existed, and the complete subjection that certain owners of patents have held over those to whom they had licensed their patented machines and processes, so provision is made in the new bill for preventing such harassment in the future, and for rendering null and void licenses that are granted and contracts that are made with inequitable conditions attached to them. It will be important for patentees in the future to bear in mind the conditions of the new bill when arranging for licenses, or they will find no advantage resulting to themselves from the documents drawn up for their benefit.

Some attempt was made in committee to change the appointment of the Patent Office Comptroller by making him hereafter a legal official under the Lord Chancellor, instead of a departmental official under the Board of Trade. It was, however, urged against the proposal that, seeing the decisions that the Patent Office Comptrollers in the past have given have only been reversed upon appeal in about one case out of five hundred decisions, the committee, with one exception only, come to the conclusion that no case was made out for altering the present system of appointment and control of the patent office.

The portion of the Bill relating to designs will be very interesting to those producing articles that are valuable for their form and shape, rather than for their combination with other articles, and there are many mechanical devices which, made up in one form, produce results that cannot be obtained when made in any other form. For these mechanical designs the present life of protection when registered is five years. Under the new Bill the life is to be extended to ten years.

With a view of preventing the trade of this country being injured by patents that are applied for and yet never put into force in this country, the clauses in reference to the power of revocation will be read with much interest. It will be hereafter in the power of any person to apply to the patent office to have a patent revoked if the demand for the article—four years after the date of the patent— is being met mainly by goods manufactured solely abroad. Patentees, both British and foreign. who take patents out in this country will have, hereafter, before the expiration of four years, to see that the market which has been formed in this country for their patented products shall be met by the products actually manufactured in this country, unless it is shown, upon a petition and hearing before the Patent Office, that there are good reasons why the article cannot be manufactured here without prejudice to the other industries that would be dependent upon its production in a mechanical manner.

As the result of experiment, it has been learned that among woods, birch and poplar decay in three years, willow and horse-chestnut in four years, maple and beech, elm and ash, in seven years, while the juniper would be quite unmjured at the expiration of the same period

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Hardening an ordinary drill in sulphuric acid, states the *English Mechanic* makes an edge that will cut tempered steel or facilitate cutting hard rock. The acid should be poured into a flat-bottomed vessel to a depth of about ½ inch. The point of the drill is heated to a dull cherry red, and dipped in the acid to that depth. This makes the point extremely hard, while the remainder remains soft. If the point breaks, re-harden, but with a little less acid in the vessel.

Three Concrete Bridges.

Without entering upon the relative merits of different structural materials we refer here to three railway bridges with spans of 187 feet 211 feet, and 211 feet, respectively which have lately been erected in plain concrete on the three-hinged principle All of the structures were designed by Mr Beutel chief engineer to the Bavarian State railways One of them at Lautrach crosses the river Iller with a main arch span of 187 feet and two smaller arches at the abutments. As the rise of the main arch is only about one sixth of the span the three-hinged system is particularly advantageous The arch rib in this instance carries across walls connected by small arches surmounted by the road upon which the permanent way is laid. The other two bridges cross the river Iller close to Kempten station, where there is a network of several branch lines One of these bridges carries four railway tracks, and the other only two, but their structural features are practically identical, the main arch of each bridge having a clear span of 211 feet, with a rise of about four-ninths of the span We are glad to say that all three bridges were finished without the casting of stone or other veneer which some engineers seem to imagine is necessary for decorative effect It is stated that the cost of the Lautrach Bridge was 17% less, and the cost of the two Kempten bridges was nearly twenty per cent less than the estimated cost of steel bridges The ultimate saving should be considerably more owing to the fact that practically no maintenance is necessary in the case of concrete structures

Lubricate the Outer Rail on Curves.

As everyone is interested in the safety of railroad travel, it behoves the public in general to give this matter all the thought possible.

The friction of the wheels on outer rails of curves is well known During rain there is little trouble; in dry weather the wheels "climb" They now have pipes so arranged that they would throw a jet of water or cheap oil against the side of the outer rail when the locomotive struck the curve thereby lubricating same and reducing the tendency the wheels have to climb.

It would be a very simple matter to arrange the feed valves for the control of lubricant so that they would open only when the engine struck the curve, closing again when straight track was reached By a system of this kind and a practice of bolting the two rails together in curves so that they could not spread the public would hear less of wrecks in such places.

The above suggestions of a correspondent are sound. The practice of directing a fine stream of water against the outer rail was tried in Western America some years ago with good results.

The Panama Canal.

It will be remembered that the estimated area of the great storage lake, which is to be formed by the construction of the Gatun dam, was 110 square miles. This calculation was based upon the preliminary reconnaissances of the area to be flooded, and was understood to be only approximate The detailed surveys of the Isthmus, which have now been completed, show that the area of the lake will be more than double the original estimate, or 225 square miles. The larger lake represents some very material advantages in favour of the 85-foot high level canal as now being constructed, advantages which will be felt both in the wet and the dry season. In the first place, the lake will have sufficient capacity to receive and retain all the flood waters, even those of such heavy floods as occurred in December of last year; and secondly, it will be possible to handle this water with considerably less fluctuation in the canal level. It is estimated that the increased lake area will double the amount of water that will be impounded in the lake at the commencement of the dry season. The statistics of past years show that, even in years of extremely small rainfall, the run-off from the area draining into the lake amounts, during the rainy season, to 7200 cubic feet per second; and this will be sufficient to raise the level of the lake the 4 feet which it will be lowered during the dry season It is true that because of the increased area of the lake, the evaporation will be double what it would have been from a lake of only 110 square miles area, but since the total supply impounded will also be doubled it is estimated that, after deducting the loss by evaporation, there will be sufficient water available for fifty-six lockages a day, instead of twenty six, which was the number estimated as available with the smaller lake.

Strange, if True.

A CURIOUS ACCIDENTAL WELDING OF STEEL SHAFTING.

Mr. P N. Bockaroff, M E, of Mockba, Russia, tells in a valued publication, an interesting story of a very curious accident which occurred recently in a large cotton mill near Moscow From a steam engine of nearly 1500 horse power, 350 horse power is transmitted by ropes to one of the stories of the mill The driven shaft makes 320 revolutions per minute

The main shafting in the rope drive is arranged so that the power from the flywheel is transmitted by ten ropes to the rope pulley on the first shaft, then by a pair of bevel wheels to the second shaft, and then by a Wullfel's friction clutch to the third shaft, and from the rope pulley on this shaft to the rope pulley on the line shaft in the mill

By some mistake of the fitter, the second shaft was put too close to the third shaft, so that it touched the latter, and all the pressure from the bevel wheel was transmitted directly to the end of the third shaft.

One morning the first bearing on the third shaft became warm The engineer, wishing to cool it, loosened the clutch and thus stopped the third shaft. Thus all the pressure from the rotating second shaft became applied to the end of the third shaft. Both shafts have the same diameter, 170 millimeters (6⅔ inches).

As the pressure from the bevel wheel on the shaft was considerable, and the shaft was making 320 revolutions, in a few moments the touching ends of the two shafts between the two halves of the clutch were heated, not only to a red heat, but to the welding point as well, so that the liquid iron spurted to the walls. The engineer became very much frightened, and signalled to stop the engine, and thus both shafts became completely welded together.

After the shafts were cooled, the engine was started again, but both shafts revolved together, notwithstanding that the friction clutch was open. The bearings did not become heated, thanks to the fact that both shafts were welded in exact alignment. So the mill was run till night, and all the usual machinery working from this shaft and taking 350 horse-power

Next day the shafts were lifted by their free ends, together with the bevel wheel, the clutch and the pulley, and though they weighed some tons, the welded joint did not separate. So it was decided to leave them in the welded state till the new shafting is ready.

Since that time, for more than a month, the shaft has been working satisfactorily with opened clutch, transmitting all the power without difficulty

Factors of Safety in Mechanics in Animal Structure and in Animal Economy.

Dr S. J. Meltzer recently addressed a lecture on the above subject to the Harvey Society of New York —

Meltzer borrows the term "factor of safety" from the mechanical engineer who thus designates the margin of safety required in constructing engines, bridges, houses, and the like If for instance, the tensile strength of boiler steel plates and stay bolts is 60 000 pounds to the square inch, the actual stress which is allowed for the work of the boiler should not be more than 10,000 pounds per square inch for the plate and not more than 6000 pounds per square inch for the stay bolts—which means that the stress to which the plates may be exposed in the boiler should be only one-sixth or one-tenth of the actual strength of the steel. The factors of safety are here said to be six for the plate and ten for the bolts. In mechanics, then, it is calculated that the structures should be capable of withstanding not only the stresses of reasonably expected maximum loads, but also those of six or seven times such loads. The factor of safety is founded upon finite human ignorance of what might happen, and upon a wise and very praiseworthy desire to provide against such contingencies. Wherefore these factors are oftentimes termed factors of ignorance And, with regard to the human machine, the latter term would seem rather the preferable one. For this machine is, by comparison with those constructed out of inorganic materials and worked by men, of complexity quite infinite. It is, of course, much more difficult to foretell the possible strain, the stress of environment, accidents, the attacks of parasitic organisms, and the myriad other agencies hurtful to the human machine, many of which we are powerless to prevent, concerning many of which we are in ignorance—ignorance, we are however proud to say, which is yearly becoming more and more dissipated.

