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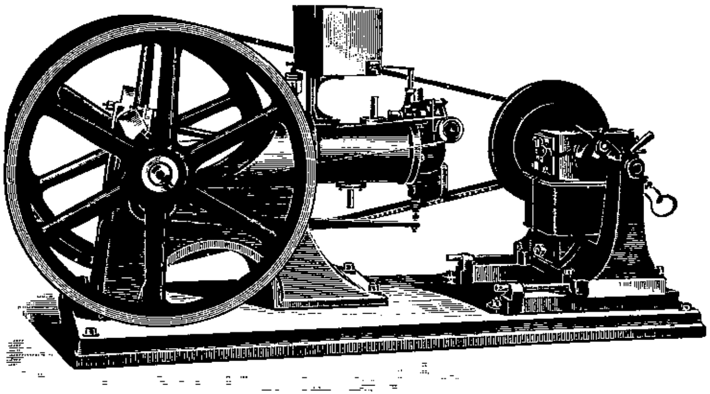

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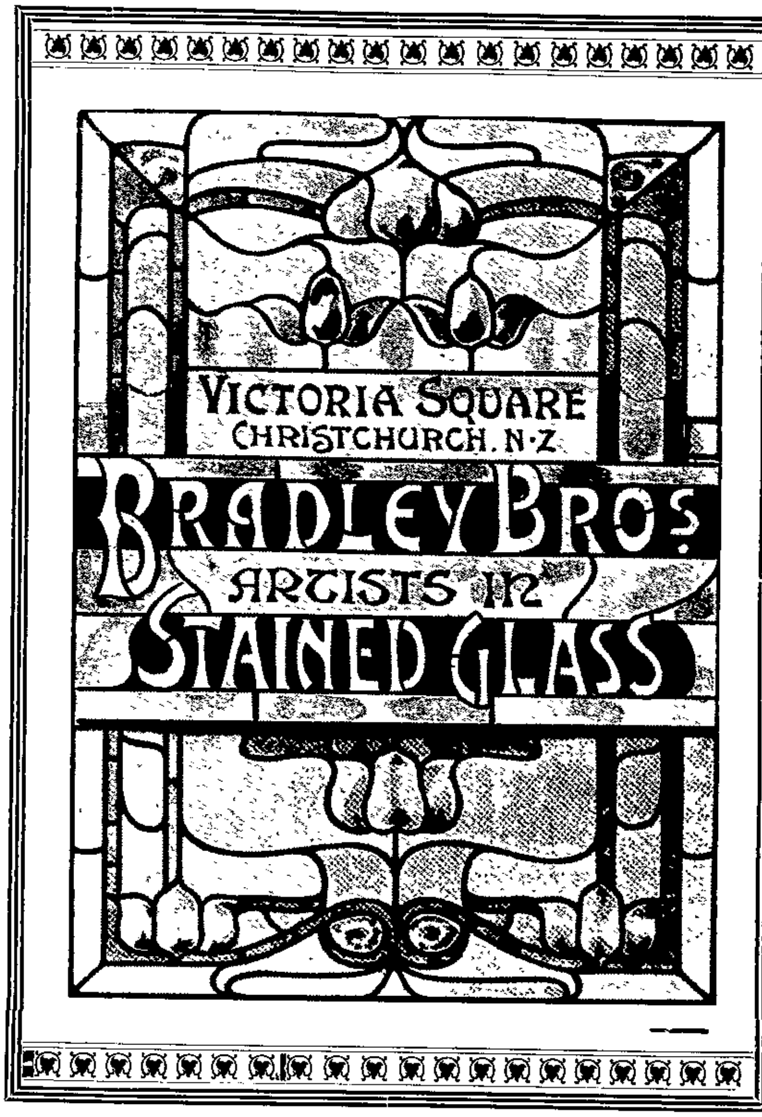

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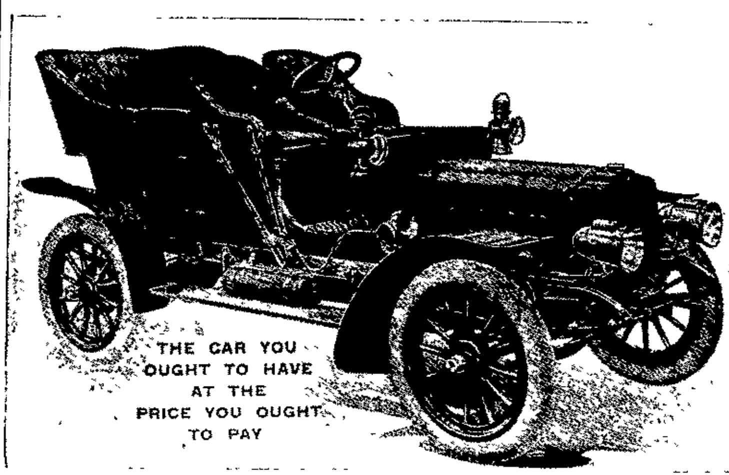

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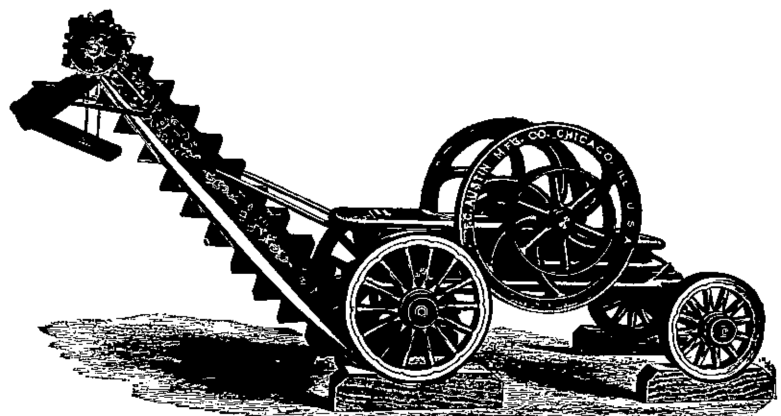

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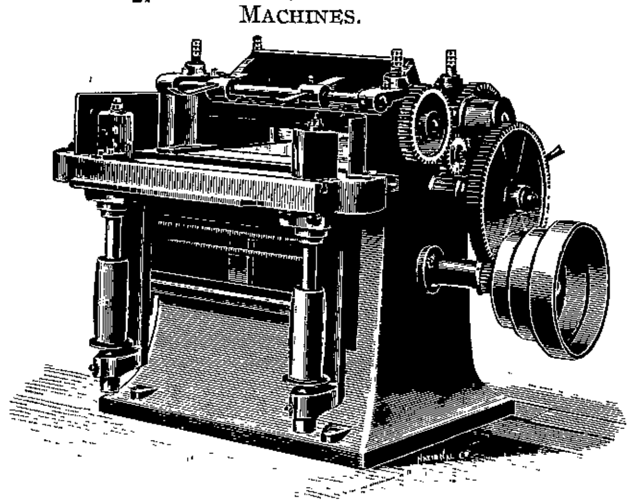

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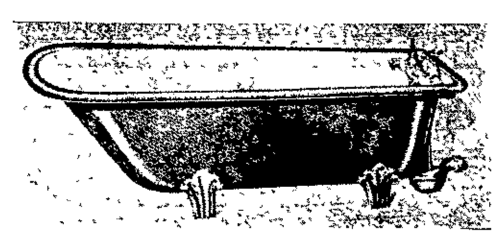

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THE SCIENTIFIC NEW ZEALANDER.

VOL. II.—No. 3. MONTHLY.] WELLINGTON, N.Z., JANUARY 2, 1907. [PRICE: 6d Per Copy; 6/6 Per Annum posted, or in advance 5/-

Progress

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WITH THE....
SEASON'S GREETINGS
TO OUR READERS IN NEW
ZEALAND AND OVER SEAS.

Training of the People.

IT is the leading, if unwritten, axiom of all the nations engaged in the industiial war of this era of unregulated production, that nations without education degenerate into unorganised bands of hewers of wood and drawers of water. Now, the hewers and the drawers are the serfs of the world. In nothing do they prevail. Manufacturing supremacy, and its logical follower, trade advantage, are to them whose brains, eyes, and hands are trained, whose minds are filled with the most useful of things knowable. At the same time it is evident that there must be the healthy body as well as the healthy mind, otherwise in the day of enterprise there will be no effort, and in the hour of defence neither courage nor endurance. The nation that holds its own must have not only a full head and a skilled hand, but also, and indispensably, a strong constitution.

Education that aims at that trinity of development is supplied in this country in full measure. The primary school, the secondary school, and the university college form the education pyramid, with a cohesion and a homogeneity which may leave some room for improvement, but are essentially improving. In addition, there is a system of technical instruction which was but yesterday in its infancy, and to-day is vigorously at work on a wide scale, and is clamorously demanding increase all along the line. Its practical benefits are many: it offers a great help to the existing apprentice system, and it bids fair to advance the status of the expert in every department of skill from day to day in a surprising manner. It is now, in fact, an integral and increasing part of the State system of education. The State, recognising the value of its system, has made primary education compulsory and requires education tests for entrance of young people into the Civil Service of the country and, of course, the learned professions; and the private employer often co-operates by insisting on a Fourth Standard certificate before the admission of a candidate to ship or counting-house.

The great question, of course, under these circumstances is whether young New Zealand appreciates these advantages of provision and compulsion. Many people believe that the young horse, when brought after all this trouble to the wholesome water of learning and practical advancement, refuses to drink, preferring the poisonous flow of gambling and the stagnant pool of over-athleticism. They prophesy a race of "flannelled fools and mudded oafs." It is comfortable to know that these prophets of evil are wrong in the extreme. Young New Zealand does, it is true, indulge in sports of all kinds; but there are two things to be noted about this indulgence. In the first place he is an accurate observer and organiser beyond comparison, a student of perfection in every detail of his sport. Secondly, he subordinates it in nearly every instance to the more serious work of life before him. The great thing to know for those who are anxious watchers over his welfare is the way in which young New Zealand co-operates with the State in the things provided by the State for his advantage and the advantage of the race. The gauge is to be seen in the matriculation lists of the University and in the examination lists of the Education Department which has the supervising of all the examination outside of the university series. These latter comprise the Civil Service examinations, the various scholarship examinations, and the examinations that count for the admission to the free places which constitute so large a proportion of the secondary education of the colonial youth. To take the latter first. the numbers of applications for all the examinations this year reach the handsome figure of 2243. It would be interestnig to have a series of the numbers of annual applications before one for the purpose of comparison and the ascertainment of the rate of progress. But there are so many new things in the education world in the way of technical examinations. examinations for free places and the rest, less than two years old, that the compilation of such a series would at the present be quite useless. It is a great thing, however, that the numbers have reached so soon up to 2243. The figures for the matriculation examinations are more clear so far as they relate to a number of years. The table for the last five years is as under:—

	Examined	Increase
1902	732	
1903	870	132
1904	830*	
1905	940	110
1906	1180	240

The satisfactory and suggestive feature of these figures is that the last increase (1906) is vastly greater than any of the previous inceases. It is of 240 against the previous largest increase of 132. Moreover, the increases of the previous years evidently were not at all regular, the series in fact being remarkable for a break. The details are not too full, but there is the certainty that the application of young New Zealand for the privilege of matriculation at the hand of the University is increasing at a greatly augmenting rate of progress. Therefore it is safe to regard the combination of all the examinations of the present year as most satisfactory. With 1180 matriculation students and 2343 going up for all the other examinations which distinguish this part of the year from the rest, we have a total of 3423 young people co-operating with all their might in the educational advantages offered them by the State. All of these may not be bent on immediate profit. But the fact cannot be gainsaid that in the education department of the national life the activity is such as to convince the most sceptical that the efforts of the State to find good education for all are not likely to be wasted for want of the co-operation of the intended beneficiaries. The conclusion is fortified by a glance at the achievements of students of the past. The name of Rutherford, the great scientist of Canada, of Reeves, the High Commissioner of New Zealand, who obtained the whole of his education in his native country—of whom it was said that he paid for his own education by the number of scholarships that he won—and of Robertson, the latest of the Rhodes Scholars from this country, are a sort of guarantee that New Zealand will not throw away her opportunities. Who doubts let him cast his eye

*An apparent reduction only: the difference being due to technical rearrangement.

around the colony and mark the many successful men in every walk of life who owe the whole of their training to the educational facilities afforded by their own country. In Law, in Medicine, in the Church, in Commerce and in Invention the Young New Zealander is able to challenge comparison with the rest of the world. Nor is he behind in physical development. The tour of the "All Blacks" is fresh yet in the public mind; the success of a New Zealander in winning the Australian cycling championship, the good records put up on every convincing ground in the country, all make excellent reading for the New Zealander. The intelligence, it is clear, and the bodily strength of the nation are both advancing at satisfactory rates, for the simple reason that Young New Zealand has thrown itself with characteristic healthy energy into the work of co-operation, without which the provision for education, admirable as it is, must necessarily fail.

New Zealand Iron.

We have all of us believed, since the days when they took to making hematite paint at Para Para, that this country possesses everything necessary for the production of iron on an immense scale. When the protraction of the negotiations for the establishment of the industry in a large way (per the Cadman-Smith combination) became disheartening, we all regretted the non-success of the New Zealand combine. When it was announced the other day that Mr. Witheford was on the eve of arranging everything, we all hoped soon to read the accounts of roaring furnaces, and to see, in due course, our own iron on our own railways and in our own foundries; to say nothing of the preparations we hoped to mark for an attack on the markets of Australia and the Western coasts of the American continent.

Some of us were just a little afraid that we might be nursing a monopoly of dangerous proclivities. These, as well as the rest of the population, will be glad to hear of the appearance of a rival to the original prospectors of the iron fields of the colony. They will be pleased to reflect that if the supply of ore is immense, the number of exploiters is not altogether limited. In short, they will read with interest the following by a correspondent from Nelson, which is at the threshold of the Para Para paradise, so to speak.:—

The Onakaka Deposits.

"The vast deposits of hematite iron ore in the Collingwood district are evidently to be worked by more than one company On the 26th October, the Hon. the Minister of Mines granted to Mr. Thomas A. Turnbull, of Nelson, formerly of Timaru, and eldest son of the late M.H.R., a mineral prospecting license over 860 acres of iron and limestone-bearing country at Onakaka, immediately south of the Cadman block at Para Para. Messrs. Wayne & Jones, ironmasters, of South Wales, who are associated with Mr. Turnbull in this enterprise, visited the locality last August, and spent ten days there investigating the ore deposits and local conditions. Since the license has been granted, a complete and exhaustive examination of the area will be made. The country is densely covered with bush, but so far as can be seen at present, their area, which has a length of two miles, carries ore throughout its extent, and the hematite has a width of from 500 to 1200 ft., and running from 200 ft. above the sea at its northern end to 3000 ft. at the south. One face examined has a height of 600 ft., from Ironstone Creek to the top of the ridge, and the ore there assays 81 per cent. of ferric oxide, equal to nearly 57 per cent. of metallic iron, and it carries just sufficient titanium oxide to produce steel of the finest quality. When the complete examination of the area has been made a lease will be applied for and works erected.

Since August Messrs. Wayne & Jones have been busy in Sydney with plans and specifications and detail drawings, and these are almost complete. Arrangements are being made at Home and in the United States, America, for machinery. The works are to be most complete and up-to-date, and for a start are calculated to produce 100 tons of pig iron per diem, but this will be increased later on. The furnaces, converters, and rolling mills will cover a space of thirty acres.

"As soon as Messrs. Wayne & Jones arrive a start will be made with the construction of a deep-water wharf for which preliminary soundings have been taken. The two miles of rail to the furnace site will be put in hand as soon as possible and rapidly pushed to completion. When this is finished the firm hope to have their ship alongside the wharf with the plant and machinery ready to send up to the prepared site of the works."

"Mr. Turnbull has been making inquiries at this end with regard to the supply of firebricks and fuel. The firm will probably do their own coking, and the small coal for this will be obtained in New Zealand. Their pay-sheet for a start will exceed £30,000 for the first year, and necessarily grow as the capacity of the works is increased.

"At present we import £300,000 worth of iron and steel, all of which Messrs. Wayne and Jones claim that they can produce here, as well as securing a certain foreign market for their excess over this. If such be the case, sleepy Nelson must become one of the most prosperous places in New Zealand."

The subject of this month's cover is Pegasus, the winged horse of Greek mythology, which arose with Chrysaor from the blood of the Gorgon Medusa, when she was slain by Perseus. He is said to have received his name because he first made his appearance beside the springs (*pegai*) of Oceanus. He afterwards ascended to heaven to carry the thunder and lightning of Zeus. Some later authors make him the horse of Eos. Bellerophon had in vain thought to catch Pegasus for his combat with the Chimæra, but at length was advised by the seer Polyidus of Corinth to sleep in the temple of Minerva. The goddess appeared to him in his sleep, and gave him a golden bridle with which he caught Pegasus, and by his aid overcame the Chimæra. Modern writers ignorant of mythology make Pegasus the horse of the Muses, with whom, however, he had nothing to do beyond having by a kick of his hoof made spring up the inspiring fountain of Hippocrene.

London seems to like motor 'buses. There are now in that colossal city 700 of these vehicles owned by London companies, of which number there were in actual running work during the first week of October last 469, the balance being in the hands of the repairers. Manchester, on the other hand, is remarkable for the success of the long agitation for the banishment of the motor 'bus from the streets of the great cotton metropolis. In consequence, the Hackney Carriage Committee of the City Council has decided to recommend that the licenses shall not be renewed of these vehicles The reasons for the decision are that "they create a nuisance in the suburbs and that, as at present built, they are not fit to run on the roads."

The New San Francisco.

Some particulars of the progress of the building operations at San Francisco have been given by Mr. T. Cooper, manager of the Southern Pacific Railway Company, and published in the November number of the *Colonizer*.

Planing mills, with their shrill scream, are rushing out lumber by the million feet; strings of waggons, loaded with sand, cement, brick, stone, girders, and all that goes to make up a modern high-class building, roll along the streets in almost endless procession. Streets are being cleared, and watered and swept; broken bricks and twisted pipes are carried away with beaver-like persistence; frame buildings and bright corrugated iron buildings are growing like magic, almost in a night, that business may go on without interruption. Almost the entire cement in the United States will be on its way there in a few months. It is computed that in a short time this city will be using more cement in one day in the rebuilding than all the states of the Union were using a decade ago.

One of the large construction concerns of this city has engaged 1000 barrels of cement a day to be delivered in August. Later in the year it is expected that the demand will be such that the same firm will have to use 10,000 barrels a day, or about seventy car-loads. This cement will be needed in the erection of about 5,000,000 dols. worth of buildings.

Eastern capital is interested in the situation, and some of the large capitalists have sent men out on prospecting expeditions to see if some of the raw materials cannot be located. A cement quarry at the present time would be almost as valuable as a gold mine, and the same eagerness and enthusiasm attend the search for it as that for the yellow metal.

Some of the temporary structures which are now going up promise to be worthy of a longer existence than the short term which will elapse before they will make way for the greater combinations of concrete, steel, marble, stone, and brick.

One thousand men are now at work on a building in Van Ness avenue which covers a lot 275 ft. long by 180 ft. deep. It will contain 300 offices and thirty-eight stores. The foundations are of concrete. The building has four floors and fast elevators, and will very soon be ready for occupancy.

The new Masonic Building will cost 65,000 dols., will have accommodation for twenty-five lodges, and will have the largest lodgeroom in the United States. The French-American bank building is to be nine storeys in height and cost 80,000 dols.

There is a large demand for labour. Plasterers, bricklayers, masons, carpenters, and hod-carriers are needed. The demand for lathers, stone masons, and painters is not so heavy, but in a few months the large steel office buildings, which only lost their interior furnishings and were not structurally damaged will have been cleaned of rubbish and then the work of fitting and decorating will require many hands.

Mining Mercury.

Probably the largest exposed deposit of cinnabar, or quicksilver ore, is that forming the mountain from which the town of Black Butte, Oregon, derives its name. There a vein 400 feet wide has been opened for more than a mile along the mountain, at a depth of 1000 feet below the crest. In Europe the chief mines are at Almaden in Spain, and at Idria in Austria, a town twenty-eight miles from Trieste

The process of obtaining the mercury is called distillation After being crushed, the ore is subjected to intense heat (1200° F.) When the ore has reached the temperature of 680°, the mercury is driven off in the form of vapour. This vapour is passed into large wooden or brick chambers called "condensers," which are surrounded by water jackets and other devices designed to reduce the temperature. In these chambers the vapour is condensed, the quicksilver resuming a metallic form, and being deposited in fine globules on the walls and floors. These globules, as they increase in size, merge together, and run out in troughs, ready to be marketed. The product is shipped in wrought-iron flasks weighing fourteen pounds each, and holding 76½ pounds of the metal, for which the present wholesale price is fifty three cents a pound.

One day of fret and worry may blight a whole week.

Every man is sometimes what he should be all the time.

Our Industries.

No. XI.—R. Bell & Co., Limited, Wellington.

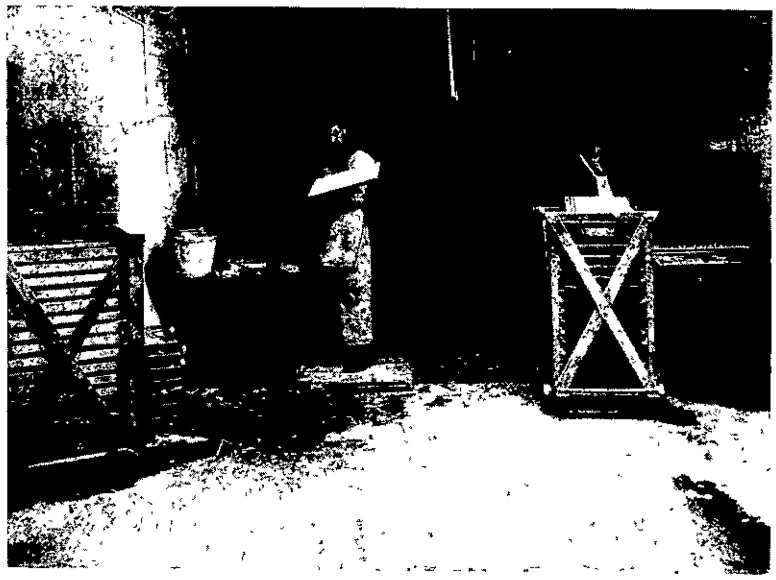
IN 1894 the first match factory in Australasia opened its doors in Wellington, fully enough equipped to invite and withstand the hardest criticism from the few who scoffed at the attempt to establish such an industry in this colony of ours. Speaking at the opening ceremony, the Premier, the late Mr. Seddon, said: "It behoves the Government to foster an industry established in the colony which would not only keep the money in the colony, but which would also provide work for the sons and daughters of New Zealand, and I see no reason why Wellington should not be capable of supplying not only New Zealand with wax vestas, but also the whole of the South Pacific group."

The venture, it is well to know, has by this fully justified its inception, and is at once a credit to New Zealand and a satisfactory sequence to the efforts of those who were responsible for the introduction of the private capital essential to the ultimate success of such a concern.

In reviewing the present-day operations of this important industry it cannot be overlooked that Messrs. Bell & Co. have done much to keep the importation of foreign-made matches down to the very lowest returns, and thus we come to realise that their establishment is fraught with potentialities of great moment to the colony. In addition, it should be noticed that the factory gives employment of a light nature to hundreds of girls, and at wages far in excess of those ruling in other occupations to which female labour is best suited; and Mr. Walter M'Lay, manager of the factory, is of opinion that if a full complement of hands were only procurable it would be possible to double the present output, which reaches in busy times as high a figure as 2000 gross of boxes *per diem.* The girls at work evince the smartness and energy which seem to be the inseparable accompaniments of the piece-work system. Their interests are protected by a registered union and the rates of wages are fixed by the Arbitration Court. The representative of PROGRESS examined the pay sheets of the Company for the last four weeks, from which twelve girls' names appearing consecutively were taken, and the wages earned and hours worked by those girls were as follows:—

Wage.		Hours.	Wage.		Hours.	Wage		Hours	Wage		Hours
s.	d		s.	d		s	d.		s	d	
26	6	45	26	3	45	25	5	45	25	6	45
25	1	44¼	21	6	40	23	9	45	23	6	43
21	0	44¼	20	6	41¾	19	2	45	20	3	44
28	2	45	20	11	35	25	1	45	27	0	45
20	0	45	16	6	38	19	10	45	21	8	45
15	0	45	13	6	44	11	2	40	13	4	37
15	3	42¾	13	8	41	15	3	45	20	0	41
35	3	45	35	10	45	24	0	34	27	3	36¾
11	9	32½	15	6	45	8	0	28½	15	6	43
10	0	25	18	9	44	13	7	32¾	20	0	45
30	11	42¼	36	0	45	31	9	45	35	9	45
24	0	41	25	6	45	21	6	45	26	5	45

Messrs. Bell's factory at Newtown is divided off into two main sections—the matchmaking and the boxmaking. The raw materials which form the basis of manufacture are: phosphorus, wax, cotton, glue, chlorate of potash, and straw-board. We shall see to what uses these ingredients are subjected as we proceed.



THE DIPPING PROCESS THE LAYER OF PHOSPHOROUS IS SEEN ON THE SLAB IMMEDIATELY IN FRONT OF THE OPERATOR, WHO PLACES HIS FRAME, FILLED WITH TAPERS, ON THE LAYER, AND THE MATCH IS THEREUPON "HEADED."

There are two large drums, one at each side of the factory, with a little wax tank half way or so between, and a small vertical engine forming the motive power. The cotton threads are passed in suitable thicknesses through a perforated plate, the engine is set in motion, the drums revolve, the cotton threads are gripped, and dragged first through the tank aforesaid, in which is a solution of stearine and gum—yclept wax. The mixture is kept hot by steam, and the threads are, in fact, dipped in it, being forced down by an ingenious iron clamping arrangement. They pass out of the tank through almost numberless guides, and are led to the first drum, which winds them up into a great reel, and from this drum they are wound off on to the other drum, and are now sufficiently advanced to be called "taper." The process goes on until, at the end of the sixth round, the taper is of the necessary roundness, smoothness, and consistency. Three or four hands are at the work; one feeds the cotton from the hanks, paying it out quickly and regulating the motion by keeping a good brake grip on the bulk of moving taper; another attends to the machinery, others to the guiding. Every now and then the taper becomes obstreperous, sticks where it ought not to, has to be seized, straightened, humoured, while the machinery is stopped and got ready for another spin. When the taper is complete it is wound off on to smaller reels, and from the reels it is transferred to what are known as frame filling machines. These frame filling machines are each capable of cutting to the required length 320,000 tapers an hour, and they are semi-automatic in action. Taper is fed into it in lengths about 50 or 60 abreast. The operator stands with her foot on a treadle which works a knife. Her hands are busy with the frame. The frame is filled with laths covered on each side with felt. She drops the lowest lath, leaving a vacant space. The taper, 60 abreast, is fed into the space, the treadle moves, down comes the knife, and 60 matches are cut off from the taper lying on the lath. The hands deftly drop the next lath, in goes the taper again, down comes the knife, and we have 60 more matches; and so on until the frame is filled with matches in rows, separated from each other by a felt-covered lath. When full the frame is screwed down, and it is ready to be carried away. It looks like a newspaper "forme," with matches standing on end instead of type. Trollies are ready to

THE TAPERS BEING FED FROM REELS INTO THE FRAME FILLING MACHINE.

R. BELL & CO. LTD.'S MATCH FACTORY, WELLINGTON.

THE MATCH FACTORY: SHOWING THE TAPERS UNWINDING AND BEING TAKEN INTO THE FRAME FILLING MACHINES.

THE MATCHBOX FACTORY: THE ROTARY TABLE IN THE FOREGROUND IS PART OF THE PLAID BOXMAKING APPARATUS.

wheel away loads of these frames to the dipping, or heading, department which has a building to itself away from the main workroom. There a man is busy at a metal table finely levelled, spreading the material—phosphorus, chlorate of potash, and glue—into a layer ¼ inch deep. He employs a gauge to ensure this uniform thickness. That done, he takes up the top frame (still full of tapers as we saw it last at the frame filling machine) from the trolly, and lays it bodily down in the ultramarine mass on the table, picks it up in a few seconds, and behold, every one of the evenly protruding matches has a head upon it.

Away now to the drying bins, where the matches, still held in the frame, are turned heads down in order that the blue phosphorus mixture may settle into the rounded tops peculiar to match heads. After this the frames with their loads of headed matches are finally sent to the boxing tables and the match girls. The girls unscrew the frames, take out the rows of matches heads up in handfuls, and drop them into the boxes. The pace they do it at is something wonderful, those who have had practice (and they have no time to deal gingerly with their work) ramming the handfuls of matches into the boxes. Occasionally a match resents this energic treatment, and a half-filled box becomes a miniature volcano. There is a hiss and a flare, a smoke, and a match box falls out of the path of the useful—a failure. The filled boxes are finally cased, and that ends the process.

In order to manufacture such an apparently simple article as a wax match, nearly every portion of the globe has to be searched for material wherewith to accomplish the work; the sheep on a thousand hills supply the stearine, the teeming cotton fields of Georgia and Alabama, the cotton for the core of the match; the tropical forests of Java, Borneo and Sumatra and the gorgeous slopes of the Amazon country, the gum which hardens, and without which no match would strike, and the gum which binds; the Swedish factory where the chlorate of potash is made for the head by an electrical process patented there, which has reduced the cost to one-fourth; and the phosphorus and strawboard from England.

In one year the processes of matchmaking and boxmaking at Messrs. Bell's absorb the following quantities of raw material: cotton, 35 tons; wax, 150 tons; New Zealand glue, 12 tons; strawboard, 50 tons; chlorate of potash, 15 tons; and English phosphorus, 3 tons. The phosphorus has to be kept under fresh water until required for mixing with the glue and other substances of which the match head is composed, and it much resembles clarified kauri gum.

Chinese Wireless Telegraphy.

Arrangements have been made by the Chinese Government for the establishment of several stations throughout the Empire to experiment with the Marconi system of wireless telegraphy, in the working of which Chinese operators will be instructed. Apparatus has been installed on several Chinese war vessels at Shanghai, and at the northern cities of Peking, Tientsin, and Pao Tingfu. Instructions will be given by an Italian officer, who has been appointed for this purpose and who will also serve as engineer and superintend the operations. The establishment of other stations besides those mentioned is being contemplated, and viceroys throughout the Empire have been directed to investigate the subject.

State prisons are filled with people who thought they were clever.

Building & Architecture.

The Architectural Editor will be glad to receive suggestions or matter from those interested in this section. Address: Architectural Editor, Progress, *Progress Buildings, Cuba Street, Wellington.*

A contract has been let for the erection of a power house at Longwood, Featherston, for £115. Architect, John S. Swan; contractor, R. Heald.

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Mr. J. M. Dawson, architect, has started the practice of his profession at his office in Hume's buildings, Willis street, Wellington.

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A contract has been let for the erection of additions to Mr. F. W. Mansfield's residence at Khandallah at £415. Architect, John S. Swan; contractor, John Moffat.

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The contract for the supply of fittings for the National Bank's head-office building has been let at £1900. Architect, John S. Swan; contractors, W. Nees & Sons, Dunedin.

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The contract for additions and alterations to the Wellington Club, Wellington, has been let at about £1900. Architect, John S. Swan; contractors Hunt & McDonald.

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A block of two-story brick shops and dwellings are now in course of erection in Colombo street, Christchurch, for Mr. A. Lowry, and which will be a pleasing addition to the architecture of the street. Architect, W. V. Wilson.

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A contract has been let for the erection of a residence in Daniel street, Newtown, for Mr. M. Segrief, at £1300. The building will be of timber on a concrete foundation. Architect, John S. Swan; contractors, Parkin & Betts.

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A contract has been let for the erection of a new Primitive Methodist church at Newtown. Tenders are now being called for the erection of business premises in brick at the Lower Hutt. Architects, Maisey & Johns; contractor, A. Wilkening.

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The contracts for the supply and fixing of plaster and steel ceilings for the National Bank's head-office building have been secured by the following: Plaster, the Carrara Ceiling Co., Ltd., £760; steel, Briscoe & Co., £205. Architect, John S. Swan.

