This file contains copies taken from several different articles in the magazine lightening, the popular and business review of electricity published between 1895 and 1899 as follows:

August 1895 aletter about the confusion between Frank Hope-Jones and his brother Robert

November 1895 an article by Hope-Jones and Powell on municipal synchronous clocks

October 1897 a follow-up article entitled electric time service

October 1897 the Piccadilly Circus clock

August 1899 editorial comment on Synchronome

December 1899 a record of the audience discussion following Hope Jones presentation of his paper on electrical time service

Wigan—Little or nothing has been heard of the electric lighting question here for a long time. In February last the electric lighting sub-committee selected one of the tenders received for a complete scheme, and recommended the Council to confirm their selection. Unfortunately the matter was referred back by the Council, under circumstances detailed at the time, and since then no further progress has been made.

This inaction has been more than once commented upon, and at the last Council meeting Alderman Ackerley brought up the subject by asking if anything was being done with regard to the electric light.

Mr. Holmes, the chairman of the sub-committee, replied: I am afraid the electric light is snuffed out for a time.

Alderman Ackerley: I am sorry to hear it.

Mr. Holmes said it was very much against his will. He thought the sub-committee were making a great mistake in the action they were taking, but he could not sit in judgment upon them. Unless they got the unanimous feeling of the sub-committee he did not wish to proceed. If it were a question of a majority, he had every reason to believe they could carry it, but he desired the whole committee to be in union and harmony. He hoped it might be soon. The committee might, perhaps, be taking the right course, but to him it did not appear to be so.

Alderman Richards: It is in a torpid state.

Mr. Fyans said he was sure the Council would be obliged to Alderman Ackerley for eliciting a statement from the chairman as regards the electric light. Look at the money they had spent in decorating that room, and at the free library, with its valuable contents, which would speedily deteriorate under the present conditions of lighting. Were they to understand that, because one or two gentlemen on that sub-committee did not see eye to eye on the expediency of introducing the electric light, the Council were not to have the opportunity of casting their vote upon it? He said most unhesitatingly that the Council would unanimously support the action of the majority of the sub-committee.

Alderman Phillips said he knew there were important works of decoration waiting to be done, but the parties would not proceed because the electric light had been promised. When they saw the effect of the light in other towns, how it set off the shop windows, he felt they were behindhand, and he believed the chairman would have the support of the Council in carrying the work through.

Mr. Laycock felt sure it would come as a surprise and disappointment to manufacturers and business-men that they were not as yet to have the electric light. He hoped the sub-committee and Gas Committee would take the matter in hand again, so that they could have in Wigan what was already common to most towns.

Mr. C. B. Holmes, in replying on the debate, stated that in his opinion the discussion must have the effect of giving the committee confidence to push forward with the matter.

LAMPLIGHTER.

The Water Supply—Le Grand and Sutcliffe, hydraulic engineers, London, have completed a further series of ten Abyssinian tube wells, yielding 15,000 gallons of water per hour, for the Inveresk Paper Mills, Musselburgh; also two more artesian tube wells, yielding 14,000 gallons per hour, for the Ackman Pulp and Paper Company, Northfleet. At both these mills the coupled-tube well system has been adopted for many years.

The Institution of Junior Engineers—The annual summer meeting of this Institution, whose headquarters are in London, takes place from 17th to 24th August, the rendezvous being Belgium. The towns to be visited include Antwerp, where the municipal docks, M. Kryn's diamond-cutting works, and other places of interest will be opened to members' inspection. At Ghent, MM. Carels' engine works, M. de Hemptinne's cotton-spinning works, and M. Van Houtte's nursery gardens will be seen; at Brussels, the electric lighting station; whilst at Liége, the works of the Société Cockerill, the Vieille Montague zinc works, the St. Leonard locomotive works, the Val St. Lambert glass works, the small arms factory, and the electric tramway installation will be visited. In honour of the Institution a banquet is to be given by the Liége section of the Society of Engineers from the University, and the members will also be the guests of the Société Cockerill. An excursion to Verviers, where the Chamber of Commerce will entertain the visitors, is arranged for the purpose of seeing works in connexion with the woollen cloth industry. Here MM. Peltzer's works, and those of M. Duesberg-Delrez, La Vesdre, and M. Hauzeur Gérard fils, will be opened. The celebrated Gileppa reservoir, from which Verviers receives its domestic and manufacturing supply, is also included in the programme. A large number of members have notified their intention of being present at the meeting, which promises to be one of the most successful the Institution has held.

Letters to the Editor.

We cannot be held responsible for the opinions or expressions of our Correspondents.

"Semper ubique idem."

To the Editor of LIGHTNING.

SIR,—In your notice of our synchronome system of electric clocks in the current issue of LIGHTNING, you speak of Mr. Hope-Jones as one of the inventors, "a name of good augury when we remember his success with the electric organ." Mr. Robert Hope-Jones, M.I.E.E., whose "revolution" in organ building is somewhat akin to our inventions, in that a simple electrical movement replaces a quantity of complicated mechanism, is thus confounded with his brother, Mr. Frank Hope-Jones, who, with his partner, Mr. G. B. Bowell, has the honour to remain, yours faithfully,

THE SYNCHRONOME COMPANY.

Birkenhead, August 10th, 1895.

Electro-Magnetic Couplings.

To the Editor of LIGHTNING.

SIR,—Solomon informs us that God made man upright, but that he had found out many inventions. This seems to indicate that the wise king had no great opinion of inventors; nevertheless, it is difficult to imagine a thriving industrial kingdom, presided over by so perfect a ruler, without the existence of those very obvious advantages to the revenue derivable from a Great Seal Patent Office in full blast.