Building Railway Coaches with Side Doors.

President Harriman, of the Southern Pacific, a short time ago gave orders to have a number of new fine passenger coaches built at the company's car shops at Sacramento with side doors instead of end doors

Harriman believes that cars thus constructed will be much stronger and more durable than the style now used, and also that in case of wreck, there will be little danger of the coaches telescoping each other. These new cars will have a small passageway by which passengers may go from one coach to another, but this will be so arranged that it will not weaken the end walls of the cars.

Another feature of these coaches is the use of round instead of square windows. New patent ventilators now being used by the Union Pacific on its motor cars will be placed on the new coaches, and the cars will present an appearance so little in common with the ordinary coach that they will at first hardly be recognised as passenger vehicles. Some of these cars will soon be completed and placed in commission on the Southern Pacific western roads.

The Railroads of the World.

The statistics of the railroads of the world, published in the June number of the Archiv fur Eisenbahnwesen gives the mileage of the several continents as follows —

	Miles.		Miles.
Europe	192 251	North America	252 098
Asia	50,593	South America	32,859
Africa	16,538	Australasia	17,441
	259,382		303,398

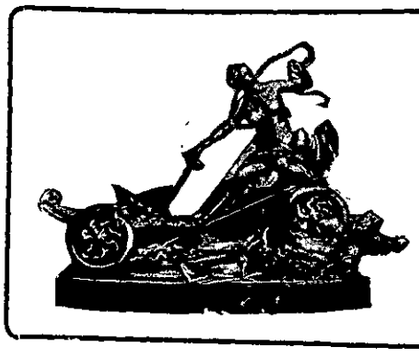
making a grand total of 562 780 miles in the whole world at the end of 1905. or the nearest date for which reports are made. This is an increase of 12 525 miles or 2.3 per cent. over the previous year, and is the smallest increase since 1900, it having varied since 1898 from 10,800 miles in 1900 to 16, 754 in 1904 while the total additions to the world's mileage since 1898 have been 95,816 miles, an average of 13,688 miles yearly.

Of the increase in 1905 a little more than one-half was in America, 5 891 miles in North America and 426 in South America (including the West Indies). Canada is credited with 990 miles, against 533 in the year before but in Mexico the additions were but 150 miles in 1905, against 1,720 in 1904. In South America, Argentina opened 337 miles Peru 39, Brazil 36 and the other additions were 12 miles in the West Indies

The experiment of growing tobacco under cover is being tried in Porto Rico. The cost of production—about £100 per acre—is more than repaid in the increased yield and finer quality of leaf.

* * * * * *

In a laboratory of the Pasteur Institute two months ago a well-known surgeon broke a glass tube containing virulent tuberculosis bacilli. and a fragment of the glass cut his neck. He immediately began a treatment. but the disease, which in a few days had seized him, has not yet been got under, and it is a question whether he will overcome it.

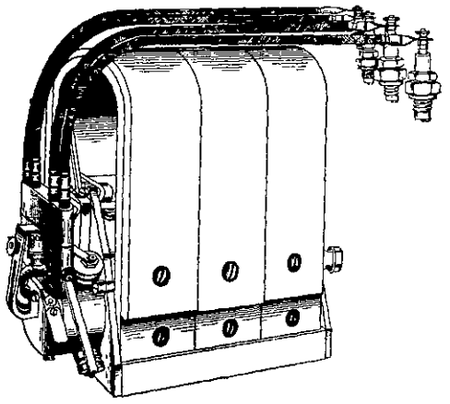


The ....Motor.

MOTOR NOTES.

BY "ACCUMULATOR."

Wind screens are a constant source of interest in a breezy climate such as ours, and though there are many on the market, they are by no means uniformly successful. One of the latest and best to be introduced here is the "H. and B." particulars of which reach us from the Motor Import Company. It is claimed to be adjustable to any position and a glance at the accompanying illustration showing



THE SIMMS-BOSCH HIGH-TENSION MAGNETO

a few of the adjustments possible is sufficient to demonstrate this contention. The screen is fitted with patent polished plate glass, and is warranted to be absolutely free from rattle when the car is running. In addition to supplying the screens to car owners, the agents are prepared to supply the trade either with the complete screens or necessary fittings to enable them to build for themselves.

Among the recent purchasers of Argyll cars we notice the names of Lord Wenlock, Mr. Andrew Carnegie, and Major Ponsonby.

* * * * * *

A long-standing complaint with New Zealand motorists has been the difficulty in obtaining spare valves when required. To obviate this the Motor Import Company, of Christchurch, are making a specialty of stocking a complete range of both inlet and exhaust valves for all the leading makes of cars —De Dion, Aster, Panhard, Darracq, Renault, Clement, Daimler, Humber, Minerva Riley, etc. All the valves are guaranteed to be made of the finest 5% nickel steel, and as the prices fixed are as low as is consistent with good quality, it should certainly pay motorists who have experienced trouble in this direction to communicate with the above firm.

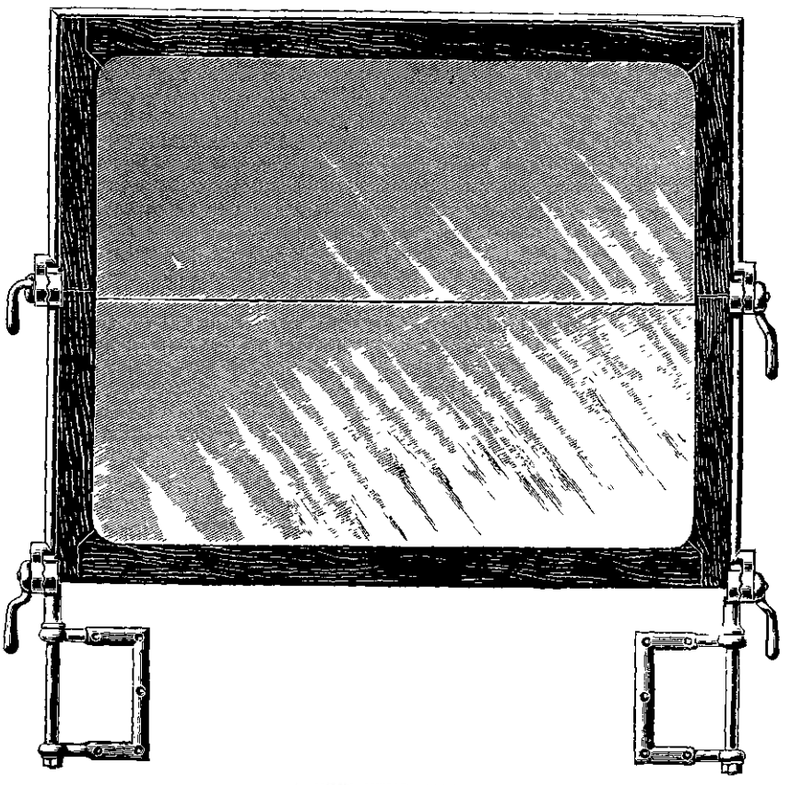
* * * * * *

According to the most recent statistics of the French Ministry of Finance, there are in France, a total of 32 000 cars, of which 4922 are owned in Paris. An exchange thinks that, allowing for cars "overlooked" and those owned by manufacturers, agents etc, the total figure would be close to 40,000.

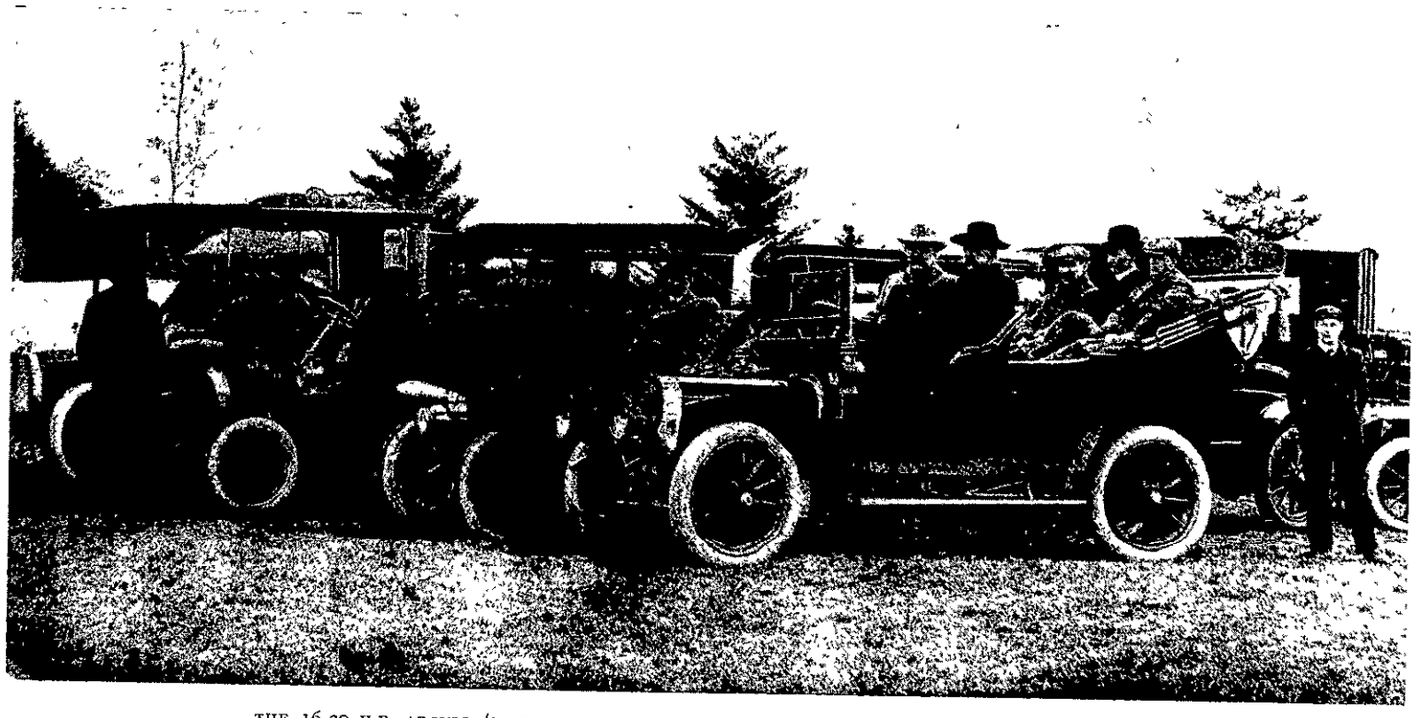
* * * * * *

Mr. H. E. Avery, of Wellington, is having his two-seater De Dion car converted into a four-seater tonneau.