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One of the most up-to-date residences, situated at Gonville, near Wanganui, is nearing completion for Mr A G Bignell. The house has a tiled roof, and is fitted with every modern convenience, and altogether presents a very striking appearance. Architect F Atkins; contractors, Russell & Bignell.

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A residence is being erected at Goldie's Brae for Mr S Brice. It is to contain seven bedrooms, kitchen, drawing-room, dining-room, a spacious reception hall, and a 27' x 12' billiard room, also two bath rooms, laundry, and the usual conveniences. Architect, J. M. Dawson; contractors, McLean & Gray.

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A handsome brick building, in Ridgway street, Wanganui, is in course of erection, and is to be occupied as the Commercial Travellers' Club. The building is of two stories, and forms an interesting addition to the better-class architecture of the town. Architect, F. Atkins; contractors, Russell and Bignell.

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A large and up-to-date building in Victoria avenue is shortly to be completed for Dr. Earle, and will be let for business purposes. The building is opposite the Technical School, and when completed will be a striking contrast to the old structures formerly situated there. Architect, F. Atkins; contractor, W. Kursky.

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Plans for a new Commercial hotel, to take the place of the old wooden building on Lambton quay destroyed in the recent big fire, have been prepared. The new Commercial will consist of a four-storied brick building of 108 ft. frontage, built in the Renaissance style, and relieved in the front with three large oriel windows, an ornamental balcony running the whole length of the building, and balconettes for means of fire escape. There will also be provided means of escape from the rear on to the Terrace. The front of the ground floor will be occupied by several shops, a public bar, and a sitting-room. On the first floor will be a large dining-room, commercial, sitting, and drawing-rooms. Bedrooms and sitting-rooms will occupy the other floors, and there will be about one hundred bedrooms in all. An electric lift is to be provided, and throughout the whole building the fittings and appointments will be of the most modern and up-to-date kind. Tenders for the work are now being called. Architect, J. Charlesworth.

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A fine two-storied building, mostly of brick, has just been completed for the Wanganui Meat Freezing Co., Ltd. Part of the downstairs portion is to be occupied by them as a butcher's shop, while the remainder of the ground floor will be occupied by a leather merchant. The upstairs portion is very commodious, and will be let for office purposes etc. The building is in Ridgway street, and is up-to-date in every respect. Architects and contractors, Burton & Benge.

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The contractor for the new Theatre Royal, Christchurch, has made a good start with the work of the basement and substage. The buildings are to be completed and ready for opening by November, 1907. The chief feature of the auditorium is that there are no posts or columns to support the circle or gallery floors, the whole being carried from the walls. We hope to publish illustrations of the exterior and interior at a later date. Architects, S. & A. Luttrell; contractor, W. H. Bowen.

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Tenders were recently called by Mr. Frank Messenger for a two-storied or one-storied parsonage for the Wesleyan Church, New Plymouth. The one-storied building plan was adopted, and the following tenders were received: J. D. Smith £795, Boon Bros. £817, R. W. Bond £836, Turner and Beadle £865, Coleman & Son £873, J. Salt £907, A. Cliff £941, J. T. Mannix £942. The tender of Messrs. Boon Bros. was accepted. The building is to be completed in about four months.

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The following tenders were received by Mr. Frank Messenger for the erection of a warehouse in Brougham street, New Plymouth, for Messrs. Macky, Caldwell & Logan: Coleman & Son (accepted) £1847, J. Salt £1848, R W. Bond £1893, Boon Bros. £1960, A. Cliff £2140, Turner & Beadle £2295, J. T. Mannix £2346, Pikett & Wilkie £2470. This price did not include the plumbing and electric lighting, Messrs. Smart Bros.' tender at £177 being accepted, the only other tender received being that of Griffiths & Co. at £178.

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Our illustration depicts the New Zealand Express Co.'s new building in Hereford and Manchester streets, Christchurch. This structure has just been completed, and it certainly redounds to the credit of the contractor. It has a frontage to Manchester street of 78 ft., and 66 ft. to Hereford street; from the path to the top of the parapet the height is 130 ft. The foundations and first two stories are of reinforced concrete, whilst steel has been freely used in the upper stories for ties and standards. The building, whilst presenting a bold appearance, has nothing of an aggressive nature. The building has been installed with two electric lifts, one for goods, and one for passengers Architects, S. & A. Luttrell; contractors, W. H. Bowen; plasterer, A. Menzies.

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An up-to-date and commodious residence has just been completed for Mr. Robert Davis at Kumeroa. The new "Homestead" has dining and drawing rooms, each with a floor space of 388 sup. feet, entering off a large hall, which is screened from the lobby by a fine grilled archway in oiled rimu, five bedrooms, kitchen, bathroom, laundry, store, and pantry, with meat safe, and dairy built outside. The drainage is on the septic-tank principle, and all according to the By-laws of the Napier Borough Council. The house has hot and cold water throughout and is fitted with electric bells having indicator board in kitchen. The contract price was £675. Architect, Reginald G. Craig, Woodville; carpenters and joiners, Hambling and Rabone; decorator, H. T. Perkins; septic tank and drainage, G. Perfect, Woodville, plumbers, Holben & Kirk, Palmerston N.

West Australian Timber in New Zealand.

THE object kept in view in the designing and execution of the Millar Co.'s exhibit at the Exhibition has been to show the great variety of uses to which jarrah can be applied, and to group the whole into an exhibit pleasing and instructive.

The exhibit is formed of a raised platform 20 ft. long by 12 ft. wide, and 10″ high, of 9″ x 2″ jarrah nosed on the edge, with a scotia underneath it. At each end of the platform is a short piece of balustrading finished in various styles. Upon this platform is erected a partition of 4″x 2″ jarrah studding, one side of which represents an internal wall of a hall or room. The centre piece of this side is a door, the bottom panels being raised, fielded and bolection-moulded; the upper panels are also raised and moulded, but the framework surrounding these is chamfered. The frame surrounding this door is of 5″ x 3″ jarrah rebated and ovolo moulded, mitred at the angles and stopped. The frame is surrounded by an 8″ architrave, which is built upon a large moulded block. This block also forms a stop for the skirtings.

On each side of the doorway are erected massive columns 10 ft. high, 15″ wide, and 15″ thick The columns on the sides nearest the door are of a plain surface with a sunk fiddle-back mould stopped above the skirting and at top The front and remaining side of these columns are panelled, the lower panels being raised and moulded over the whole surface and surrounded by a scotia. The upper panels are carved in relief. These columns are further adorned with one small neck mould immediately above the carved panels, also a band mould 6″ wide above neck mould, and to crown the whole is a cornice of 24″ girth in the space between these cornices and band mould, reaching from one column to the other; immediately over the door is a panel on which is carved the name of Millar's Karri and Jarrah Co. On each side of the columns a partition is continued, which is covered with jarrah match-lining laid vertically, diagonally and horizontally, and is formed into panels by means of cover moulds. The whole of this elevation is finished in French polish. The back of the partition is covered with jarrah weatherboards of various kinds, viz. rough sawn, dressed, check and chamfered and rusticated; these being treated so as to represent the various styles and methods of using the timber for external coverings of houses. No undue polish has been given to this part of the exhibit, but it has been treated in a natural manner by being oiled, as is the usual custom with such work in Western Australia. Behind this, at a distance of 3′ 6″, is a massive piece of bridge work, and this is designed to give an impression of its great strength, and should form a very useful part of the exhibit.

In addition to this set piece, there are also a great variety of mouldings, turnery, etc

THE NEW ZEALAND EXPRESS CO.'S FINE NEW BUILDING IN CHRISTCHURCH

REINFORCED CONCRETE AND STEEL HAVE BEEN FREELY USED IN THE CONSTRUCTION OF THESE PREMISES.

Architects—
S & A. Luttrell

Contractor—
W. H Bowen.

Plasterer—
A Menzies

Of paramount interest to engineers, and especially railway engineers, are several sleepers, which have been in track use varying from 20 to 21 years, the whole of which are in more or less perfect condition, although having been in use in trying situations and having carried heavy main-line traffic. As a practical proof of the suitability of jarrah for the New Zealand climate, special attention is drawn to the two jarrah sleepers recently withdrawn from the Leeston–Southbridge line, after having been in track for 31 years, and which are still in a perfect state of preservation.

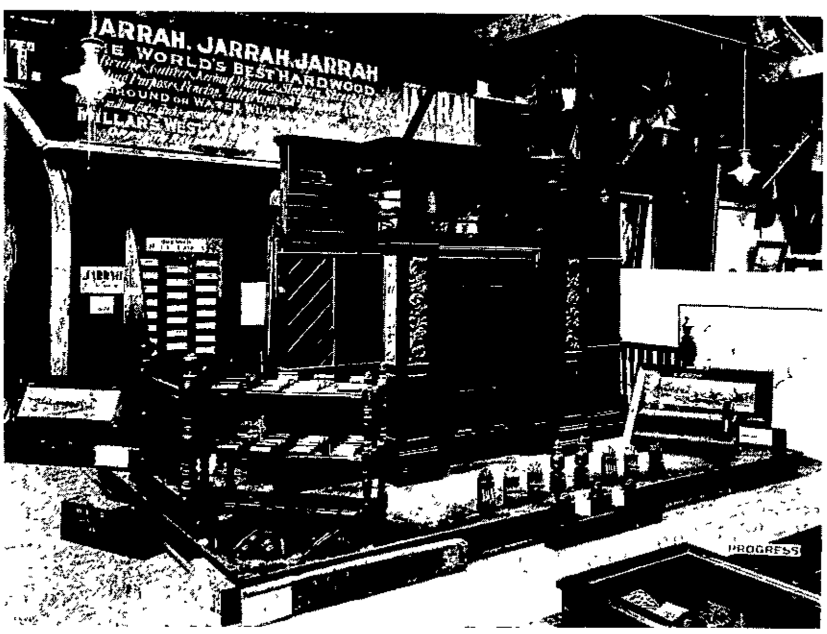
Another interesting item is shown by a portion of a jarrah pile, which has been in the Bunbury (W A) harbour for thirty years being drawn in 1906. This pile has been sawn into halves, and shows no sign of decay.

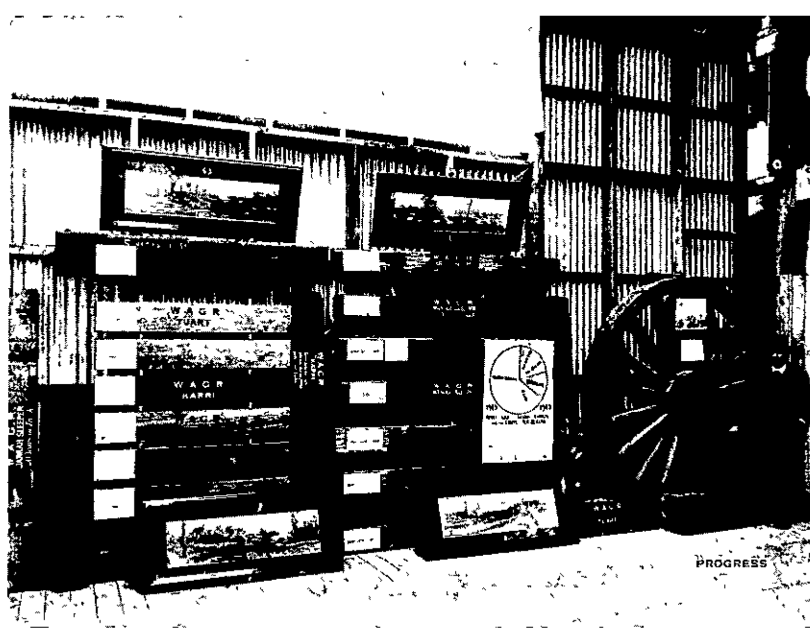
Buy the best—poor raw material wastes the time of men, and it actually tends to discourage them in their work.

New Warehouse, Christchurch.

A new warehouse for Mr. H. F. Stevens, wholesale druggist, Worcester street, Christchurch, has recently been completed.

This handsome building has a frontage of 66 ft. and a depth of the same dimensions. The front is of pressed bricks from Crum's brick yard, Ashburton, pointed in cement; the lower bands and window-sills are of Mount Somers stone The upper bands, columns, sills, window-heads, moulded strings, cornice, parapet, also rose window and mortar and pestle in pediment, are of Oamaru stone. The rest of the walls are of wire-cut bricks. The basement is 61 ft. by 48 ft., divided into two cellars, the front portion being used as a bonded store. There is a spacious gateway on the eastern side running from front to back, and giving access to the yard, and also to packing-room. The entrance lobby has bluestone steps and a pair of handsome swing doors giving access to the ground floor, on





THESE TWO PICTURES REPRESENT THE EXHIBITION DISPLAY OF MILLAR'S WEST AUSTRALIAN HARDWOODS CO, AND THEY SHOW THE GREAT VARIETY OF USES TO WHICH JARRAH CAN BE APPLIED.

STUCCOLIN DECORATION: THE BANKING CHAMBER OF THE BANK OF AUSTRALASIA, WELLINGTON.

which there is a roomy passage leading to a general office in front, 25 ft. by 15 ft, which has a very handsome screen of figured rimu with sashes glazed with Muranese glass. This passage leads also to the accountant's office and Mr. Stevens' private room at the western side, warehouse at rear, 38 x 31 ft., and to the packing-room, 17 x 32 ft., which contains an office for warehousemen.

Two doors open from packing-room to yard, two open to warehouse, and two open to gateway. A bold stair-case opposite the entrance doors leads from this floor to the floor above, which has two large sample rooms in front, each 32 x 24 ft., and a warehouse at rear, 64 x 38 ft. From this floor another stair-case on the eastern side leads to the top floor, which occupies the whole area of the building. Each floor is amply lighted from front and back. Another room, 25 x 25 ft., behind pediment, is approached by a movable step ladder and lighted by the rose window in front.

Massive iron columns in basement support the ground floor; while similar iron columns on ground floor support the floor above, which has 8" x 8" wooden story posts for supporting the top floor, where similar posts support the roof, which consists of three spans. The internal walls on each story are match-lined, as also are the ceilings.

There is an up-to-date electric lift to convey goods from basement to each floor, and a small hand-lift running from ground floor to each floor above. There is a spacious store in the yard, 74 ft. by 23 ft., with concrete floor, and provided with copper, for heating water, and also with wash tubs, etc. Convenient W.C s are also erected in yard, with all sanitary arrangements. The windows on ground floor in front have plate glass, while the upper floor windows in front have opening casements with fan lights over, all the back windows are fitted with opening transom lights.

The main building is most substantially constructed, and forms a striking feature among the up-to-date establishments of Christchurch. The cost amounted to close upon £5000. Architect. A. H. Hart; contractors, W. Greig & Sons; clerk of works, W. Gee.

Criticism is thought to be a form of enjoyment for the one who makes it. But sometimes it's worth money to the man who gets it

Stuccolin Ceiling Decoration.

It is only a little over one-and-a-half years since the Carrara Ceiling Co Ltd started business in New Zealand, and already we find springing up in our midst an industry of great importance, not only to our architects, builders, and decorators, but to those who are interested in the steady improvement of all that pertains to the various branches of building construction. On every hand may be seen the truly artistic work in ceiling and wall decoration that follows on the use of Stuccolin, which is the well-known and exclusive product of the Carrara Ceiling Co. Ltd.

Our illustrations are representative of many examples of fine work executed in Stuccolin, and they show the possibilities of this material when fashioned at the hands of an artist.

One shows the entrance to the Grand Hotel, Wellington, and the style adopted is Louis XVI. Fluted pilasters are seen surmounting an ornamental dado, while the pillars and arches are of an exceedingly delicate design. In addition to this main hall, some fifteen rooms have been finished in Stuccolin, and the work executed by the Company right through this magnificent hotel is of a highly meritorious character.

The above illustration depicts the interior of the new Bank of Australasia, Wellington, and gives a good idea of what is undoubtedly one of the finest banking-chamber ceilings in the colony. This illustration also serves to present an idea of the extent to which the plasticity of Stuccolin may be worked. The style adopted in this ceiling is Italian Renaissance, and the work has led to a very faithful representation of this style. In the centre there is a perspective balustrade in low relief, giving the appearance of a dome. It will be readily concluded on studying this illustration that Stuccolin is possible of greater effects than any other material used for ceiling work. There is a vigour and finish about it that are peculiarly its own—thus a good future for the material is assured.

We shall yet be going to the far East to learn the ways of modern methods in craftsmanship. There is always something we can pick up, though the tools and methods are strange to European or American users. Pre-eminent among the skilled craftsmen of China the carpenter still retains the leadership. Though almost invariably wedded to the use of the tools of his ancestors and to their methods, yet, when judged by results, he is more efficient in his line than are the average of the foreign-trained fitters and machinists in theirs.

The Education of Architects and Builders.

It is now well understood, says *The Carpenter and Builder*, that the demand for efficient workmen can only be met—if we must assume a revival of apprenticeship to be out of the question—by a great extension of the work of trade and technical schools. But if every reform that is needed in this direction could be achieved, if we could develop a race of highly trained workmen, so that efficient and skilful labour were the rule rather than the exception, we should still have a great deal to do before the building industry reached a really satisfactory position. We should then have a highly trained army with ill-trained or untrained officers. The education of the foreman, the clerk of works, the master builder, and the architect is at least as important a matter as the education of the workman.

Everything at present is haphazard, unscientific, unorganised. Take the case of the foreman, for instance. The foreman is generally the smart workman, who has kept his eyes open and made the most of his opportunities; but often he is quite innocent of scientific training, and is apt to be greatly puzzled, if not completely baffled, by an unfamiliar problem, and in regard to certain trades his position is often one of real embarrassment. The skilful carpenter becomes a general foreman, and is entrusted with the duty of superintending the work of masons, plasterers, and plumbers. He has picked up a smattering of these trades, but has never had a thorough grounding in them. Consequently, he has to walk very warily in dealing with men who, he feels, know their trade better than he does, and would be only too pleased to find him tripping. He may therefore feel obliged to pass over imperfections of workmanship, lest he should discover his ignorance to his subordinates. The case of the clerk of works is not much better. There are highly trained clerks of works, but there are others who have nothing but a foreman's experience and a good share of mother wit to carry them through. That may be sufficient equipment for many occasions, but there come times when the lack of knowledge, which perhaps they have had no opportunity of acquiring, means conscious loss of power and failure on some critical occasion.

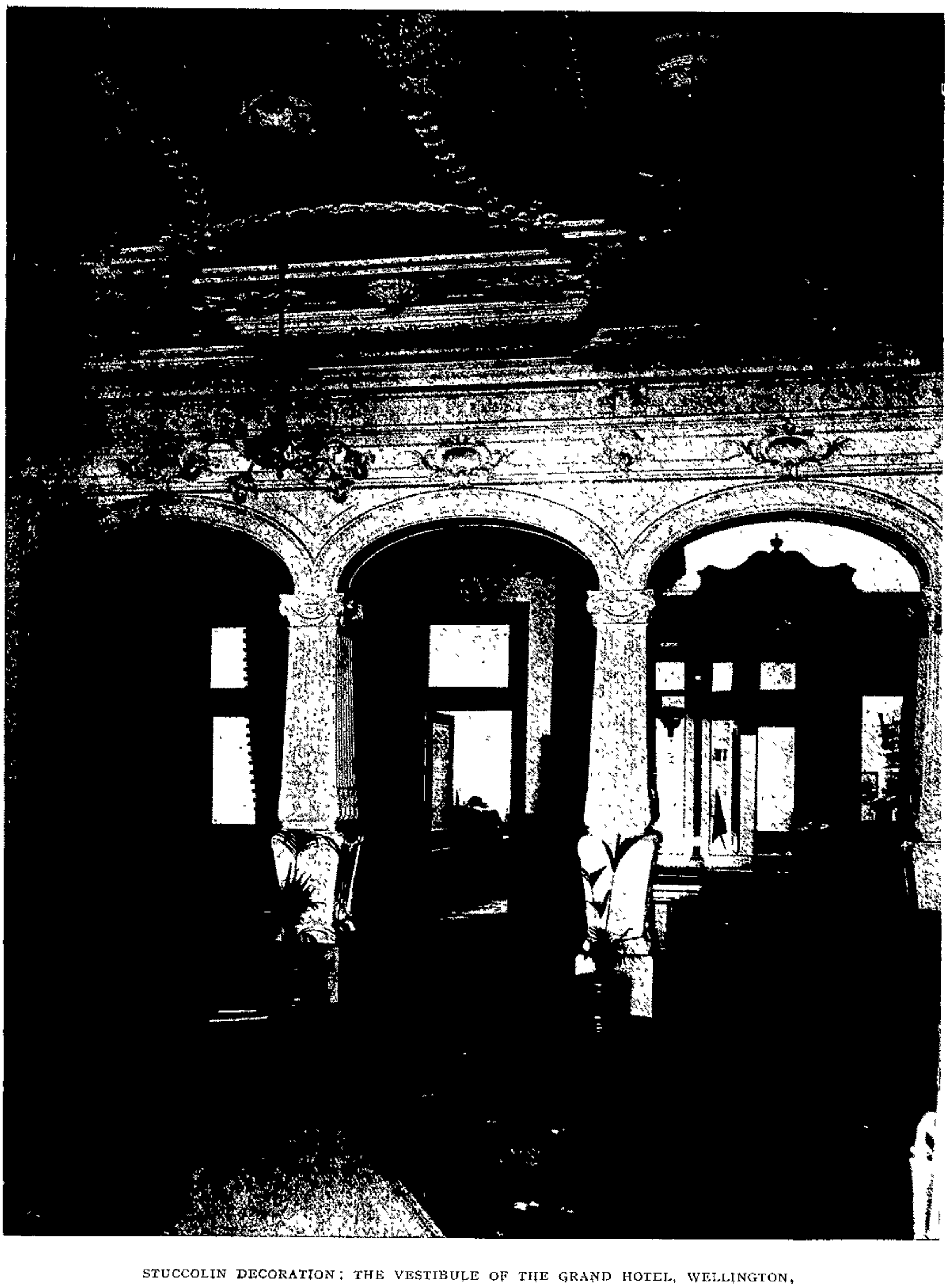
Nor is the case of the employer one wit better. One of the least satisfactory features of the modern building industry is that the master builder has become in very many cases the mere financier, concerning himself only with the commercial aspects of his undertakings, ignorant of the trade processes he directs, and dependent upon subordinates for the carrying out of duties which, under more healthy conditions, it would be an object of pride with the employer to discharge personally. And the unfortunate thing is that there is as yet nothing which could be called a national system for educating the master and his sons. There are opportunities provided by our technical institutes of which the young builder who desires to be a builder indeed, and not merely the "boss," will gladly avail himself. But these facilities need to be greatly multiplied and to be systematised, as is already done in Germany. The elimination of jerry building—a consummation devoutly to be wished by all who are concerned for the credit of the building industry—is very largely a matter of education. There is a certain amount of what is commonly called jerry building which arises from the sheer ignorance of the employer—his inability to detect faulty materials and faulty workmanship, and to direct and control his workmen. There is more which arises from a conscienceless disregard of every canon of good workmanship in the struggle to secure a quick return on invested capital and labour. For both evils the remedy is education, for education that is worth the name means not only the imparting of knowledge, but the inculcation of right business principles and worthy ideals of craftsmanship.

And what shall be said of the architect? The question of the education of the architect is perhaps the most difficult of all. Architecture is an art as well as a profession, and artists are born, not made. But the artistic person who will not, or cannot, concern himself with such prosaic and commonplace matters as drainage and ventilation should choose some other sphere than architecture for the exercise of his gifts. For architecture is the most practical of all arts, and the most exacting of all professions. There is, perhaps, no other calling which demands so varied an educational equipment and so many seemingly incompatible qualifications for its successful following. And yet the professional education of many architects is notoriously deficient. They make working drawings which cannot be carried out, and estimates which have little relation to the actual cost of the building when completed, their plans fail to take account of the requirements of the hot-water or lighting systems, and generally exhibit a lack of that insight into the whole complicated business of house building, which is the result of wide and varied knowledge. The subject of the architect's education is a many-sided one, and has been much discussed of recent years. The work of the Royal Institute of British Architects and of some of the technical colleges and institutions is gradually raising the educational standard of the profession. But the provision made by such institutions is still far from adequate.

Newcastle-on-Tyne now possesses a modern marvel in building, which is scarcely less wonderful than those ancient monuments of architecture which have been regarded as the wonders of the world. No temple, palace, or amphitheatre is this latest achievement; it is merely a prosaic railway station constructed in the Hennebique system of ferro-concrete work by the North-Eastern Railway Company. The "high level" goods station as well as extensive warehouse accommodation, are all carried out in Hennebique ferro-concrete. The high level goods station occupies the whole of the first floor, and measures something like 430 ft. long by 180 ft. wide by 40 ft. high. This is provided with tracks for travelling and other cranes, and, in addition, the floor has to carry a load of more than 12 000 tons, making the total dead and live load not far short of 20,000 tons. The floor is supported in the centre by a row of ferro-concrete columns, each of which was designed for the enormous load of 1100 tons, and yet such is the elastic strength of the material that the dimensions of each column are scarcely greater than those of a steel column of the same strength, taking into consideration the usual casing necessary for protection against fire.

London is ever abuilding. The new war Office is beginning to create a more favourable impression than was the case three months ago. The total cost will be about £600,000, and the style of architecture differs from that of every other Government building, although there are touches in common with the neighbouring fragment of old Whitehall Palace, now the United Service Institution. It has handsome cupolas and sculptured groups of symbolical statuary representing the horrors of war and blessings of peace. The new wing of the Admiralty buildings with facade to the Horse Guards parade is nearly finished, and is already partly occupied. The foundations of the official residence of Lord Tweedmouth, First Lord of the Admiralty, and the first Naval Lord, Sir John Fisher, to be erected in the triangular portion of the land in Spring gardens, through which the splendid roadway of the Mall will ultimately be extended to Trafalgar square, have reached the level of the ground. Good progress is being made with the Government Offices in Parliament street, and, after some modification, the building of the towers has been resumed. The building is still surrounded by scaffolding. The Abbey is in course of restoration on the north side. Some of the stonework was so decayed that it was found necessary entirely to remove several of the beautiful windows. Close by, on a portion of the site of the Westminster Aquarium, the foundations of the Wesleyan Methodist Church House and connectional buildings are being rapidly got in. The handsome building erected as the headquarters of the Ecclesiastical Commissioners, near the Victoria Tower of the House of Lords will shortly be ready for occupation.

In a letter appearing in a daily contemporary on a totally different subject we find, remarks *The Carpenter and Builder*, an extract of considerable value in these days of declining apprenticeship. The writer says "The apprenticing of boys—the last remnant of the usefulness of old trade guilds—is fast decaying, and no amount of night



STUCCOLIN DECORATION: THE VESTIBULE OF THE GRAND HOTEL, WELLINGTON.

technical schools will ever produce the finished craftsman that the guilds did. Even where apprenticeship exists, the duty of master to pupil is largely shirked. This is reduced to a minimum in Germany. In that country the boy has to satisfy examiners at the conclusion of his articles that he has mastered his trade. Should it be found that he has not been properly taught, the master pretty soon hears of it, either in the shape of a heavy penalty or the compulsory tuition of the boy for a further period." This, agreeing as it does with the views of many of our correspondents in all parts of the world, is worth preserving. We may not return to the system as a whole, but it will not go unlamented.

Hollow-Concrete Block Construction.

BY SPENCER B. NEWBERRY.

SECOND PAPER.

Block Machines. There are a multitude of machines on the market, and new advertisements appear in every issue of the cement journals. From this we may well believe that money is more easily made by the sale of machines than by their use in block manufacture. Practically all the machines offered are repetitions of the same fundamental design, and differ only in minor mechanical details. A discussion of relative merits and expression of preference would be useless Each intending purchaser should study the various machines offered and select that best adapted to his needs, giving preference to those of solid and substantial construction and taking care that he gets real value rather than " blue sky " for his good money.

Block machines may be generally divided into two groups those with horizontal and with vertical cores. The former are usually considered the more convenient for making " faced " blocks though a facing can be put on with either type of machine. The use of a facing of finer, richer or coloured mixture must be called a matter of taste In the judgment of the writer it does not pay to use a facing as the additional labour and preparation of a separate mixture cost more than to make the whole block of suitable composition to give a good surface. If the facing differs much from the body in composition, also, it is likely not to adhere perfectly, and trouble has been experienced from this cause However for water-proof and coloured work a facing may be found an advantage, and doubtless many will give preference to a machine which allows this to be conveniently applied

Machines are provided with face-plates for the production of rock-faced tool-faced, and plain blocks and various ornamental designs, for borders and friezes are also furnished Plates for rock-faced blocks should always be cut from a *natural stone* and several different patterns of each size should be obtained, to avoid monotony in appearance of the work Many machines are provided with rock-face plates evidently cast from some moulded soft material which yields blocks of a surface more like that of pats of butter than natural stones. Such makeshifts are abominable, and a fraud on the purchaser

As to size of blocks, most machine-makers appear to have adopted the standard dimensions of 32 in in length by 9 in in height, giving two square feet of face to each block. Machines are generally made for blocks 8, 10, or 12 in. in thickness Some machines are adjustable to allow blocks of either thickness to be made. Where the business will warrant it, however, it saves time to have a machine for each size. An 8-inch wall is abundantly strong for foundations or walls of 2-story dwellings, but in many cities the building code prohibits anything less than 12-inch walls for foundation and first story. There seems to be only small demand for the 10-inch block.

Machines are generally provided with attachments for making corner blocks Arrangements for making 45 degree and 30 degree angle blocks, for bays and towers, are also desirable.

Tamping. This is generally done by hand, by means of iron rammers Some well-equipped plants use pneumatic tampers, operated by compressed air, with considerable economy in labour and probably some improvement in density Excellent results can, however, be obtained by hand-tamping, if the mixture is wet enough.

Sticking to the plates may be largely prevented by rubbing the inside surface, when dry, with paraffine, animal or vegetable oil, or soft soap. Mineral oils, such as common lubricating oil are less effective.

Handling, Hardening, and Storage. For good results, blocks must be kept under roof, protected from sun and wind, and frequently sprinkled, for at least five days, and preferably for seven days They may then be piled up outside, and in dry weather should be kept moist by occasional sprinkling with hose for at least three weeks more. Blocks should never be built into a wall until at least four weeks old. Freshly-made blocks will be found to shrink more than 1-16 in, in length on seasoning a month, and if put into a building when only a few days old will develop unsightly cracks in the joints or through the blocks themselves.

In handling blocks from the machines the use of three-decked cars on tracks will be found a great saving in time and labour. In a factory so equipped each machine, with two men tamping and one shovelling, will easily make 150 blocks, 32 in. long and 8 in. wide, in ten hours.

PROPERTIES OF BLOCKS.