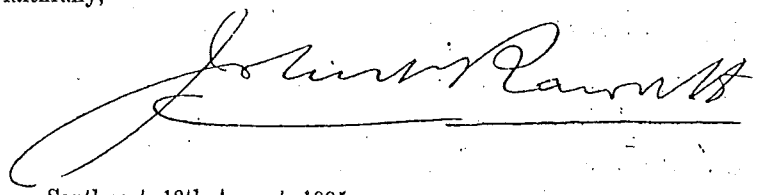
Assuming for one moment that such an institution formed one of the many marvels that excited the admiration and astonishment of the Queen of Sheba, it would be extremely interesting to know how many specifications per annum were filed for water-wheels to pump their own water and clocks to wind-up their own springs. Even in this nineteenth century, Her Majesty (Queen Victoria) derives no inconsiderable emolument from the fees on these and similar efforts of unappreciated genius. The early part of the present reign was especially prolific of repetitions of simple mechanical ideas, of which some (as for instance the corrugated piston) were palpable absurdities to all but their inventors, whilst others were more or less useful antique devices.

During the past and present decade however, the inventor—the real inventor, who worships his invention and persuades capitalists to back him up—has found in the mysteries of electricity and magnetism a field fertile in those magnificent fungi which spring up in a night and feast the eye but fail to fill the stomach; he has consequently abandoned mechanics for electrics, to the great gain of the Chancellor of the Exchequer. We have any number of "Inventors' Guides," all framed to flatter the inventor and to wheedle money out of his pocket, but the really useful "Guide" which will persuade him to "stick to his last" and save his money has got to be written, and I have hopes of taking it in hand myself one of these days, with, probably, as much advantage to myself as others.

Take for instance, the electro-magnetic coupling, which you illustrated in your issue of the 1st inst.

The conception of this marvellous device sprang up in my mind in the year 1887 I think, but before I had quite recovered from the inflation of finding myself a genius, I discovered that Mr. H. M. Sayers (now of Bournemouth) was a co-progenitor, so we patented the invention together. I then learned that Mr. Frank Wynn had anticipated us with a variation of the same idea. A year or two later, Mr. Willans came on the scene with another modification; then followed Mr. Illius A. Timmis, and later Mr. Worby Beaumont; and, last of all, Major Holden and Messrs. Drake and Gorham. But the list is not by any means complete; the intermediate spaces have been well filled in by the less familiar names of equally aspiring inventors. Of the invention itself, I have had considerable experience, and can testify that the grip of the coupling is tremendous, but, like the British bull-dog, it objects "to let go."

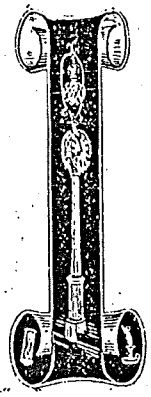
With cast steel, which is now available, this propensity may probably be palliated sufficiently for practical purposes, but in any case the patent is public property, that is if the word property can properly be applied to it. I estimate the debtor side of the account at something over £5,000; so nothing will please me more than to see the scheme successful and the adverse balance obliterated.—I am, sir, yours faithfully,



Southport, 12th August, 1895.

Municipal Synchronous Clocks.

By F. HOPE-JONES and G. B. BOWELL.



N "Looking Backward" Edward Bellamy speaks of an interesting relic of the nineteenth century—a picture of a busy London street on a wet day—a study, in fact, of umbrellas. The citizens of Boston in the year A.D. 2000, whose streets are roofed with canvas by the authorities so soon as a shower approaches, treasure this above all other works in their art gallery, as a typical example of the selfish individuality of their forefathers. They chuckle as they think of those ten thousand people opening ten thousand umbrellas, and thus trying to do for themselves the work of a properly organised department.

If the author had been an electrician, he would probably have taken for his text not umbrellas but *clocks*. Is there anything so unjustifiable as to expect every member of the community to keep his own time? We all do it—at least we try to. Our clocks are generally within five minutes, if we are methodical in winding them or pay someone else to be so. Of course it is not so much the selfish individuality that we complain of here as the inefficient independence. There is not the slightest doubt that the work would be done better by a properly constituted authority. We have grown up with our own clocks, and have been for ages satisfied with such a low standard of efficiency that it will probably take a long time to convince people that there is no more justification for independent time than there is for every house in a city having its own installations of water, gas, or electricity.

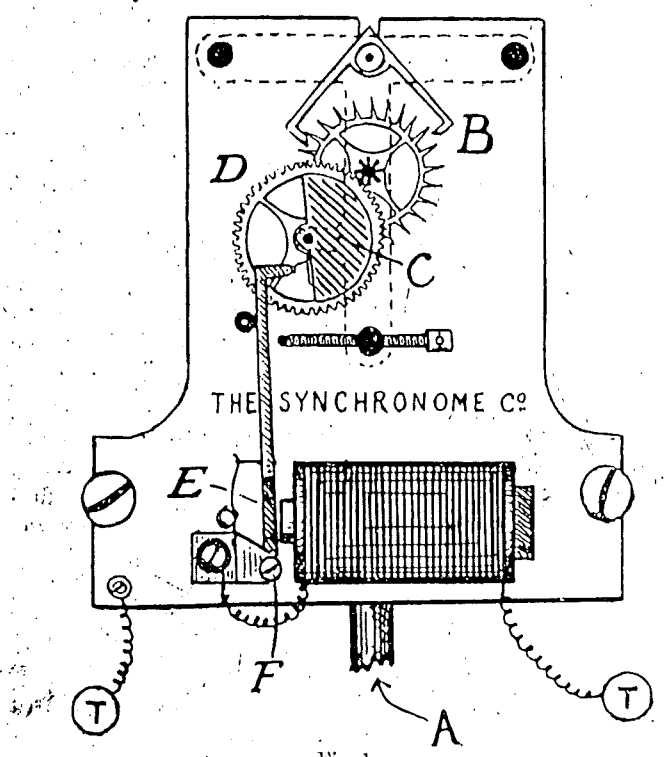


Fig. 1.

All this assumes that a simple and trustworthy method of indicating time electrically is possible; and we need hardly say that if we did not believe that the difficulties of the problem had been overcome, we should not take up the pen.

What we require for the purpose is, firstly, an electrical dial movement capable of turning the hands of a clock by means of periodic impulses, and, secondly, an instrument (not necessarily a clock) for sending out these impulses at regular periods. As our space is limited, we must ask our readers to take the dial movement for granted. It is a simple method of obtaining a step-by-step rotatory motion from an electro-magnet. The means of closing the circuit of these dials at regular intervals is, however, of more interest, and we will describe it with the assistance of Fig. 1.