The greatest event in the motor-cycle world, *viz.*, the Auto Cycle Club's Reliability Trials, have just concluded. The test is a particularly severe one as it lasts 6 days and covers 1000 miles of country, a portion being through picturesque, but hilly Wales. It looks rather humorous to see the light weight "Motosacoche" of 1¾ h.p. competing against machines of 6 h.p. down, the nearest competitor being 3½ h.p. The "Motor Cycle" comments upon the performance of this wonderful little machine as follows:—"A motor bicycle which is creating enormous interest in the A.C.C. reliability trials is the Motosacoche. One could reasonably expect that this machine would finish every day inside maximum time with reasonable luck, but it has exceeded all expectations since it has proved itself to be not only reliable, but fast, as it has always arrived early and when seen on the road has always been travelling at a respectable speed. At the famous Fish Hill grade 1 in 9—11 the Motosacoche came up remarkably well, only giving a few easy strokes of the pedal on the steepest portion. The excellent running of the Motosacoche created a most favourable impression, proving to be fast on the level and with pedal assistance a remarkable hill climber."



A NEW WIND SCREEN



THE 16-20 H.P. ARGYLL (IN FOREGROUND) RECENTLY PURCHASED BY DR. THACKER, CHRISTCHURCH.

The motor-car industry in the United Kingdom is progressing by leaps and bounds There seems no possible drawback to a continued period of great activity. Last year the British motor market was approximately worth twelve millions sterling The principal British motor markets are taxed to their utmost capacity At the present rate of production there will be over 20,000 cars of all grades made this year, the half-dozen leading firms being responsible for more than half this number.

* * * * * *

The disadvantages of the standard four-volt coil with its high-current consumption and consequent frequent necessity for accumulator charging, rapid wearing of platinum contacts, etc., are well known to all motorists, so that much interest attaches to the new two-volt coil named the "Voltoo," particulars of which reach us from the Motor Import Company, Christchurch.

The advantages claimed for this coil are — First— a big economy of current. The majority of four-volt coils consume from 1 to 3 amperes, but the "Voltoo" coil only takes 1-5 of an ampere, that is to say ⅓ or less, of that required by the majority of four-volt coils. It has indeed been repeatedly demonstrated that a 'Voltoo" coil will run a modern high-compression engine perfectly on a single dry cell (1.5 volts), consuming only 1-10 for an ampere Second—absence of pitting. Owing to the extremely small volume of the primary current, the great trouble of pitting of the platinums is eliminated, thus reducing to a minimum the expense and trouble of constantly renewing, trimming, and adjusting the platinum points. Third—spare battery dispensed with With a four-volt coil it is absolutely necessary to carry a spare accumulator, which both takes up space, and adds weight. Such a precaution is, however, quite unnecessary when using a "Voltoo" coil, as a standard four-volt accumulator constitutes a spare in itself, only one cell being in use at a time. This is, of course of especial interest to motor cyclists to whom both weight and space are important considerations

* * * * * *

The strides made by the commercial vehicle at Home, says the *Commercial Motor*, have been so rapid that manufacturers have been compelled to devote their attentions mainly to the Home demand. It must not be forgotten however that there is a vast field waiting to be opened up in the colonies. We were forcibly reminded of this fact during an interesting interview we had recently with Mr. A Roslington, an old member of the Yorkshire Automobile Club, who has just returned from a motor tour through Australia in the interests of the Belsize Company. Mr. Roslington tells us that the motor car is used very little as a pleasure vehicle in Australia. Cars are owned by farmers on up-country stations, and are used very extensively for purely business purposes Carting is still done by wagons but our informant was sure that the time was ripe for the motor wagon The well-to-do farmers are already owners of cars, and are fully alive to the value of the motor wagon which would be a real boon to them. It is important to give them the right thing at first. To use the colonies as a dumping ground is to put back the chance of business for years, if not for ever, because, once bitten, the colonial is for ever shy.

Another important point for the manufacturer to consider is that the colonial prefers vehicles of British manufacture, once his confidence in them is established. The opening-up of trade in Australia and New Zealand is well worth consideration and careful study. Mr. Roslington also informed us that there is a big scope for commercial motor vehicles in Ceylon What is required is a van that will carry two or three tons of tea from the plantations up-country to the coast A van body that could be locked up and barred would appeal to the planters, because the pilfering that goes on by the natives from the ordinary bullock wagons is so great that, if prevented, it would pay for the upkeep of the motor wagon At present, the journey takes six days by bullock wagon. They consider it would be covered in one day by motor wagon.

The Simms-Bosch High-Tension Magneto.

[By W. H. Trengrove.]

The Simms-Bosch high-tension magneto is so rapidly growing in popular favour that the following description and notes on the care of the invention will be read with interest.

The apparatus combines the functions of an induction coil with those of a low-tension magneto and contact breaker. One end of the primary wire is earthed while the other end is in connection with the secondary wire and also with the insulated side of the contact breaker. The other side of the contact breaker being earthed The primary current is complete only while the platinum points are in contact The condenser is connected across the contact breaker as in the ordinary accumulator method of ignition. This system prevents destructive sparking across the platinum points when they are parted by the action of the bell-crank lever that revolves inside the recessed fibre ring. The secondary wire is connected to one end of the primary and then to earth. The other end, which it is necessary to have extremely well insulated from the body of the machine, is connected to the sparking plug, which should be one of the best quality plugs specially made for the magneto ignition When the platinum points are mechanically separated the primary current stops flowing The lines of force fall in upon the armature core, cut the secondary coil producing a current of high voltage, and at once a spark is produced at the plug The distance between the points of the sparking plug should be as near as possible one fiftieth part of an inch to obtain the best results

Locating Faults.

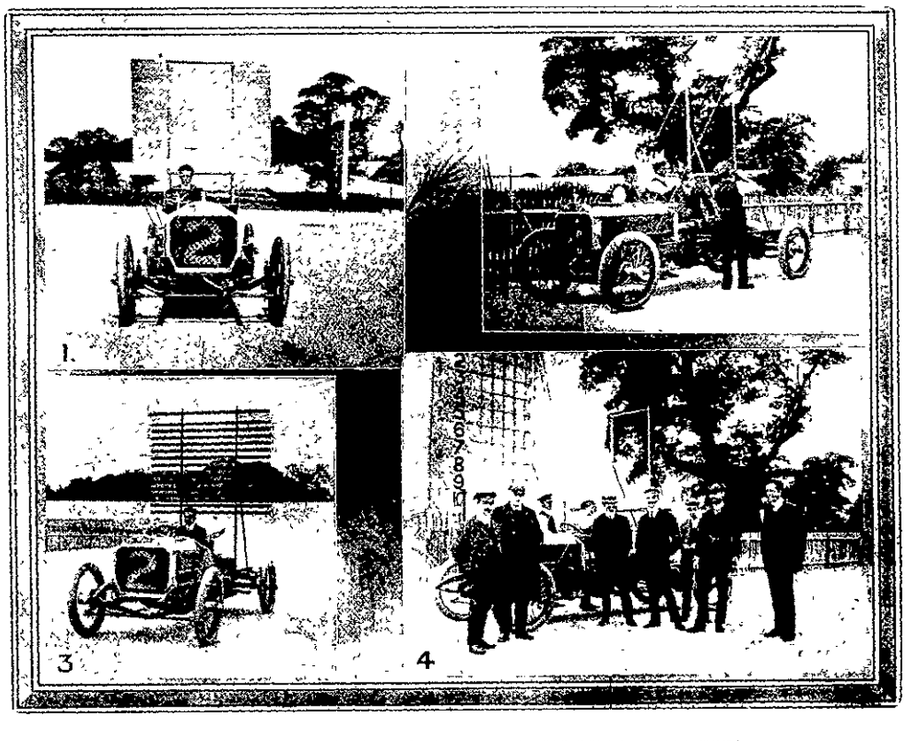
If there is a failure of the ignition system the sparking plug should be first suspected as the most likely cause, provided that the contact breaking mechanism has been kept thoroughly clean from dust and oil A key spanner or piece of wire will help to find a fault It should be placed on the secondary terminus when the secondary wire has been removed, and the end placed close up to the field magnets so as to leave a gap of about one-twenty-fifth of an inch It then the armature is quickly revolved a spark should flash across the gap at regular intervals If the spark is uneven or does not pass at all, the fault is in the magneto and is probably caused through a bad contact due to oil or dirt The point on the flat spring that presses on the centre of the brass cover and the carbon brush on the screw should be very thoroughly cleaned Other causes of stoppage are the failure of the bell-crank lever to make and break contact, or misfiring, through the fibre ring being worn out which should be replaced with a new fibre ring

Lubrication.