Strength Well-made Portland cement concrete, of good sand and gravel or limestone screenings, 1 to 5, will have a compression strength at 4 weeks of over 2000 lbs. per square inch, and at one year of over 3000 lbs. Tests of various mixtures, in 3-inch tubes, at the Case School of Science in Cleveland, showed the following:

COMPRESSION STRENGTH AT SIX WEEKS

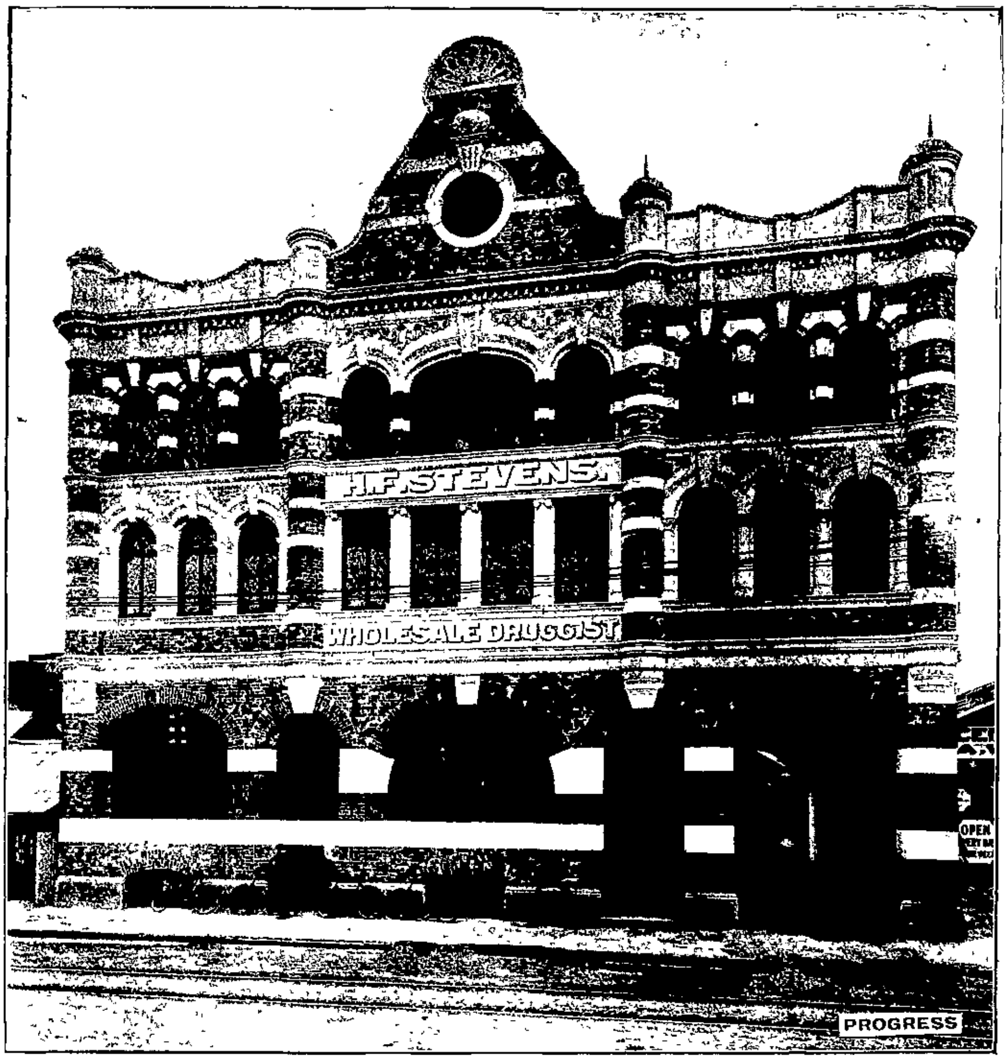
	Strength, lbs. per sq in.	Specific Gravity.	Water Absorption per cent.
Cement .... 1½, Sand and gravel 6	3200	2 17	4 16
Cement .... 1½, Hydrate lime .. ½, Sand and gravel 6	3880	2 18	4 10
Cement ...... 1½, Limestone screenings .6 (Poured in porous mould)	2000	2 05	5 04

It is very difficult to obtain reliable crushing tests of actual hollow blocks, owing to the difficulty of applying the load uniformly over the whole surface Three one-quarter blocks, 8 in long, 8 in wide, and 9 in. high 10 weeks old, made of cement 1½, lime ½ sand and gravel 6, were crushed with the following results:—

	Net area.	Max. load.	Stress per sq. in.
1.	49.7 sq. in.	99,700 lbs.	2,000 lbs.
2.	49.7 sq. in.	89,800 lbs.	1,805 lbs.
3.	49.7 sq. in.	76 200 lbs.	1,530 lbs.

Two blocks, 6x8x9 in., 22 months old, showed a crushing strength of 2,530 and 2,610 lbs. per sq. in.

Now a block 8 in. wide and 32 in. long weighs 120 lbs., and has a surface of 174 sq. in. Assuming a crushing strength of 2000 lbs. per sq. in. we find by calculation that 2900 blocks could be piled one upon another before the lowest would give away, making a total height of 2175 ft. Allowing a factor of safety of 5, a height of 435 ft. would be admissable This shows how greatly the strength of concrete blocks exceeds any demands which could possibly be made upon it. As stated above, if it were not for the question of water absorption, much poorer mixtures than are generally used would give abundant strength. Where water-proof qualities are no object, and good gravel, containing plenty of coarse pebbles, is to be had, mixtures as poor as 1 to 8 or 1 to 10 will often be found to answer.



NEW PREMISES FOR MR. H F. STEVENS, CHRISTCHURCH. [*Architect: A. H. Hart.*

WATER ABSORPTION.

One of the chief faults often observed in work done with concrete blocks is their tendency to absorb water to such an extent as to cause dampness to appear on the interior surface. This is especially noticeable in blocks poor in cement and made too dry. The fault may be overcome by use of suitable materials and sufficient care in manufacture.

(To be continued).

Italian railroad authorities are experimenting with a device for use at railway stations, by means of which all tickets are printed and stamped with their price in the presence of the passenger, a record of each sale being, at the same time, made on a roll of paper inside the machine. Each machine is equipped for printing tickets to more than 400 stations

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Destiny has turned many a man down while he was waiting for something to turn up.

Wireless Telegraphy.

BY CAPTAIN LOUIS E WALKER.
(*Colonial Representative of the Marconi Company.*)

INTRODUCTION.

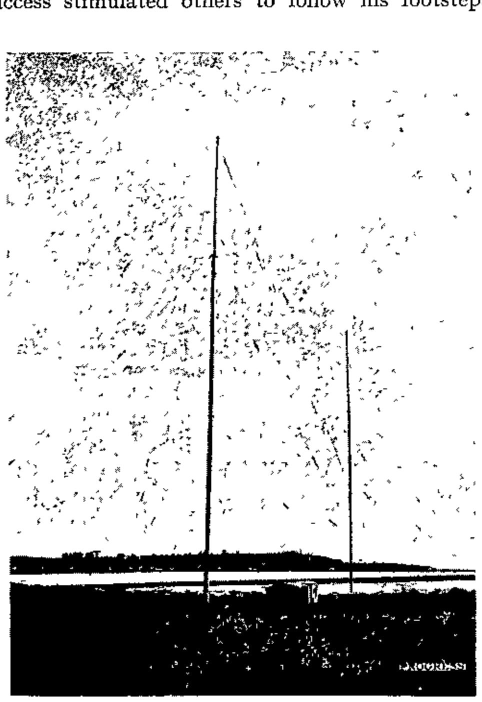
THIS is pre-eminently an age of science. In literature the firmament is apparently without stars of the first magnitude. Art can but claim a general raising of public taste. But the recent achievements of science defy the imagination of mankind to keep pace with them.

The scientific record of the early Victorian period has been eclipsed. Recent years have witnessed an output of dazzling discoveries. X rays, wireless telegraphy, liquid air, radium—how they have staggered human credulity! Latter-day science has taken to itself a magician's wand and performed unthinkable miracles. What the average citizen would have characterised as downright hare-brained impossibilities have become—facts The fancies of Jules Verne proceed on lines of more sober probability than the achievements of present-day electricians and chemists. And note how recent revelations have the quality of the unexpected; while certain discoveries, for which the world long has waited, are still deferred. After centuries of sanguine expectancy, with the precedent of the bird daily before our eyes, we are still without a reliable flying machine. Not yet are we able to put the nitrogen of the air to commercial use. But it is permitted us to pry into opaque bodies—nay, the very word "opaque" has lost its meaning. While our forefathers were instructed that Fahrenheit zero was the lowest degree of cold, we have lived to see ice used as a furnace for thawing frozen oxygen. After all the assurances that combustion involved consumption, and that perpetual motion was a contradiction in terms, here comes radium to throw doubts on the text-books. Just when "wire" was establishing itself as another word for "telegram," behold Mr. Marconi, and the synonym must be hastily erased from our dictionaries.

But a few years ago the man in the street would have staked his life on the proposition that a connecting wire was no less essential than electricity in modern telegraphy.

BIRTH OF WIRELESS TELEGRAPHY.

It has been said that wireless telegraphy came upon the world as a bewildering surprise. That is to represent matters from the point of view of the man in the street, for as far back as 1844—when telegraphy with wires was still in its infancy, and ocean cables had not been heard of—Professor Samuel Morse telegraphed without wires under the Susquehanna river. Nor was this an accidental phenomenon. He deliberately laid his plans to secure the result he achieved, and a full account of the experiment was published. Moreover, his success stimulated others to follow his footsteps.



THE AERIALS AND ANTENNÆ AT DEVONPORT, TAS

Nevertheless, as we know, the subsequent history of telegraphy was identified with wires, and the world knew nothing of an alternative possibility. In a word, Morse's discovery proved to have no practical value.

A further fact concerning Morse's achievement must be noticed. Save that no wire connection was employed, it had nothing in common with wireless telegraphy as we know it to-day. Paradoxical as the statement may seem, Morse's method of communication was more nearly allied to post office telegraphy with wires than to Marconi telegraphy without wires. Marconi telegraphy rests

GUGLIELMO MARCONI BORN APRIL 28TH, 1874.

on knowledge that is only seventeen years old.

In 1888 Professor Heinrich Hertz demonstrated that a disruptive electical discharge causes electro-magnetic waves to radiate through the ether, travelling with the velocity of light. In 1895 Marconi devised and subsequently patented the application of Hertzian waves to telegraphy.

Between "Puffing Billy" and a modern Great Northern engine there is a world of difference both as regards appearance and power, but the former is nothing less, and the latter nothing more, than a steam locomotive. One is a crude original; the other a gradual development.

Like all great practical inventions, Marconi telegraphy began in the "Puffing Billy" stage. But it has been the fortune of few such inventions to develop so rapidly as Marconi telegraphy has developed. The velocipede was an unconscionably long time in becoming a safety bicycle For a number of years electric light remained in the half-way stage of flickering unreliability. And so with the telephone—how long the interval separating practical performance from promise!

GUGLIELMO MARCONI AND HIS EARLY ATTEMPTS

Guglielmo Marconi was born at Bologna on April 28th, 1874, and was educated at Leghorn and Bologna University. When quite young he took a keen interest in electricity, and at the age of twenty-one commenced his work, which was destined to develop into such marvellous results and achievements; and some time before he left Italy for England, in May 1896, he had succeeded in telegraphing wirelessly between two stations situated at a distance of a mile or more apart This was the beginning he had made his discovery and had invented the means by which at the present day, he can communicate thousands of miles through the air

Soon after arriving in England he made the acquaintance of Sir W H Preece, and, at the latter's request, made some experiments for him and the post-office officials between the post office and the Thames Embankment, which were highly successful, and Mr. Marconi was requested to make further trials on Salisbury Plain, which also proved satisfactory to the post office and to officers of the army and navy who witnessed them.

In the year 1897, at the invitation of the Italian government, Mr. Marconi went to Rome, and gave a series of exhibitions of his system at the Quirinal before the King and Queen of Italy and high Italian government officials, and he subsequently went to Spezzia, where his system was put to practical test on board two Italian battleships. The Italian government, recognising the great value of Mr. Marconi's invention, conferred upon him the honour of knighthood (chevalier), and are now using his system extensively and exclusively. The Italians have recently renewed the contract after several years' experience, and entered into an agreement last October with the Marconi Company for fourteen years, the terms of which give the Marconi Company the sole right to supply the government with wireless apparatus the Italian government pledging itself also not to communicate with any other system

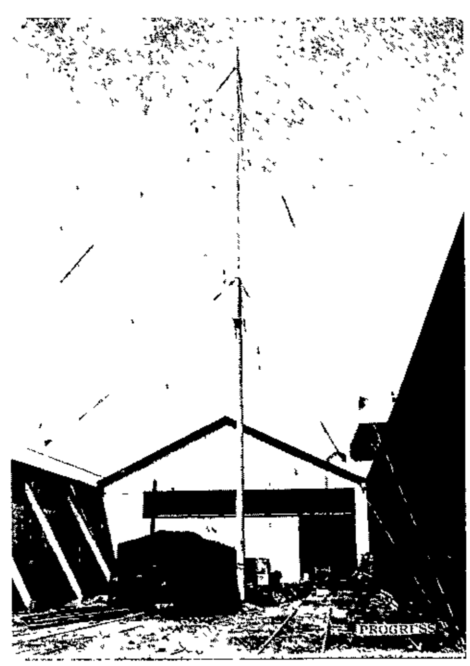
In the year 1897, the Wireless Telegraph and Signal Company, Ltd. was established with a capital of £100,000, and two permanent stations were put up, and in July, 1898, the *Dublin Express* gave, day by day, a wireless telegraphic report of the yacht races during Kingstown regatta week, and proved the system's usefulness and facility with which it can be applied to commercial purposes.

Later Mr Marconi established communication between the late Queen's residence, Osborne House, Isle of Wight, and the Royal yacht *Osborne* lying in Cowes Roads, and her late Majesty was kept constantly apprised of the progress made by the King during the process of recovery from a serious accident

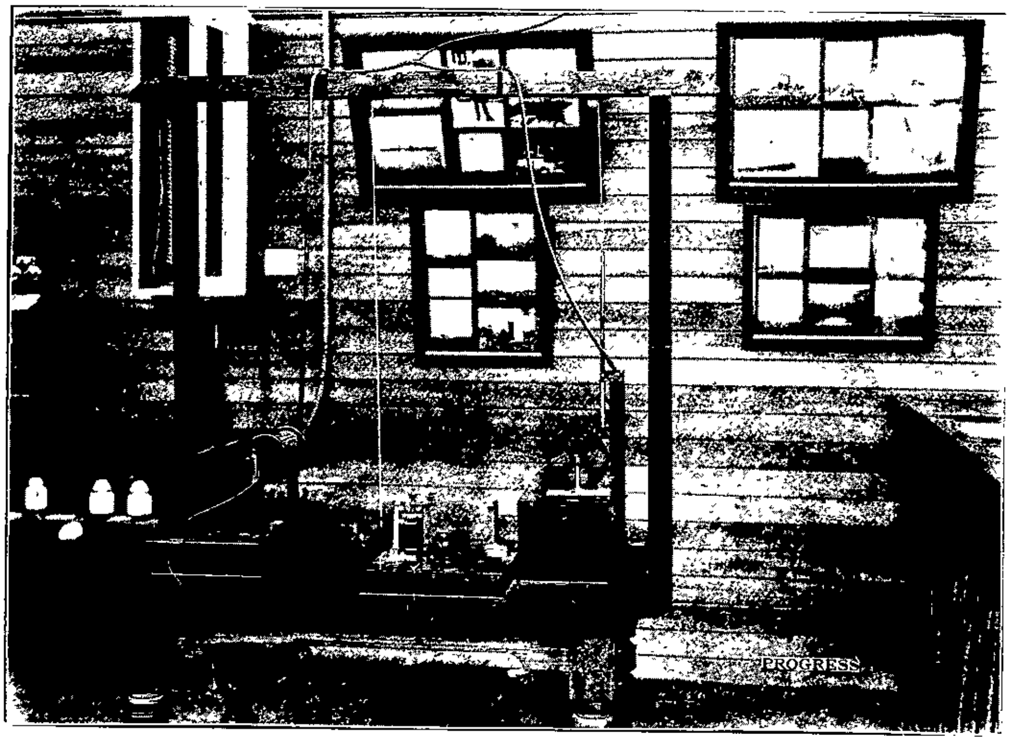
Mr. Marconi became a member of the Institution of Electrical Engineers, and read a paper on "Wireless Telegraphy" before the members in February, 1898, and lectured at the School of Military Engineering, Chatham, in March, 1899. In the same year he journeyed to the United States in connection with the America Cup yacht race between *Columbia* and *Shamrock I* During that year (1899) a number of the ships of the British navy were equipped with Marconi apparatus. Early in 1901, telegraphic communication was established between two points more than 250 miles distant, and, at the end of that year, Mr. Marconi transmitted signals from Poldhu, in Cornwall, to St. Johns, Newfoundland.

THE VALUE OF WIRELESS TELEGRAPHY.

Marconi installations are now working commercially on practically the whole fleet of liners crossing the Atlantic, including vessels of foreign nations, German, French, Italian, Dutch, American, etc. The following are amongst the better-known companies which have adopted the Marconi system, viz: Cunard, Norddeutscher Lloyd, Hamburg-American Line, American Line, Anchor Line, White Star, Red Star, Compagnie Generale Transatlantique, Holland-American Line, Allan Line, etc. There are many incidents recorded of the extreme usefulness of wireless telegraphy on board ships, of which the following are specimens:—



THE AERIAL AND ANTENNÆ AT CHRISTCHURCH EXHIBITION, COMMUNICATING WITH ISLINGTON.



MARCONI APPARATUS AT CHRISTCHURCH EXHIBITION THE INSTRUMENTS, TAKEN FROM LEFT TO RIGHT, ARE . TRANSFORMER, MORSE KEY, RECORDER, TAPE REEL.

In January 1899, during a heavy gale, seas severely damaged the East Goodwin lightship, on which was a Marconi installation. The accident was at once reported by wireless telegraphy through the South Foreland lighthouse, on which was another Marconi installation, and means taken to repair the damage.

On 1st January 1901, the Royal Belgian mail packet *Princesse Clementine* reported by means of her Marconi apparatus that the barque *Medoni*, of Stockholm, was ashore water-logged on the Ratel Bank, and a tug was despatched at once from Ostend, and the crew saved.

In January 1903 the *St. Louis*, when on a passage to New York, had an accident to her machinery, making her greatly overdue and causing much anxiety to both owners and passengers' friends and relatives. No information of her whereabouts was received until she was sighted from Nantucket lightship, but no particulars could be supplied until twenty-four hours later, on her arrival in New York harbour. The report of the passengers' committee contained the following extract. "It is a matter of keen regret that a first-class steamer, such as the *St. Louis* is reported to be, should not be supplied with a Marconi apparatus, the absence of which is seriously felt" Needless to say, the *St. Louis* was subsequently fitted with the Marconi apparatus.

On 30th March 1904, 3 a.m., and in thick fog, the s s. *New York*, from New York to Cherbourg, went ashore on the rocks off Cape la Hague, and wireless communication through English stations effected the dispatch of tugs, lifeboats, and salvage appliances from Cherbourg to the position given in the wireless messages. The ship, however, floated before assistance reached her, but the owners were advised that the entrance to Cherbourg could not be attempted before day-light, owing to the nature of the damage to the ship's bottom. They were also kept advised of the ship's progress across channel from France to England. Had the ship slipped off the rocks and sunk, instead of floating, the advantages of the Marconi apparatus in summoning and providing life-boats, tugs, etc, for the salvage of life and property, would have been most pronounced.

Extract from *Cunard Daily Bulletin No* 33, published on board s s *Campania*, 7th June 1905 Tuesday 2 a.m. Communication was established and the following news received from Marconi station, Cape Breton (Canada), when the *Campania* was 2000 miles from New York "Icebergs—According to reports which continue to come to hand, more icebergs than usual have been sighted in the Atlantic, the steamer *Island*, from Copenhagen for New York, in particular, reports having passed ten"

In addition to the above there have been innumerable cases where the wireless installations on board passenger ships have proved of enormous advantage, as for instance when passengers have run short of money on board and, by communicating by wireless with their friends, they have been enabled to obtain funds through the pursers of the ships for their immediate requirements

THE WORK OF TO-DAY.

The Marconi Company possesses a powerful and perfectly controlled organisation which is rapidly becoming world-wide. The Company has its own shore stations in different countries, and these are continually being added to, so that the day cannot be far distant when there will be a chain of Marconi stations round the world, and we shall no longer be entirely dependent on cables. The Company's own operators work their stations both on shore and on board ships, and the system is worked smoothly and without the slightest confusion, principally due to the fact that it is controlled, worked and regulated from one centre and headquarters.

The Company's agreements include those with the British government, namely, Admiralty, War Office, Post Office, and Board of Trade; with the Canadian, Newfoundland, United States, Italian, Russian, and many other governments Most of these contracts have been renewed and extended.

In February 1904, Marconi wireless telegraph stations were opened at Broomfield, in Essex, England, and at Amsterdam, in Holland, for the transmission between the two countries of Press messages and Stock Exchange quotations, these messages being transmitted in Dutch by English operators having no knowledge of that language, at a speed of from twenty to thirty words per minute, and afterwards published daily in a leading Dutch newspaper, the *Handelsblad*. On June 4th 1904, a daily service of wireless news messages all the way across the Atlantic was inaugurated on board the Cunard R.M.S. *Lucania*, and a newspaper entitled *The Cunard Daily Bulletin* is now regularly published on this vessel, as well as on the s.s. *Campania*, *Etruria*, and *Umbria*, whilst other vessels are now being equipped for a similar service. At the end of June the University of Oxford conferred upon Mr. Marconi the honorary degree of Doctor of Science. On August 3, 1904, Marconi wireless stations were opened at Bary, Italy, and Antivari, Montenegro, for the purpose of carrying on a public telegraph service between Italy and the Balkan States. Since that date many developments have taken place until, at the present time, there is a chain of stations as far east as Suez; and it is confidently anticipated that such places as Aden and Colombo will, very shortly, have their stations with which vessels approaching from all directions will be able to communicate.

AUSTRALIA AND NEW ZEALAND.

Coming now to Australasia, on July 12th of this year, the Marconi Company having, at its own cost, installed and equipped two stations, one at Queenscliff on the Australian coast, and one at Devonport on the north coast of Tasmania, (a distance of 215 miles apart), a demonstration was given at both stations, when the first inaugural messages by wireless telegraphy were exchanged between His Excellency Lord Northcote, Governor General of the Commonwealth, and His Excellency Sir Reginald Talbot, Governor of the State of Victoria, at Queenscliff, and His Excellency Sir Gerald Strickland, Governor of Tasmania, at Hobart; the messages being conveyed by land wire from the wireless station at Devonport to Government House, Hobart.

The Company's representative had the honour on this occasion of entertaining, in addition to Their Excellencies, the Prime Minister of the Commonwealth, Mr. Alfred Deakin, the Postmaster General, Mr. Austin Chapman, the Treasurer, Sir John Forrest, the Minister of Defence, Senator Playford, the Hon. T. Ewing, the Hon. L. E. Groom, Senator Keating, members of the Government, many senators, nearly all the members of the House of Representatives (which adjourned for the occasion), members of the State Government, and the principal shipping and commercial gentlemen of Melbourne, including the Chairman and members of the Chamber of Commerce—in all close on 300 guests. The luncheon took place in a large marquee adjoining the wireless station, and the operators' instruments were placed upon a table immediately in front of Their Excellencies, so that the messages were sent and received during the luncheon, in full view of the entire company. The following were some of the messages sent and received :—

The Governor General to the Governor of Tasmania:

"The Commonwealth greets Tasmania, and rejoices at the establishment of new means for knitting people of Australia more closely together."—NORTHCOTE.

1 CAPT. L. E. WALKER 2 LORD NORTHCOTE 3 HON. A. DEAKIN

A NOTABLE GATHERING AT QUEENSCLIFF, VIC., ON THE OCCASION OF THE OPENING OF THE QUEENSCLIFF–DEVONPORT WIRELESS STATIONS.

From the Governor of Victoria to the Governor of Tasmania:

"Victoria salutes her sister State Tasmania."—TALBOT.

The Prime Minister of the Commonwealth to the people of Tasmania.

"Australia, tirelessly subduing her great distances by rail and wire to-day, enlists the waves of the ether in perfecting the union between her people in Tasmania and upon the mainland."

There can surely be no question as to the desirability of establishing wireless telegraphy stations around the coasts of New Zealand, in fact, it would seem in every respect an ideal country for the adoption of this most useful and up-to-date method of communicating between the shore and ships at sea between the mainland and isolated islands, and between ships at sea, more especially when one considers the large proportion of the inhabitants who are constantly travelling round the coasts in passenger steamers. The additional sense of security when travelling on a vessel equipped with the Marconi system has only to be experienced once to be fully realised, but this feeling of safety and of not being cut off is not merely confined to the passenger, but is also appreciated by all his, or her, friends and relatives on shore.

The Marconi Company has established the first wireless telegraph stations in New Zealand, namely, at the Exhibition at Christchurch, where there is a station installed in the Post Office annexe, which is in daily communication with a station at Islington, demonstrations being given constantly, when he who wishes may see this marvellous invention in actual work. Let us hope that, in its small way, it is the forerunner of a comprehensive scheme for the entire colony.

Thus we bring to a close our cursory history of an invention which has increased the facilities for human intercourse, forged new links between lands separated by the sea, aided journalism, given new data to the meteorologist, provided a safeguard for future geographical explorations, and added to the pleasure, while it has diminished the peril, of ocean travel.

Details of the Marconi System.

BY G.A.P.

The arrangements for working the Marconi installation are sure to be much discussed during the next few months, by reason of the negotiations pending between the Government of this country and the Marconi Company for the use of their system here. Another reason is the discussion which has been going on at the recent conference in Berlin, at which the German Government attempted, but failed, to generalise the use of all installations. A third reason is the claim put forward by the Danish inventor, Valdemar Poulsen, for the discovery of a system of tuning wireless messages so as to render them absolutely safe from interruption and discovery of the kind sometimes known to have been experienced in the working of some existing systems of wireless telegraphy. Sir William Preece, it will be remembered, declared a few days ago, having heard the Danish inventor explain his system during a lecture in London, that the same was certain to supersede all known systems. This produced many comments in the New Zealand press, which in their turn obtained from Captain Walker, the representative in Australasia of the Marconi Company, a letter of explanation to the effect that, firstly, Sir William Preece is not an authority on a subject which does not lie within the sphere of his expert experience, and, secondly, that Marconi had tried the system of continuous sparks, which is the foundation of the Poulsen invention, and after many experiments discarded it for his own, the distinctive feature of which is the intermittent sparking system. It is further claimed for the Marconi system that it is capable of being "tuned" or syntonised, as the electricians call it, with just as good results as any that can have been obtained by the Poulsen process, or any other for that matter.

With reference to this point, Mr White, of the Engineer-in-Chief's department of the General Post Office, London, dealing with the Marconi system, says in his little book on Wireless Telegraphy. "It is found that the best syntonic effects are obtained with a comparativly weak coupling. There is a limit, of course, to the extent to which the coupling can be weakened. If carried too far, then the current of energy supplied to the aerial circuit, and radiated therefrom, would be insufficient to produce effects at any great distance. A strong coupling would correspond to the case in horology where the balance-wheel was connected as closely as possible to the driving system, the earlier forms of clock mechanism being of this character. Both in horology and in radio-telegraphy it is good policy to have the connection between the oscillating system and the source of energy as far apart as possible." For these reasons we give subjoined an illustration of one of the transmitting and receiving processes of the Marconi system for comparatively limited distances.

The Text Book of the International School publishes the following with the remark that the arrangement of the transmitting and receiving apparatus patented by Marconi, and said to be used by him, is shown in the figure.

TRANSMITTING APPARATUS.

The essential part of the transmitting apparatus is an induction, or Ruhmkorff, coil, as it is commonly called. The primary winding *p* and the secondary winding *s* of the Ruhmkorff coil are both wound upon the same iron core, which is here represented, merely for the sake of clearness, as lying between the two coils *p* and *s*. The current may be rapidly interrupted by almost any form of interrupter, and a condenser *C* must be connected across the break *c d*. The condenser reduces the sparking between *c* and *d*, and also improves the action of the coil by causing a more sudden interruption of the current that flows from the battery *B* through the primary *p*. Both *d* and *c*, where they come in contact with each other, are tipped with platinum to better resist corrosion and fusion. Marconi says he found it advantageous to rapidly revolve the contact *d* by means of an electric motor of some kind geared to the wheel *h*. By this means the platinum contact surfaces on *d* and *c* are kept smooth, and any tendency to stick is removed, and also they last longer.

When the key *K* is closed a constant stream of sparks will pass between the large centre sphere and the two smaller spheres, one on each side. The

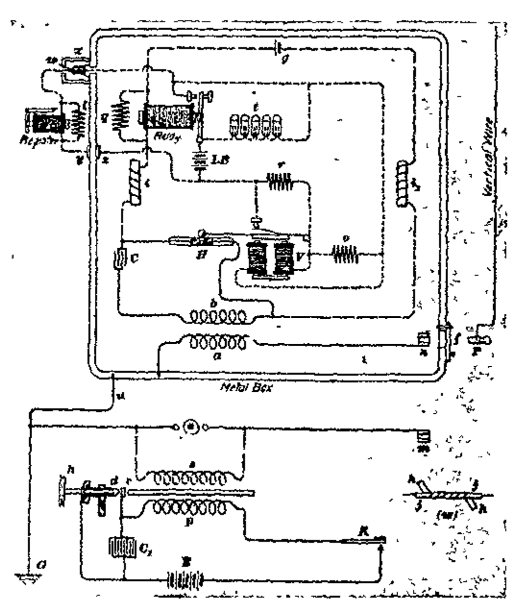


DIAGRAM OF THE MARCONI TRANSMITTING AND RECEIVING APPARATUS

total air gap usually varies from ½ in to 2 ins, but the coil must be powerful enough to give an 8 or 10-inch spark. One of these small spheres is grounded, and the other connected to a long vertical wire.

The current in the oscillator (merely the circuit from the top of the vertical wire through *m* to the ground *G*) surges back and forth between 100,000,000 and 200,000,000 times per second each time it does so it charges or discharges the long vertical wire. The charging and discharging currents flow up and down the vertical wire, and consequently produce electro-magnetic waves that are projected out into space, as horizontal circular waves, from every part of the vertical wire. Furthermore, on account of the static disturbances that are produced in the surrounding space between the vertical wire and the surface of the earth, due to the electro-static capacity of the vertical wire, it is probable that so-called electric waves, which vibrate up and down in vertical planes, are also projected out into space.

Since these waves spread out through space in all directions, it is evident that another vertical wire, if not too far distant, will be cut by some of them. The waves that cut the second vertical wire seem to set up oscillating currents that follow it down to the earth.

RECEIVING APPARATUS.

To prevent the oscillations generated at a station from acting on its own coherer and rapidly destroying the same, Marconi encloses all the receiving apparatus, with the exception of the Morse register, in a metal box, and leads the wire connecting to the register through a coil encased in bands of tinfoil, the tinfoil being connected to earth. The box is usually made of iron, merely because it is the cheapest material. The metal need be only 1/26 or 1/16 of an inch thick. The hole at *f* should be securely closed by a metal door when transmitting. To receive, the door is opened and the plug *P* inserted in the receptacle *n*. The current waves that slide or follow down the vertical wire pass through the primary winding *a* of a step-up *induction coil*, or *transformer*, as it may be called, when they pass through the metal of the box and the wire *u* to the ground *G*. The secondary *b* of this coil is connected in series with a condenser *C* and a coherer *H*.

The induction coil or transformer *a b* should be in tune, or *syntony*, as it is called, with the electrical oscillations transmitted the most appropriate number of turns and the most appropriate size of wire varying with the length of the wave. Marconi says in one of his patents that he obtained the best results (presumably for 10-inch waves) by using a transformer which he duly described. This has been improved upon considerably since the first of the operations of the Marconi Company.

RATE OF WORKING.

By means of the key *K* the current flowing in the primary coil may be broken up into ordinary Morse signals. This will cause waves to be projected into space according to the Morse code. To be sure, each dot consists of millions of waves, but all waves cease when the key is opened. The key *K* used by Marconi when in America was not an ordinary telegraph key in the strictest sense, although it was somewhat similar. It had a longer lever (about 14 to 18 inches) pivoted at about its middle but instead of a finger button there was a handle extending upwards about three inches. The key was moved up and down over a wide gap in order to break the spark in the primary circuit when it was opened. This accounts for the fact that the speed of twelve or fifteen words a minute seems to be about the best so far attained, while ten words is a good average speed.*

MULTIPLEX WORKING

"By means of loose coupling" says Mr White, "Marconi has succeeded in designing an apparatus for what may be termed wireless multiplex working."

RADIATION OF WAVES CONFINED TO CERTAIN DIRECTIONS

According to a note written in March last by Mr. Marconi, and communicated to the Royal Society a few days later by Dr Fleming, F R S, "when a horizontal conductor is substituted for the usual vertical apparatus it receives with maximum efficiency only when the transmitter is situated in the vertical plane of the said horizontal receiving conductor and in such a direction that the end connected to the detector and to the ground is pointing towards the transmitting station. The wireless telegraph station on H M S *Furious* consisted of an ordinary vertical wire about fifty metres in length connected to a suitable spark gap. The station on the ship transmitted at intervals, and the ship followed a course describing an arc of about 180° round Poldhu keeping a distance varying up to sixteen miles. By means of the horizontal wire arrangement the bearing of the ship from Poldhu could be determined at any time by noting on which particular wire or wires the reception of signals was strongest and also by observing which wires were non-receptive."

Here we have the method employed in finding ships at sea for purposes of communication. In this direction Marconi announced his intention of making further experiments.