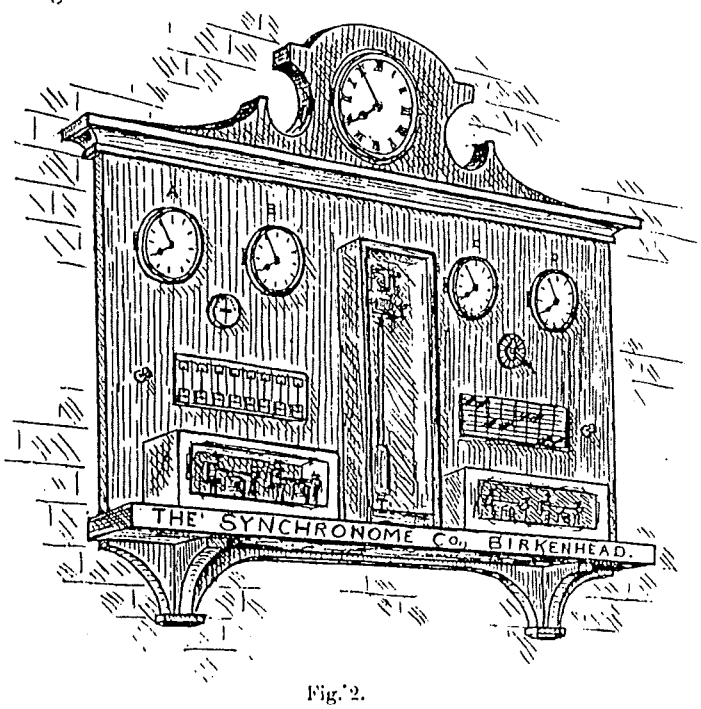


Fig. 2.

A is a pendulum driven by an escapement, B, in the usual way. The necessary turning force is applied to the escapement wheel by means of the semicircular weight C, which in falling through a small arc communicates its power through a click and ratchet to wheel D, which gears with the escapement wheel. E is an armature centred at F. As the weight falls it meets with the extension arm of the armature, and the circuit of the magnet and of the dials is closed by the contact of these two parts. The weight is then thrown up, the action of throwing causing a quick break, and the cycle of operations is repeated every fifteen seconds.

We had the pleasure of demonstrating, *nemine contradicente*, before the British Horological Institute a short time back, that this is a very perfect method of measuring time; but we will pass over its time-keeping qualities, and briefly refer to its other claims. These lie in its simplicity, its few working parts, and the peculiar arrangement of the contact. It will be noticed that the contact is made between two moving parts, and that one part (the armature) drives the other part (the weight). The result of this arrangement is that the entire power dealt with is transmitted through the points of contact at each operation.

The contact has ever been a prominent source of failure in electric clocks. There is so little power available for making it off the "going train," that when made in this way it is necessarily light and untrustworthy. When, however, it is made directly by the motion of the armature in the act of imparting its thrust to the clock, it is all that can be desired. Intermittent contacts (which would, of course, put the dials all astray) are practically impossible, as it will be seen that if contact is sufficient to send out a signal at all, it is ensured by the action of the armature.

This instrument, which may be described as the combination

of a pendulum with a contact maker, is all that is necessary for controlling a circuit of a large number of dials; but for municipal use, where a great quantity are required, and the installation must be capable of rapid extension, it is advisable to divide the service into districts. In addition to the large number of public dials at the street corners and on the lamp-posts, each householder who wishes to avail himself of the city circuit has in his hall a "master" dial, which is different to the others in this respect, that its armature, in addition to operating the hands, works a contact; and the regular action of this contact is all that he requires to work as many of his own dials as he pleases from his own Leclanché battery.

In a provincial town let us assume that 200 public dials are required, and that provision is to be made to supply 1000 householders with master dials. We would thus have 1200 to deal with, and for these, twelve sub-station switchboards, each with a capacity of 100, would be provided at the centres of suitable distribution areas. Such a switchboard is shown in Fig. 2, and its connections in the diagram, Fig. 3. It will be noticed that each sub-station is the centre of four groups of twenty-five dials. Each circuit passes through its switchboard dial A, B, C, or D, and the contacts of its relay. These relays are operated by a circuit which also includes the pendulum (shown in the centre) and the station dial shown above. A single line starting at headquarters, where the standard clock is located, and returning thither, joins up all the sub-stations in

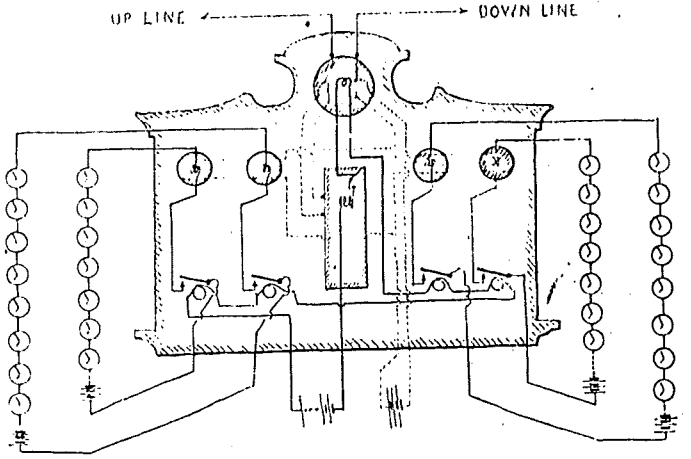


Fig. 3.

series for the purpose of synchronising their pendulums, and for enabling each sub-station dial to report its performance automatically to the central station. In Fig. 3 the switchboard connections to this line are shown dotted, and it will be seen that the station dial operates two contact levers which normally short-circuit the line connections, but at three minutes to the hour each station dial puts its synchronising apparatus into the line circuit, so that an hourly synchronising current may be sent from headquarters through all the stations. At three minutes after the hour the station dial replaces the short circuit, and the line is used in turn by each station for sending to headquarters signals which there record upon a chronograph the state of each of its four circuits. To do this each switchboard dial is provided with a commutator. These commutators are joined in parallel, and through the battery to the arrangements in the station dial for cutting them into the line circuit.