This is one of the very serious items that is far too often overlooked or neglected, causing ruin to the magneto and worry to the owner. The armature shaft must certainly be well lubricated with thick oil of high quality. It is of the utmost importance that after every two or three weeks running the oil reservoirs should be washed out with kerosene and then filled up again with oil until it runs out of the overflow pipes. By strict attention to this matter one will be rewarded with better results from the magneto.

Setting the Magneto.

The correct setting of the magneto in relation to the engine is a simple matter. As soon as the piston has reached the top of the compression stroke the timing lever with gunmetal strap and fibre ring should be taken off A line will always be found cut on the edge of the contact-breaker disc, and a similar line on the right side of the front bearing the two lines must be set to coincide exactly, then the connection between magneto and motor, either by chain or gear wheels, can be connected up. The Simms-Bosch magneto can be easily adapted to work in the opposite direction of rotation by fitting another fibre ring with the recess differently placed. The life of the fibre ring, from writer's experience, is about 3,000 miles.



SOME RECENT EXPERIMENTS WITH WIND-RESISTING APPLIANCES.

Tractor and Mowing Machine Combined.

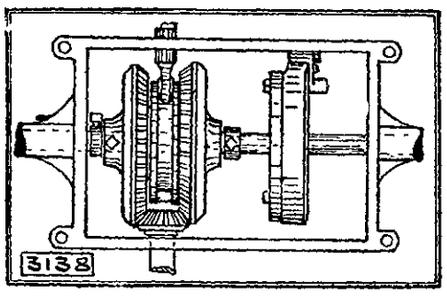
The considerable degree of success which has attended the introduction of the internal combustion motor into the field of agricultural enterprise has led many farmers, who are generally of a conservative disposition to adopt this compact form of power generator in one form or other The uses to which a petrol or paraffin engine may be put on the farm are innumerable, but the purposes for which such an engine is more generally applied are the hauling of ploughs, harrows, reapers, binders and other implements, which previously were drawn by horses Our readers are probably familiar with the Ivel, the Saunderson and other agricultural tractors that are in use throughout Great Britain and abroad, but the following description is of a new machine, which embodies tractor, reaper and portable power plant, the invention of Mr. W. Sharp, mechanical engineer, of Lower Ridge, Barrowfield, Lancashire. Two of these machines have been made by Mr. Sharp, and are operating very successfully in the Barrowfield district Of one of them with the inventor driving we withhold an illustration This particular machine has clearly demonstrated its ability to cut three acres of grass per hour, at a cost of sixpence per acre for labour, fuel, and oil The question of forming a syndicate or otherwise arranging for manufacture in large quantities, is under consideration.

As certain British and foreign patents are still pending we are able only to give a general outline of the design and construction of the machine.

A two-cylinder engine is fitted, and petrol is used as the fuel for the two experimental machines: it is hoped however that paraffin may be used in the future. The cylinders are 85mm in diameter, and the piston stroke is 115mm High-tension ignition with coil and accumulator is employed and a large, gilled-tube radiator is fitted in front of the tractor The power of the engine is transmitted from the engine to the rear road wheels through a cone clutch of the leather-to-metal type, and a differential countershaft and spur pinions which mesh with internal-toothed rings that are bolted to the rear wheels Only one gear-ratio is provided, but this is so arranged as to be available for travelling in either direction and gives a very easy reversing motion Referring to our sectional view of the countershaft casing it will be seen that a bevel pinion transmits the drive to either of two bevel wheels; these are loosely mounted on a shaft and their inner faces are provided with ratchet teeth The central sliding piece is operated by means of a bridle and a lever the latter of which projects through the casing and is in a convenient position for manipulation by the driver, the central, sliding member is arranged to slide on feathers, and ratchet teeth similar to those on the bevel wheels, are cut in its sides. The form of these teeth is such that there is never any possibility of "missing gear,"

and the manoeuvring of the machine in the oft-times close quarters of a farmyard is made perfectly easy. To the lid of the differential case is fitted an arm; this is jointed to a support in the middle of which is a sliding plunger. When the arm is depressed, the plunger passes through a hole in the lid of the casing, and applies a band brake which is mounted on the differential gear.

In order to transmit power to the cutter-blade an eccentric sleeve and connecting rod are provided, these are brought into operation by means of a hand lever (*A*), shown in the plan view of the tractor. The hand lever is fixed to a short longitudinal shaft (*B*), mounted on two bearings which are fixed to the frame, the forward end of the shaft is bent as shown, and it engages with the forked end of a bent cross-shaft (*C*). Two hanging levers are fixed to the latter shaft, and their ends carry a clutch bridle, for the purpose of engaging or disengaging the positive clutch (*D*). That portion of the clutch which is marked (*E*) is free on the shaft and it has an eccentric turned on it. When the positive clutch is in mesh, the eccentric imparts movement to a reciprocating or rocking arm, to which the cutter blade is attached by means of a toggle-jointed link; it is thereby reciprocated by the throw of the eccentric. To tilt the points of the cutter, so as to bring them down to their work from time to time as required, a hand lever is employed. The lower arm of this lever has, in engagement with it, a hook or catch connected to a chain link attached to the finger-bar of the cutter. When the hand lever is pulled back, it raises the cutter out of action, and the lever then enters a notch in a cross-piece fixed to the support for the steering rod, as shown in the side elevation of these parts. The length of the cutter-blade is five feet; this is considerably longer than the blades of an ordinary horse drawn reaper and a much wider strip of grass can therefore, be mown at one cut.

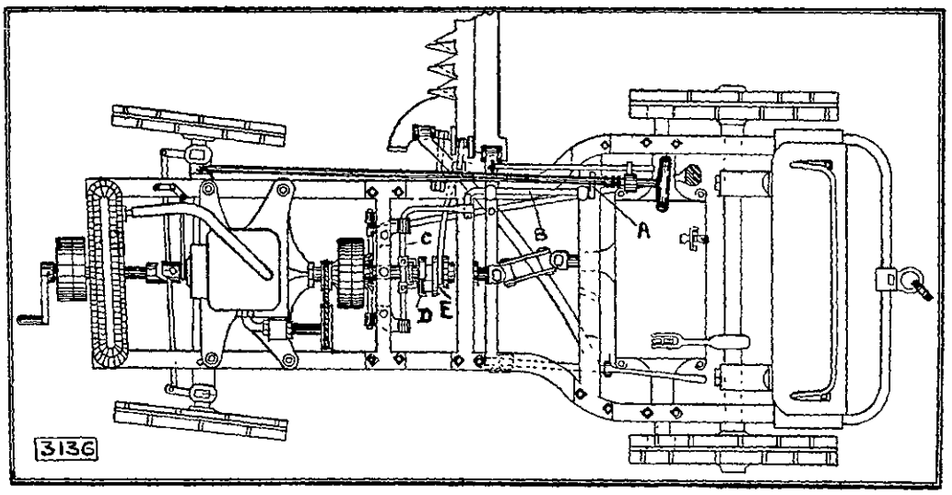


REVERSING GEAR (MOUNTED ON THE COUNTER-SHAFT).

The steering gear of this machine is somewhat novel; the support for the steering rod consists of an upright bracket, which carries an internally-threaded socket or bearing. The steering is effected by means of a long shaft or rod, screwed to suit the threaded socket this rod inclines downwards to the leading axle, and its lower end terminates in a ball. This ball is fitted into a cup-shaped socket screwed into the near side axle-arm. The two axle-arms are connected together by means of a front connecting rod in the usual manner. We can understand that this arrangement may be produced at a low cost, and if the machine is used as a reaper only, there is no reason why it should not prove itself stiff enough for the purpose, but if the machine is to be used on hard lumpy roads, such a method of steering might not last long.

The forward end of the main frame is supported on semi-elliptical springs and the road wheels are of the type usually to be found on all agricultural motors.

The general arrangement of the complete machine is such that its operation is controlled with perfect ease by the driver. The motor and reaper, being combined in the one construction render trailer-couplings and their attendant evils unnecessary. The drawings show that the addition of a pulley for belt transmission of power to fixed or portable machines has been considered, but such an arrangement has not been incorporated in the machine which is illustrated on this page.



PLAN, SHOWING GENERAL ARRANGEMENT OF SHARP'S MOTOR REAPER.

Effect of Wind Resistance.

AN INTERESTING EXPERIMENT FOR THE BENEFIT OF MOTORISTS.

[TO THE EDITOR]

SIR,—During the past motoring season I have watched with considerable interest a large number of events take place handicapped under formulæ which take into consideration wind resistance.