* Since the above was written the average speed has been increased to thirty words.—ED. PROGRESS

Transmutation of Metals.

By ROBERT A. MILLIKAN, PH. D.
Assistant Professor of Physics in The University of Chicago.

No one can observe and reflect upon even the simplest facts of nature, without soon coming to the conclusion that the thousands of different types of matter which we find about us in this world are not all independent and distinct substances; for at every turn we see one form of matter being transformed into another, or two or three forms coming together and giving rise to a third. Thus, we heat water, and it changes into steam; we touch a match to gunpowder, and it is gone; but the smoke and odours in the air quickly inform us that some new substances have been produced. How many ultimate forms of matter are there then? And how many of the manifold substances in the world are only compounds of these elementary substances?

This question was first propounded thousands of years ago, and an absolutely certain answer has not yet been found. This does not mean, however, that no progress has been made towards its solution. My purpose in the present article is to give a brief record of the attempts of man to unlock this most profound of nature's secrets, and to show to what extent he has thus far succeeded, and what remains still unknown.

GREEK SPECULATIONS

The earliest Greek philosopher, Thales, about 600 B.C., taught that water is the fundamental principle of all things. Xenophanes, who came a hundred years later, held that there were two fundamental principles—air and water; while Hippocrates (460 to 377 B.C.), the "Father of Medicine," first launched the doctrine that there were four elementary substances—earth, air, fire, and water. His argument for a number of elements, instead of one, is rather naive. It was something like this:—If man were composed of a single element, he could never be ill, but since he is at times ill, and requires complex remedies to keep him well, he must himself be complex. Aristotle, (380 to 322 B.C.) added to the four elements of Hippocrates a fifth—the ether, eternal and unchangeable, the ultimate substance of which the four elements are formed. And this Aristotelian philosophy of matter held sway throughout the Greek and Roman worlds, and down through the Middle Ages to the very dawn of modern science in about 1600 A.D.

PROF. J. J. THOMSON, OF CAMBRIDGE UNIVERSITY. BORN IN MANCHESTER, ENGLAND, IN 1856. THE MOST CONSPICUOUS FIGURE IN THE INVESTIGATIONS UPON THE CONNECTION BETWEEN ELECTRICITY AND MATTER.

THE ANSWER OF ALCHEMY.

According to the Aristotelian philosophy, not only are all substances composed of earth, air, fire, and water, but the properties of different substances depend upon the proportion in which these four elements are mixed. Furthermore, all substances were supposed to be transmutable into these four elements, and these four elements, in turn, transmutable into one another.

Let us pause for a moment upon this seemingly strange doctrine, since in it is found the explanation of the search for gold and the elixir of life, pursued so untiringly for fifteen hundred years by the ancient and mediæval alchemists. If we could forget the discoveries of the last two hundred years, the doctrine would not seem to us at all absurd. Apply fire to ordinary water and what happens? The water disappears into the air, and an earthy deposit is left in the vessel. In other words, when you mix fire and water in right proportions, you get earth and air. Similarly, since nearly all substances can be volatilised by heat, and since nothing remains after the volatilisation except an ash or powder, is it not evident that mixing fire with any substance in the right proportion causes it to change into the elementary substances, earth and water? Or, again, if we put salt or sugar into water, is it not apparently soon changed to water? And if we add more fire, will not a larger and larger amount change into water? Or, still again, if we take copper, or almost any metal, and put it into a strong acid, (a kind of water) does it not in time apparently disappear?—that is, is it not apparently changed into a form of water? Is it strange, then, that for so many years earth, air, fire, and water were considered the four elements, which only had to be mixed in the right proportions to produce any and all known substances?

The alchemists, then, were not all charlatans. They were simply men who were striving—most of them earnestly and seriously—to find the secret of producing any desired transformation of matter. They were trying to convert one substance into another by varying the proportions of the constituent elements. It was not unnatural that the principal object of their efforts should be the production of the substances which men most covet—namely, the precious metals, gold and silver. This however, was not their sole aim. They sought, rather, to find the great secret of the combination of the elements, not alone so that they might become rich, but so that they might learn to control matter, to prevent its disintegration when they wished—that is, to prevent death and disease. In the sixteenth century, especially, their attention was directed towards finding what they called sometimes the "Universal Solvent," sometimes the "Philosophers' Stone," and sometimes the "Elixir of Life," which are only different ways of describing that magic something which they honestly believed to exist, and which would have the power, when used under the control of the human will, of converting any form of matter into any other form.

Some of the ablest minds of the Middle Ages were engaged in this search. Roger Bacon, Spinoza, Luther, and Leibnitz, all believed in the Philosophers' Stone and in the transmutation of the metals.

Now what did this search yield? Did the alchemists find what they were after—the secret of the combination of the elements? In a sense they did. They learned that their efforts to transform the *metals* into one another were vain, but at the same time, they learned that they could transform at will many kinds of substances into other substances. In other words, they learned the laws of the combination of *many* of the substances which with they worked, but not of *all*. They learned to control certain transformations of matter, but they learned that there were certain other forms which baffled all attempts to reduce them to any thing simpler; and this is where alchemy began to pass over into modern chemistry. They learned that the old conception of the elements—earth, air, fire, and water—was quite insufficient to account for the results of their experiments, and toward the last of the eighteenth century, the last of the alchemists and the first of the chemists began to call all those substances which they were unable to reduce to any simpler forms, the *elements*. The number of these elements has grown continually as investigation has progressed until to-day we recognise about eighty such substances. These eighty odd elements are nothing more or less than substances which we have thus far been unable to reduce to simpler substances by means of any of the chemical reagents known to us. They are, however, the eighty substances into which we can easily transmute all of the two or three hundred thousand different kinds of substances which we are able to distinguish.

It is obvious from this survey that the eighty odd substances which we now call the elements bear no trace of a resemblance to the elements of the ancients, so that when we speak to-day of the possibility of the transmutability of the elements, we have in mind something entirely different from what the ancient alchemists had when they used a similar expression. However, since all the *metals* known to the alchemists have now taken their places among the *elements* of modern chemistry, when we raise the question as to whether or not our modern elements are transmutable, we do indeed include in it one of the foremost queries of the alchemists—namely, are the *metals* transmutable? This is the question which they answered from *a priori* considerations, in the affirmative, because they believed the metals to be nothing but combinations in different proportions of the four elements, earth, air, fire, and water.

Now, what sort of answer does modern science give to this same question? Let me divide the question into two parts. First, have the elements been produced in nature's laboratory from a common substance, or from common substances? In other words, have they been transmuted one into another in the making of the world? That is are they *fundamentally* transmutable? Second, are they *practically* transmutable? That is, can man ever hope to transmute them?—can he hope to duplicate with the agencies at his command, in his own little pygmy laboratories, the processes which may be going on in the laboratories of nature?

I shall not be able to give an absolutely positive reply to either of these questions, but I shall attempt to show what the modern trend of scientific opinion is, and to show something of the foundation upon which this opinion rests.

THE ANSWER OF MODERN CHEMISTRY.

Doubtless, many a chemist who has worked for years with chemical reactions, and who knows all the futile attempts which have been made during the past one hundred years to reduce the so-called elements to simpler forms, has come to feel that these elements are indeed ultimate, independent things, the original foundation stones out of which the universe is made. But this has not been the view of the most far-seeing investigators in the domain of physical science. In 1811, the great Sir Humphry Davy wrote:—

"It is the duty of every chemist to be bold in pursuit. To enquire whether the metals be capable of being decomposed and composed is the grand object of true philosophy."

And Faraday, to whom physics and chemistry perhaps owe as much as to any other one man, said in 1815:—

"To decompose the metals, to re-form them and to realise the once absurd notion of transmutation are the problems now given to the chemist for solution."

PROF. ERNEST RUTHERFORD, A NEW ZEALAND SCIENTIST NOW AT MCGILL UNIVERSITY, MONTREAL, DISCOVERED THAT THE RADIO-ACTIVE ELEMENTS ARE IN A CONTINUAL PROCESS OF DISINTEGRATION.

Also, in 1815, Prout put forward what is now known as "Prout's hypothesis," which made hydrogen the primordial stuff, and all the other elements simply groups of hydrogen atoms. This hypothesis rested, so far as experimental evidence is concerned, upon the observed fact that the weights of many of the atoms are almost exact multiples of that of the hydrogen atom. But more careful weighing showed that this hypothesis wouldn't work—that there are some elements whose weights are not at all exact multiples of the weight of hydrogen. Nevertheless, men kept seeking for connections and relationship between the elements, for to many a man the idea of a world built up of eighty different things, with no suggestion of a relationship between them, has been intolerable. In 1863 a new type of relationship was indeed discovered by a man by the name of John Newlands. This discovery was developed chiefly by the Russian chemist Mendeleeff, and is now known under the name of "Mendeleeff's Periodic Law." The essential thing in this law is this: If you write down in a horizontal row the elements in the order of their atomic weights, leaving out hydrogen for the present, and, after getting up as far as fluorine, go back and start another row, putting that element which is eighth in order of weight under that which is first, the ninth under the second, and so on, and then, when you reach the fluorine column, go back again and put the sixteenth under the first, the seventeenth under the second, and so on, the elements in all the vertical columns are found to bear striking resemblances in both chemical and physical properties. The relationship is sometimes surprisingly close, as, for example, in the case of the alkali metals lithium, sodium, and potassium, or of the strong reducing agents oxygen, sulphur, and chromium.

To go into a complete study of this so-called periodic law of the elements would be beyond the limits of this article; but its immense significance may perhaps be understood if I say that it is necessary only to know the atomic weight of any element in order to predict beforehand practically all of its chemical and physical properties. To convince ourselves of how certainly this relation ship does exist, we have only to have our attention called to one of the most remarkable scientific prophecies which has ever been made and verified. In 1871, when Mendeleeff first published his periodic table of the elements, he found it necessary to leave three blanks in his table, in order to get the related elements into vertical columns. He therefore jumped at the conclusion that three elements probably existed somewhere in nature, which had not yet been discovered, and which had the atomic weights which belonged to the blank spaces in his table. And so confident was he of his ground that he proceeded to predict very minutely the properties which these three elements would be found to have when discovered, judging of these properties from the properties of the other elements which were in the same column. He told what their atomic weights would be; what their specific gravities would be; what colours, what solubilities and what combining powers they would have. He never dreamed that he would live to see the discovery of these elements which he had so minutely described; but in a very few years every one of them had been found, and *they had exactly the properties which he had assigned to them.*

Now, let us ask ourselves what bearing this periodic law has upon the problem of the transmutability of the elements. First, it tells us in perfectly unmistakable terms that the elements are not and cannot be independent, ultimate things, for it shows that they have relationships. They group themselves into definite families. It shows that if you add something to the weight of an element, you change in a perfectly definite and predetermined way its properties. Does not this point in an almost unmistakable way to the conclusion that the elements have a common origin, that they are built up from a common material; and that our world is indeed at bottom, as Aristotle thought, something less complex than a compound of eighty different, independent things?

The Answer of Modern Astronomy.

Let us next turn from chemistry to the study of the stars, and see whether this field of investigation has added anything to our knowledge of the transmutability of the elements. It is now less than fifty years since the spectroscope was invented (1859) by the Germans, Kirchoff and Bunsen, the one a physicist and the other a chemist; but this instrument has already added more to our knowledge of the stars than did all the work of the astrologers and astronomers who lived before its time.

What has it taught? Primarily these two things:—First, it has taught us to determine with certainty what elements exist in the sun and stars; and, Second, it has given us a means of estimating the relative temperatures of the heavenly bodies. And it does this in a very simple way, for it separates into different coloured lights the complex

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light emitted by any glowing body, and thus enables us to determine just what colours are found in any given luminous source. Since each different element emits a light of a characteristic colour, we have only to compare the colour of the light emitted by an incandescent element on the earth with the colour of the light emitted by the sun or by a star, to find whether this particular element exists in the sun or star. Again, since we find that when a body first grows hot enough to emit light the light given out is red, and that the hotter the body becomes, the more abundantly does it emit, first yellow, then green, then blue, then violet, and so on; it is obvious that, if we find that of two bodies, which we can study only through their spectra, the one emits much more blue light, for example, than the other, then we may conclude that the first body is the hotter of the two. Thus we have been able to make rough estimates of the temperatures of the stars, and Sir Norman Lockyer—perhaps the most noted of living astronomers, and the man to whom we are most largely indebted for the results given in this section—

SIR NORMAN LOCKYER PROFESSOR OF ASTRONOMICAL PHYSICS IN THE ROYAL COLLEGE OF SCIENCE

has calculated that the hottest stars have temperatures as high as 30,000° Centigrade, and from this frightful degree of heat they run down to about 5000° Centigrade, which is only about one thousand degrees higher than the temperature of the electric arc, the hottest temperature which we have so far been able to produce on earth. He estimated the temperature of our sun as about 10,000° Centigrade.

Now, before we consider what the spectroscope has shown about the constituents of the stars of varying degrees of hotness, let us reflect upon the effect which we know temperature to have upon the compounds with which we are familiar on the earth. In general, the hotter a compound body becomes, the more does it tend to break up into its constituents, until, at the highest temperatures which we can produce on earth, all known compounds are broken up into their constituent elements. Now, if the elements themselves are compounds, as the Periodic Law would seem to indicate, what might we expect to happen to them if we could produce temperatures enormously higher than those attainable on earth? It would be natural at least, to expect to find the elements themselves decomposed into simpler substances. Now, since these high temperatures exist in the sun and in the stars, it ought to throw much light upon our search to investigate the kind of substances which are present in the hottest stars. The following is the result of Lockyer's and other astronomers' studies with the spectroscope:—

The hottest stars consist almost exclusively of the very light gases hydrogen, helium, and a gas called "asterium," which is so far unknown on earth. In the stars of somewhat lower temperature there begin to appear some of the heavier elements, like calcium and iron, and in the coldest stars we find nearly all the elements which exist on the earth. In other words, as a general rule, as the temperature decreases, the elements put in their appearance—approximately, at least—in the order of their atomic weights. Since, then, a star which is very hot has but few elements, and since more and more appear as it grows cold, is not the evidence of modern astronomy at least as strong as the evidence of modern chemistry, that *the heavier elements have evolved in nature's laboratory from the lighter?* In other words, that the elements are indeed transmutable?

The Answer of Modern Physics.

Such was the state of our knowledge up to about ten years ago. No one had ever decomposed an atom. Could it be done? Out of the laboratory of the physicist came the answer. Yes, we can decompose atoms at will. In 1879, Sir William Crookes began the study of the so-called "cathode rays," which appear in an exhausted tube, such as an X-ray bulb, when a discharge of electricity is produced within it. It was he who first brought forward the hypothesis that these cathode rays consisted of streams of projected particles shot with enormous velocities from the surface of the negative electrode. And these particles he thought to be, not atoms, but something much smaller than atoms. By the year 1898, it had been definitely settled, largely through the labours of Prof. J. J. Thomson, of Cambridge, England, that the cathode rays do indeed consist of particles of matter which have a mass only about 1-2,000 of that of the lightest of the atoms of the elements—namely, the atom of hydrogen. Furthermore, no matter from what sort of metals these cathode rays come, or what the nature of the residual gas that is in the tube in which they are produced, these cathode-ray particles are always found to have precisely the same mass. Again, all hot bodies, when their temperatures are sufficiently high, are found to emit these same particles; and, finally, the spectroscopic study of the effect of a powerful magnet upon light, has made it practically certain that it is the vibration of these same particles within the atom which produces light. The conclusion, therefore, seems to be inevitable, that these particles are constituents of all the elements; and J. J. Thomson has brought forward the hypothesis that they themselves constitute the primordial stuff of which all matter is built up. Whether this hypothesis is correct or not, the experiments made upon cathode rays by many investigators—the foremost of whom have been Crookes, of London; Thomson, of Cambridge, and Lenard, of Kiel, Germany—have shown beyond a doubt that the elements themselves are, under proper conditions, decomposable into simpler forms.

But the physicists have gone still farther than this. In 1896, the strange phenomenon of radioactivity was discovered by Becquerel, of Paris, and physicists were groping about in the attempt to find an explanation of what it might mean, when Prof. Ernest Rutherford, of McGill University, Canada, solved the mystery. He proved almost beyond a doubt that the radio-active elements—radium, uranium, and thorium—are actually in the process of continual disintegration. Their atoms are continually shooting off from themselves, with stupendous velocities, minute particles of matter, some of which are the cathode-ray particles themselves, and others of which are particles 4000 or 5000 times as large as these—that is, about twice as large as the atom of hydrogen.

If you look into a so-called "spinthariscope"—an instrument invented by Sir William Crookes in 1903, and consisting of a tiny speck of radium placed just above a zinc sulphide screen and viewed with a common magnifying glass—you can almost see the particles projected. You do actually see the continual flashes of light to which they give rise when they impinge upon the zinc sulphide screen. Here, then, we are in the very presence of a disintegrating element. Have we yet found the products which are formed through this disintegration? Yes, in part, at least. In 1903, Sir William Ramsay, and Frederick Soddy, of London, found with the spectroscope that helium was one of the products of the disintegration of radium. Prof. Rutherford's investigations have made it probable that there are quite a series of such products. He thinks that ordinary lead is formed in this way. Again, only last year, it was shown by Prof Boltwood, of Yale, and by Frederick Soddy, that radium itself is only a disintegration product of uranium Hence, in the phenomenon of radio-activity we are actually in the presence of the transmutation of some of the elements into other elements. The three elements which thus far have been shown to exhibit this property—namely, radium, uranium, and thorium—possess the heaviest atoms of any of the elements. And these heavy atoms are spontaneously disintegrated into simpler forms.

I have given the answer of modern science to the first of the questions which we set out to answer. Chemistry has proved that the eighty elements are not independent, ultimate things. Astronomy and chemistry together have rendered it probable that all the elements are simply stages in the evolution of matter from simple into complex forms, the organic life which exists on the earth being simply the later end of this process of evolution from the simple toward the complex. Physics has found a way of producing out of ordinary atoms minute cathode-ray particles which are much smaller than atoms, and has also found that certain of our heaviest elements are in the very act of spontaneously transmuting themselves into simpler forms. To our first question, then, as to whether the elements are transmutable in the laboratories of nature, we may return the answer that certain of them, at least, are transmutable; and it is probable that in nature's laboratories all of them are being produced from some simple, primordial stuff.

Let us turn, now, to the second question—Can man effect the transmutation? Thus far he has indeed learned how to obtain cathode-ray particles from any of the different forms of matter; but he has not learned how to produce by any of the agencies at his command, any of the eighty recognised elements from any other He has caught nature in the very act of doing it herself; but none of the agencies now known to the chemist or to the physicist appear to be able either to accelerate or to retard the process, that is, to change in any way the rate at which radio-active substances are spontaneously transmuting themselves into other substances

It seems probable from the results already given, that the "Universal Solvent" which will produce this transmutation, and which is perhaps producing it now in the stars, is temperature, that the old Greek philosophers were right in assuming that a proper admixture of their old element, fire, would produce any desired transformation. But, unfortunately, the temperatures required to produce these changes, are probably for ever beyond man's reach The relatively little changes which we are able to produce on earth have no measurable effect at all upon the transmutations which uranium, radium, and thorium are undergoing. Although, then, our modern science has opened out before us a view which the ancient alchemist never had, of the wonderful operations going on in nature's laboratories, we are at the present day just as impotent as they in the face of the problem of the transmutation of any element into any other element If the secret of this transformation should ever be found we should be able to unlock almost infinite stores of energy which we now know to be wrapped up in the atoms of the elements The lamented Curie, whose untimely death has robbed science of one of her most gifted sons, proved in 1903 that the disintegration of a gramme of radium liberates at least 300,000 times as much heat energy as is evolved in the combustion of one gramme of coal. Furthermore, it is extremely probable that similar enormous quantities of energy are locked up in the atoms of all substances existing there in the form of the kinetic energy of rotation of the cathode-ray particles, now commonly called *electrons*. J. J. Thomson estimates that enough energy is stored up in one gramme of hydrogen to raise a million tons through a hundred yards It is not improbable that it is the transformation of this sub-atomic energy into heat which maintains the temperature of the sun. Should man ever be able to unlock this energy, he would doubtless look back upon the day in which his progenitors burned coal to warm their houses and to drive their engines, with the same curiosity and pity with which we look back upon the day when our naked ancestors ploughed their fields with a crooked stick, and lit their fires with the spark from a flint.—*Technical World.*

SPONTANEOUS COMBUSTION.

By PROF EASTERFIELD, VICTORIA COLLEGE, WELLINGTON

OF the large number of fires which occur annually it is probably correct to say that the majority may be classed under one of three heads, fires due to incendiarism, fires due to ordinary carelessness, and fires due to spontaneous combustion. It is of course easy to imagine cases, for instance, fires following earthquakes which fall outside of the above classification; or again cases may occur in which the fire belongs partly to one and partly to another of the above three classes The classification suggested will, however, be found to cover the majority of cases

Of these three types it is the spontaneous fires to which the greatest interest attaches They are, to say the least, uncanny, and they are generally regarded as entirely beyond control. Let us see whether we can learn something of this class of phenomena.

In the first instance we must recognise that chemical changes are taking place around us perpetually, of which we take no heed until they are brought to our notice by some special circumstance Let us take an extreme case A block of granite, exposed to the weather, appears to be undergoing no change, nevertheless, the examination of any piece of granite that has been so exposed for years will show that great changes have taken place, and in particular that the feldspar is breaking down and yielding white china clay There is reason to believe that the weathering of the feldspar is accompanied by heat evolution, but so slow is the change that the heat evolution cannot be measured; for the equalising agencies of radiation and conduction dissipate the liberated heat so quickly that there is no perceptible rise of temperature

Take again the case of the exposure of an iron rail to weather even the most careless observer knows that rusting will take place Now, careful observation has shown that ordinary rusting or atmospheric oxidation of iron requires the presence (*a*) of moisture, (*b*) of carbonic anhydride, (*c*) of oxygen; and that the rate, and this is important, at which rusting will occur is considerably greater in a warm atmosphere than in a cold one Now, if the atmospheric oxidation of the iron take place at a sufficiently high temperature, the rate of chemical change is so great that the metal glows and becomes hotter and hotter up to a definite limit, a fact which is made use of in the ordinary Bessemer steel converter Any circumstance then which hastens the rate of chemical action may be regarded as a possible source of fire risk The circumstances which affect the rate of any particular chemical action are chiefly these (1) The temperature at which the reaction is carried out, (2) the presence of so-called catalytic substances which though apparently unchanged, serve in some way to profoundly modify the course of the action, (3) the state of subdivision, and hence the area and nature of surface of the substances which are undergoing change.

I Temperature In nearly all cases it is found that substances which enter slowly into chemical reaction in the cold will react vigourously at a higher temperature, the rate of action increasing in geometrical progression as the temperature rises in arithmetical progression When once, then, the temperature has risen to such a point that the rate of heat evolution is greater than the rate at which heat can be dissipated, the conditions for an ultimate flare are present Conversely, the cooling of a burning substance to a certain limit will cause the burning to stop, a fact well illustrated by the familiar experiment of extinguishing a burning candle by placing a spiral of cold copper in the flame At the temperature of liquid air very few substances appear capable of chemical action

II The influence of foreign substances in bringing about chemical actions may be illustrated in many ways. (1) A trace of spongy platinum will almost instantly cause a jet of coal gas to ignite in the air, the platinum remaining unchanged. (2) A small quantity of iron oxide may render chlorate of potash explosive, though the oxide appears to be itself unacted on (3) In the absence of a trace of moisture, phosphorus burns with difficulty, even in oxygen.

III. As illustrating the influence of state of subdivision upon the rate of chemical reaction, it may be mentioned that very finely divided iron and lead oxidise so rapidly in atmospheric air that they eventually catch fire—an exceedingly interesting experiment.

If we once firmly grasp the idea that all combustible substances exposed to the air are really undergoing a slow combustion process, and that it is only necessary to hasten the process in order to get an outbreak of fire, we shall, I think, be filled with wonder that the number of such so called spontaneous (Latin *sponte*—of free will) fires is not much greater than we actually find it to be.

Let us now turn to a few specially interesting cases of spontaneous combustion.

I Firing of coal in a ship's bunkers This is perhaps the commonest of the spontaneous firings. Experience shows that such fires occur most readily if the coal be finely divided, if the coal be moist, if the quantity stocked in one bunker be large, and if the ventilation be inefficient. With small quantities and proper ventilation the heat generated by the slow combustion is carried away as rapidly as it is generated, and hence no dangerous rise of temperature can occur Highly sulphurous coals containing finely divided iron pyrites are particularly to be regarded with suspicion.

II Firing of haystacks This phenomenon is almost invariably due to the stacking of hay in an insufficiently dried condition The rise of temperature under such circumstances is often extraordinarily rapid, and in the first instance appears to be undoubtedly due to bacterial action. The temperature being thus raised to a point at which atmospheric oxidation of the vegetable matter can proceed more rapidly than the generated heat can be dissipated from the mass actual incandescence will eventually be brought about In the making of ensilage the original fermentation and rise of temperature occur, but, owing to the fact that the silo is under great pressure, the supply of air is insufficient for rapid oxidation to further increase the temperature of the mass.

III. Firing of greasy rags. Many mills have been destroyed owing to this cause. The initial rise of temperature is due to rapid absorption of oxygen by the large surface of grease exposed to the air in a thin layer Most animal and vegetable oils are liable to cause these accidents, but of all oils linseed oil appears to be the most dangerous on account of its great affinity for oxygen.

IV. The cause of wool fires on ships appears to offer no special points for consideration The evidence appears to be overwhelming, that if wool is shipped in a clean and dry condition the risk is practically nil, but we shall await with interest the report of the Royal Commission which is now investigating the phenomena from the New Zealand standpoint.

V Spontaneous combustion of explosives. This is a peculiarly interesting case. In an explosive we place certain substances which have a great tendency to chemical action in such close proximity that they will not, we hope, act upon one another rapidly at the ordinary temperature When we wish to bring about the explosion we hasten the action to begin either by detonation or rise of temperature Sometimes the reaction begins "spontaneously" if it does there is little evidence for the coroner

Paper Gas Pipes.

PAPER has proved itself a valuable substitute for iron and wood in a variety of ways. It is now used for making pails, tubs, and other domestic articles. Car wheels are also made from it, and are superior to the metal product in toughness, resistance to vibration and durability.

The latest application is in the making of gas pipes For this purpose manila paper is cut in strips of a width equal to the length of the pipes to be made These strips are placed in a reservoir filled with fused asphalt, and are rolled firmly and uniformly around a rod or core of iron, until the desired thickness is obtained Strong pressure is then applied, after which the exterior is covered with sand, and the whole cooled in water. The core is then removed, and the outer surface covered with some water-proof material

These pipes, it is claimed, are perfectly tight, and are more economical than metal pipes.

Astronomy of To-Day.*

Notes of a Lecture delivered by SIR ROBERT STOUT, K.C.M.G., *under the auspices of the Wanganui Astronomical Society, in September, 1906.*

PART I.

Do we realise when we look up to the sky how few stars we can see with our unaided vision? It is said that we can only see between 7000 and 8000, even if we examine the sky in both hemispheres. And yet the stars are innumerable. The more powerful we make our telescopes, the more stars we discover, and the most powerful telescope has found no place in the heavens devoid of stars.

We may consider the heavens in two or three aspects. Let us for a little see if we can realise (1) the immense distances of the universe, (2) the sizes of many of the stars, (3) the beauties of the heavens, and, lastly, (4) some theories of the beginning and end of the universe.

(1.) If we are in the Wanganui Observatory, we would perhaps ask to see the Southern Cross. Who has not seen that brilliant constellation? It is situated in that portion of the sky which is the richest in stars, and as we watch it from month to month in its varying altitude to us, we are always struck with its beauty. We will notice the pointers of the cross; they belong to a constellation called Centaur.

You are aware perhaps that the stars in each constellation are named by the Greek alphabet, or by numbers, and named according to their apparent brightness. For example, the brightest star in a constellation will be called Alpha, the next brightest Beta, the next Gamma, and so on. The brightest pointer is called Alpha-Centauri When you come to examine it through a telescope you will find that it is not a single star, but it is a "double star"—there are two stars. It is a beautiful object. The reason, however, why I wish to direct your attention to it is, that so far as we know, it is the nearest star to this earth. It is from considering its distance that we can get some idea of the vastness of the distances in the heavens. The distance of the sun from the earth is according to the latest calculation 92,874,000 miles. This is the calculation of Sir David Gill, who I see has just been appointed President of the British Association, he is an eminent astronomer, and during his residence at the Cape of Good Hope has done good service for astronomical science.

One way of testing distances is to consider how long it takes for light to travel from the sun to the earth. Light travels at the rate of 186,300 miles a second, i e seven times round the earth in a second; this would show that light will travel from the sun in about nine minutes. Now, light takes nearly 4½ years to travel from Alpha-Centaur to our earth, so when we are looking at Alpha-Centaur we are looking at the star as it existed about 4½ years ago—it may have perished in the meantime. This shows that the distance of Alpha-Centaur from our earth is about—I am giving you round numbers only—25 billions of miles. Let me show you the distance in another way You have no doubt seen an orrery constructed, that is, you have round globes or balls showing the size of the sun and the different planets and their relative distances. Well, let us suppose that at this table there is the sun, and we place the earth, we shall say, a yard off from the sun; where will Alpha-Centaur be? Alpha-Centaur would have to be placed in our orrery 150 miles off. That will give you some idea of the distance of Alpha-Centaur, the nearest star to us.

I may illustrate the relative distance and size by quoting to you what Sir John Herschel said about our solar system He said —

Let us suppose we have a globe 2 ft. in diameter; this would stand for the sun. If Mercury is placed 82 ft. away it will be relatively to the sun the size of a mustard seed; Venus will be 142 ft. away, and the size of a pea; the earth 215 ft. away, or 3 chains and 17 ft., and the size of a pea a little larger; Mars will be 327 ft. away, and the size of a large shot; the Asteroids—small planets—will be 600 ft. away, and of the size of grains of sand; Jupiter will be ¼ mile off, and as large as an ordinary orange; Saturn will be four-tenths of a mile off, and of the size of a small orange; Uranus will be ¾ mile away, and like a large cherry, and, lastly, Neptune like a large plum 1¼ mile away. But the nearest star Alpha-Centauri would be a globe about 3 or 4 ft across, and 10,000 miles distant.

Sometimes during the year we may cast our eyes to what is the brightest star in the southern sky—it is the star Sirius Well, Sirius is double the distance of Alpha-Centaur from us. Let me try and give another illustration of the distance: We will suppose that we take a train—and it will be an express train going far faster than any express train runs in New Zealand—let us suppose that it travels at the rate of 60 miles an hour; travelling at that rate it would take us 130 years to reach the sun, but to reach the nearest star, namely, to reach Alpha-Centauri, it would take us about 35 millions of years.

There is another star which was at one time thought to be the nearest star—it is in the constellation of the Swan, and is named 61 Cygni. To reach it would take about 40 millions of years travelling at the same rate, and, remember, these are the nearest stars to us If we take some of the more distant stars, say for example Sirius, we could not reach it, going a mile a minute, under 72 millions of years

Let me give you yet another illustration, so that we may try if we can dimly realise the vast distances in the heavens. There burst out in 1901 a brilliant star in the constellation of Perseus. A star had been known in about the same position, but it was not of great magnitude or brilliancy. On the night of February 21st/22nd Dr. Anderson of Edinburgh noticed a bright star which increased so rapidly in brightness as to become about the third brightest star in the sky. Afterwards it began to fade away slowly. Now, this star was so distant from us that what Dr Anderson was seeing took place in the reign of Henry VIII. The star was trillions of miles from us.

Many more illustrations might be given, but perhaps those used may impress us with the vast distances of the stars in the sky

It is computed that the diameter of the known Sidereal universe is so great that light would take 90 millions of years to travel across it. This would make the diameter 374 trillions of miles, 374,340-326,400 000,000 000, or 374 with eighteen figures following it Can we comprehend it?