Such is the outline of a system suitable for municipal time supply; but civic authorities are proverbially slow to move, and a deal of pushing will be required before they realise that street timing is as much their duty as street cleaning and street lighting. When they do realise this, the question of who is to do the work will crop up. It is not for us to speculate into whose hands it will go, but if asked, we should say the telephone company are best fitted for it. Their organisation being designed to deal with way-leaves, construction, maintenance, and rentals, it would be a simple matter for them to run a time circuit over a city. Now, however, that corporations are so rapidly acquiring their own lighting installations, the system might be modified to suit the borough electrical engineer and the facilities at his disposal. He would erect all the necessary street dials on the arc lamp standards, putting down a special wire for the purpose, which would follow the same grouping and take the same course as the street lighting circuits, and be under the control of a little switchboard in the generating station. For private time service about a dozen householders' master dials would be connected through a relay contact in the base of the nearest arc lamp standard or in any other convenient place for cutting into the time circuit.

It is, of course, unfortunate that existing networks of telephone or lighting wires cannot be utilised for time supply instead of special lines. Several methods have been suggested for doing this, but they are rather interesting than practical.

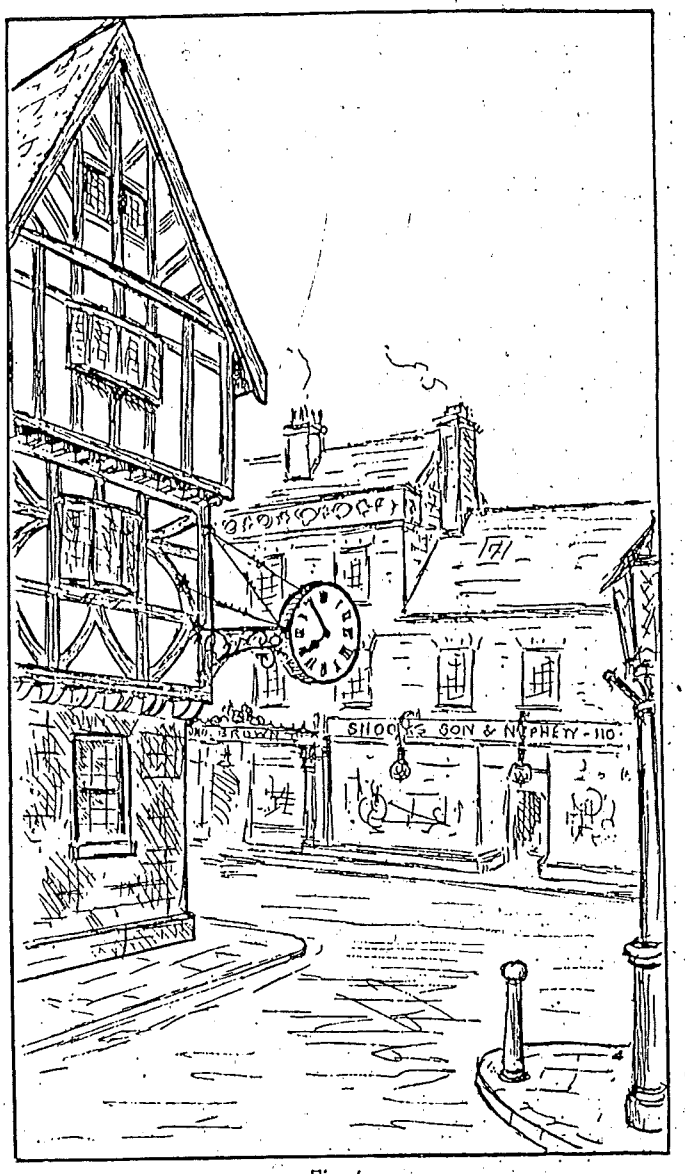


Fig. 4.

On a continuous current system each consumer wishing to have time as well as light could have a tiny transformer put into his circuit, the secondary coils of which would be closed through the coils of a relay. At regular intervals an alternating pulsation would be sent out from the generating station for the purpose of exciting these little transformers and so closing the local time circuits. But the electrical difficulties of this method, on a large network where thousands of dials are to be driven direct by quarter-minute impulses night and day, are so great as to render it practically prohibitive. Moreover, we are not acquainted with many central station engineers who would welcome such an innovation on their mains—and the reasons are obvious.

Another arrangement, for our knowledge of which we are indebted to that central station for the distribution of electrical information—we mean the offices of LIGHTNING, seems at first

glance Utopian. In this method a standard clock is placed in the engine room at the central station of an alternating system, and with it a dial, the hands of which are rotated by a tiny synchronous alternating motor connected to the mains; the gearing between this dial and its motor being such that, when the alternators are run at their normal frequency, the hands progress at the proper rate, and thus any consumer who joins a similar dial across the mains will obtain the same result. We should imagine that, among other accomplishments possessed by the dials, they might incline to be musical.

However we may regret it, lighting circuits cannot be encumbered with step-by-step impulses for time service, for these assume a perfect immunity from breakdown, to say nothing of the difficulties of testing the mains under such circumstances. Special lines are, however, in our humble opinion, no obstacle, as the demand will quite justify the outlay.

PROPOSED CHANGES IN COMPANY LAW.

When the victims of the recent fever for speculation in African mines reckon up their losses, reduce their establishments, and retire into temporary or permanent obscurity, a keen desire will spring up in their souls to wreak vengeance upon the authors of their misfortunes. If this desire leads them to consider the ways in which directors and promoters of companies may be brought to book, they will probably arrive at the conclusion that the law is not in a satisfactory state. Some account of projected legislation on the subject may therefore possess a kind of painful interest for them, similar to that which the Peri doubtless felt when she surveyed the proceedings in Paradise through the gates which she might not pass. The benefits were not for her. Neither will the proposed Act be retrospective.

The committee of distinguished company lawyers and commercial big-wigs recently appointed to report upon this subject have issued a bulky bluebook, which may be compared to the Hill Difficulty in "The Pilgrim's Progress." When you have surmounted it the view is very fine, but the ascent is toilsome and the path obscure. Opinions have been sought from every quarter, notably from the principal Chambers of Commerce in the kingdom. The answers to questions addressed to these various Chambers display a most bewildering difference of opinion on almost every point. The answers of Walsall and Leith seem to be amongst the most valuable.