I was wondering whether anyone had any reliable data in regard to the wind resistance of rapidly moving motor cars, and as there did not seem to be much available I thought some test at Brooklands Track would be useful to motorists, and therefore on Friday last, thanks to the courtesy of Mr. Rodakowski and the Brooklands authorities I was allowed the use of their finishing straight, for timing trials on a 38.4 h.p. (R.A.C. Rating) Napier. I had the advantage of the assistance of two R.A.C. Official timekeepers, Messrs. F. T. Bidlake and A. G. Reynolds, who timed the car over each test.

The six-cylinder Napier driven by Mr. Tryon as shown in picture No. 1 had a wind screen erected on it of 30 sq. feet, the dimensions being 6ft. wide by 5 ft. high and being built up of laths 6ft. long and 2in. wide, so that each lath represented one square foot. Sixteen runs were made commencing with the total area exposed to the wind, and after each run 2 sq. feet, *i.e.* two laths were removed, and the result of these runs came out as follows.—

Wind-resistance tests carried out August 16th 1907 on a 38.4 (R.A.C. Rating) six-cylinder Napier car. Timed by F. T. Bidlake Esq., and A. J. Reynolds Esq., official timekeepers Royal Automobile Club. Total area of wind screen 30 square feet.

	Area of wind resisting screen.	Time over flying ¼ mile.	Speed in miles per hour.
1st run	30 square feet	18 4-5 secs	47.85 mph
2nd ,,	28 ,,	18 ,,	50.0 ,,
3rd ,,	26 ,,	17 ,,	52 9 ,,
4th ,,	24 ,,	16 ,,	56 15 ,,
5th ,,	22 ,,	16 3-5 ,,	54 0 ,,
6th ,,	20 ,,	16 1-5 ,,	55 5 ,,
7th ,,	18 ,,	15 4-5 ,,	57 0 ,,
8th ,,	16 ,,	15 3-5 ,,	57 6 ,,
9th run	14 square feet	15 secs.	60 mph
10th ,,	12 ,, ,,	14 2-5 ,,	62 5 ,,
11th ,,	10 ,, ,,	14 ,,	64 2 ,,
12th ,,	8 ,, ,,	13 3-5 ,,	66 15 ,,
13th ,,	6 ,, ,,	13 4-5 ,,	70 25 ,,
14th ,,	4 ,, ,,	12 ,,	75 0 ,,
15th ,,	2 ,, ,,	12 1-5 ,,	73 8 ,,
16th ,,	Normal	11 2 5 ,,	79 0 ,,
17th ,,	15 sq. ft. arranged as gridiron	15-4 5 ,,	57 ,,
18th ,,	24 sq. ft. in two blocks with 6 sq. ft. interval between them.	17 3-5 ,,	51 1 ,,

Besides these 16 runs there were two others, the results of which were very interesting.

First, a run with each alternate lath removed leaving a total wind-resisting area of the screen of 15 sq. ft. The time however for this run was 15 4-5 secs. giving a speed of 57 m.p.h. showing very clearly that although there was actually only 15 sq. ft. of resistance on the screen, owing to the arrangement and apparent extra skin and corner friction, etc., the resistance was the same as if it had 18 sq. ft. of continuous surface. Motorists should take special note of this, as it is pretty good proof that a large number of small protuberances on a motor car are detrimental to its free running.

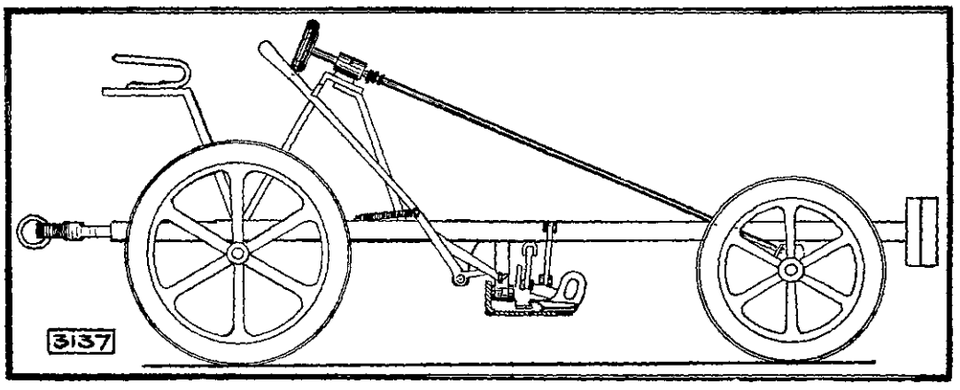
The next test was to have the total area exposed of 24 ft., but arranged in two portions, the top one consisting of 13 sq. ft. solid then a gap of 6 sq. ft. and then the remaining 11 sq. ft. solid, the total solid area exposed thus being 24 sq. ft. but the actual effect on the car was as if about 27 sq. ft. were exposed. It will be noted in going through the accompanying table that the slowest speed recorded with maximum wind resistance was 47.85 miles per hour, whereas the highest was 79, a variation of over 31 miles per hour merely by the addition of wind resistance and practically no additional weight; so all owners of large touring cars with wind shields, limousines, etc., must realise the enormous extra work they are giving their engines to do, and incidentally their driving tyres, when they travel fast against a strong head wind. This extra work is of course only obtained by the consumption of considerably more petrol, and so the varying petrol results that motor-car users sometimes get must be very carefully considered, and the direction of the wind when petrol consumption tests are being made; in fact, the only useful ones are when an "out and home" course is chosen.

The accompanying pictures show, No. 1 the six-cylinder Napier car end on showing the full capacity of the wind screen. No. 2 some of the Brooklands men showing how the laths were removed. No. 3 the gridiron type of wind screen referred to in test No. 17.

No. 4. is a group of gentlemen round the car who assisted me to make the experiments a success, and reading from the left to right they are as follows.—Messrs. Reynolds, Bidlake, two of the Brooklands' mechanics, Staner, Edge, Smith, New and Tryon.

I can only conclude by thanking those who assisted, and particularly the Brooklands track people for allowing the uninterrupted use of their finishing straight. It is merely another example of the extraordinary value that the Brooklands track can be to British Automobilists and I hope at an early date to carry out very much more exhaustive experiments in many other directions, including the effect of weight on speed and petrol consumption without increasing wind area.

If there are any details not mentioned here (which of course I have in a very elaborate degree) that would be useful to other British manufacturers who have not had the opportunity of attending at Brook-



THE CUTTER-BLADE LIFTING ARRANGEMENT

lands, I shall be very happy to supply them as it is only by attention to details of this sort that the British motor car can continuously improve. Yours truly,—S. F. EDGE.

P.S.—The front area of the car and the driver outside the wind screen area was about 11½ to 12 sq. ft. in addition.

Motor 'Buses.

[By J.T.L]

In taking the duty off motor-bus chassis the Government, evidently through the influence of the Premier's visit to England, saw that the public of New Zealand would not be long in following in the steps of the Motherland, and that this means of transit would be eminently suitable for the country and suburban districts throughout the Dominion, for, in spite of the fact that at the beginning of the year the London County Council brought in by-laws prohibiting any motor 'buses running which caused a smell from the exhaust or gave forth too much noise, the number running in London in August last exceed those in operation at the same period last year, by 230.

In reviewing the list of makers it is pleasing to note that an English firm, Sydney Straker and Squire, Limited, now top the list with no fewer than 312 vehicles, with an increase during the year of 155 machines, or nearly double the number, whereas their Continental rival's (Milnes Daimler, Limited) increase was only 68. No less than eight different makers have dropped completely out of the running; whilst several others have but few vehicles remaining in use.

There is no doubt that the British makers are now able to hold their own in this class of vehicle. At the half-yearly meeting of the London Road Car Company the chairman pointed out that the Straker-Squire (179) and Maudslay (8) vehicles had shown good working profits since the first date of their being put to work on the streets.

But outside the Metropolis there is a greater demand than ever for the motor-'bus and it is now by no means a novelty for the inhabitants of villages and isolated country districts to hold public meetings at which resolutions are passed in favour of motor-'bus services. The next step usually is to send a memorial or a deputation to the management of the nearest railway company and there are many head-shaking grumblers if a negative reply has to be returned. A large number of people who had hitherto been content to exist without travelling facilities, other than those furnished by the halting and "mixed" conveyance of the local carrier, are giving signs, in innumerable parts of rural Britain of their restlessness under the knowledge that the population in other or neighbouring areas is better served than is that in their own districts. Local pride, if not jealousy, dictates the opinion that it is unbearable to continue without at least equal opportunities of access to the railway, market-town, or other point of attraction and the genesis of another request quickly assumes concrete form in consequence.

The latest examples to come under our notice are provided by the action of a committee of residents in the villages of Turriff Cumnestown, New Byth, Strichen, and Brucklay.

However, in this country, particularly, great discrimination in the selection of the most suitable vehicle required is called for on the part of those who are entrusted with it, and those who make first cost rather than substantial construction both in chassis and body, the deciding point, will make an error for which they, or their financial supporters, will subsequently have to pay very heavily.

The motor-'bus, in as far as New Zealand is concerned, is practically *untried*, and in initiating 'bus services, care should be taken to profit by the experience of the companies in England, and thus save financial loss and disappointment

The Grand Prix Automobile Race.

SEVENTY MILES AN HOUR ON COUNTRY ROADS.