(2.) I have spoken about distances let us consider the size of the stars we see in the sky. I assume that we are still looking through the telescope at Alpha-Centaur but Alpha-Centaur consists of two stars about equal in size: they are really two vast suns, and each, compared with our sun, is more than seven times its size. They take 81 years to travel round their orbit The one revolves round the other There is another star that we sometimes see It is called Arcturus or a Bootes, and was at one time thought to be the quickest-moving star in the sky. We see it in April in the north-east, in June in the north at 8 p.m. I refer to it now because it may give us an illustration of the vast size of some of these suns called stars. To try and realise the size of Arcturus, let us look at the size of the sun. The size of our earth is about 8000 miles in diameter, that is, if we bored a hole from pole to pole that would be about the diameter of the earth—I am giving you round numbers. The diameter of the sun is 865,000 miles, but the diameter of Arcturus is 86 millions of miles—about one hundred times the diameter of the sun. Let us not forget that the distance of the sun from us is nearly 93 millions of miles. If the star Arcturus came between us and the sun it would almost fill the space. It is in volume a million times the size of the sun, and there are no doubt many thousands of stars, perhaps hundreds of thousands of stars, as large as Arcturus. The fact is that our earth, relatively to the size of some of the heavenly bodies, is as a grain of sand is to the size of our earth. Sirius, also, is a large star, about 3½ times larger than our sun, and about 48 times as bright. There are no doubt stars smaller than our sun, but we may say that there are hundreds of thousands of stars larger than it

We speak of the stars as "fixed" stars. Compared with the planets they appear immovable. The fact is, however, that some of them are exceedingly rapid in their movements. If we consider their velocity we will be further impressed with the vastness of the universe. There is a difference of opinion amongst astronomers as to what star, the movements of which can be approximately ascertained, is the most rapid. In 1893 it was said that Arcturus was the most rapid, and Prof. Newcomb in his work on "The Stars" assumes that this is correct. The immense distances of the stars make accurate observation very difficult. It has been computed that Arcturus travels at the rate of 376 miles per second or 32,486,400 miles per day. A star called 1830 Groombridge—because that is the number of the star in Groombridge's catalogue of stars—situated in the northern constellation of the Great Bear, travels, it is said, at the rate of 231 miles per second, or 19,958,400 miles per day. And yet these stars, because of their immense distance from us, seem immovable or fixed.

The distance of Arcturus is so vast that light travelling at the rate of 186,300 miles per second would take 181 years to reach our earth from Arcturus It is about 41 times more distant from us than Alpha-Centauri. From 1830 Groombridge light would take 36 years to reach us.

And now let me say something about the number of the stars Through the aid of photogrophy, which has been of as great service to astronomy as the telescope, some of the most recent astronomers have come to the conclusion that there are perhaps known now a hundred millions of suns, and if you consider that each of these suns may have, like our sun, planets revolving round it, which, however, are never seen by us, and that these planets have other planets around them, such as our moon around our earth, you may get some idea of the number of heavenly bodies that exist in the universe.

(3.) Let us pass to another stage—the beauties of the heavens. The first thing of beauty that you would likely have your attention directed to is in the Southern Cross. There are what are termed in the sky clusters—magnificent clusters of stars. To the naked eye, if you have a keen vision, the cluster may appear a single clouded star, but when you look through the telescope you behold a most beautiful spectacle. You see thousands of stars sparkling such as no diamonds or other precious stones ever sparkled in the finest piece of jewellery. Sometimes the stars in a cluster are of varied colours, white, yellow, red, violet. You will often stand in wonder at the beauty of many clusters.

The numbers in the clusters will surprise you. What appears as a single star may, with the aid of the telescope and the photographic lens, become thousands. You know the Pleiades, often called the Seven Stars. You see them on a clear summer night in the north-east heavens You could see them about 11 p m. on the 1st October. One with ordinary vision can count six stars. If one has extraordinary vision, twelve may be seen. When you look through a powerful telescope you may count about 2000, and in one photographic plate that had been exposed for some time, 2326 have been counted.

Around one of the stars in the cross—the star Kappa—there is a brilliant cluster The stars are not so numerous as in some clusters, but they are large and brilliant and of different colours.

Another very fine cluster is round a star in the constellation of Toucan This constellation is at present high up in the sky, lying between the constellations Hydrus and Grus (the Crane), to the west of the bright star Acheron The cluster is round the star 47 Toucani It is a large circular cluster, with the stars apparently closely compacted together, as seen through the telescope in Wanganui.

The cluster that is said to be the brightest in the sky is Omega-Centauri, the constellation in which the Southern Cross pointers are. It is just within the border of the Milky Way. To the unaided eye, and on a clear night, it appears a hazy star of the fourth magnitude. Prof. Newcomb says over 6,000 stars have been counted in one photograph of this cluster, and the whole number is greater—some say perhaps 15,000 stars. It is a most beautiful cluster, and, if the sky is clear, is always visible to us in New Zealand.

There is a fine cluster between Alpha and Beta Scorpionis. It is near Antares, that beautiful red star otherwise called Alpha-Scorpionis. Sir John Herschel considered it the richest and most condensed mass of stars in the firmament. A strange thing happened in this cluster in 1860: one bright star appeared, almost blotting out the cluster by its brightness.

The beauties of these and other clusters will grow on you, and I doubt not but that, whenever you visit an observatory, you will again and again ask to see them. There are plenty to show you. 226 clusters have been observed in the milky way, and 38 outside.

(*To be continued*).

*The lecture was illustrated by slides, and they were explained, and further information not in these notes given

DEVELOPMENT OF THE MARINE STEAM TURBINE.

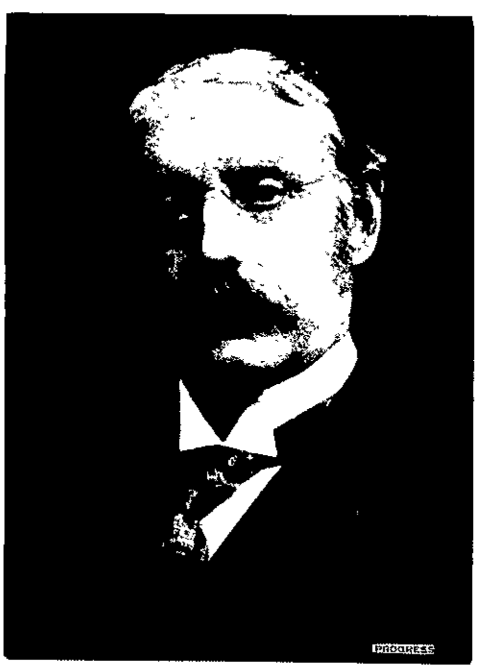
BY THE HON. C. A. PARSONS AND R. J. WALKER.

IT was not until 1894 that the idea of propelling a vessel by means of a steam turbine was put into practical forms. The *Turbinia* was the first vessel to be fitted with turbine engines, and between 1894 and 1898 many experiments were made with her, necessitating radical changes in the design and arrangement of the machinery. The first engine which was tried was of the radial flow type, giving about 1500 h.p. to a single screw. The results, however, were far from satisfactory, a speed of only 18 knots being obtained. Several different propellers were tested with this engine, and the results compared with the power registered by a dynamometer showed in every case a very low propeller efficiency. The original turbine engine was removed, and the engines finally adopted consisted of three turbines in series—high pressure, intermediate pressure, and low pressure—each driving a separate shaft, with three propellers on each shaft. A reversing turbine was coupled with the low pressure turbine to the central shaft.

Following the success of the *Turbinia*, the torpedo-boat destroyers *Viper* and *Cobra* were built and fitted with turbine machinery for the Royal Navy, and achieved remarkable speeds, the *Viper* taking the position of being the fastest vessel in the world, having attained the phenomenal speed of 36.86 knots per hour. Unfortunately, however, she ran on the rocks of the Channel Islands in a fog, and ultimately became a total wreck , and the *Cobra* foundered in a storm. Thus, after two or three years of hard work the *Turbinia* was the only vessel afloat fitted with turbine engines

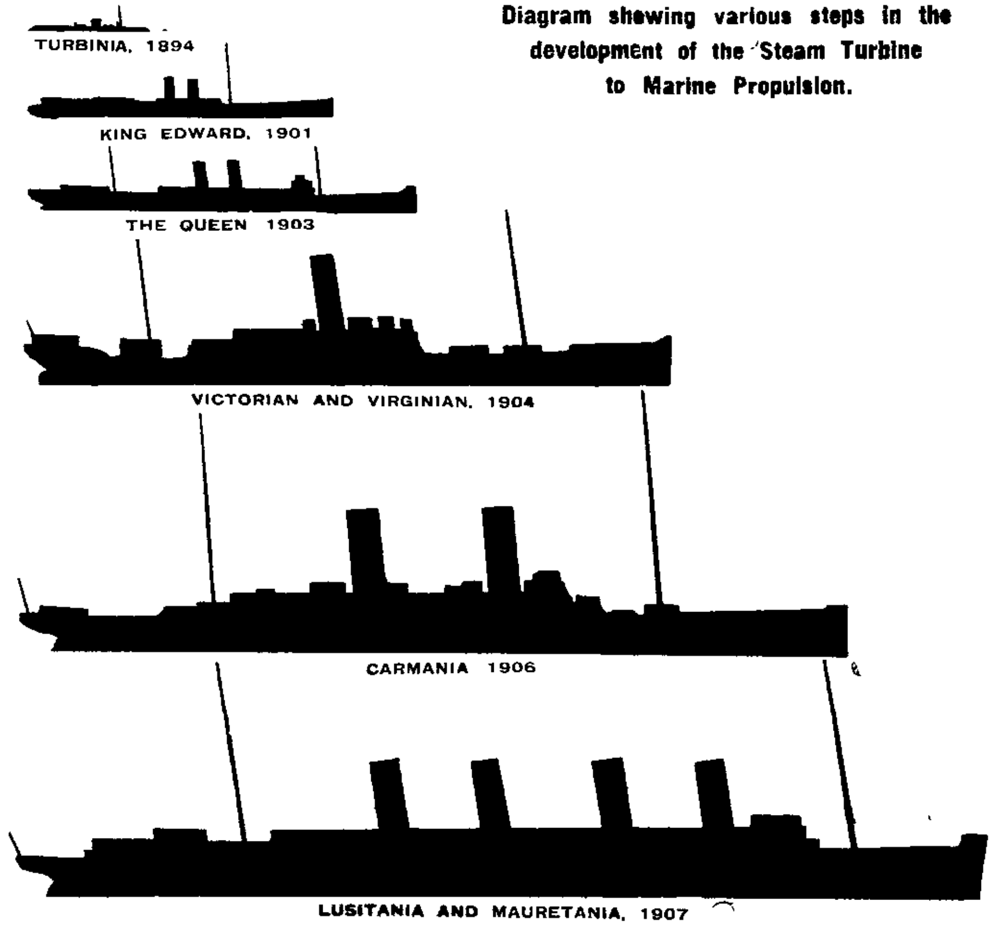
The marine turbine was first adopted for commercial purposes in the Clyde steamer *King Edward* to the order of Captain Williamson, in the summer of 1901. So successful was this vessel during the first season's running on the Clyde that an order was placed for a second vessel, *Queen Alexandra*, and the performance of these two vessels running on the Firth of Clyde demonstrated the commercial advantages accruing from the adoption of the turbine system. Other vessels quickly followed the *King Edward* and *Queen Alexandra*, until there are at the present time thirty-one turbine vessels in service for commercial purposes, representing a total of about 105,000 gross tonnage and 235,000 i.h.p. Our illustration shows in diagrammatic form, the comparative sizes of the various steps in marine propulsion. The profile of the vessels shown are to the same scale, beginning with the *Turbinia*, of 100 ft. in length, 44 tons displacement and 2,000 i.h.p., to the express Cunarders *Lusitania* and *Mauretania*, of 785 ft. length, 45,000 tons displacement, and 70,000 i.h.p. each.

Comparisons of the earning powers of turbine vessels have been made from time to time with similar vessels on the same respective routes, which have been found to be favourable to the turbine, and in some cases the saving in coal is very considerable. By the courtesy of Mr. Pierrard, of the Belgian Government, particulars are just to hand of the first season's running of the turbine steamer *Princesse Elisabeth* on the Ostend and Dover service,



HON. C. A. PARSONS, C.B., F.R.S., INVENTOR OF THE PARSONS STEAM TURBINE.

Diagram shewing various steps in the development of the Steam Turbine to Marine Propulsion.



[From *The Mariner*.

and are given in the accompanying table,* along with the particulars of similar vessels on the same service, but fitted with paddle engines .—

In the year 1905 the mean consumption of coal per single trip and the mean time per trip from Ostend to Dover, and *vice versa*, of the four preceding vessels were as follows :—

	P E	P.C.	M H.	L. II.
Total number of trips	82	278	278	232
Mean duration of trip (minutes)	187	217	212	227
Mean consumption per trip (tons)....	23.01	24 05	23 82	24 30

For the six months of the year 1906 the corresponding results were the following :—

	P E.	P.C.	M.H.	L. II.
Total number of trips	134	132	106	44
Mean duration of trip (minutes)	185.2	210 5	206 4	202 4
Mean consumption per trip(tons) . .	22.71	23.22	24 27	24 87

	Mean Results. Turbine.	Paddle.
Total number of trips	216 ..	1 070
Mean duration of trip (minutes)	185 9 .	215 4
Mean consumption per trip (tons)	24 06 ..	24

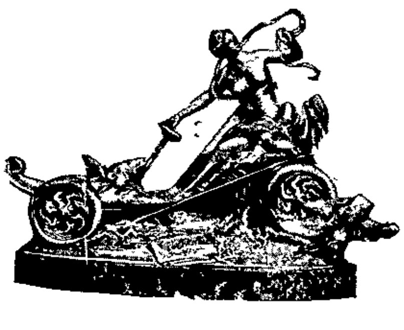
From the above table it will be seen that the turbine boat does the passage in about 15 per cent less time than the paddle steamer, on the same coal consumption. To reduce the turbine boat to the displacement and speed of the paddle boats, and assuming that the i.h.p. varies as the cube of the speed, the mean consumption of the *Princesse Elisabeth* would be about 17 tons, as against 24 tons in the paddle boats thereby showing a saving of over 25 per cent.

The following mercantile vessels have been completed and placed on service this year :—The pleasure and mail steamer *Rewa*, for the British India Steam Navigation Co , Ltd , of 455 ft by 56 ft. and 16½ knots speed ; the new Clyde passenger steamer *Duchess of Argyll*, for the Caledonian Steam Packet Co., of 250 ft. by 30 ft. beam and 20 knots speed ; the Thames passenger steamer *Kingfisher*, for the General Steam Navigation Company, of 275 ft. by 32 ft. and 20 knots speed ; the three cross-Channel steamers for the Great Western Railway Company's new route, Fishguard to Rosslare, viz., *St. David*, *St. Patrick*, and *St. George*, of 350 ft. by 41 ft by 13 ft. 6 in and 22½ knots speed; the cross-Channel steamer *Viper*, for Messrs. G. & J. Burns, of 315 ft. by 39 ft. 6 in by 12 ft. and 21¾ knots speed ; and another Clyde passenger steamer, the *Atalanta*, for the Glasgow and South-Western Railway Company, of 210 ft. by 27 ft. by 10 ft. 6 in. and 17½ knots speed. In addition to these the two Great Central Railway steamers are nearing completion, and will, it is anticipated, be put on service this year ; and the yacht *Mahroussa*, which has been re-engined by Messrs. A. & J. Inglis, on her recent trials attained a speed of 17½ knots.

In addition to the two express Cunarders, the following mercantile orders are in hand —Two large ocean-going liners by the Fairfield Shipbuilding and Engineering Company , two cross-Channel steamers for the South-Eastern and Chatham Railway, similar to the *Onward* and *Invicta* , and a further steamer for the Union Steamship Company of New Zealand, by Messrs. Denny , two large sets of turbine engines for shipment to Japan, by the Turbine Company, of Wallsend ; and the Royal yacht, building by Messrs Inglis, the turbine engines for which are being manufactured at the Turbinia Works, Wallsend ; representing a total i h.p. of work in hand of about 590,000.

The development of the marine turbine has taken place almost entirely in Great Britain. A few war vessels have been built in France and Germany. The reason that the Parsons marine turbine has made so little progress on the Continent in the past is probably due to the fact that in France and Germany rival turbine systems of local origin have been energetically exploited, inducing those responsible for the ordering of new vessels to defer the adoption of a new system until the claimants had results to show Turbine vessels which have been engined in England with Parsons turbines up to the present date represent a total h p. actually completed of about 280,000 i h p. The total h p of marine turbines completed and on order with the Parsons Company and their licensees is over 870,000 i h p.

*COMPARATIVE TABLE.	Princesse Elisabeth	Princesse Clementine.	Marie Henriette.	Leopold II.
Length b p.	104 85 m.	103.70 m.	103 70 m.	103.70 m.
Breadth	12.192 m.	11.58 m.	11.58 m.	11.58 m.
Mean draught	2.92 m.	2.85 m.	2.82 m.	2.82 m.
Displacement in metric tons	2,005	1,853	1,847	1,829
Registered tons	1,747	1,474	1,450	1,375
Type of engines	Turbines.	Compound.	Compound.	Compound.
Speed on trial (knots)	24	22 187	22 2	22
Date of construction	1905	1896	1893	1893



The ....Motor.

MOTOR NOTES.

By " Accumulator."

I have received from the Scott Motor & Cycle Co. an illustrated brochure in commemoration of the opening of the new Argyll works at Alexandria, near Glasgow.

* * * * * *

The use of motor vans for mail purposes is being extensively tried by the British Post Office They have been already adopted in several places Hastings, Brighton, Eastbourne, Redhill, Epsom, Epping, Romford, Hitchin, and elsewhere. Their general use all over the Kingdom is considered now to be only a question of time.

* * * * * *

Unnecessary horn blowing has been attracting attention in the English press of late, and not without reason, for there is hardly anything which annoys other road users so much as the constant use of the horn. Such abuse of the warning signal tends to give the public the idea that car drivers want all the road, and it is the " get off the earth " attitude which other road users resent.

* * * * * *

Experiments with spraying cold tar upon the roads under pressure have been recently made at Birmingham, under the supervision of the City Engineer. The advantages claimed for this method are that it is not only effective, but the cheapest yet devised for fixing surface dust with tar. It is asserted that it is possible to coat roads with tar and render them dustproof at considerably less cost than by watering.

* * * * * *

Dunlop tyres were recently booming in the Isle of Man, for not satisfied with having a large percentage of their tyres on competing cars, the makers had a couple of captive balloons in the grounds of Mona Palace These balloons when up in the air tell you at once that their object is to advertise Dunlops. Mr. Spencer was in charge of one which was fitted with a basket, and those who wished to undertake the delights of a balloon voyage could do so at a very nominal charge.

* * * * * *

In order to extend the motor bus' trade of England and Scotland, negotiations have been completed for a combine between Argyll Motors Ltd., one of the largest manufacturing firms in the British Isles, and Scott, Stirling & Co., of Pioneer motor 'bus fame. The extension of the Argyll Works on the banks of Loch Lomond will enable twenty 'buses to be produced in a week, at such a low price that foreign competition can be combated. The new company is to be known as Argylls and Stirling Commercial Motors Ltd. The Argyll firm will continue to produce their very popular lighter vehicles in even greater numbers than previously.

* * * * * *

A peculiar incident occurred in a garage recently. A car was being overhauled, and for very good reasons naked lights were not being used In their place the ordinary hand electric lamp with a length of cable was placed under the car and the work carried out by its light. One of the mechanics happened to tread on this cable connected to the lamp, when there was a sudden flash and a small explosion. The explanation given was that the pressure of the man's weight in treading on the cable had set up a short circuit between the wires, producing a spark which ignited local petrol fumes.

It could hardly be the case for petrol fumes to remain in the air for any length of time, but it is possible it was so; I should be more inclined to think that the crack, referred to as the explosion, was due to the electrical discharge brought about by the high voltage electric current The point to bring out is this, that even with an electric lamp care must be exercised, as on the lines mentioned above, even with the usual precautions, it is possible to cause a fire or explosion.

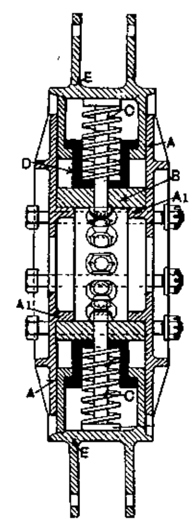
The Jackson Resilient Hub.

A few days since, says *The Autocar*, we were afforded an opportunity of making a test run in a Germain car, all four wheels of which were fitted with the Glyda resilient hubs (Jackson's patents). The object of the trial was to afford us proof that the effect of these spring hubs when fitted to all four wheels of a motor car fall little short of pneumatic tyres, while of course, advantages incapable of being shared by inflated tyres are claimed for them, as for all hubs of their type Like many good things, the Glyda resilient hub stands in some danger of being spoiled for the proverbial ha'porth of tar; or, rather, having its excellent effect and behaviour masked by being fitted to an old type of vehicle which has already seen much service, and which discounts the effect of the particular fittings it ought to demonstrate to the best possible advantage.

The design of the Glyda hub can be fairly gleaned from the accompanying drawing taken from the patent specification, but it is needless to suggest that in actual construction it has been found expedient to vary this somewhat in detail It will be seen that the hub flanges A are formed with concentric internal flanges A1 carrying a heavy ring B supporting twelve radial springs, as shown by C C, mounted round cheese-headed spindles The springs are carried as to their inner ends in a kind of plunger gland D, which slides upon, or upon which slides, as the case may be what for lack of a better term we will call the spoke ring E E

By a study of the drawing it will be seen that the hub, consisting of the two side flanged discs A A, can play upwards or downwards to the spoke ring E E, compressing the coiled springs C C, through the heavy ring B, already mentioned, and the pot-shaped spring holder D, or that the spoke ring can move inwards towards the centre by pressure on the cheese head of the spring spindle, compressing the coiled spring within the pot-shaped holder. Now, it must be borne in mind that this inward and outward movement of the two parts can take place all round the hub in varying degree, and in this manner is the resiliency obtained

So far as our trial went—and it was by no means so comprehensive as we could have wished—we were more than impressed by the behaviour of the hub, which is undoubtedly resilient and comfortable. Running over some of the worst macadam in London, the effect of the hub was remarkable, although, of course, differing in some degree from pneumatics As we have already said, the operation of the fitting was discounted by the running and noise of the old type car to which they were fitted. It would be well if the Glyda hubs were submitted to a test similar to that undergone by the Hale. It is only by such prolonged trials that devices of this kind can be sufficiently proved.



THE JACKSON RESILIENT HUB.

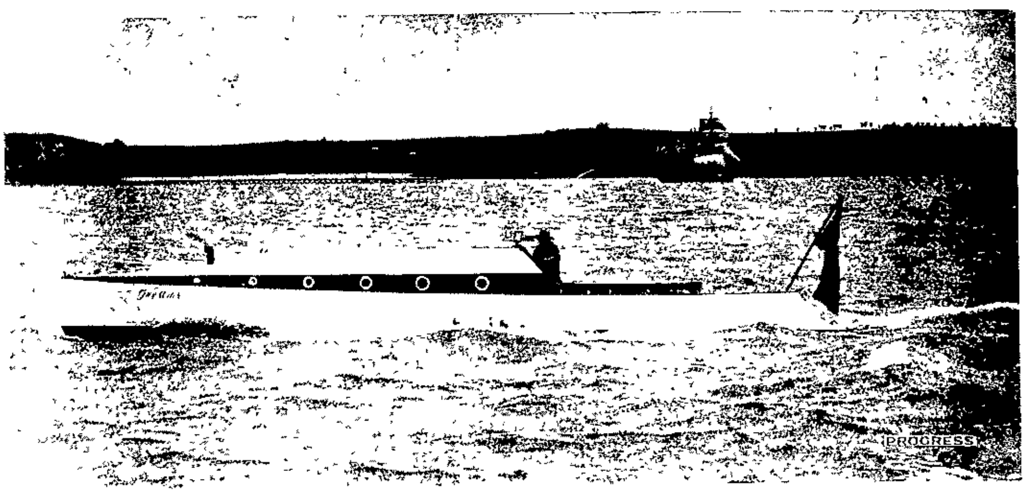
A A, wheel flanges
A1, flanges on A A
B, ring carrying spring spindles
C C, helical springs
D, cup or thimble carrying springs
E E, spoke flanges

The Six-Cylinder Ford.

In addition to landing the first of the new popular, low-priced Ford model " N," four-cylinder, 18 h.p. runabout, specifications of which have already appeared in Progress columns, the New Zealand agents for the Ford Motor Company have just landed in Wellington a Ford model " K" six-cylinder, 40 h p touring car, the intention being to exhibit it at the Christchurch Exhibition. Much interest attaches to this as being the first six-cylinder car imported into the colony, There has been much discussion in automobile circles on the question of the tendency to multiplication of cylinders in the car of the future, and it cannot be denied that the cry is for more power, and for a standard type of design that will be accepted for years to come, and it is a rational, sensible and reasonable demand; all prominent motor manufacturers acknowledge a limit in the size of a four-cylinder motor, beyond which trouble arises from added weight, decrease of motor speed, loss of motor flexibility, and increase of vibration due to the powerful impulses and heavy reciprocating parts. In the six vertical cylinders a happy solution of the question is found. The driving force is divided into six power strokes, the six cylinders develop

AT WALLSEND-ON-TYNE AT THE RECENT LAUNCHING OF THE FIRST OF THE GREAT CUNARDERS, THE " MAURETANIA," A NOVEL DEMONSTRATION WAS GIVEN. THREE OF HER FOUR OVAL FUNNELS, WHICH ARE 17 FT. 6 IN. X 23 FT. IN., AND WHICH TOWER 120 FT. ABOVE HER LOAD WATER LINE, WERE LAID IN A ROW, AND FORMED A HUGE TUNNEL THROUGH WHICH MOTOR CARS WERE DRIVEN TWO ABREAST.

light impulses in rapid sequence—in fact, before one impulse ceases the next begins. This applies the power so constantly and so uniformly to the driving-shaft that no pulsation and no vibration is felt; this continuous, unbroken application of force, this constancy of torque, gives a smoothness of running, closely approaching the electric dynamo or the steam turbine. The overlapping impulses raise the pressure to a very high average, which greatly accentuates the gain in power; but it means even more than this to the motorist—a light car with ample power permits travelling on direct drive practically all the time, over all roads, up and down the steepest grades, through long stretches of deep sand, mud, etc., without touching the change speed lever. It is not only necessary to have



MR. C. A. WHITNEY'S "GREY WITCH" OFF THE BASTION, AUCKLAND HARBOUR

power; it is necessary to have the proper design and light construction and serviceability. A careful inspection shows that every feature of Ford model "K" is along the advanced ideas to which manufacturers are tending, and embodies careful evolution and development of all the minute details that make the car, and make it a well-balanced car.

The other specifications are:—

Motor, 6 cylinder, vertical, 4½ in. bore x 4¼ in stroke, **40 h.p.** Speed, 50 miles per hour, down to 4 miles per hour on the high gear. Improved planetary transmission, with improved clutch. Pressed steel frame. **114** in. wheel base. Water cooled, circulation by gear pump. Perfected magneto ignition. Mechanical oiler. Gasoline tank under seat, containing 15 gallons—good for 250 miles. Water contained in radiator. Hub brakes—internal expansion, with lever control. Emergency brake on driving shaft, controlled by foot lever. Springs, full elliptic on the rear, and half elliptic on the front. "Famous Ford" Direct Drive construction. Ample Roller Bearings on rear axle, with ball bearing thrust—special design. Ample Ball Bearings on front wheels. Wheel steering (fitted with Ford reduction gears) takes all the strain from steering over the roughest road—an exclusive Ford feature. Luxurious body, ample for five passengers. Weight—2000 pounds. 56-inch tread. Wheels, artillery, 32 in. Tyres, 4 in. Lubricating oil, sufficient for 250 miles. Colour (?) Equipment, two side oil lamps, tail lamp and tubular horn.

We are enabled to reproduce in this issue, through the courtesy of the owner, Mr. C. A. Whitney, two pictures of the motor launch *Grey Witch*. This fast craft is 42 ft. long and 6 ft. 8 in. extreme beam. The draught, including propeller, is 2 ft. 9 in., and draught of hull about 5 in. The engine is a 50-h.p. Monarch four cycle. The hull is Carvel built, the total thickness being about ¾". The whole of the hull is built of American cedar for lightness. The *Grey Witch* is covered by a whale back of American cedar which extends three-quarters of her length. Forward of the engine is a cabin of two berths. The whole of the boat is controlled from the steering wheel after the engine has once been started. Friction gear is furnished for reversing or going astern. The boat is driven by a three-bladed 26" propeller, and develops a speed of between 16 and 17 knots when cleared for racing. When fully equipped for cruising purposes, carrying a dingey etc., her speed ranges from 13 to 15 knots in fine weather. Of course, rough weather considerably decreases the speed. The *Grey Witch*, at the present time, is one of the fastest power launches in Australasia, and one of the best cruisers. She is lighted up by electricity supplied by accumulators, which are also used for ignition.

The well-known builders, Messrs. T. M. Lane and Sons, are to be congratulated on turning out such an excellent model, the lines of which are considered perfect for developing a high rate of speed, while at the same time, the craft has proved herself to be an excellent sea boat.

Tourist Trophy Race, 1906.

The *Autocar*, commenting on the great race which recently eventuated at the Isle of Man, says:—

After the lapse of 4h. 6m. 3/5s. from the start, Rolls flew by in his 20-h.p. Rolls-Royce for the last time, an easy winner. His times were: First circuit, 1h. 0m. 13-3/5s., speed, 40.2 m.p.h. Second circuit, 1h. 0m. 46-4/5s., speed, 39.8 m.p.h. Third circuit, 1h. 1m. 24-1/5s., speed, 39.4 m.p.h. Fourth circuit, 1h. 3m. 36s., speed, 37.9 m.p.h. The course over which the four circuits were run measured forty miles, three furlongs. The race has again gone to the swift, as it did last year. The great fear that Rolls would fail for want of petrol before the finish was not justified, but other and slower cars failed for shortness of fuel.

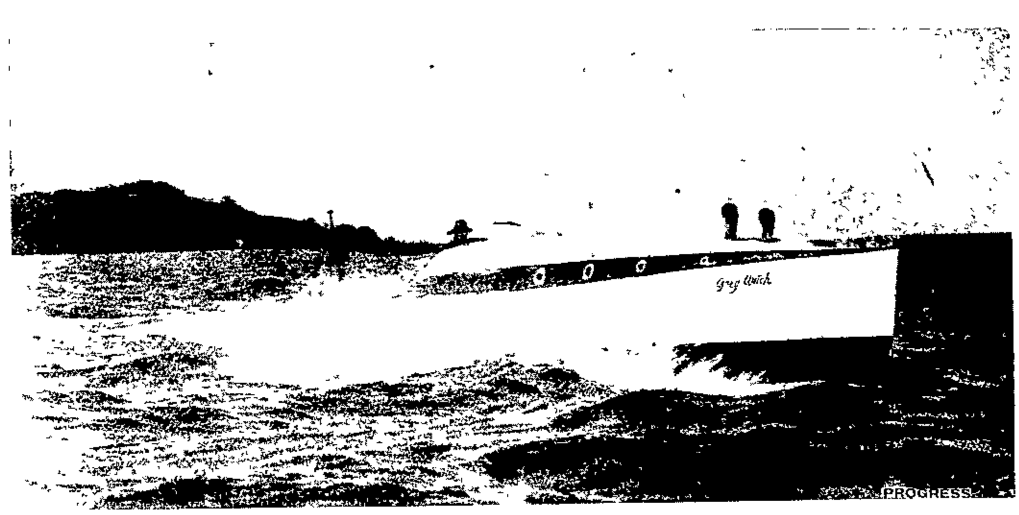
THE FINAL PLACINGS.

The final placings were:

1.—No. 4, *Rolls-Royce* (Hon. C. S. Rolls), 4h. 6m. 0 3/5s. Average speed 39.4 m.p.h.

2.—No. 23, *Berliet* (M. Bablot), 4h. 32m. 58-1/5s. Average speed 35.3 m.p.h.

3.—No. 2, *Darracq* (A. Lee Guinness), 4h. 42m. 48-1/5s. Average speed 34.3 m.p.h.



ANOTHER VIEW OF "GREY WITCH" GOING AT TOP SPEED.

4.—No. 15, Clement (G. Brand), 4h. 47m. 20s. Average speed 33.7 m.p.h.

5.—No. 17, Beeston Humber (T. C. Pullinger), 4h. 56m. 1-1/5s. Average speed 32.8 m.p.h.