The committee appear to have laid down several excellent guiding principles. First, "no drastic changes." In 1894 the paid-up capital of the companies existing in the United Kingdom exceeded that of all the companies in France and Germany combined by at least £315,000,000. It would be folly to drive business elsewhere by placing obstacles in the way of the formation of companies for lawful purposes. Secondly, that the legislature cannot supply people with prudence, judgment, and business habits. Thirdly, that the multiplication of criminal (as opposed to civil) pains and penalties would deter honest and competent men from becoming directors, as it has largely done in France. Fourthly, that anything like a Government inspection of companies would be impracticable, and create a false sense of security. Bearing these principles in mind, let us proceed to consider the main features of the draft bill proposed by the committee.

The first shot is aimed at the practice of advertising as directors men who have not in fact consented to act as such. A few well-known names inserted (without authority) in a prospectus act like a charm in conjuring money out of the pockets of the public. To get the money back again may not be so easy. Before directors can be advertised as such, they must file with the Registrar of Joint Stock Companies a consent to act, and a contract to take and pay for their qualification shares.

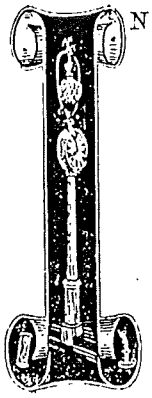
It is common knowledge that allotment on insufficient capital is a fruitful cause of disaster to companies An attempt has been made to render this more difficult in the future by compelling a statement in the memorandum or articles of association of the minimum subscription (exclusive of shares credited as paid up) upon which the directors will proceed to allotment. Companies may not commence business until the minimum subscription has been reached, three-fourths of the amount payable on application and allotment has been actually paid in cash, and a statutory declaration has been filed that the provisions of the Act have been complied with.

Then as to the liabilities of directors and promoters. The clauses dealing with this point are mainly declaratory of the present law, which is stated with admirable clearness. In some respects the liabilities of a director are materially increased. If he creates any debt, knowing at the time that there is no reasonable expectation that the company will be able to discharge it, he will be liable to pay it himself. This provision is intended to prevent directors from carrying on business when they know the company to be insolvent, and will be worth much or little according to the construction put upon "reasonable expectation." A large part of the increased responsibilities of a director are connected with the prospectus, and will be dealt with later. The payment of a commission by a company for the underwriting of its own shares is legalised (an alteration of the law), provided the amount or rate per cent. of the commission is authorised by the articles and disclosed in the prospectus. Suppose two shares were underwritten at a very small rate, and the prospectus contained a statement that "commission at the rate of ½ per cent. has been paid for underwriting shares of the company," without disclosing the number underwritten, might not a false impression that those "in the know" thought well of the company, be created?

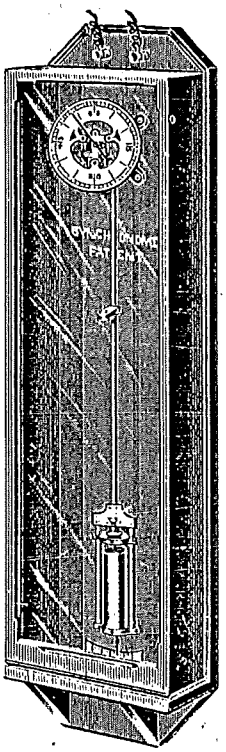
The prospectus has been the subject of about forty subclauses, and it is impossible to do more than sum up the effect of them within the limits of this article. The idea underlying them is that adequate information from responsible persons shall be assured to all who intelligently read the prospectus of a new company. One feels inclined to exclaim with Mr. Yellowplush, "Men and Hangels!" Who ever reads a prospectus? Brown invests because Jones, who has a sound reputation, winks knowingly when the company is mentioned; or because Robinson is a director; or because he knows the office boy, who has overheard, etc., etc.; or for some other equally conclusive reason. But as for reading the prospectus—not he!

The names and addresses of directors, vendors, and auditors must be inserted in the prospectus; every contract and fact which would influence the judgment of a prudent investor must be disclosed, together with the minimum subscription, intended working capital, and an account of the profits made by promoters and vendors. This last would be exceedingly valuable information, and, if it could be secured, would put an end to the practice of "loading the purchase money," which dooms many a company to a sad end. For the benefit of those who do not know how this is done, an illustration of the process is given. A, a promoter, obtains from B, the owner of, *e.g.*, a business, an option to purchase that business for a price usually payable in shares or debentures of a company to be formed. A then gets together a syndicate (which is often registered as a company), to whom he purports to sell this option at an advanced price. The syndicate secures two dummies, C and D, the former to act as nominal vendor, and the latter as trustee for the future company. The option is then sold to C at an advance upon the price which the syndicate agreed to give for it, and he agrees to sell it to D, subject to adoption by the proposed company. Then, amidst a flourish of trumpets, a prospectus is issued to the public, in which C is described as the real vendor; and it is stated that he will bear all the expenses of the formation of the company. The public subscribe; they acquire the business. B makes a profit, A makes a profit, the syndicate makes a profit; the enhanced price at which the option was sold to C covers registration fees, brokerage, and tips all round. Result—over-capitalisation, liquidation, and consternation. After the disclosure of these intermediate profits is made compulsory, so that the public can see how much the real vendor (B) is willing to take for his business, and what increase of price they are expected to give for it, they will have only themselves to blame if they give too much. Waiver of these provisions is prohibited. The future prospectus, then, will either be a document of many pages of microscopical print.

ELECTRIC TIME SERVICE.