FASTEST TIME ON RECORD

[By the Paris Correspondent of the "Scientific American"]

One of the most brilliant and successful races of the season was the grand Prix of the Automobile Club of France, which brought together the leading racing cars of different countries, mounted by the most experienced drivers. The race was run on the second of July over a forty-eight mile circuit laid out in the northern part of France, and for a certain distance the route lay near the coast passing between Dieppe, the starting point of the event, and Treport, then passing inland, taking in various towns of Normandy. Among the cars entered in the race were the principal French makes—Darracq, Lorraine-Dietrich, Clement, Renault, Panhard-Levassor, Gobron and Brasier; then the Italian Fiat cars which won the two previous big international races of the year; and the Mercedes. Walter Christie's curious car awakened many comments from the assembled crowd. Among the drivers were Nazzaro, Lancia, Szisz, Jenatzy, Farman, Baras Wagner, Gabriel and many others whose names are familiar as record winners. The total length of one round of the circuit was 76 98 kilometres (47.84 miles) and there were ten rounds covered in the race, making a total distance of 478.4 miles. The roads were in fairly good condition and with good weather prevailing, everything favoured the Grand Prix event, and in fact the race was a most exciting one. Nazzaro, the winner, made an average speed of no less than 113.6 kilometers (70 miles) an hour, which is remarkable for such a long distance

The start took place at six o'clock in the morning in front of the handsomely decorated tribunes which had been erected at Dieppe, where a large crowd representing the automobile clubs of Europe and the leading sportsmen had assembled. Minister Barthou of Public Works represented the French Government on this occasion. The race was started at 6 01 by Lancia on his Fiat car, then came Collomb on a Corré racer at 6 02, Hanriot on a Darracq, Duray piloting a Lorraine-Dietrich, and so on. The cars started at intervals of one minute, and the last one started at 6.33. Soon after, the arrival of Lancia was announced. He passed the tribunes at lightning speed, having made the first round in good form in 41.33, but he is closely followed by Duray who has gained a minute and a half over the Italian champion. Then follows Hanriot (Darracq car) and close behind is Szisz, the winner of last year, on his Renault car, who is gaining ground and is only 39 seconds behind Duray. Nazzaro makes the first round at a prudent speed before letting himself out on the final heat, according to his custom. The French pilots Caillois and Gabriel are in good condition as is Wagne, on a Fiat car, who is also gaining. At the first round it appears that the three Lorraine-Dietrich, the three Fiat, the Renault mounted by Szisz, the three Darracqs and the two Mercedes are to take the lead in the race and are ahead of the Brasier Clement, and Panhard. As to the others they seem to be already out of the race. During the first round the Renault car mounted by Richez makes a skid and overturns. Bablot with his Brasier racer is just behind, and in trying to avoid him he runs up the bank and also has a spill, but the two pilots and their mechanics are not hurt and are able to repair their cars and start up again. What is striking about the race is that it does not end as is expected from the results of the first rounds. During the first part of the race the struggle is between Wagner on his Fiat car, the Italian Lancia also on a Fiat and Duray, with the French Lorraine-Dietrich, and this was without doubt the most exciting part of the event. On the second round, Wagner is in the lead, followed by Duray and Lancia, and the struggle between the latter two is very close; at each round they appear together on the route, and Duray is following hard upon the Italian, seeking to pass him. At the fifth round Duray has the lead, and then is obliged to stop to fill up with gasoline. Lancia does the same farther on. Almost all the interest in the race is now between these two champions. At the sixth round Lancia and Duray pass before the tribunes with scarcely a hair's breadth between, and Duray has now gained three minutes, seeing that he started later and he soon passes ahead of his adversary. Lancia now begins to slacken, as something has gone wrong with his motor. On the ninth, or next to the last round, it seems as if Duray must win the race, since he is ahead, and Lancia is now obliged to abandon it as one cylinder of his motor is damaged. Unfortunately, Duray is thrown out of the race just as he expects to win. A ball-bearing in the transmission gear is out of order, and he is obliged to stop. This changes the state of affairs and as the two champions have disappeared we now find that the Italian Nazzaro is in the lead with his Fiat car, followed by Szisz piloting the Renault who is four minutes behind in the race although, as he started first he finishes before Nazzaro. At the final heat, Szisz crosses the line, but Nazzaro who started nine minutes after him, has made the round at lightning speed, gaining ground in the final heat and crossing the finish only 6½ minutes after his opponent, thus winning the race after a hard struggle and a most brilliant performance of the Fiat car. What is remarkable is that Szisz was the winner in the last year's race over Nazzaro and the latter has just won the Emperor's cup not long since. Still more striking is the fact that Nazzaro is now winner in the three leading races of the season—the Targa Florio, the Emperor's cup and the Grand Prix. His time in the present event is 6h 46min. 33sec. for the total distance of 478.4 miles, making an average of 113 621 kilometres (70 55 miles) an hour. Second comes the French pilot Szisz on his Renault car, in 6 53 10 3-5. Third Baras piloting a Brasier car in 7 5 05. Fourth, Gabriel on a Lorraine-Dietrich in 7 11 37. Fifth Rigal (Darracq car), time, 7 12 36. Sixth Caillois (Darracq), in 7:15:58. Seventh, Barillier (Brasier car), in 7 27 54. Eighth, Garcet (Clement car), time 7 34 17. Ninth, Fitz Shepard (Clement) 7 39 56. Tenth, Hemery (Mercedes) 8 24 25. There were sixteen cars which were able to finish the race.

Messrs Trengrove and Petherick have cabled for a 12-18 Riley chassis for garage purposes. The body will be built locally.

* * * * * *

The two-cylinder Riley motor bicycle, which was associated with the fatality on New Brighton beach some months ago has been sold to Mr Stanley Morgan, captain of the Wellington Motor Cycle Club, who will have it converted by Messrs. Trengrove and Petherick into a bucket-seat side car. This machine, being the most powerful motor cycle in the dominion should easily attain a high rate of speed with the added load.

* * * * * *

Mr. Peter Ellis, of Wellington, has started a small workshop at No. 6 Ebor street, off Tory street Wellington. At present he is engaged in making the patterns of his new steam motors which are being built for the market, late experiments and tests having proved the efficiency of the engine. The engine at present under way is to be especially suitable for the country district butter factories etc. Being of simple design and comparatively "fool-proof" a big demand may reasonably be expected for this class of engine, for, notwithstanding that gas and oil engines have found a large place steam power is preferred in many instances. In starting this workshop Mr. Ellis has in view the making of patterns for castings of all kinds for engineering and architectural work, models for patents, mechanical and architectural drawings and copies of drawings, sun prints etc. Also the giving of mechanical advice and assistance in working out inventors' ideas, works for which he is by nature and experience well fitted. His eldest son has joined him in the business.

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Mr. C. F. B. Livesay, architect, has commenced the practice of his profession at the National Mutual Chambers, Customhouse quay, Wellington.

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Mr J. Hoggard (until recently associated with Mr. Charlesworth) and Mr. W. J. Prouse (for some years past connected with the firm of Messrs. Prouse Brothers), have entered into partnership and will commence the practice of their profession as architects in their rooms, Hunter street. Mr. Hoggard, who has had experience in Wellington, has just returned from a visit to America, where he interested himself in architecture and sanitation. Mr. Prouse has had practical experience in timber construction and the use of New Zealand timbers.

NEW ZEALAND RAILWAYS.

KING'S BIRTHDAY HOLIDAYS, 1907.

HOLIDAY EXCURSION TICKETS, available for return until 6th December, 1907, will be obtainable from any station to any station on the Wellington-Napier-New Plymouth Section and Manawatu Company's Line (except where ordinary fares are less) from 5th to 11th November.

NOTE.—Holiday Excursion Tickets issued at any station between Te Aro and Masterton, inclusive, to any station between Te Aro and Masterton, inclusive, WILL NOT BE AVAILABLE by the Te Aro-Napier and Napier-Te Aro Mail trains on 11th November, either on the outward or return journey.

CHEAP RETURN TICKETS, available on date of issue only, will be available on 11th November as under;—

From Te Aro, Belmont, and intermediate stations—1st class 2/6, 2nd class 1/6 } or vice versa.

Tickets for use on 11th November may be obtained at Te Aro and Wellington on 9th November, between the hours of 9 a.m. and 9 p.m.

For full train arrangements see posters and handbills.

By Order.

Applications for Patents.

THE following list of applications for Patents, filed in New Zealand during the fortnight ending 1st Oct, has been specially prepared for PROGRESS.