6.—No. 18, Coventry Humber (L. Coatelen), 5h. 0m. 52-4/5s. Average speed 32.1 m.p.h.

7.—No. 1, Arrol-Johnston (John S. Napier), 5h. 22m. 1s. Average speed 30.1 m.p.h.

8.—No. 25, Siddeley (A. E. Crowdy), 5h. 47m. 19s. Average speed 27.9 m.p.h.

The time of the Argyll was unofficially given as 4h. 28m. Except so far as any odd seconds might be concerned, this was as nearly as possible what it did, as the car lost a good bit of time in the third round. That is to say, there is no doubt whatever that this time was the second fastest, despite the delay George had in cutting the coat and rugs clear of his propeller shaft. It seems that the floor boards were pushed up by the differential case so that the sand bags broke through as they bumped about in response to the agitated movements of the car.

Useful Hints.

A MYSTERIOUS SQUEAKING NOISE.

Sometimes a motor will develop a mysterious squeak when running, and this often takes a deal of locating. Many motors are fitted with the wipe type of contact-maker, and it is well to look to the wiper blade and the disc on which it rubs for the source of the squeak. If the disc is allowed to get dry, a most distressing noise is caused by the rubbing of the steel wiper piece on the fibre of the disc or by the bearing of the roller on the wiper arm when the latter is rotated. A spot or two of ordinary lubricating oil will effectually cure the trouble.

FITTING SPARKING PLUGS.

Though all sparking plugs are theoretically of a standard size as to that part which screws into the cylinder, there would appear to be some difference of opinion between makers as to the internal diameter of the sparking plug hole in the cylinder. This has been brought home to us in this wise: We were out for a short run a few days ago, when the engine commenced to misfire, undoubtedly from plug troubles. Having a new set of plugs awaiting an opportunity for testing, we decided to fit the new set, but, to our surprise, found that the plugs could not be induced to enter the cylinders. The old plugs were replaced, the faulty ones having been cleaned and adjusted. The next day we proceeded to investigate the why and wherefore of the new plugs not fitting, but found they entered the cylinders quite easily when the engine was cold. There is no difficulty in accounting for this, but it incidentally shows why some manufacturers wisely make the sparking pluck orifices of larger diameter than the corresponding screw threads on the plugs. Very often in new sparking plugs the thread is burred where the earth wire is let in. The burr should be removed with a triangular file.

BATTERY TROUBLES.

When an accumulator has been standing idle for any length of time, although it may show four volts, and even slightly over, when tested by a voltmeter, it is not safe to assume that it will work in a reliable manner when desired for ignition purposes to run a motor. The voltage of an accumulator may appear to be fairly high after a rest, and yet immediately a small amount of current, such as is used by an induction coil, is required from it, the voltage drops down from below 3.8, and this is insufficient to work an ordinary ignition coil. With such a battery the engine will start up readily enough, and will run for a matter of twenty seconds or so, then the engine speed will gradually decrease, and ultimately the engine will stop. After a few moments' rest the engine can be again started, with similar results. The novice is rather inclined to think that this shows that the battery is in good working condition, and that the trouble lies with the petrol supply. The symptoms, however, are different, for with an insufficient petrol supply, in addition to slowing up and stopping of the motor, there is also always a back firing in the carburetter when the petrol supply is insufficient. The best way to keep accumulators which are not used regularly is to give them a freshening up about once a week or fortnight by connecting on to a charging dynamo. When treated in this manner very little charging current is required, and the batteries are always kept in excellent working condition, free from sulphating of the plates, and can always be relied upon for use when required.

REPAIRING RADIATORS.

Leaky radiators are not a common complaint, but as they do occasionally occur, as we know to our sorrow, the recital of the means we adopted to overcome a badly-strained tubular radiator will be of interest. It was but a few days ago that we started for the scene of a competition which we desired to witness. The route took us over some exceedingly lumpy by-roads, which, despite good springing, had such a vibratory effect on the radiator, that no less than six of the vertical tubes became loose in the lower tank to such an extent that the water flowed freely from them. The first intimation of trouble was overheating of the engine and steaming at the radiator filling cap. As we were approaching a small town, and could run down hill thereto with the clutch out, we did so before making investigation.

Having pulled up at a convenient place, and made everything right for a good inspection, we got out of the car and took a preliminary walk round, arriving in front of the car, to find the radiator fast emptying itself from unexpected sources. There was nothing for it but to drain the tank, which we did. Then, drying off the water from the tubes, we procured a canful of water from a neighbouring hostel, and filled up again until we had located the faulty tubes by watching the water run from the fractures, which all occurred at the soldered joints of the lower tank. Time and circumstances did not permit of our having the joints re-soldered, so we procured some white lead from an ironmonger, and smearing this on small pieces of rag, laid them round the fractures, previously dried and cleaned, binding each tube round with string, so as to force the coated rag downward on to the tank. When each tube had been so treated, the radiator was filled up with water to test the joints, which were found satisfactory, and packing was introduced at suitable points to brace up the radiator. The journey was continued, and between thirty and forty miles traversed without the loss of more than half a teacupful of the cooling fluid.

Napier Automatic Lubrication.

The lubrication of the six-cylinder Napier engine is very interesting and simple in its action. There are no drips in connection with it, and merely one oil gauge, which is situated on the dash

On the left side of the crank case a small direct acting pump, A, is carried, which is driven by a worm on the half-time shaft, the worm being solid with the shaft. The oil is collected by this pump through a strainer from a well in the bottom of the crank case.

The amount of oil necessary is determined by means of one of the well-known Napier gauge cocks, operated by means of a lever inside the bonnet. The crank chamber is filled up each morning to the correct level, that is until oil runs out of this small gauge cock; when the correct level is obtained, the gauge cock is shut, and the lubrication of the car is right for the day

The oil is delivered from the pump by means of a *large* bore copper tube, which carries it first of all to the dashboard, so that it may pass through the oil gauge, B, and be in evidence to show that it is working properly. It is then led away from the dashboard, still by means of a large bore copper tube, to the middle of the off-side of the engine, where it meets a T-piece, and is then carried both backwards and forwards, and distributed by means of oil studs, C, to the four main bearings direct, and also a certain definite determined amount is fed to each of the cylinders.

Between the cylinders and the crank case there is a metal shield which limits the splash from the crank chamber to the pistons. This shield having a turned-up lip D, as shown in the diagram, catches the oil, retains a definite quantity always in the groove formed, delivers a portion to the big end bearings, E, and also to the cam shaft, F.

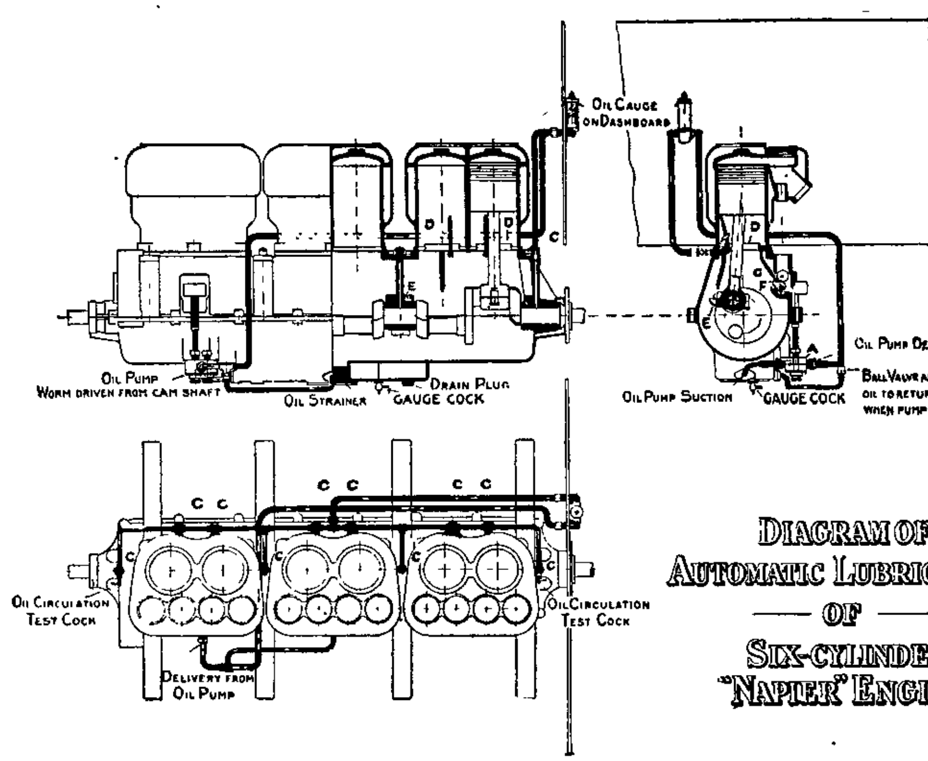


DIAGRAM OF AUTOMATIC LUBRICATION —— OF —— SIX-CYLINDER "NAPIER" ENGINE.

The whole of the oil, after being used, drains into the well of the crank case, and *after passing through a strainer*, is sucked back to the pump. The principle underlying it is a certain definite quantity is *delivered continuously to each of the bearings*, and also to the cylinders. This eliminates the possibility of a smoking engine, if the detail of having the correct amount of oil in the well is attended to, and this, owing to the Napier gauge, is the simplest thing in the world.

It will be noticed in the plan view that at the termination of the pipes leading to the two main end bearings of the engine, there are two small oil circulation test cocks. These are merely for test purposes, to make sure occasionally that the pipes are quite free. There is, however, scarcely any necessity for these cocks, as the pipes themselves are purposely made of large bore to obviate the possibility of stoppage. Should anything happen to the pump, which would be immediately shown by the oil gauge on the dash, all that is necessary to do is to put more oil in the crank chamber, and lubricate by splash until the pump can be put in order.

The mechanism for oiling the "big end" is shown in section in the small diagram, where the pipe will be seen leading downwards and squirting into the small scoop, carried by the big end marked E. The pipe leading to the cam shaft is marked G

The delightful simplicity of the whole system is its chief charm It is entirely independent of any exhaust or other pressure, is self-contained with the engine, does away with all drips that may become blocked, and require adjustment, according to the temperature and weather, etc.; it starts when the engine starts, and stops when the engine stops, and the lubrication in every case is *directly proportional* to the speed of the engine. This is automatically kept correct, and undoubtedly much of the sweetness of the running, and the ability to run fast without deterioration or fuss which these Napier engines possess, is in great measure due to the perfection and certainty of their lubrication.

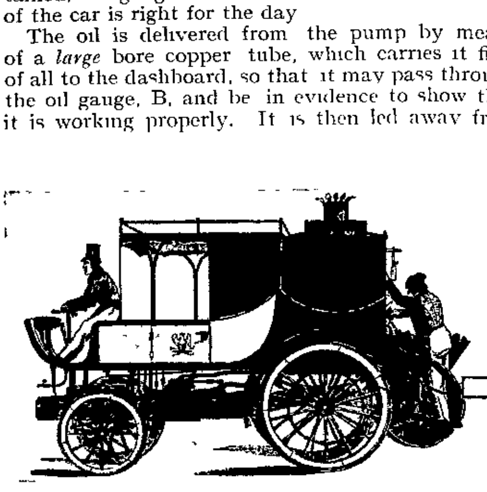
As to the pressure at which the oil is fed, this, of course, rises with the speed of the engine, but in all cases it is sufficient to actually force oil into the bearings, etc., according to the varying conditions. It would be difficult to imagine a more perfect or simple method of lubrication for a motor car engine, and it is merely another example of the care and trouble taken in the details of the Napier engine.

Hard work is not to be classed among the most potent factors in humanity's death rate. Sometimes we tend to look on the dark side of things, and marshal in review the so-called "industrial martyrs" who are exhausting their energies and lives in unhealthy and hazardous occupations.

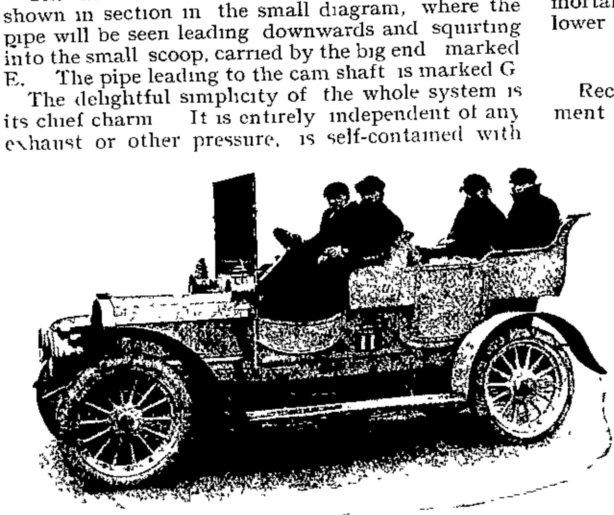
There is, however, a bright side to this as to all other questions Many occupations—probably by far the greater number in which men are engaged—are, in their very nature, health-giving and stimulating To mention one, for instance—the making of dye from coal-tar. This is said to be the healthiest trade in the world Tar, and the odours that come from it, are among the best of tonics and tissue-builders. The average life of a tar worker is eighty-six years, and the mortality in this occupation is eighty per cent. lower than in any other factory trade

Recent reports published by the Labour Department of the Board of Trade furnish material for comparing the conditions of labour in most of the skilled trades with those obtaining in other countries. As regards the building trades especially, the record is almost uniformly one of advance. The wages current among bricklayers, masons, plasterers, painters, and plumbers show a great appreciation during recent years, both in England and in most of the countries of Europe, as well as in America. In the great cities of Germany and France wages are now only a little below those of London, but in the matter of hours the British workman has a considerable advantage. The paradise of the building trade workers would appear to be the United States. In all great American cities bricklayers earn more than £5 a week. In San Francisco the average weekly wage is nearly £7, but, of course, conditions in that city are just now quite exceptional.

Rest, but do not rust.



1833



1907

The Squire-Maceroni Steam Carriage, built in 1833. This vehicle plied for some time between London and Edgeware. It had a multitubular boiler with a fan draught. The boiler was located behind the carriage, a horizontal two-cylinder engine being below the body of the vehicle. The comparison of this antiquated machine with an up-to-date motor car is interesting.

Told by Finger Prints.

By WILLIAM G. FITZ-GERALD.

Author of "Round the World" and "Travel and Exploration in Central Australia."

"I HAVE the description cards of more than 200,000 criminals filed away here, but, in spite of their great number, I will guarantee to positively identify, by their use, any man who has ever passed through my hands, and I will do the work within five minutes."

It was Dr. Alphonse Bertillon, the great French expert, who spoke He was standing in his private office, at the end of the long suite of rooms in the Paris Palace of Justice, which is given up to the Bureau of Identification. The floor of the office was marked out with chalk lines, as if some one had been drawing geometric diagrams on a large scale. Rising from the floor at regular intervals stood tall rules and measuring rods, like those used by surveyors.

The man who has done more than anyone else to make hard the way of the modern criminal, is tallish, thin, and enthusiastic in manner, looking more like a student than one of the greatest of living criminologists. He walked back into a long room lighted by skylights and half filled with cabinets of drawers running from floor to ceiling. Between each pair of cabinets stood a small desk, occupied by an assistant in a long brown linen blouse.

"In these drawers," said Dr. Bertillon, "we keep our records. And now, if you please, I will explain the system which makes it so easy to find among all these thousands, the card of the one man wanted.

"We have, let us say, 300,000 different cards in our files when a criminal whom the police do not recognise is brought in to us to be identified. First of all we measure the length of the suspect's head, from the centre of the forehead back. On the basis of this measurement alone we divide men—and our record cards—into three classes, viz. —

1. Small, length of head not greater than 7 24 in
2. Average, length of head from 7 25 to 7 48 in
3. Large, length of head 7.49 in. or more

"At once, then, when this measurement is taken, we have eliminated theoretically, at least, two-thirds of the cards, leaving only 100,000 to be considered.

"Next I measure the breadth of the head from side to side, classifying men and cards, again, into three groups, according to whether this measurement is small, average, or large. By this time I have only 33,000 cards left in which to look for my man.

MEASURE FACE AND FINGERS.

"The next division is according to the length of the middle finger, leaving 11.000 cards. Further subdivisions, based on the length of the forearm, and the breadth of face across the cheek bone, bring the number down to some 1300.

"At this point I take advantage of a comparatively new and extremely interesting addition to the system. It is that of finger prints.

"When a criminal is brought to us for record we require him to ink the balls of each of the fingers on his left hand, by pressing them one at a time on a plate of copper, covered with a thin coat of printer's ink. He then presses each finger in turn on his record card, in a vacant space left for the purpose at the bottom, and thus leaves a permanent imprint.

FINGER PRINTS A TEST.

"These imprints show the design of the lines on the skin of the fingers. They are of infinitely varied form and arrangement, and differ in practically every individual. At the same time they can all be classified into four different groups, viz. —

1. Skin showing loops directed towards outside edge.
2. Oblique furrows towards inside edge
3. Oval, circular, spiral, or volute furrows.
4. Arches and other furrows not included under previous headings.

"By classifying the remaining 1300 cards among which I must find the record card of the man under examination, on the basis of his finger prints, I am able to throw out all but about forty. There remains only to classify these forty on the basis of the subject's height and the length of his foot. By this time there are not likely to be more than five or six cards remaining, which can be looked over in detail and the proper card picked out."

NO CHANCE OF ERROR

"But is there no fear of error?"

"With so many indices it is almost impossible," he replied "The finger prints taken alone might possibly mislead, but not when taken in conjunction with the measurements, and so I can say, infallibly, whether a man has been through my hands before Two years ago I had a convincing proof of the value of finger prints. A burglar broke into an office, killed the caretaker and robbed the safe. He had left his finger prints marked on a pane of glass he had broken, and these I photographed It took my staff some time to identify them, but at last I was able to declare that the prints were identical with those of an old convict named Schiffer He was arrested and confessed the crime

"Of course the finger prints are of use only to aid us to recognise criminals who have been caught but it struck me some years ago that I might utilise the photographs as aids in the recognition of old offenders who were "wanted" or suspected, or had returned after having been banished from the district or the country. I therefore prepared an album which included the photographs of 1500 criminals. That was by no means all, but that was the largest number the detectives could deal with comfortably.

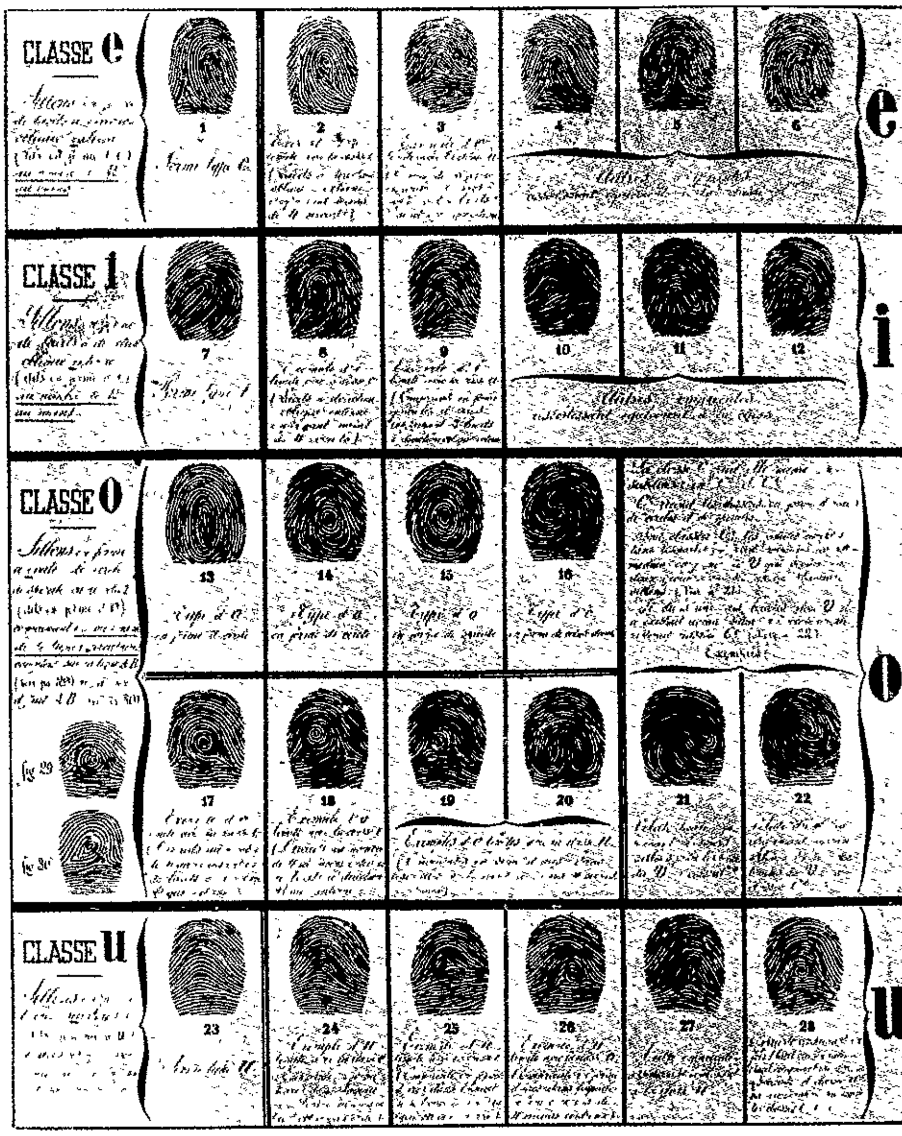
HOW TO REMEMBER FACES.

"In fact it would be too much to expect that a police agent could remember 1500 portraits—the large majority of them of men he had never seen—unless there was some method of aiding his memory. I therefore devised what I call "The Spoken Portrait." I chose as the basis of the system the ear, which in its general conformation and in the shape of the lobe and the *tragus*, differs very much in different individuals. Besides, it can be studied without the owner's knowledge, which is a great desideratum; for if a criminal—an escaped convict say—saw a policeman staring at him full face, conscience and common sense would suggest a retreat and so put an end to the examination

"Ears I divided into several classes, and the nose, forehead and eyebrows were treated in the same way. The colour of the eyes and hair and scars, if any, complete the description. The photographs in my album, though small, are clear and are arranged according to the system described.

"Nine years ago I first began by making experiments as to whether it would be possible to recognise a man from an oral description. I had a class of a dozen intelligent detectives and *gendarmes*, and I made them learn the outlines of the system, and then describe one another. Then I let half my class go amongst the prisoners awaiting examination—of whom there are always fifty or a hundred every day—and take mental notes of the appearance of some half dozen men.

"Having done this, they went into a room where my other pupils were, and made "spoken portraits" of the men they had peeked at. The others listened and were then required to go into the court-yard and find the persons described by their comrades



CLASSIFIED FINGER PRINTS DR. BERTILLON HAS REDUCED TO AN EXACT SCIENCE THE IDENTIFICATION OF CRIMINALS BY MEANS OF THEIR FINGER PRINTS

"The men enjoyed the work, and used to make little bets amongst themselves as to who would first spot his man, and even the prisoners thought it a good game! Afterwards I used to take my class to one of the great prisons where there are several hundred convicts. Of course, the men reversed their parts and the describers one day were the finders the next. Usually five out of six of the persons described would be found in from one to eight minutes, but the last would take nearly twenty minutes.

PRIZES FOR QUICKNESS.

"I still keep my classes, and the last three years I have given prizes to the men who are quickest and surest at identifying. One detective who is exceptionally clever at the work, has arrested over 150 criminals whom he identified from their portraits in the album.

"So far I have spoken only of the identification of live men. Corpses are more difficult to recognise, and it not infrequently happens persons will swear to the identity of a corpse shown in the morgue, and the supposed dead man will turn up alive and well a few days or weeks later. The bodies found in the river are often injured by bridges or boats, but the chief difficulty in the way of recognition is the fact that the eyes, which give vitality to the face are closed, or, if not closed, dull and sunken.

"Two Swiss surgeons, Drs. Cross and Reiss, obviate this by injecting glycerine into the chamber of the eye, which causes the eyeballs to enlarge and keeps the eyelids open. I employ this method and find it tolerably successful in giving an appearance of life. I am also careful to see that the head is exactly in the same position as it is carried in during life—that is to say, when a line drawn from the corner of the eye to the top of the *tragus* forms an angle of 15 degrees with a horizontal line across the plate. I have the two lines marked on the ground glass of the camera, and the body is placed on a couch, the back of which can be screwed up until the corpse is in the desired position.

"I think that completes the list of all I have done, except the work you now see me engaged upon."

WHAT THE CHALK LINES MEAN.

"May I venture to ask the nature of that work?" I said. "If there is no secret about them, I should be glad to learn the use of all these diagrams and measurements."

"There is no secret about them, but they belong to a different branch of my work and concern not the detection of a crime, but the crime itself. You know that in France we attach great importance to the reconstruction of the scene of a crime or a suicide. This may be needful a long time after the crime or the accident, and when the body has been buried and the furniture, etc., disturbed. I always employ the same lens and by means of these measurements and a scale applied to the edge of the photograph, I can tell the exact height, size, and distance from the camera, of every article in the room.

"A dead body I photograph three times. I first use the camera in the ordinary way, then I place the tripod across the body and photograph downwards; and finally I employ a camera which stands on the floor without any tripod and which my men call the "rat trap." The rat trap also comes in very useful for photographing a number of small articles standing on a table, such as medicine bottles or the remains of a meal.

"From these three photographs I can reproduce the scene of a drama so accurately that not even a pin shall be out of place. This, I think, completes the list of all I have done or have in hand at the moment."—*Technical World*.

CAMERA AND ACCESSORIES WITH WHICH DR. BERTILLON PHOTOGRAPHS CRIMINALS.

Source of Nickel.

Nickel is an element the use of which, in conjunction with steel has revolutionised the manufacture of ordnance and armour-plate. Scattered deposits occur over wide areas throughout the world, but there are only two extensive deposits known. One of these is in Canada and the other is in the French colony of New Caledonia at the antipodes. Nearly all the nickel used in the United States comes from the Ontario deposits located near Sudbury on the line of the Canadian Pacific Railway. The average annual output from this source is over ten million pounds.—*Mechanical World*.

It has long been a recognised custom for an artist or sculptor to sign his work with his name and the date. Two reasons may exist for this—the pride of craftsmanship (for every good workman takes a pride in his work) and the provisions of the English Copyright Act. This latter has made it imperative that, to create or preserve a copyright, the name and date must be appended. There is likely, however, to be trouble in the future if we are rightly informed. The Vicar of Clewer St Stephen's, Windsor, finding that to two stained glass windows recently erected in his church the artist had put his name, insisted on its being at once removed. In the current parish magazine the vicar says that this affixing of names is "just what monumental masons will do with tombstones if you let them, but he never allows this sort of thing. A window or a tombstone is not intended as an advertisement to a tradesman or an artist." We wonder what the good vicar would have said to that very plain advertising epitaph which states "Resigned unto the heavenly will His wife keeps on the business still"?

Gigantic Steel Ingot.

What is probably the largest steel ingot ever made was recently cast at Manchester, England. It weighed 120 tons and is being used in the manufacture of the low-pressure turbine motors for the new 70,000-h.p. turbine steamships of the Cunard Line. After the moulten steel was poured from the melting-furnace the huge mould-box was pushed under an immense hydraulic press having a hydraulic ram six feet in diameter and a working pressure of three tons per square inch. The ingot, while in a molten condition was subjected to the enormous pressure of 12,000 tons. This process made it homogeneous and sound throughout, and free from cracks and fissures.

..Legal..

CONTRIBUTED BY H. F. VON HAAST, M.A., LL.B.

RECENT DECISIONS.

LAND TRANSFER ACT. SUBMORTGAGE, TRANSFER OF MORTGAGES SUBJECT TO SUBMORTGAGE.—Section 94 of the Land Transfer Act 1885 provides that "In case of a mortgage by a mortgagee of his estate or interests in a mortgage, the person in whose favour such charge is created shall be deemed the transferee of such estate and interest, and shall have all rights and powers as such. . ." Mr. Laing submortgaged several mortgages to him to Mr. Govett and then transferred the mortgages to Mr Pott subject to the submortgage. Mr. Pott presented his transfer for registration, but the District Land Registrar refused to register it, on the ground that the submortgage operated as a transfer of the mortgages. HELD by Cooper, J., that the Registrar was right, and that as long as the submortgage was in existence the original mortgagee was devested of all the powers vested in him under the original mortgages, that the transfer could not be registered, that it was a question whether the transferee had the right to lodge a caveat, but that he could to some extent protect his rights by notice to the submortgagee. *In re Transfer Laing to Pott. IX Gaz. L.R.* 137.

CONTRACT. MONTH'S NOTICE. OBLIGATION TO PROVIDE WORKMAN WITH WORK.—Mr. Deomald was employed as a rollerman at Rosser & Sons' tinplate works in South Wales, was paid by piece work, and by the firm's rules was not to quit or be discharged from the works without giving or receiving 28 days' notice. Owing to the state of the trade Rosser & Sons could not run their works at profit, and on July 20th they closed the works. On 3rd August they gave Mr. Deomald notice to terminate his employment on 31st August. He sued them for damages for breach of an implied agreement to provide him with work to the expiration of his notice. They contended that there was no obligation on them to find him work if there was none for him to do, and also that it was a custom of the trade that the employers should be at liberty to close their works without notice, if there were a lack of orders at remunerative prices. HELD by the Court of Appeal that there was an implied undertaking by the employers to provide Mr Deomald with a reasonable amount of work as long as his employment lasted the measure of what was reasonable being the average amount of his earnings previous to the stoppage of the works, also that the custom was neither certain nor reasonable, and therefore not good. *Deomald v. Rosser and Sons* 1906 2 *K.D.* 728.

TRADE UNION. INDUCING WORKMEN TO BREAK CONTRACT WITH MASTERS. PRINCIPAL AND AGENT. On 29th June, 1902, at the instigation of certain officials of the Denaby and Cadeby branches of the Yorkshire Miners' Association, the men in the Denaby and Cadeby collieries struck abruptly, thereby unlawfully breaking contracts which required 14 days' notice to terminate them. The Council of the Association however refused to maintain the strike by giving strike pay, and sent representatives to the collieries who told the men that they had acted illegally in breaking their contracts and must return to work. The men would have resumed work but for the fact that the new contracts presented to them for signature embraced new regulations as to timbering issued by the Home Secretary which the men considered *ultra vires*. The strike continued and the Association then treated it as a case of lock-out, and granted strike pay down to February 1903, when a member of the Association obtained an injunction against any further grant of strike pay on the ground that the rules did not permit of this payment under the circumstances. The men in both collieries then submitted and the strike ended in March 1903. The Denaby and Cadeby Main Collieries Ltd then sued the association and others for damages for the loss sustained by the collieries. HELD by the House of Lords that the union was not liable, as those who had procured the strike had not been authorised by the rules or by the action of the union and that those who helped to maintain the strike by money and counsel were not liable to pay damages to the employers merely because losses had been thereby caused to the employers. *Denaby and Cadeby Main Collieries Limited v. Yorkshire Miners' Association* 1906 A.C. 384.

PARTNERSHIP. DEATH OF PARTNER. BUSINESS CARRIED ON BY SURVIVOR. Messrs Bourne and

Grove carried on business in partnership. On the death of a partner, his executors were entitled to his capital with 5 per cent. interest. Mr. Grove died on May 9, 1901. Mr. Bourne continued to carry on business in the partnership name until 3rd December 1902, when he died insolvent. At Grove's death the partnership account with Berwich and Co. was overdrawn to £6476. After Grove's death Bourne continued the account in the firm's name for the purpose of the business. On 7th February 1902 he deposited title deeds of real estate forming part of the partnership property, and signed a memorandum of deposit to secure the overdraft which then stood at £5088. Between Grove's death and 7th February 1902 Bourne had paid into the bank to the credit of the account £10,073 and had drawn out £8688. After 7th February 1902 further sums were paid in and drawn out, and at Bourne's death the overdraft stood at £4463 odd. After Bourne's death the business was sold by order of the Court, and the property, the subject of the equitable mortgage was represented by £5300. The Bank and Grove's executors each claimed priority. HELD by the Court of Appeal that a surviving partner, for the purpose of winding up the partnership business, may continue it and mortgage the partnership property, both real and personal, to secure a partnership debt, that the bankers were entitled, in the absence to the contrary, to assume that the surviving partner was continuing the account for the purpose of realisation, that therefore their mortgage was a valid security and took priority over the lien of the deceased partner's executors. *In re Bourne.* 1906, 2 *Ch.* 427.