IN our issue of 28th November, 1895, we published an article by Messrs. F. Hope-Jones and G. B. Bowell on 'Municipal Synchronous Clocks.' Our readers possibly considered their ideas Utopian; and that it will take years to accomplish such a reform as the establishment of municipal time services goes without saying. But that a decisive step has been made in the right direction by private enterprise was demonstrated to us the other day at Piccadilly Circus, where the Synchronome Syndicate have had a time circuit installed for some months, and where they have now erected a large external clock, which has aroused a good deal of comment in the lay press. The essential features of the system advocated by Messrs. Hope-Jones and Bowell, which now appears at Piccadilly under the name of 'Synchronome,' will doubtless be familiar. One pendulum only is used, and that is kept in motion electrically by mechanism of such simplicity that it consists of little more than two wheels and an electro-magnet. As described in our article above referred to, the self-winding action of this pendulum occurs say every half minute, and the excellent rubbing contact obtained in the act of winding is also used to advance any number of dials placed in circuit with it. Shortness of space required us to take the step-by-step dial movement for granted, but we are now able to give a sketch of the movement as applied to the hands of the larger dial in the Circus, together with a diagram of the circuits in and about Piccadilly and Regent Street.



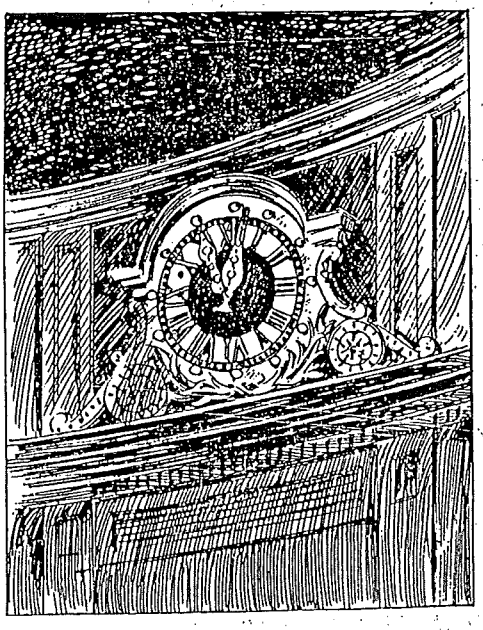
ELECTRICAL REGULATOR.

One wheel only is employed, and that is in rigid connection with the minute hand. It is provided with 120 rectangular teeth, the face of each tooth being at an angle of 45 degrees with its radial line. Though there are only two clicks engaging in its teeth, the wheel is nevertheless perfectly locked not only in the position of rest, but at every point in the circle of its movement.

The actual arrangement of the electrical circuits is shown by the diagram, from which it will be seen that the regulator, the movement of the big dial, and the coils of several relays are grouped into one circuit: this circuit is closed by the regulator contact, and is opened by another contact on the big dial movement, thus providing a very simple electrical 'interlocking' of these movements. As the contact on the regulator is made by an electro-magnetic movement, instead of by the more usual mechanical arrangement driven from the actual wheelwork, this action is incidentally employed to replace a small gravity piece at each time of contact (each half minute): thus it becomes unnecessary to continue the regulator wheelwork beyond the scape wheel and one gear wheel, one important result of which is that the regulator keeps very accurate time and requires no winding. The diagram shows the connections of the internal indicator dials in the vicinity, worked from the contacts of the distributors, which are of special design to permit of working up to 100 instruments in each circuit.

At present one regulator only is employed to operate the entire plant, but we are told that it is intended shortly to fix another regulator with an automatic emergency change-over switch, designed, in case of stoppage, immediately to transfer the entire responsibility from the first regulator to the stand-by one.

The novel illuminating arrangement consists of a circuit of twelve tubular lamps arranged on the hands, and another circuit of twelve candle-lamps outlining the circle of the dial. These circuits are put across 100-volt supply, and together take only 1·2 amperes. Yet this method is, if anything, more effective than that obtained by a bank of twelve 16-c.p. lamps placed behind an opal glazed dial, though the latter method would take about six times the current.



THE PICCADILLY CLOCK.

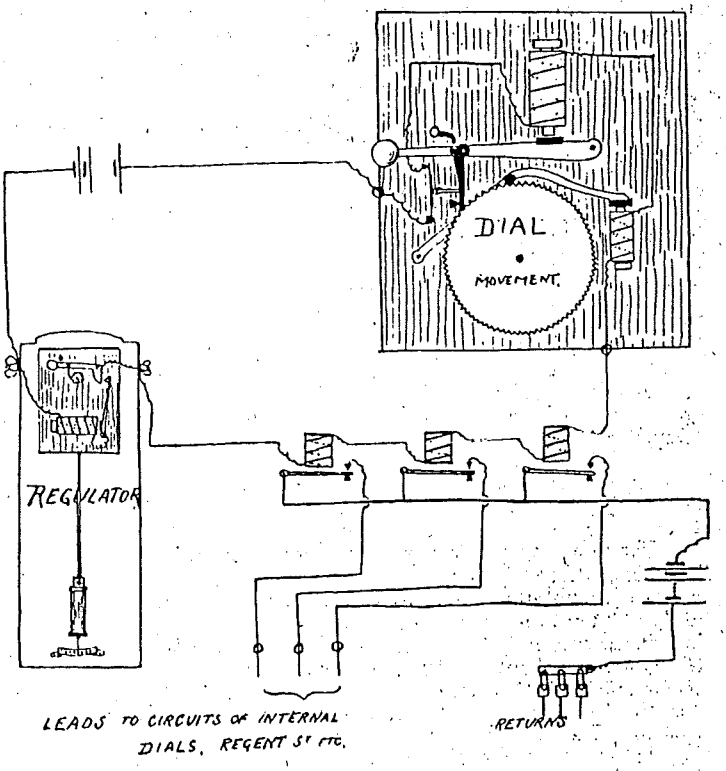


DIAGRAM OF ELECTRIC CLOCK CIRCUITS IN AND ABOUT PICCADILLY.

really been found, and I made no question that colliery owners and managers, sooner or later, would find it necessary to adopt it. That it would be later rather than sooner, English caution and English trade conservatism—which often mean a lazy reluctance even to examine a new thing—rendered inevitable, and as yet the shareholders in the company have received no return. Perhaps, too, the miners themselves may object to a lamp with which they cannot, at the risk of their lives, light a surreptitious pipe. But abroad the invention has met with more appreciation. A Belgian Royal Commission on Electricity has reported to the Director General of Mines that the lamp 'fulfils all the conditions we have thought fit to impose for the sake of safety,' that the inventors undertake to supply and to maintain the lamps at the rate of 42 centimes per lamp per week—the price for vegetable oil lamps—and that the problem may be considered as being now practically solved.