23410—C. H. E. Hope-Johnstone, Aramoho: Treatment of milk.
23411—B. H. Ihwaite and W. Defries, London, Eng.: Manufacture of molten metals
23412—C. H. E. Hope-Johnstone, Aramoho Preparing milk for food.
23413—F. A. Alcock, Melbourne, Vic. Cushion rails for forming billiard tables.
23414—S. Doyle, Melbourne, Vic.: Potato washer.
23415—H. J. West and Co., Ltd, Saxilby, Eng.. Counter-pressure bottling machine.
23416—J. L. Ohlson, Adelaide, S.A.: Sewing machine.
23417—W. J. Green, London, Eng.: Branding machine for boxes, casks, etc.
23418—R. P. Myers, Walthamstow, Eng.: Arc lamp.
23419—R. H. Millar, Wellington: Trolley pole.
23420—A. E. Macindoe, Onehunga: Feed regulator for boilers, etc.
23421—W. J. O'Connor, Nightcaps: Hammer and spanner.
23422—J. E. Crowle, Ballarat, Vic.. Lifting jack.
23423—T. O. Turnbull Kinohaku: Ridging
23424—Manufacturers Machine Company, Montclair, U.S.A.: Buffing machine pad covers for boot and shoe manufacture.
23425—J. Delbridge, Windsor, Vic.: Air-compressor, usable also as a pump.
23426—C. H. Harris Wellington: Fire-extinguisher.
23427—T. N. Brocas, Opotiki: Dubbin.
23428—W. E. Chamberlain, Feilding: Packing-case opener.
23429—E. D. Bilham, Poverty Bay: Fencing standard.
23430—D. W. McLean, Methven: Tyre protector.
23431—J. C. Drewet, Auckland: Method of bleaching fibres.
23432—W. W. Harverson, Wellington: Trolley pole.
23433—J. L. Wilson, Waiamwa: Sharpening chaff-cutter knives.
23434—C. Craig, Doyleston: Collapsible crate.
23435—T. R. Christie, Dunedin Hot-water pressure & supply cylinder.
23436—C. H. Gannaway, Wellington: Bowlers' measure.
23437—A. H. and D. J. Byron and T. M. Scott, Wellington: Flax dressing and drying machine.
23438—W. Miller, Christchurch: Checking wall plates and similar timbers.
23439—D. A. Watt, Levin: Construction of globes for geographical instruction
23440—H. Quertier, Dunedin: Motor bicycle and cleaner.
23441—W. Diack, Centre Bush: Earthenware drain.
23442—F. Schneider, Christchurch: Track-gauging implement for permanent way.
23443—J. and R. Lindsay, Dunedin: Trolley pole.
23444—J. C. Drewet, Auckland Celluloid egg-shield.
23445—W. Brierly, Auckland: Obtaining power from the tides.
23446—P. Speirs, Tulla Marine, Vic.: Plough disc.
23447—A. O. Penwarden, Okato Cow bail.
23448—N. Bouraid, Otahuhu Post card.
23449—N. Bouraid, Otahuhu Envelope.
23450—W. Aston, Blenheim: Spring check for force feed drill.
23451—C. Suttie, Waharoa, and M. H. Wynyard, Auckland: Catching flax after stripping.
23452—C. Suttie, Waharoa and M. H. Wynyard Auckland: Cleaning flax after stripping.
23453—C. Suttie, Waharoa, and M. H. Wynyard, Auckland: Operating mechanical catcher for flax.
23454—G. Findlay, Dunedin Bicycle support
23455—"Z" Electric Lamp Syndicate, Limited, London, Eng.: Manufacture of filaments for incandescent electric lamps
23456—W. F. Chamberlain, Feilding. Lock-nut
23457—J. Brockbank, Auckland Device for tuning pianos, etc.
23458—W. H. Blackham, Melbourne, Vic Equalising the vacuum in the pipe lines of milking machines.
23459—W. A. Johnston, Hobart, Tas Saucepan, etc., cleaner
23460—C. G. Whitaker, Christchurch Egg-carrier.
23461—A. H. Brownley, Onehunga Locket.
23462—A. Jack, Palmerston North Production of gas from hydrocarbon oils
23463—W. P. McIndoe, Invercargill Truing up surfaces of flax-stripper beaters.
23464—A. J. Carr, Wharekopae: Wire-strainer.
23465—W. Beamish, Wellington: Cigar holder.
23466—The Konomax Rock-drill Syndicate, Limited Johannesburg, Transvaal Rock-drill and water spray therefor.
23467—The Konomax Rock-drill Syndicate, Limited, Johannesburg, Transvaal: Fluid actuated rock-drill, etc.
23468—The Konomax Rock-drill Syndicate, Limited Johannesburg Transvaal Cutting machine
23469—O. Coates, Christchurch: Tram or railway point-shifter.
23470—F. J. Swanston, Dunedin Broom-handle coupling
23471—J. and R. Lindsay, Dunedin. Securing trolley-pole to car.
23472—R. F. Sorenson, Hastings. Gig.
23473—R. F. Sorenson, Hastings: Road-cart.
23474—R. G. Saxby, Tokomaru Bay Girth and surcingle.
23475—A. J. Roycroft, Waihi. Fire alarm.
23476—A. H. Byron and T. M. Scott, Wellington. Wool-pressing apparatus.
23477—G. F. Double and E. S. Quicke, Invercargill Holding razor blades when setting or stropping.
23478—I. Lewis, Hokitika Gold concentrator.
23479—J. W. Synnerholm, Lower Matakana. Extracting kauri gum from sand.
23480—J. Ross, Wellington: Grease trap for sinks, etc.
23481—D. E. Davis and S. H. Knight, Hastings, and C. D. Lightbrand Wellington: Leather.
23482—J. H. Beamish, Auckland Method of glass roofing.
23483—K. R. Macdonald, Wanganui Combination cash and receipt book.
23484—C. Giorgi, Palmerston North Mail-bag and basket lock,
23485—G. Beaumont, Dunedin: Belt dressing.
23486—F. J. T. Brown, Wanganui: Damper of register-grate.
23487—J. R. Brown, Los Angeles, U.S.A. Lining for grinding mill.
23488—W. McKeegan, Wellington: Tension apparatus for wire-hauling ropes.
23489—T. J. Heskett, Brunswick, Vic: Extraction of zinc from its sulphide.
23490—E. McCorrigan and E. M. Payne, Dunedin: Puzzle-box for matches.
23491—W. B. Curtis and D. Morrison, Auckland and Gisborne, respectively, : Stripping and washing flax.
23492—United States Automatic Box Machinery Company, Boston, U.S.A.: Paper box-making machine.
23493—S. G. Roseman, Auckland Sweeping brush or broom.
23494—W. H. Triggs and W. H. Denton Christchurch: Preventing trotting horses breaking into a gallop.
23495—T. R. Bond, Wanganui: Hoe.
23496—P. Rafferty, Wellington: Trolley head attachment
23497—J. C. Atkinson, Auckland Umbrella, hat and book rack combined.
23498—W. S. Clark, Melbourne, Vic.: Fire kindler.
23499—W. G. Landells, Coburg, Vic, and H. J. Huckson Pakenham, Vic.: Self-heating soldering bolt and blow lamp.
23500—A. P. Bond, Auckland: Spark arrester.
23501—C. C. Wakefield, London, Eng. Gas burner.
23502—W. Walkerden, Marrickville, N.S.W. Boot or shoe.
23503—D. Brisbane, Ardmore: Economical form of power.
23504—W. F. Chamberlain, Feilding: Washer.
23505—A. R. Wilfley, Denver, U.S.A. Ore-roasting process.
23506—C. P. Stewart, Los Anglees, U.S.A. Process for making sugar.
23507—American Cork and Seal Company, New York, U.S.A.: Bottle seal.
23508—B. Ward Auckland Fastening the ends of fencing wire
23509—A. G. Jackson, Brisbane, Queensland Electrical releasing mechanism for clocks, etc.
23510—C. Loomes, Wellington Coin-freed apparatus for selling stamps, etc.
23511—A. K. W. Rissel and W. H. Hennah, Wellington: Recording and indicating course of a vessel.
23512—T. J. McBride, Christchurch: Resilient wheel for vehicles.
23513—G. Westinghouse, Pittsburg, U.S.A. Yielding resistance mechanism.
23514—A. Ravelli, Arenzano, Italy Utilising the movement of sea-waves.
23515—H. Corbett, S. Yarra, Vic. Manure and method of manufacturing same.
23516—H. Corbett, S. Yarra, Vic: Food for stock and method of manufacturing same.
23517—R. M. Kemp Durham Ox, Vic: Subsoil cultivator for attachment to ploughs
23518—F. G. Cottrell, Berkeley, U.S.A. Manufacture of sulphuric acid.
23519—T. S. Royds, Invercargill Milk bucket holder.
23520—R. Millis, Dunedin: Preparing fibre from *Phormium tenax*.
23521—C. M. Chamberlain, Pueblo, U.S.A: Ore-extraction apparatus.
23522—W. Dixey, Burwood. Range hot-water boiler.
23523—J. C. Drewet, Auckland. Fibre-bleaching method.
23524—L. F. J. N. de Farelle, Te Kopuru: Screw propeller.
23525—L. H. Rogers and A. Myers, Wellington: Puncture composition for tyres.
23526—L. R. Tingey, Wellington: construction of metallic letters, etc., for signs.
23527—G. L. Burton, Napier: Acetylene generator.
23528—E. G. Langton, Masterton: Shirt-cuff fastener and protector.
23529—C. R. Skipage, Wellington: Cow-bail.
23530—A. E. Slipper and D. J. Smith, Kohuri: Belt fastener.
23531—H. W. Mears, Balfour: Feed-gear of chaff-cutters.
23532—M. Ruping, Charlottenberg, Ger.: Impregnating wood and other porous material.
23533—W. H. J. Ridley, Penrose: Furnace for extracting metals from ores.
23534—G. E. Partridge, Cromwell. Device for tying bundles of flax.
23535—H. Stephenson, Edenham: Fencing standard.
23536—Commonwealth Manufacturing and Galvanising Company, Limited, Brisbane, Queensland. Machine for folding edges of sheet metal.
23537—J. Owen, Wollstonecroft, N.S.W.: Draught fitting for retailing aerated liquids from bulk.
23538—J. F. McCarva, Christchurch: Baby cradle.
23539—H. A. Fry Nelson. Acetylene generator.
23540—F. C. White, Auckland. Range.