LANDLORD AND TENANT. ROOM IN MILL LET WITH MACHINE. CONTRACT TO SUPPLY POWER TO WORK MACHINE.—Metcalfe & Co., occupiers of mills, let to Bentley Bros., for the purposes of their trade as mungo manufacturers, certain rooms at the mills with the rag machine therein, and agreed to supply power for working of the machine. The power was supplied by an engine, which had a defect in its governor, and in consequence ran at an excessive speed, and caused the drum of the rag machine to revolve at so high a rate of speed that it broke into pieces and killed Dews, one of Bentley & Co.'s workmen. Bentley & Co. had to pay his widow £202 as compensation and sued Metcalfe & Co. for this amount as damages. HELD by the Court of Appeal that the obligations of Metcalfe & Co did not arise as incidents of a demise of property, but arose out of a specific contract to sell and supply "power," and that there was an obligation upon them to see that the power supplied should be reasonably fit for the purpose for which it was to be supplied, that it was not so fit, and Bentley and Co. were therefore entitled to judgment. 1906 2 *K.B.* 548.

COMPANY. ENTITLED TO COMMENCE BUSINESS CONTRACTS.—Section 99 (3) of "The Companies Act 1903" provides that any contract made by a company before the date at which it is entitled to commence business shall be provisional only and shall not be binding on the company until that date, and on that date it shall become binding. The Otto Electrical Manufacturing Co (1905) Ltd was registered. Some shares were subscribed for in its memorandum of association, it issued a prospectus inviting the public to subscribe for its shares, but none of its capital was paid up and none of its shares were allotted. The company never had a registered office, was never entitled to commence business, and went into voluntary winding-up. In the liquidation Mr. Jenkins claimed that the company was indebted to him for sums paid for furnishing offices which he took for the company at the request of the directors. HELD by Buckley, J., that the section applied to all contracts of a company, whether preliminary or final or in the course of carrying on its business, that the word "provisional" means that the contract is to be read as if it contained a provision that it shall not be binding on the company unless and until the company becomes entitled to commence business. Mr. Jenkins' claim was therefore disallowed. *In re "Otto" Electrical Manufacturing Company* (1905) *Limited* 1906 2 *Ch* 390

TRADE MARK WORD HAVING REFERENCE TO CHARACTER OR QUALITY OF THE GOODS "CENTURY" The Printing Machinery Company made an application to register the word "Century" as a trade mark in respect of machinery The Comptroller-General refused the application on the ground that the word conveyed the idea that the article to which it was applied included all improvements that had been discovered up to date and therefore had reference to the character or quality of the goods. HELD by Farwell, J, on appeal to the Court that the word "Century" was a commendatory phrase and was therefore rightly refused registration. *Re The Printing Machinery Company's application* 23 *Reports of Patent Cases* 38

PASSING OFF. TRADE DESCRIPTION —Burberry's have for many years manufactured waterproof garments, which are known and sold in great quantities as "Burberry" and "Burberry Slip-on." Raper & Pulleyn, a firm of makers of waterproof articles, published the following advertisement in the Yorkshire papers —

BURBERRY'S SLIP-ON COATS.

Raper & Pulleyn have now added this Manufacture to their Mackintosh Department. In appearance the coats are identical with Burberry's, and the cloth is equal to theirs in every way, being treble-proofed. The Firm's reputation for Mackintoshes is itself a guarantee to purchasers. The price is Two guineas."

A farmer, reading the advertisement, and wishing to buy a coat of Burberry's, wrote to Raper and Pulleyn for "one of your Burberry Slip-on Coats at 42s" and received a garment manufactured by Raper & Pulleyn Burberry's brought an action against Raper & Pulleyn for an injunction to restrain passing off. Raper & Pulleyn contended that the terms "Burberry" and "Slip-on" did not indicate manufacture by Burberry's' but indicated a coat made by any manufacturer of a particular shape and of a particular class of cloth. HELD by Warrington, J., that the advertisement was calculated to deceive and actually did deceive, and an injunction was granted restraining Raper & Pulleyn from advertising or selling as "Burberry" or "Slip-on" goods not of Burberry's manufacture *Burberry's v. Raper & Pulleyn.* 23, *Reports of Patent Cases* 170.

HIGHWAY DEDICATION USER. An intention to dedicate land as a highway will not be presumed from mere user, if that user is explained by circumstances negativing such an intention A mortgagor cannot, without the consent of the mortgagee, dedicate as a highway part of the land the subject of the mortgage. *Resident of the Shire of Navacan v Lewston* 3. *Commonwealth L.R.* 846

Mining Meerschaum.

Meerschaum, although the name means "sea foam," is not a marine product, but is a soft, soap-like stone which is mined just as coal is mined Asia Minor is the principal seat of the industry. In its crude state, meerschaum is yellowish-white in colour, and a red clay coat or skin envelops the blocks taken from the mine These blocks bring from £7 to £40 a carload They are soft enough to be cut with a knife After being dried under the open sun in summer, or in a warm room in winter, the blocks are sorted into different grades They are then wrapped in cotton and packed in cases for the market The bulk of the product goes to Vienna, where the best pipe-makers are found In the estimation of the connoisseur meerschaum makes the lightest, cleanest smoking outfit

Mineral Wealth of Austria.

There are few if any countries in Europe that surpass Austria-Hungary in mineral wealth. Mining has been a favourite pursuit for centuries. Coal leads in production and value There are more than 225,000 persons employed in mines The annual output of rock salt is large there being no less than 10,000 persons engaged in this industry Of the other minerals gold, silver, and iron are produced in large quantities the exports running into millions of dollars annually Mineral springs are in abundance the waters from which are sold in nearly every country in the world

The Homeless Army of San Francisco.

Notwithstanding the progress made in the re-building of San Francisco, there are still 50 000 people living in tents It is impossible to fill the need for houses in the near future (says the *Morning Post*), for there is a lack of skilled artisans and the erection of building premises is monopolising the attention of the available labour at present.

According to the *Machinists' Monthly Journal* more men are killed in Alleghany County Pa every year than fell in many of the great battles of history Last year 9000 men were killed and injured in the steel and iron mills and blast furnaces In other mills the casualties numbered 4000 Railroad employees killed or injured in the county during the same year numbered 4300, making a grand total of 17,700 on the roll.

If a high ball is your first object in the morning, you will play a grounder before night.

Applications for Patents.

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

22055—J. I. Moss, Abbotsford, Vic. Window-fastener.
22056—A. Doxey, Seymour, Vic.: Testing dampness in wool
22057—H. J. Marks, Toowoomba, Queensland: Buffer-coupling
22058—United Shoe Machinery Company, Paterson, U.S.A.: Guides for inseam-sewing machine.
22059—United Shoe Machinery Company, Paterson, U S.A. Sewing-machine.
22060—United Shoe Machinery Company, Paterson, U S A. Machine for inserting and producing fasteners.
22061—E. B Killen, London, Eng.: Rubber tread or tire for wheel.
22062—E Burt, El Oro, Mexico: Filters for metal ores, slimes etc.
22063—G. Brennan, Petersham, N.S.W. Folding bedstead.
22064—A. A. Stephenson, C. P. Kelly, and J. B. Zander, Melbourne, Vic. Hydrocarbon-gas manufacture.
22065—W. Tyree, Nelson: Feeding hydrocarbons to incandescent burner.
22066—United Shoe Machinery Company, Paterson, U.S A Machine for inserting and producing fasteners
22067—United Shoe Machinery Company, Paterson, U S A Clicking-press.
22068—A. W. Chatfield, Auckland: Transplanting teeth
22069—P. Morice, Sydney, N S.W. Utilising force of sea-waves
22070—J. H. Crutchley, Kyeburn Protector for inner tubes of tires.
22071—S. G Roseman and J. Lock, Auckland: Bunching materials used in brush and broom making
22072—T. R. Christie, Dunedin Level inlets for drainage purposes.
22073—G. Dunne, Palmerston North, Device for cutting string.
22074—F L Davis, Auckland Sash window.
22075—S. B. Hunter, Moreland, Vic, and H. Wilson and E. J. Rigby, St. Kilda, Vic. Boring-appliance.
22076—C. Suttie, Waharoa, and M. H. Wynyard, Auckland Cleaning flax-fibre, etc
22077—T Read, Auckland Rubber heel-protector.
22078—C O. Marklund, Lowburn Ferry. Water-engine
22079—E. Shadgett, Kilbirnie Treating bananas for preparation of a food.
22080—G H. Saywell, Feilding Race-starter
22081—G G. Turri, Melbourne, Australia: Centrifugal cream-separator.
22082—G G Turri, Melbourne, Australia: Centrifugal cream-separator.
22083—G G. Turri, Melbourne, Australia. Centrifugal separator.
22084—G Stacy and G. A. Julius, Perth, W.A.: Voting-machine
22085—National Cash Register Company, Dayton, U S A Store service credit system apparatus
2086—W J Teese, Balaclava, Vic. Milking-apparatus
22087—F H Jackson, New Plymouth Gate.
22088—E McFee, Dunedin Desk.
22089—H A Cole, Wanganui Swing
22090—D N Wilson, Kumeroa Temperature-indicator
22091—S Allen, Killinchy Potato-digger.
22092—E Deister, Port Wayne, U S A. Ore-concentrator
22093—H Howell, London, Eng Incandescent burner
22094—G Schauli, London, Eng Electric cell
22095—W and H B Bell, Mosman, N S.W. Half-tone-printing block
22096—L W and R A Potier, Brisbane, Queensland Boot or shoe with attachable toe-cap.
22097—L W and R A Potier, Brisbane, Queensland Shoe or slipper with attachable insteps fronts
22098—C Burt, New Plymouth Room-heater.
22099—J T Hunter, Wellington Joint for earthenware pipe
22100—A Gunn, Wanganui Liquid washing-soap.
22101—H V Johansen, Auckland Explosive engine
22102—J A Yule, Gore Wrench for operating nuts of fish-plate bolts.
22103—H. Ellis, Geelong, Vic. Making bands of straw, etc, for binding sheaves.

22104—L. O. Hooker, Hawera: Perch-carrier.
22105—A. F. Golding and E. Campbell, Hobart, Tas.: Variable-speed pulley.
22106—S. Blackman, Christchurch: Plastering walls and ceilings.
22107—G. B. Holmes and A. D. Allen, Wellington. Trolley-head.
22108—J. E Friend, Annandale, N S.W. Rotary Engine.
22109—N. J. Hansen, Motu. Axe.
22110—M. Saunders, Pleasant Point. Sheep-shearing emery grinder.
22111—B. Ward, Tauranga Braces-attachment
22112—G. S. Fleming, Woodlands Wagon for carrying dishes.
22113—R. Allport and T. Normoyle, Hobart, Tas.: Finger-ring.
22114—W. G. Richardson, Auckland. Preparing flax-waste as a cattle-food.
22115—M. J. Hooper, N. Carlton, Vic. Oil-lamp burner.
22116—S. Dickens, Carlton, Vic. Musical instrument (mouth-organ).
22117—N. C. T. Harper, Durban, Natal. Manufacturing crystallised carbonate of soda.
22118—F. L. Bartelt, Bristol, Eng. Apparatus for washing linen.
22119—Cork Asphalt, Limited, London, Eng. Manufacture of building, road-making, etc., blocks
22120—Cork Asphalt, Limited, London, Eng. Making blocks from plastic material
22121—R. M. Lyons, Colac Bay Shaft-coupling for marine engine.
22122—C. Loomes, Wellington Testing wool from centre of bale.
22123—A. R. Randall, Wellington Chamber
22124—T. Fleming and W Lucena, Hobart, Tas. Clothes-line.
22125—J. P. Lynn, Kalgoorlie, W.A Electro-magnetic stamp battery
22126—R. Dietz, Albert Park, Vic., E Krieger, Adelaide, S.A., and C. E. B. Hart, St. Kilda, Vic. Seat-support for bicycle, etc
22127—A. Gillies, Heidelberg, Vic Teat-cup.
22128—H. R Lees, Daylesford, Vic Potato digger, bagger, etc
22129—R. J. Oldfield, Wellington Saw or cutting-tool.
22130—G. C. Palmer, Dannevirke: Knee-pad of riding-saddle.
22131—R. Bowman, Parramatta, N.S.W. Wearing strip for tire.
22132—J. Hammond, A. A Preuss, and T. H. Mutch, Johannesburg, Transvaal Concentrating alluvial deposit.
22133—F. Clutsam, Melbourne, Vic. Pianoforte, organ, etc
22134—H Quertier, Dunedin Apparatus for cleaning tram-rails, elevating spoil, etc
22135—R H Sollitt, Palmerston North Floor-cramp.
22136—C. Lindsay, Waianiwa: Draw-bar for traction-engine.
22137—A. Ashcroft and C Richardson, Auckland Electrically distilling and purifying gum.
22138—F A Rich, Auckland Tachometer
22139—W. F. J. Curnow, Aramoho Hose-coupling
22140—W. W Wilson, Christchurch Specific-gravity-estimating apparatus
22141—R. E Burke, Timaru Non-refillable bottle
22142—T. Lester and A C. Murray, Cromwell Asthma, bronchitis, etc, cure
22143—E. Hayes, Rough Ridge: Wire-splicer.
22144—D. Coghill, Waverley Pen-holder
22145—J. Brockbank, Auckland Piano, etc, tuning device
22146—W H. Bird, Wanganui Tire-cover
22147—A E Body, Christchurch Device for pulling up tramway-rails.
22148—J. K. Toshach, Christchurch Piano-attachment.
22149—J H. Davidson, Christchurch Tailors' or dressmakers' marking-device
22150—J. S. White & Co., Limited, E C Caint and A Forster, East Cowes, Isle of Wight, Eng Marine turbine
22151—P. Browne, Waikino Centrifugal thickening and separating machine.
22152—W. N. and W H. Maybury, Iona, Vic Grading and screening apparatus for potatoes, etc
22153—O. Riegelhuth, Ballarat, Vic Electrical signalling-device.
22154—R. J Fry, Wellington Power-gear
22155—United Shoe Machinery Company, Paterson U S.A Assembling parts of boots or shoes.
22156—United Shoe Machinery Company, Paterson, U.S.A Attaching heels to boots or shoes
22157—A. Tropenas, Montelimar, France Manufacture of steel
22158—A. W. Omond and W M Johnson, Bendigo, Vic. Siphon
22159—A. Gentzsch, Vienna, Austria Utilisation of waste rubber
22160—A. Gentzsch, Vienna, Austria Utilisation of waste rubber.
22161—J. Pettitt, Geelong, Vic.: Field, etc., gate.
22162—A. Storrie, Invercargill: Disc furrower.
22163—J. Macalister, Invercargill: Rotary-disc skimming or paring harrow
22164—F. B. Clapcott, Auckland: Billiard-board.
22165—Lamson Store Service Company, Limited, London, Eng, and Sydney, N.S.W.: Cash or parcel carrier.
22166—G. E. Humphries, Wellington. Scaffolding.
22167—J. H. Brown, Hawthorn, Vic. Revolving apparatus for cleaning metal surfaces.
22168—C. H. Gannaway, Wellington: Bowler's measure.
22169—E. Schmoll and C. J. Ellison, Wellington: Boot.
22170—H. W. Cleary, Dunedin. Pulley for motor-cycles.
22171—E. W. Barton-Wright and Q. Marino, London, Eng. Treatment of wood to be used in electro-chemical apparatus.
22172—F. J Darling, Roxburgh Concrete-mixer.
22173—R. Olds, Cromwell Fencing-standard.
22174—Gies Gear Company, Detroit, U.S.A.: Reversing-gear.
22175—A Waltho, Liscard, Eng. Stopper for bottles, electrical fittings, etc.
22176—W. Snee, W. Elizabeth, U S.A Wave-motor
22177—E. Howlett, Auckland Easy-chair.
22178—W. E Hughes, Wellington Linotype Machine
22179—R Beresford Newcastle-under-Lyme, Eng Wheel-rim for inflated tire
22180—W Fricker, South Woodford, Eng Paper-bag-making machine

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

THE PATENT LAWS AND THE MINISTER FOR LABOUR.

As the administration of the Patent Office devolves upon the Minister for Justice, one wonders why the Minister for Labour should have thought it necessary to make a pronouncement upon the Patent Laws A patent is the protection afforded by the State to an inventor to encourage his inventive faculty That is one of the conditions which must not be lost sight of Another set of conditions embraces the effect of the patent upon both Capital and Labour Thus it appears that as regards the conditions surrounding the status of a patent the department of Labour is interested only remotely The patent laws, it follows, ought not to be dealt with by any one who may be regarded as holding a brief for Labour. But that is Mr. Millar's position as the Minister for Labour

The Minister is reported to have said (to an interviewer at Waihi) that a patent ought within a certain time of sealing to be in manufacture, either directly by the inventor himself or by some one to whom he has given a license, failing which the patent should be forfeited, and that he has an amendment on the stocks of the patent law to that effect

Now the Patent Act (1889) already provides for the license very clearly Section 33 is as follows —

Compulsory License —" If on the petition of any person interested it is proved to the Governor that by reason of the default of a patentee to grant licenses on reasonable terms,

(a) the patent is not worked in the colony, or
(b) the reasonable requirements of the public with respect to the invention can not be supplied, or
(c) any person is prevented from working or using to the best advantage an invention of which he is possessed,

the Governor may order the patentee to grant licenses on such terms as to the amount of royalties, security for payment or otherwise, as the Governor, having regard to the nature of the invention and as the circumstances of the case may seem just, and any such order may be enforced by *mandamus* "

The Act of 1883 provided (section 22) that all patentees must "distinctly use and practise" their inventions and permitted them (subsection 4 of the same section) to grant licenses to others to do so Under the old law there was therefore a working as well as a licensing condition When the law was amended in 1889 the first of these was discarded because experience had demonstrated the hardship to inventors of the principle of compulsory working In this respect New Zealand does not stand alone At the last meeting of the International Association for the Protection of Industrial Property, held at Milan on the 14th and 15th September last, a resolution was carried advocating the abolition of the working clause in the conditions of all patents, and advising the substitution of the compulsory license system; thus suppressing forfeiture for non-working. The Convention knew that the working clause in many instances led to technical working only, and therefore moved to lay it aside as an unnecessary tax on the inventor, while saving all interests by recommending the Compulsory license system.

In Canada, the country to which the Minister for Labour is reported to have referred in support of his proposal, the requirements of the law can be met by a technical working. In the United States there is no working clause in the Patent Law; neither is there in the law of the Australian Commonwealth, the latest enacted of all the patent laws. It may be added that the latest of the up-to-date nations, Japan, has after examination into all the patent laws of the world, adopted the American.

In the face of this universal experience the proposals of the Minister for Labour may be regarded as distinctly reactionary. In Canada the terms of the license are submitted to arbitration in the event of failure of the parties to agree, and it is the same with the British patent law. If the Minister were proposing to substitute the arbitration principle for the settlement by the Governor one could have understood his zeal in the matter of reform. But what he can see to recommend the return to an unnecessary and vexatious technical working, instead of the present certainty of true working whenever needful with absolute protection to all interests both of inventor and public, it is impossible to understand.

There is much more to be said on this subject, but as the news of the Ministerial intention only reaches us as we are going to press, we must postpone the saying of it till next month. For the present we take the opportunity of protesting on behalf of inventors against the conclusions arrived at by the Minister, and of expressing our hope that now that his attention has been drawn to the other side of the question, which he does not appear to be at all familiar with, he will reconsider the matter in the judicial and historical spirit so necessary to a satisfactory understanding of the subject.

A Hungarian chemist has produced a fluid optical lens at a moderate cost. The largest lens used for astronomical work has hitherto cost hundreds of pounds and taken several years to produce. A few weeks time and an expenditure of £100 is all that is now required

ENGINES, MACHINERY, APPLIANCES,
&c., WANTED AND FOR SALE.

FOR SALE — Two Astronomical Telescopes. One 3½ in. and one 6in. (Cook & Son). Apply to F. Hitchings, Sydenham Observatory.

WANTED to sell two small Dynamos, one of 6 amperes, the other 12. Both will work at any voltage up to 50. Apply to "X," PROGRESS Office.

PICTURE FRAMING executed in all the latest and most up-to-date styles; Antique Brown Stained Moulding a speciality. Write for our illustrated catalogue. R. & E. Tingey & Co., Ltd., Wellington.

MOTOR CARS.

THE GARAGE, 81 Manners St. Motor Cars for Sale: Beeston Humber, 6½ h.p., £225 terms; new Covert chainless, any trial, £215; Winton Touring Car, 4 seat, £175. Cars cleaned and stabled from 2/6 per week. Nicholls, The Garage, 81 Manners St., Wellington.

WANTED Partner, with capital, for Branch Business (Engineering). Previous experience not essential. Interest and salary guaranteed "Guarantor," c/o PROGRESS, Wellington.

WALTER GEE & COMPANY—Manufacturers of Self-coiling Revolving Shutters and Venetian and Holland Blinds of every description. Factory: Quin St., off Dixon St., Wellington.

PURCHASERS of real estate, either houses, sections or farms, should apply to H. Ernest Leighton, 9 Featherston St., or Hutt, who has the finest selection on the market.

WANTED KNOWN—All Classes of Electro-Plating and Engraving executed at Chas. H. Williams & Sons, 85 Willis street, Wellington. We are not experimenters but have been established over 30 years. Write for Price List.

REXETTE TRI-CAR FOR SALE, Low Price. 5 h.p., water cooled, De Dion pattern engine; two speeds, handsomely upholstered, seat two, climb any hills. Herbert H. Smith, Farish St., Wellington.

WANTED—Everyone to know that they can have their old electroplate ware made equal to new; Bedsteads relacquered, Fenders, Lamps, Screens, etc., antique coppered; Bicycle and Coach-builder's work, Nickel or Brass Plated; Electro-plating of all descriptions executed at the Sterling Electro-Plating Co., 34 Lower Cuba street, Wellington.

Canterbury Builders

If you require New Zealand or Foreign Timbers in any quantity, Picton Cement, Stone or Hydraulic Lime, T.T. or O.K. Stone, Fancy, or other Bricks, Pipes, etc., let us quote you.

We will undertake to deliver with the least possible delay, and furnish only the best obtainable always.

PROMPTITUDE! SATISFACTION!

REESE & BUDD,
Colombo and St. Asaph Streets, CHRISTCHURCH.

PRINTING

Fine Catalogue Work
Our Specialty.

Progress Printing Co.
Limited,
96 Cuba Street, Wellington.

Telephone 2234. *Printers of "Progress."*

MOLLER & YOUNG
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STENCIL & LETTER CUTTERS
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TELEPHONE 1677 G.P.O. BOX 333
COR MANCHESTER & WORCESTER STS
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DO YOU KNOW,

MR. ADVERTISER, how many different sorts of advertising there are?

Probably always looked on advertising as all the same, eh? But it is not. There are three great classes of advertising.

Perhaps the reason yours is not so effective as you would like, is because you are pursuing methods belonging, by right, to an altogether different kind of proposition.

Care to talk it over? No obligation.

Ronald S. Badger,
Advertising Agency. CHRISTCHURCH.

MIRACULUM.

A SURE Puncture stop for Pneumatic Tyres on bicycles, motor Cycles and motor cars. **MIRACULUM** preserves rubber. **MIRACULUM** does not affect resiliency of tyres and does not solidify in the tubes. We **guarantee** all tubes purchased from us free from all harm from the effects of **MIRACULUM**. Representatives of **MIRACULUM** are travelling New Zealand demonstrating its marvellous powers.

Write for Booklet and Testimonials to:

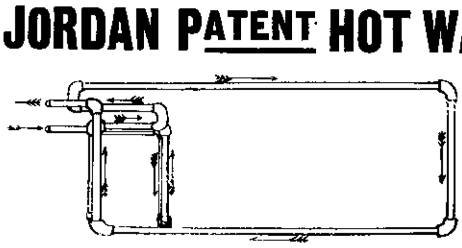
MIRACULUM CORPORATION, Ltd.,
Worcester Street - - - - - CHRISTCHURCH.

F. B. HUGHES,
New Coronation Studio.
2 VICTORIA SQUARE, CHRISTCHURCH.

Specialist in Racing, Trotting, and Prize Stock, also in Flashlight Photography.

A Motor always ready for Country Engagements.

JORDAN PATENT HOT WATER BOILER.



203 Gloucester St., Christchurch, N.Z.

MR. JORDAN, Nov. 2, 1906.

Dear Sir,—In answer to your enquiry as to the efficiency of your Patent Tubular Boiler as a heater for a domestic hot-water service, we beg to state that we have given it a thorough trial, and are satisfied that for economy of fuel and rapidity of heating there is nothing in use to equal it.

Yours faithfully, COLLINS & HARMAN.

Sole Agents **HAMMON & BLACKMORE,**
80 Lower High Street, CHRISTCHURCH. PLUMBERS.

Highest Award at St. Louis Exposition, 1904.

Nobel's Explosives

GLASGOW,

Gained the Highest Award,

THE "GRAND PRIX,"

For Excellence of Manufactures.

Cartridges loaded with Nobel's Sporting BALLISTITE and "EMPIRE" SMOKELESS POWDERS are Unequalled.

USED BY SPORTSMEN ALL OVER THE WORLD.

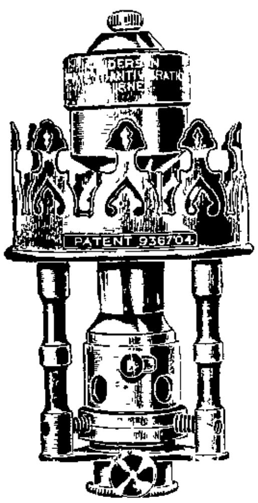
WHOLESALE AGENTS:

W. M. BANNATYNE & CO., Ltd.,
WELLINGTON.

THE "ANDERSON" ANTI-VIBRATION
Incandescent Gas Burner.

Patented in all Countries.

THE CHEAPEST AND MOST SCIENTIFICALLY DESIGNED ANTI-VIBRATION BURNER ON THE MARKET.



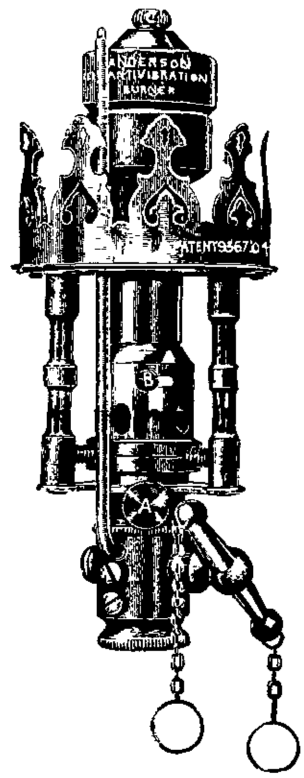
Ordinary Anti-Vibration Burner.

PROLONGS THE LIFE OF MANTLES FROM 8 TO 15 TIMES THEIR PRESENT DURABILITY.

British Manufactured Goods.

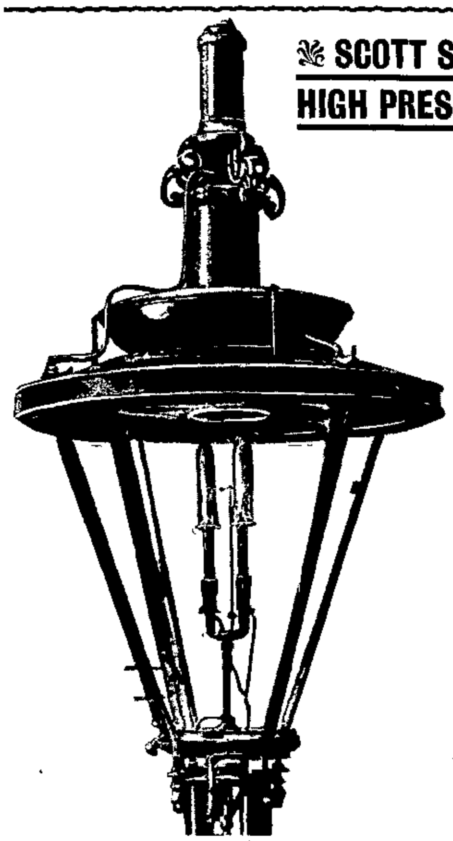
ADVANTAGES.

- DOES NOT OBSTRUCT THE DOWNWARD LIGHT.
- PATENT ANTI-VIBRATOR AND BURNER COMBINED.
- BURNER EASILY AND INSTANTLY DETACHED FROM NIPPLE.
- DOES NOT LIGHT BACK.
- FREE FROM ROARING.
- MANTLE ROD SECURELY HELD FAST OR INSTANTLY RELEASED IF BROKEN.
- STEATITE RING FITTED TO EVERY BURNER HEAD.
- EVERY BURNER FITTED WITH A STANDARDISED BRASS NIPPLE.



Complete Anti-Vibration Burner.

For Street Lighting, Railway Stations, Factories, Workshops, Warehouses, Churches, Licensed Houses, Shops, and Household Use.



TYPE OF DOUBLE BURNER LAMP. 1,200 c.p. Consumes 28ft. per hour.

SCOTT SNELL HIGH PRESSURE Gas Lamp.

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

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

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

COMPARED WITH COMPRESSING SYSTEMS

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

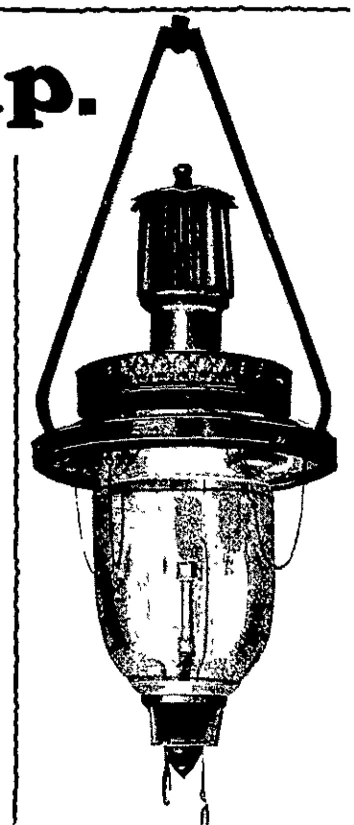
A street may be transformed in a single day by installing Scott Snell Lamps, **without disturbing street surface or traffic.**

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

COMPOSITE BODY LAMPS.

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

Guaranteed gas consumption, 15ft. per hour.