Information has also reached me that within the last few days a company has been formed in Belgium to work the patents for this lamp. Belgians are usually slow to take up any novelty until they have gone thoroughly into it, and indeed, before they would move in this matter they required a series of examinations, tests, and trials, which have been going on for nearly a year past. That they were satisfied with these, and that a company was ultimately formed, counts much in favour of the lamps. The Sussmann batteries are not used only for miners' lamps, however: I have seen some neat little bicycle lamps, named 'The Hero,' run off them, some of which will be exhibited on the Rudge-Whitworth stand at the coming Stanley Exhibition. Reading lamps for railway journeys, etc., can also be run from a battery weighing but one pound and small enough to be carried in the pocket without inconvenience. The Sussmann Company prefers to do one thing at a time, but when its battery is thoroughly established for lighting purposes it will attack the field of traction. With larger cells the battery has much in its favour for this purpose, chiefly its absolute immunity from damage by shaking; and it is probable that as electric cabs and carriages become more common, the Sussmann accumulator will take a fair share of that work.

A few days ago I went to see the new clock in Piccadilly Circus, an account of which will be found on a later page. Mr. F. Hope-Jones, of the Synchronome Syndicate, met me there and explained the mechanism and the advantages of the system; but its chief beauty is that there is so little mechanism to explain. A pendulum, an escapement, a weight to drive it, and an electro-magnet to raise the weight every half minute—that is practically all, so far as the regulating apparatus is concerned. A cogged wheel, another electro-magnet, a counterpoise for the minute hand, and two detents—such is the machinery of any one of the hundred clocks that can be driven from this one regulator. The Synchronome Syndicate had arranged to have standard time signalled to them every hour, but the variations of their own pendulum proved smaller than those of the standard time signals; nor is this hard to account for. No clock with a train of wheels can possibly attain to the accuracy of one in which the mechanism is reduced to a single wheel. The one incalculable element, variation in friction, will come in, and will upset the nicest regulation to the extent perhaps of a second or two a day: whereas the clocks of the Synchronome Company, when once the pendulum has been rightly adjusted, will not vary by more than a few seconds a month. Moreover, with this simple mechanism it is not necessary to build clock works on a colossal scale because one wishes to have a large dial. The dial may be five or six feet in diameter, and yet the whole machinery be contained in a box a few inches deep and in area scarcely exceeding this page.

I have received a cutting from a Darlington paper, which is obviously opposed to electric lighting, and the editor of which shows his impartiality by quoting under the heading, 'Some Plain Facts for Darlington,' a circular issued by the Shrewsbury Gas Light Company. This manifesto professes to show by figures the relative cost of gas and electric lighting, and makes out the latter to be more than two-and-a-half times as expensive as ordinary gas, and some seven times as expensive as the Welsbach light. The time has gone by when such an argument could deserve a serious answer. Were these calculations sound, electric lighting would never have gained the place it has done in England, nor should we hear of instances where it has replaced gas to the pecuniary advantage of the customer. Of course, the figures have been manipulated in the usual manner. The illuminating power of gas is over-stated; the price of electric light is put high, and no allowance is made for rebates; nothing is said of deterioration in the incandescent mantles, nor of the cost of renewals; and, of course, the incidental advantages of electric light, its facilities for economical use and the saving in paint and decoration, are left out of account. But such over-statements must by their very absurdity defeat their end, for there are few or none so credulous as to swallow them.

Germany has for some years been sedulously nursing that youngest fledgeling of science—electro-chemistry—in her universities and polytechnics, and the large and well-equipped laboratories that now exist at Leipzig, Aachen, Darmstadt, and Göttingen for the special study of this branch of science, and the renown of the professors—of whom Ostwald and Nernst are the best known—who have charge of these, bear witness to the activity of the past. As a set-off to this what do we find in this country? A demonstratorship of £100 or £120 a year in this subject at the Northern Polytechnic, a day class for practical work in electro-chemistry at the Finsbury Technical College, just started, and an evening course of four (!) lectures at the same college by Professor Silvanus Thompson. So far as I am aware, this represents all that our schools or colleges in London yet have to offer to those who desire to study this subject under professorial guidance; and there is no reason to believe that more is being offered by any provincial technical school or college. The contrast would be laughable if the future results were likely to be less serious. The blame for this state of things does not rest with our professors of electricity or chemistry. There are many men in this country who could do good work in this new branch of science if free to devote themselves to it, as are Ostwald and Nernst in Germany. Neither are funds lacking: the amount annually spent upon technical education is ridiculously great, when judged by the results obtained.

Professor Silvanus Thompson delivered the first of his short course of four lectures upon 'Recent Developments in Electro-Chemistry' at the Finsbury Technical College on Thursday evening last. The audience gathered to hear Professor Thompson was larger than I had anticipated, and bore witness to the very general interest in this new branch of electrical science. It was composed chiefly of students of the college, with a sprinkling of outsiders of more venerable appearance—like myself. The

Road, whereby almost any advertisement may be displayed in luminous letters by a suitable choice of lamps to be lighted out of about a thousand. The London County Council, which passes by with indifference many a real nuisance, has chosen to drag this inoffensive sign into the police court as contrary to the provisions of the Building Act. It was admitted that the sign was not dangerous, and that other advertisements in the neighbourhood projected yet further beyond the general building line. The real objection to it seemed to be that it had cost a lot to put up, and that therefore the L.C.C. thought it worth worrying. The matter is postponed for a month, and it is to be hoped that in the meanwhile the prosecutors may see the inexpediency of making a fuss about a trifle.

I rejoice to hear that Mr. Hope Jones, of the Synchronome Company, is going ahead with his system of synchronised clocks, all driven electrically and controlled by one pendulum, to which LIGHTNING has several times referred. The lately opened house of the Institution of Mechanical Engineers has nineteen of these dials; the Surveyors' Institute has seventeen, and in each case the current is taken from the electric light mains, without, of course, sensibly affecting the meter. I have a long list of other places in all parts of England where the system has been adopted, and its convenience is such that no one who has once installed these dials is likely to discard them for independent clocks—all showing different times like those at Waterloo Station in Mr. Punch's cartoon. Where electric light mains are not, the small current required can be got from cells, and where uncertainty of tenure or other causes make it inadvisable to buy the dials and pendulums, they can be rented at scarcely greater cost than is paid for a periodical winding and setting of the ordinary clock; and without the initial cost. I am not an ardent advocate for State control, but if only on grounds of economy and uniformity, I should like to see all the public clocks in a town, if not all in the kingdom, electrically compelled to keep together, and I know of no better method of achieving this result than that of Mr. Hope Jones.