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

Benzol.

Benzol is a product of the distillation of hard coal. For a long time the only source was the coal tar of the gas works, which contained from 1 to 1.5 per cent. benzol and toluol together. This source was not sufficient to supply the demand in the chemical industries. A new source was opened out in the manufacture of coke by distillation. In this process tar, benzol, and ammonia were made as by-products. In 1904 Germany had 19,309 stills, of which 9110, or 47 2 per cent., delivered these by-products; the rest did not. The amount of benzol produced was but small, being only about 0.5 per cent. In that year there were made about 60,000 tons of benzol from twelve million tons of coal. Of these 60,000 tons the greatest part——about 75 per cent.—was used in the dye industry as the source of nitro-benzol, anilin, etc., for in the coal-tar dye industry Germany now has the lead. In 1906 the exportation of that country in anilin and other coal tar products amounted to 116.6 million marks, equalling, say, £5,500,000. The gas industry also used benzol for improving the quality of gas of low illuminating power. A mixture of two-thirds coal gas and one third water gas, such as now generally made by the gas-works, is usually enriched by about forty grams of benzol per cubic metre. This uses up 6000 tons per year in Germany alone. Not only in gas-works is it employed, for benzol is also used for increasing the heating power of furnaces, etc., and it is also utilised in open-air burners, such as are used for street lighting. In all, for these purposes about 1000 tons per year are used. The same material is also used as a solvent for fats, resins, guttapercha, and indiarubber; also to remove varnishes and in the extraction from bones of oil for oil-cake. The consumption for these purposes amounts to between 3000 and 4000 tons per year. There are, therefore, left for the purpose of automobiles only between 3000 and 4000 tons!

The St. Lawrence River Bridge Disaster.

[TO THE EDITOR]

SIR,—On reading through this month's PROGRESS I was much interested in the article on the St. Lawrence River Bridge Disaster. I am a young engineer, and have taken a course of evening lectures at the Canterbury College School of Engineering, one of the subjects being elemental strength of materials. I very naturally read this article through carefully, especially when particulars of this great bridge were given. I was surprised that the engineer should call a design like that safe, at least, according to our standard of safe stresses. The first departure from our standard that caught my eye was 25lb per square foot allowed for wind pressure I remembered being taught to allow 50lb per square foot and also allow for the area of the train or other traffic likely to be on the bridge, as well as the area of the structure itself. On looking up my notes I found that my memory had not played me false. The next thing was the tension and secondary members; maximum stresses allowed 17,000 and 20,000lb per square inch. We were taught to allow no more than 13,200lb per square inch for live loads and 20 000 for dead loads. In your article they have allowed the dead-load stress to members that are subject to live loads. Then the top chord, which is expected to carry a load of 8000 tons, has a cross section of 711 square inches. This equals a load of 11.1 tons per square inch, or 24,890lb, which is almost twice as much as we allow per square inch for bridge design. I knew of course that there was a little difference between the English and American factors of safety, but on looking it up I found that the difference is not worth speaking of. It would seem, by the number of bridges and other structures that are continually collapsing over there, as though there was no one in authority to see that the standard is worked to. However, I am getting away from the subject. My object in writing to you is to see if there is any chance of the expressions used being not quite correct, for it seems incredible that an engineer should allow such small margins of safety.—I am, etc.,

JAS. MCARTHUR, JUN.

Christchurch, 16/10/07.

The following reply to our correspondent's communication has reached us from Mr. W. T. Johnson, C.E., the author of the article in question:—

"In reply to Mr. McArthur's queries *re* stresses in the St Lawrence river bridge, as given in October PROGRESS, I beg to say that the maximum stress allowed for in tension members, *viz*:—17,000lb per square inch, is considerably in excess of that allowed by the Board of Trade in the United Kingdom, who limit same to 14,360lb per square inch for structures in mild steel, having a breaking strain of from 62,720lb to 71,680lb per square inch. Regarding the allowance made for wind pressure, *viz*., 25lb per square foot, this appears low, and would not be nearly sufficient to cover the pressures experienced in this country. But this is a very open question, as much depends upon the situation of the structure; and dealing with very large structures like the St Lawrence bridge no doubt the engineers made tests or had reliable information upon which to base their calculations. In dealing with American weights it is necessary to bear in mind the fact that a ton with them is equal to 2000lb."

The Cancer Scourge.

[TO THE EDITOR]

SIR,—It seems to me that the glowing account of the results of Dr. Beard's treatment of cancer, published in your October number, should not be allowed to pass without criticism. In the present state of our knowledge such articles do a large amount of harm, as they encourage the unfortunate sufferers from this deadly disease to shrink from what is the only certain cure—*early and extensive removal of the diseased part*. There is no doubt that Dr. Beard is sincere in his advocacy of his pancreatic ferment treatment, and thoroughly believes that he has discovered the long-sought-for cure. It may be so, but he has certainly not proved it yet. On the other hand he is not a physician, and he has had very little opportunity to obtain clinical experience of cancer. He is lecturer on Embryology in the University of Edinburgh, and has worked out his "cure" by laboratory methods. The treatment of cancer by pancreatic ferment has now been tried by a large number of competent men, and the reports on the whole are discouraging. It was tried in the cancer ward of the Middlesex hospital, and the report states that no improvement took place in any of the cases. It has also been tried by Ligertwood, Von Leyden, Pusey, Campbell, Lambelle and many others without any marked success In all these cases the treatment was carried out according to Beard's directions. In connection with all "cancer cures" it must not be forgotten that there are many varieties of cancer, which vary enormously in their rate of growth Sometimes, even without treatment, there appears to be considerable improvement for a time, and the tumour becomes smaller. There have even been several cases reported in which the cancer, after growing for a time, seemed to disappear entirely. From time to time various agents have been lauded as "cancer cures" but none have stood the test of experience. Coley's fluid, X rays, and radium rays have each had their turn, and then have been discarded Several cases have been reported cured by each of these agents, but the vast majority of cases show no improvement. So may it be with Trypsin and Amylopsin

I have treated some cases with Trypsin and Amylopsin exactly according to Beard's directions, and some certainly seemed to improve for a short time—but only for a time. There are several potent preparations of both ferments on the market. The ferments are destroyed at 65°C—not F—but no one would think of sterilising them by boiling, as they are easily sterilised by passing them through a Berkefeld filter. It seems to me that it is justifiable to try the treatment on those cases that are too far advanced to offer any hope of cure by operation, but that it would be criminal to waste time in early cases and so rob the unfortunate sufferer of his only hope of cure.

I can only repeat that, at present, the only known cure for cancer is *early and wide removal with the knife*.—I am, etc.,

C. MACKIE BEGG.
M.D., F.R.C.S., M.R.C.P (ED.)

Wellington, 23/10/07.

[The article referred to by Dr. Begg was published in the interests of a community wherein the dread cancer scourge is only too prevalent. Moreover, the writer of the article deals with his subject in so clear and interesting a manner that it cannot fail to engage the attention of students throughout the Dominion.—ED. PROGRESS].

The United States built 60,000 automobiles in 1906 France 55,000, England 28,000, Germany 22,000, Italy 19,000, and Belgium 12,000. In 1901 the United States built only 314 cars, while France built 23,711.

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TREE PLANTING IN PENNSYLVANIA. Pittsburg has a project in hand for planting 2,000,000 000 trees in the basins of the Alleghany and Monongahela rivers, and thus checking the disastrous freshes which annually destroy property to the value of millions. If this task is accomplished, Pittsburg will be entitled to high credit as a creator and conservator of natural resources invaluable to a large and important section of country, stretching from Western New York through Pennsylvania and Maryland into West Virginia

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INSOLUBLE ADHESIVE FOR ENVELOPES AND POSTAGE STAMPS. Two solutions, one for the inner side of the envelope flap, and the other for the place where the flap is attached, the latter not to be touched with the lips: 30 parts of crystallised chromic acid dissolved in 15·5 parts of water and in about 15.5 parts of strong ammonia, with about 10 drops of sulphuric acid. 31 parts of ammoniocupric sulphate and four parts of fine white paper. First solution, isinglass dissolved in acetic acid 1 part acid to 7 water) at 212 deg. F.

There has recently arrived from Minneapolis, U.S.A., to the order of Mr. E. J. Ible, of the Lower Hutt, Wellington, a complete plant for the manufacture of Miracle concrete building blocks. Included in this plant are portable moulds for cement pipes, and a concrete mixer. Mr. Ible reports that everything is now in good working order, and a large number of blocks of various sizes and designs for the construction of houses, stores, factories, and ornamental walls, are now being turned out, and are on the market for practical-purpose building material. We understand that there is also another Miracle plant about to start in Auckland at the works of Wilson's Portland Cement Co.

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Recently a peculiar accident happened on one of the New York ferries. A large touring car heading the line of vehicles being transported was allowed to stand on the slightly inclined deck of the boat with all brakes released. Upon the entrance of the boat into its slip, and just after the chauffeur had started the engine, the ferry collided rather forcibly with the side of the slip, and the car, from its own inertia, started for the chain gates across the front of the runway. Several people who were standing in front of the car were pushed off into the water and one man slightly injured.

BUILDERS AND CONTRACTORS, Etc.