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

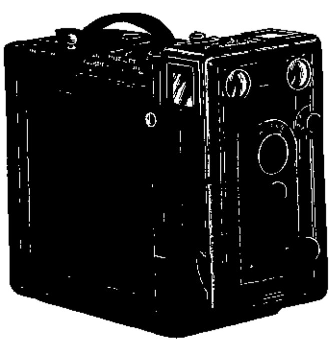
SOLE LICENSEES AND MANUFACTURERS :

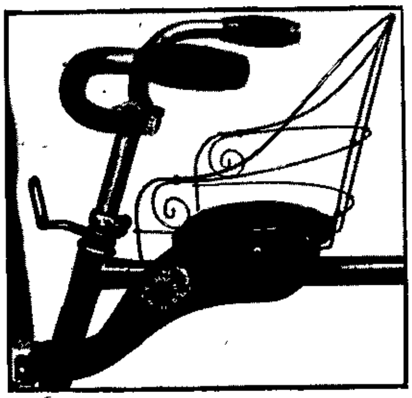
D. ANDERSON & CO., Ltd.,

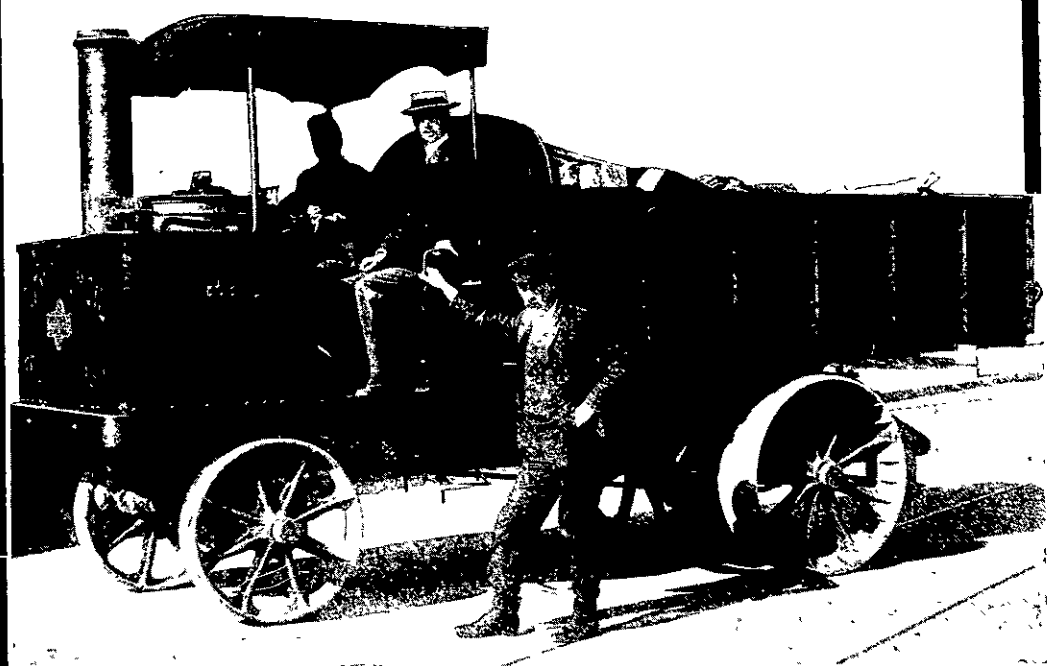
Lighting Engineers and Contractors,

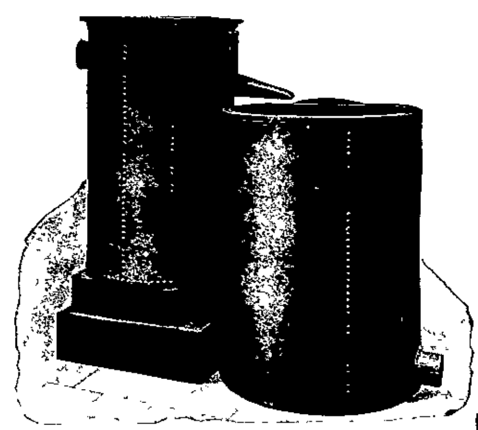
TELEGRAMS: "DACOLIGHT, LONDON."

73 Farringdon Road, LONDON, E.C.









The New Zealand International Exhibition

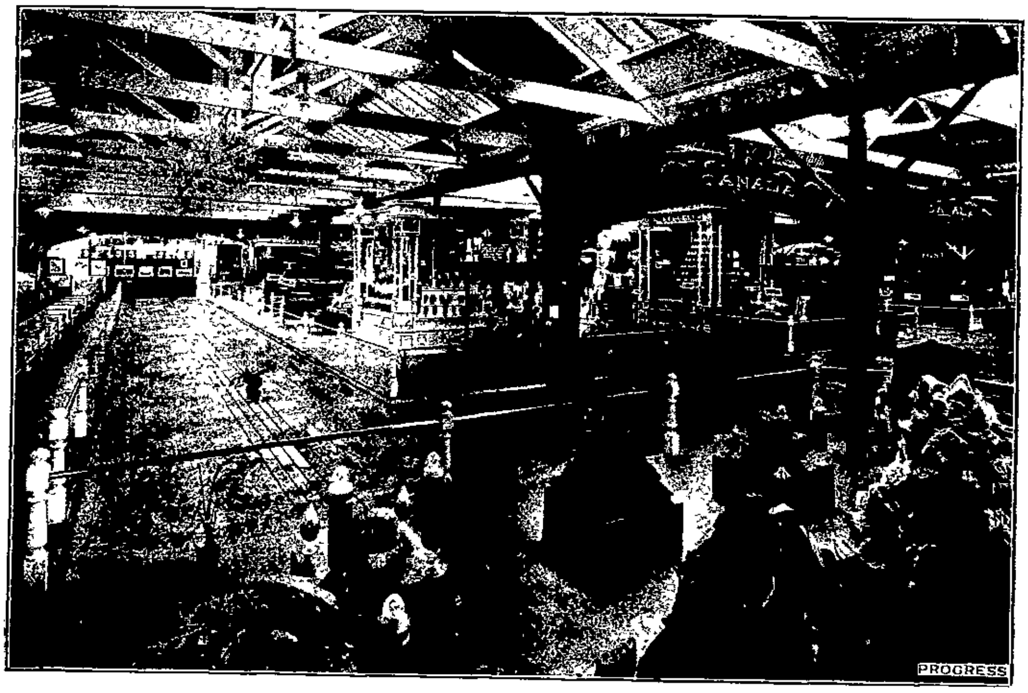
1906—1907

IN our issue of December last we described the exterior chiefly and had illustrations of the main avenues. In the present number we devote our space mainly to the interior, giving special prominence to the Canadian and New South Wales Courts, with particulars of some of the principal exhibits.

Visitors are struck chiefly on entering the building first with the hall, to which access is given by the fine vestibule. The hall, seventy-one feet square, is remarkable for its delicate colouring and the elegance of the ornamentation, and is lighted by a noble dome which rises to a height of ninety feet. Leading from the hall are the suites of rooms set apart for the accommodation of the Governor and the Ministers of the Crown. Comfortable they are and well designed, and there is also a room for the general manager North and south of the hall are the main avenues, in which are to be seen the exhibits of the private exhibitors. Of these we published comprehensive illustrations last month The Canadian and the New South Wales Courts never fail to strike the eye of the visitor, so well designed are they, so well furnished, and so well kept.

On the west of the building, and running its entire length, is the big corridor, which has the air of a hall, so large is it and of such fine proportion At the end of this corridor is the great fernery, which is seen through large glass windows, and it has a very pleasant effect even at a distance

It is evident at the first glance over the machinery hall that judicious use of many styles has been made by the designer. It has been well said, however, that throughout the design complete freedom from conventionality has been maintained. The main entrance of this hall is under the immense semi-circular roof spanning the great bay. The roof beams are semi-circular, and have been constructed on the laminated principle; the clear span of eighty feet is the widest spanned by any round wooden roof in the world, the famous roof of similar character in Bayonne, France, having only a clear span of sixty-five feet.

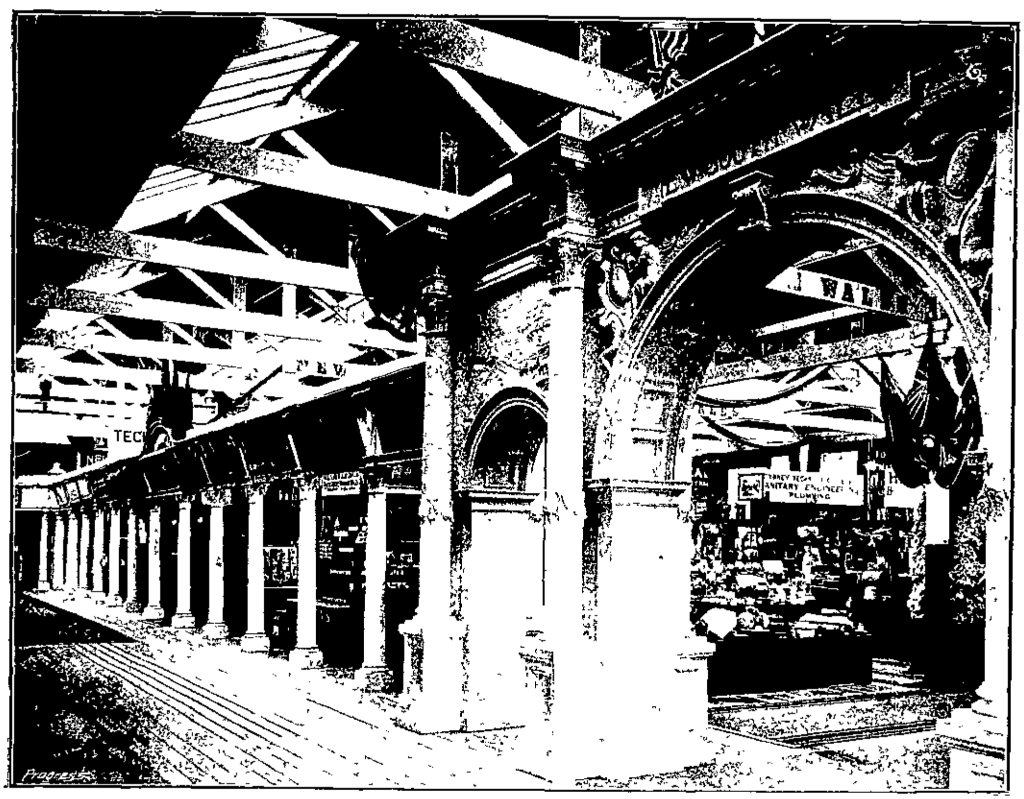


THE CANADIAN COURT

The attendance to date has been highly satisfactory. Since the day of opening upwards of 500,000 people have passed through the entrance gates, and it is confidently foretold by the management that fully 2,000,000 visitors will have attended the Exhibition ere the gates are closed on 15th April next.

Messrs. Lucas Bros. & Co., Ltd.

THE general view of Messrs Lucas's stand savours of engineering work, from the cast-iron columns and hand rails with panels (which are all their own design and manufacture) at the front, to the engine and boiler and sausage machine, including steam jacket pan and sausage fillers and brine pumps, which in themselves are a compact butchers' line of machinery. These latter Messrs. Lucas Bros. have been making and supplying to Australasian butchers for the last twenty years. The multitubular boiler, with engine attached, is a favourite size and style, as also is the No. 3 "Premier" silent meat-cutting machine. This machine cuts 30 lbs. of meat in 2½ minutes, and has several advantages over the ordinary run of machines, viz, finer knives, requires less speed and, therefore, gives less chance of the meat's fermentation through over-heating. The steam jacket pan is of standard size, and is fitted with strainer and special flanged bottom to allow of complete drainage of dripping when rendering. It is especially suitable for handling any quantity of fat, the fillers being No. 2 size Five sizes of fillers are stocked by Messrs. Lucas Bros., including horizontal and vertical. The brine pumps are in great demand in the summer season, as they enable the butchers to inject brine into the heart of the meat, instead of soaking meat in brine for a longer period; this results in a great saving of time in the pickling process. The brick-and-tile machine exhibited is of the medium size, and the makers have sent a goodly number to all parts of the colony. It is a hand machine capable of dealing with the most plastic or tenacious clay, and turns out the ordinary brick, or a twelve-inch tile of the various patterns shown, with dies conforming to the Municipal and Drainage requisites. They are represented by gulley gratings and deep sewer manholes and ventilators, also flap valves for storm-water sewers, etc The builders' ironwork manufactured by Messrs. Lucas is represented by a variety of castings. Brass and gun-metal and casting in various alloys are lines which are included in their general work



THE NEW SOUTH WALES COURT.

Messrs. Southworth & Peters.

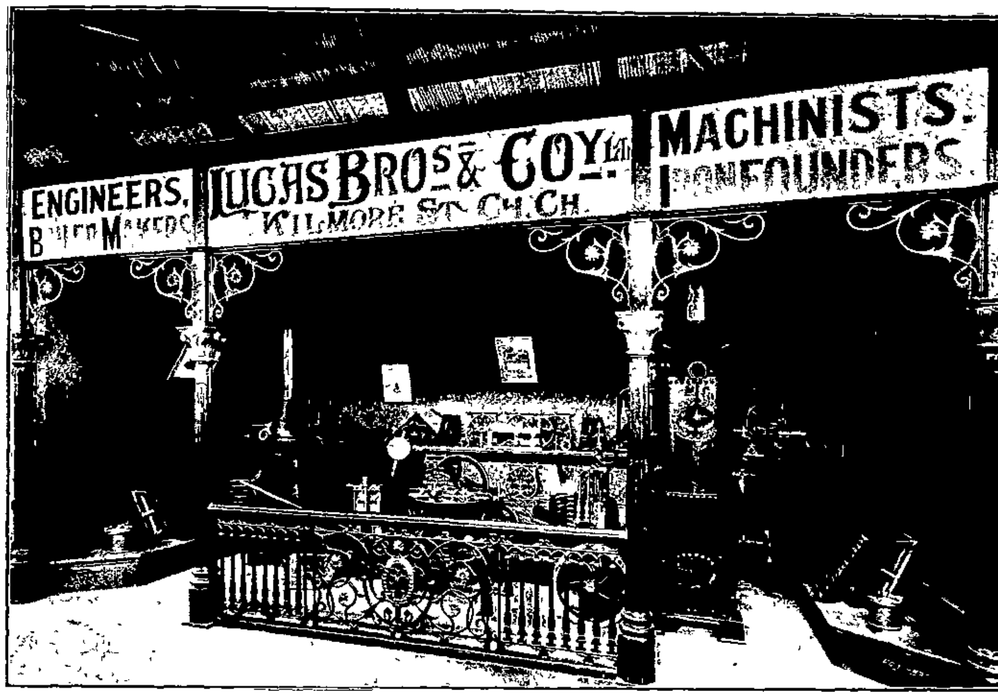
Our illustration shows an exceptionally fine example of airtight casemaking executed by Messrs. Southworth & Peters, a rising and progressive firm who, while experts in all classes of cabinet, shopfitting and joinery work, are specialists in dust-proof show-cases. The dimensions of the show-case, which occupies a good position in the South wing, are 7 ft. by 5 ft 6in by 8 ft. in height, with airtight mirror-door at back. The three slides and top are of best British plate glass, while the case is built of mahogany having three-quarter corner bars with Corinthian capitals, and polished black. During the fourteen months in business the firm have had twice to enlarge their factory, and have just put down the latest and most up-to-date machinery for this class of work.

The Union Company.

It is difficult to associate in one's mind large undertakings with small places, and yet some great industries are carried on in spots whose existence is only known through their being the birth place of some great article of commerce. This thought naturally occurs to one when visiting the court of the Union Steam Ship Company in the Exhibition.

It is only just over thirty years ago since this Company began its operations in Dunedin with a fleet of three steamers whose gross tonnage aggregated 724 tons, and whose round of services covered no great distance; and now its flag is to be seen flying in great centres of commerce in Asia, America and Australasia. Its steamers have carried troops to South Africa, and have been stopped by Russians in the eastern seas. It was the first Company to build steamers of steel,—it was the pioneer of electric lighting in the colonies, and to its order was built the first ocean steamer fitted with turbine machinery.

To enumerate its regular services is to make one sigh to use them Visions of passing delicious days in the sunshine of the South Sea Islands, surrounded by all that is beautiful in nature and interesting in uncivilised men, cross our view as we read that every four weeks you can make trips in splendid steamers fitted with up-to-date luxuries to the fair archipelago of Fiji—the seductive groups of Samoa and Tonga—and the enchanting Islands of Tahiti and Raratonga. Of its fast growing fleet—at present comprising sixty steamers—the pick run services every few days to Australia and Tasmania, and a large number trade between Australia and Tasmania alone. On the coast of New Zealand—east and west—the red funnel of their boats is to be seen in every port nearly every day, and every month steamers under their management carry the mails from Sydney to Vancouver, calling at Brisbane, Fiji and Honolulu on the way. The opportunity of comparing the fjords of Norway with the famous West Coast Sounds of New Zealand is given by their annual summer steamer cruises to that wonderful region. In their handsome court at the Exhibition are to be seen beautiful models of their splendid steamers, and a glance at these in our illustration will make one really understand why the boats of the Union Company of New Zealand enjoy the reputation they do for safety, comfort, and speed. The Company have five new steamers building at Home at the present time—one of which, a fast turbine steamer of large capacity, is to run a ferry service between Lyttelton and Wellington, bridging the two islands of the colony in a few hours.



LUCAS BROS. STALL IS A NEAT AND EFFECTIVE DISPLAY.

Messrs. J. Wilson & Co., Ltd.

The manufacture of concrete and hydraulic lime, which is now carried on very largely in the colony, forms the greater part of Messrs. Wilson's business. The firm shows a specimen of a ferro-concrete pile used in the Auckland wharf by the Ferro-Concrete Co. of Australasia, and which is made of Messrs. Wilson's "Star" Portland cement; while the exhibits generally demonstrate the strength that is possible of attainment with reinforced concrete. There is a section of the Rachael bath at Rotorua, made in 1898 of four parts Rotorua pumice, two parts pumice sand, and one part Wilson's Portland cement. There are also flooring sections for all purposes shown, together with the different methods of laying floors so as to obtain the best results at a minimum outlay. Blocks of concrete made from pure clay, pumice, scoria, river shingle, broken metal, shell coral from Tonga, and coke breeze are placed prominently in Messrs. Wilson's section, as also are some exhibits of raw material indicating the various stages in the making of Portland cement.

The works at Warkworth, near Auckland, have a capacity of 20,000 tons of Portland cement per annum, which can be rapidly extended when required, in addition to large quantities of hydraulic lime—said to be the best quality obtainable. The manufacture of Portland cement carried out at Warkworth, commences with the extraction of the Blue Lias stone from a quarry adjacent to the works. After quarrying the raw materials are mixed in the required proportions, the whole is dried and reduced to a very fine powder, after which it is conveyed to hoppers and fed automatically into the rotary kilns. The coal used in the process is also ground to very fine powder and fed by means of a blast into furnaces, the ignition being instantaneous and complete These furnaces revolve slowly, and the incineration of the powder is very thorough The mixture next comes out in the form of clinker, and is passed through a cooling tube and conveyed to more hoppers to wait for the final grinding process, which is effected by a tube mill, where it is so finely ground that it is possible to pass all but about 5 % through a sieve of 10,000 meshes to the sq. in The finished Portland cement is deposited into bins and allowed to mature before being put on the market. When bagged and delivered to customers it is ready for any work in which the highest efficiency of material is required. Messrs. J. Wilson & Co. make the claim that for fineness and tensile strength, and uniformity of quality, their "Star" brand Portland cement is equal to the best imported article. Tons of "Star" cement have been used in the ferro-concrete works at the Auckland Railway Wharf. Part of the Auckland Harbour Board's large scheme for the improved wharfage accommodation is to be carried out with Messrs. Wilson's Portland cement.

The Company also produce agricultural lime at Tekuiti in the King Country, and are breaking metal for roads.

Messrs. Andrews & Beaven, Ltd.

Messrs Andrews & Beaven, Ltd., of the Canterbury Machine Works, Christchurch, make a very good representative exhibition of their specialities.

The line of chaffcutters as made by them includes some hundred different combinations, and it is manifestly impossible to show even a fraction of their different machines They therefore show the largest, the "Empire," and the smallest, a No 1 "Zealandia" The "Empire" is fitted with every possible labour-saving improvement that the experience of 27 years can suggest. The "Zealandia" is the smallest machine the firm make.

Mssrs. Andrews & Beaven were the original makers of the screw press Self-Bagging Chaffcutter, making them eight years before any other firm. Theirs are the standard machines for the purpose in Australasia.

The largest of the two chaffcutters shown, the "Empire," is the outcome of the experience, not only of the firm as manufacturers, but of 2000 customers working their machines—every part of the machine being the best adaptation of the engineer's art to the purpose required. The machine is very strongly constructed of the timbers that have been found best adapted for the purpose required of them; New Zealand, Australia, and America are all represented, the best being selected from each country.

THE UNION S.S. CO. SHOW MODELS OF THEIR STEAMSHIPS, AND THE EXHIBIT IS CONSIDERED TO BE ONE OF THE BEST IN THE NAUTICAL SECTION.

THE PRODUCTS OF JOHN WILSON AND CO.'S WORKS AT WARKWORTH, NEAR AUCKLAND.

The straw first falls on to a travelling feed web which brings it up to the first pair of feed rolls, which are placed wide apart to easily receive the straw or sheaves, but partially compress it and pass it on to another set of feed rolls, which compress it as hard as it is possible; thus it is cut to regular length by the revolving knife wheel. The work is nearly automatic, the feeder's work being only about one quarter of that required with a single-roller machine not fitted with web feed. Two knife wheels are provided with this machine, so that one is always in the hands of the engine driver having the knifes sharpened, whilst the other is cutting—a stoppage of three minutes only being necessary to change the wheels. The riddles and elevator in the machine are much larger than usually used in chaffcutters. The bagging presses are actuated by a drive chain, which cannot slip, and are fitted with improved brakes which accurately gauge the quantity of chaff placed in each bag, so that all are pressed equally. The machine is mounted on very large and strong travelling wheels with springs, so that little vibration is passed on to the machine even when being hauled by a traction engine running at eight miles an hour. This machine has cut 52 tons in a day, and has cut as much as 7 tons in the hour. The small farmer's machine shown is a strong simple machine, capable of being worked by hand at a pinch, or by a horse gear, or by the same engine that drives the milking machine.

The firm do a large business in crushing machines for grain, and show a fine No. A4 Crusher well made and capable of doing a large amount of work.

Seed-cleaning machinery is the other speciality that Andrews & Beaven have made peculiarly their own. They make a very large series of machines for this purpose, suitable for merchants, seedsmen, seed growers, malsters and farmers but only have space to show one, the "Universal," one of their latest patents. In this they have striven to make a machine that is capable of treating all kinds of seeds and making a perfect sample The machine is fitted with two large exhaust fans for removing all dust and light impurities; a very accommodating feeding device which allows a wide range of seeds to be equally fed into the machine with regularity; a scalping riddle which removes all straws, string and material likely to impede the action of the other sieves. The six other sieves are arranged in two separate frames which, in working, balance one another so that there is an absence of vibration, and are further arranged so that once an impurity seed has been caught and separated from the good seed there is no chance for it to go back on to the sieves again; the six sieves allow the separations to be made with the least possible loss of good seed. Brushes working under the sieves keep the meshes of the sieves always clear, and do their full duty at all times. A very efficient hummeler, or polisher, is fitted to the machine; this is fitted with three separate kinds of attachments, which enable oats to be clipped, barley to be awned, fog to be shelled, or clover to be polished without there being the slightest chance of any damage to the seed. This machine, when fitted with sieves suitable to the particular seed being cleaned, will effectually clean all the principal grain and seeds grown in New Zealand and Australia, with the exception of hair grass and tares. For these cellular cylinders can be provided which, at a small extra cost will effectually deal with these impurities. The machine is one suitable for large farmers, Co-operative Farmers Associations, and merchants who have to handle a large number of different kinds of seeds.

As sole Agents in New Zealand for Messrs. Blackstone & Co. Messrs. Andrews & Beaven exhibit this firm's well-known oil engines. Their engines have now been in use three years in the colony, and on all hands are well spoken of Farmers like them because they are easy to understand and there are no electrical connections to trouble them; contractors like them because they are very economical in oil; shearers like them because they run very steadily and do not jar the hand, milking-machine owners like them because they are efficient and always to be depended upon; sawmillers like the great variation in speed the governor allows for.

As agents for Messrs Bamford & Sons, of Uttoxeter, this firm exhibit four machines for grinding and crushing all kinds of seed and grain These machines are very faithfully built, are heavy in spindles and bearings, and are well balanced so as to run very steadily at all speeds. The grinding discs are interchangeable and are each made with two cutting surfaces, so that when one cutting surface is worn, it can be turned round and a new surface presented. The grinding is done in a series of cones approaching nearer to each other as their surface increases, the grain is broken up gradually, and as it becomes finer there is more surface to operate on it, the meal is thus kept cool and the power is little compared with the work done. These mills present many advantages over mill stones, and Bamford's grinders are now to be found in most oatmeal mills in New Zealand, as well as in produce merchants' stores, spice merchants', calf-meal makers', farmers' barns, etc. The exhibit is shown off to good advantage, being arranged on a series of platforms rising one above the other.

Wilson's Patent Swingle-Tree Irons.

ALL farmers have experienced trouble through the irons on their swingle-trees becoming loose and falling off. This, of course, generally means a loss of time as the nearest place where the trees can be repaired may be a mile or so from where a farmer is working. Wilson's patent swingle-tree irons are said to be an improvement on the old order of things, inasmuch as they are very simple and easily adjustable, and can, by moving the centre iron along the tree, be made into an equalising bar at a short notice In event of a brake on the swingle-tree, Wilson's irons can in a few minutes be taken off and fixed to any suitable place roughly trimmed to shape with an axe. The irons are made of malleable cast iron, and are strong and light; and the maximum thickness of the metal is regulated so as to fall where the most strength is required. As Wilson's irons are extremely portable it is possible to carry an extra iron or so without any trouble. The irons are on view at Messrs. Baldwin & Rayward's stand in the Machinery Hall.

Our representative recently called upon Mr. Geo. Croft, organ builder, Auckland, who built the organ for the last Wellington Exhibition, and also for the Auckland Exhibition of 1899, the latter being now in regular use at the Choral Hall. At the factory, which is well equipped with machinery, a new large two-manual organ is building for St. Benedicts' Roman Catholic church, Auckland.

The quality of the material and the appearance of Mr Croft's workmanship bear strict comparison with the best English work. Our representative, who called, a few months back, upon some of the best English firms, gives this opinion with very great pleasure, and he further states that many English builders do not hesitate to get rid of a goodly number of their second-class instruments to colonial customers, even to the extent of supplying German material as English. The idea that organs with pneumatic action must of necessity be imported is quite fallacious, as Mr. Croft rarely builds an organ upon the old tracker system. Mr. Croft believes in employing the most proficient assistance upon which he can depend, and this, coupled with sound judgment and strict supervision on his part, will certainly bring to him and his assistants that support which the intelligent colonial free from the bias which often characterises new arrivals from the old world, so willingly gives and maintains.

THE AGRICULTURAL MACHINERY EXHIBITED BY ANDREWS AND BEAVEN LTD.

Mr. R. P. M. Manning.

MR R. P. M Manning, engineer and importer, 151 Cashel street, Christchurch, has several interesting exhibits.

The Dey Time Register is on a prominent stand marked on official plan, Block E No. 17 just opposite the South Canterbury court. This machine is a perfect automatic Time Recorder and Cost Keeper, and is a Money Saver It has already been extensively adopted by numerous progressive firms in the colony. Employers of labour will find this machine indispensable, and they should inspect the "Dey," and have its capabilities explained to them

The Davey Paxman suction gas-producer plants and engines, made by the world-famous firm, are in the very highest class. By the time this is in print, the most powerful plant yet erected in Christchurch district will be running at the Government Railway workshops Addington The plant is rated at 50 B H P using suction gas, but with town gas the engine develops 70 B H.P. In view of the enormous possibilities of this power, a few particulars are of interest The cylinder is 16″ bore x 21″ stroke. Two fly-wheels each7 ft. dia. The crank shaft is balanced by weights attached to crank webs, thus avoiding unequal strains in shaft and fly-wheels. A very good feature is the sensitive governor, which automatically regulates the gas consumption strictly in accordance with the power required, thus obtaining the greatest economy in fuel consumption combined with reliability of working Electric ignition is provided, and starting is easily effected by an automatic compressed-air starter.

The producer is extremely simple, the whole operation consisting of drawing air and steam in certain proportions through a deep fire of coke. The gas thus formed is next drawn through a cleaner and scrubber, and thence to the engine The plant will develop full power on the remarkably low consumption of 1¼ lbs of coke per b h p. hour

The Leyland steam wagons and petrol omnibuses are manufactured by the Lancashire Steam Motor Co , Ltd , for whom Mr. Manning is agent. Leyland wagons won first prize and gold medal in the Liverpool trials of '98, and have remained foremost ever since. The vehicles have won two £100 prizes, and nine gold and silver medals, and over one hundred repeat orders have been received.

Leyland omnibuses are also in the highest class the firm's extensive experience enabling them to keep in the forefront as regards improvements in design and construction. Motor tower wagons for electric tramway work also are manufactured.

Intending purchasers of motor cars would also be well advised to obtain particulars from Mr. Manning regarding Jackson petrol cars and Turner-Miesse steam cars, which are specially recommended. With regard to the latter *Autocar* says "The finest specimen of a steam-propelled car which has yet come under our notice, and an achievement upon which the makers may be congratulated."

A SPECIMEN SHOWCASE EXHIBITED BY SOUTHWORTH AND PETERS

THE ARTISTIC EXHIBIT OF BRADLEY BROS. IN THE NORTH WING

The car uses ordinary kerosene, is of British manufacture, has all the good points of petrol cars, including reliability, power, ease of control, flexibility, cheapness of upkeep and running, silence and simplicity. In addition, there is no changing of gears, no clutch, carburetter nor electricity.

They Know How to Advertise.

WE all had an idea before that the American advertiser is wonderfully enterprising and effective, but it is just as well to be reminded of it again, and so we turn to what Mr. Charles E. Hands says in the *Daily Mail* as the result of his observation in the States The Americans, he says, are generally better talkers than we are. They talk more, and their talk is more earnest, direct, and forcible than ours. Perhaps that is partly why their advertising is more copious and convincing. The advertising manager is chief of the most important department of every great business. John Wanamaker's advertising expert is famous throughout America. His huge announcements appear every day in every largely circulated newspaper in New York, and in every paper a different announcement. The Wanamaker advertising costs an amount which the biggest London business dare not face, although New York is very much smaller than the English capital. The other first-class houses all advertise to a similar extent, not vaguely inviting attention to their new consignments but particularising the articles and the prices. The American, perhaps, has not the same modest reticence as the Englishman with regard to his virtues or the excellence of his wares There is no proud consciousness of unappreciated merit over there Everybody advertises. A business manager seeking a new position the other day inserted in a leading paper a large-type personal advertisement, at 5s. a line, that cost perhaps twenty-five pounds, but exhibited his knowledge character, and qualifications for the position he sought so effectively that he obtained an immediate engagement with the largest house in New York within a few hours. Everybody advertises who, as the American says "has got the goods" advertises unblushingly, effectively, and most profitably

Push—don't knock !

Watching the other man's patch will not keep the weeds out of your own

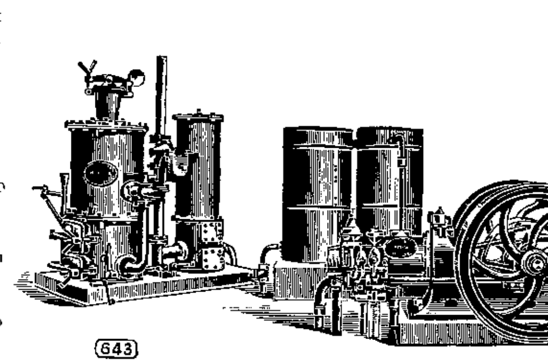
Your ship will not likely come in unless you go after it

Most of the serious slips occur after the cup has been to the lip.

Keep a-going , but don't make the life road so crooked that you will meet yourself coming back.

A Chemical Trick.

WHEN we happen to witness a phenomenon which seems to violate natural laws, we are not likely to forget its cause if it be explained to us. The following experiment, which I devised for my students (writes a Doctor of Science in the *Scientific American*) helped them to understand as well as to remember some chemical data. A white cat, made of flexible pasteboard and imprisoned in a glass jar, is shown to the audience The lecturer announces that, without opening the jar or even touching it, he will cause the cat to undergo a zoological, as well as a chemical, transformation. He takes the support of the jar, and pushes it forward in full view of the students. The change occurs almost instantaneously. The cat takes a rich orange colour on which black transversal stripes rapidly paint themselves. The cat has become a tiger. The whole transformation is produced by emanations of hydrogen sulphide, which is generated in the jar itself without any visible apparatus. The cat has been previously coated with a solution of chloride of antimony wherever the orange hue was to be produced, and with a solution of basic acetate of lead wherever the black strips were to appear. Both solutions are colourless After the coated cat has been introduced in its glass cage, a small piece of pasteboard is placed under the wooden support so as slightly to incline the jar forward. A few decigrammes of pulverised sulphide of iron folded in a piece of blotting paper are deposited behind the cat, on the elevated side of the bottom of the jar. Two or three cubic centimetres of diluted sulphuric acid are dropped with a pipette on the opposite side. When the performer wishes the transformation to take place, he takes the wooden support and pushes it forward as if he wanted to enable everybody to see better what is going to happen. By so doing he suppresses the slight inclination which kept the iron sulphide beyond the reach of the sulphuric acid. The gas is evolved, and the formation of the orange sulphide of antimony and black sulphide to lead takes place in a few seconds.



DAVEY PAXMAN SUCTION GAS-PRODUCER PLANT EXHIBITED BY R P. M MANNING.