THIS weather one wants to be in the open air as much as possible, and though fountains may be cool and refreshing, electrically lighted fountains will be more to the purpose when the sun sets a little earlier than it does at present. Then the Crystal Palace will meet the demand for this meretricious luxury. Most of us can remember the beautiful effects produced some eight or nine years ago at Earl's Court, but science and art have advanced since then, and the electric fountains at the Crystal Palace will be, it is said, superior to anything of the kind hitherto attempted. My last visit to that ambitious fane was not altogether pleasant, but hope triumphs over experience, as the widower said when he married again, and some fine evening in the autumn I may dine at the Palace, and see afterwards the chromographic display of fire and water arranged by Mr. Darlington.

THE irrepressible J. C. Koch, of Hohenlimburg, is at his old games again. As usual, he wishes to get a list of users of electrical machinery that he may circularise them, but this time he does not hold out the bait of a large order. He frankly asks for assistance, alleging as his excuse that his dynamo brushes *wear out so slowly* that he is at a great disadvantage, having to wait for years before receiving repeat orders The naïvety of this self advertisement should appeal to the commercial sympathies of his correspondents, and induce them to send him the list he wants. But, alas, the appeal has reached one stony-hearted engineer who is moved by it only to forward the letter to me. Herr Koch must either be the most hopeful of human beings, or he has struck an unexpected vein of softness in the British engineering stratum, otherwise he would scarcely try to work the well-worn dodge once more after so many years.

LAST week a colleague of mine noted a meter designed by Mr. William Stanley, with the aim of minimising the friction on the bearings of the spindle. This note brought me an invitation from Mr. Sydney Evershed, who has been at work on the same problem for the last two or three years, to inspect the results of his labours in this direction. As Dr. Lodge lately remarked, Mr. Evershed does a lot of work but prefers to keep it dark; certainly he seldom lets any one know about it till all difficulties are overcome, and therefore I concluded from the invitation that I should see something more than experimental work—nor was I disappointed.

MR. STANLEY'S method of magnetic flotation is one which was tried long ago by Mr. Evershed and abandoned. It certainly had the great advantage that the pressure of the armature, etc., on the jewel is greatly reduced, consequently the jewel is not worn out quickly as is ordinarily the case, but the spindle is in a position of unstable equilibrium in the magnetic field and the smallest possible inequality tends to set up a side pressure on the bearings that may well cause more friction than the direct pressure on the jewel, and so increase the difficulties of starting though not necessitating equally frequent repairs. Mr. Evershed's plan of overcoming this trouble is to place his magnet above the spindle. He finds that this obviates any need of an upper bearing and reduces the pressure of the lower bearing on the jewel from about 250 grammes to one gramme. Another important improvement is the reduction of the friction moment at the brushes to about one hundredth of its value in most of the best meters on the market; but how that is achieved I prefer to leave Mr. Evershed to explain next autumn to the Institution of Electrical Engineers.

WHEN the theory and practice of meter making had been sufficiently set forth we went upstairs to the experimental workshop to see the practical results. Here we found several meters running—one had been going for months at 50 per cent. above full load, and was intended to run for many more months, so that the wear, if any, might be perceptible under the microscope. There were small differences in detail, but these can scarcely be explained without diagrams. The net result is that these meters will start on the thousandth part or so of their full load and will register within 10 per cent. before other meters can be persuaded to start. Not the least ingenious part of the mechanism is that for driving the registering gear-wheels. A vertical coil is placed in series with one coil of the armature and so has the current in it reversed twice in each revolution. It thus actuates magnetically a lever which drives a ratchet wheel and so sets the counting mechanism in action. This very clever device supplies abundant force for driving the mechanism without in the least retarding the speed of the armature, and therefore the train of wheels need not be specially delicate. Another point of importance is that by turning a single screw the motor axle is locked for travelling. The meter can therefore be sent out sealed, it being only necessary to slack that screw again to make it ready for testing and for use, without any further adjustment being required.

METEOR.

LIGHTNING

The Popular and Business Review of Electricity

Entered at Stationers' Hall.] 21st DECEMBER, 1899. [Vol. XVI.—No. 427.

"Lightning" Offices,

21*st December*, 1899.

The discussion following the reading of Mr. Hope Jones' paper on 'Electrical Time Service' was prolonged over an hour beyond the usual time for terminating the meetings of the Institution. This, no doubt, was partly in deference to the numerous visitors who had come specially to take part in the discussion, partly owing to the impossibility of giving the subject another day. The Council table and the wall behind it had something of the look of a clockmaker's shop, and resembled it also in the fact that the various dials showed all sorts and conditions of time. Certain faceless clocks waved their long hands wildly in empty air, and from their diminutive working parts came an intermittent 'cluck,' suggestive of a poultry yard. Of that 'clucking' we were to hear a good deal in the course of the discussion.

The paper itself opens with an interesting account of successive attempts to drive or to control clocks electrically, most of which, with the notable exception of Mr. Lund's system of control, now worked by the Standard Time Company, have been failures. Hipp's electric escapement, it is true, proved successful as a means of driving an electrical clock, but it was not adapted to the simultaneous driving of many, which was Mr. Hope Jones' ideal. Having disposed of the history of the matter, the author went on to describe his own system, telling his early failures, and triumphantly exhibiting the exceedingly ingenious mechanism for which he now claimed unfailing success. There is no need to go into this here; it was fully described in Lightning more than four years ago, though there are several alterations in detail since then. Now and again Mr. Hope Jones is betrayed by his enthusiasm, and by a natural love of hyperbole, into overstating his case. Thus, when I read, 'we value truth so little that we prefer a clock which goes even inaccurately to a stopped one,' I feel amazed at my criminal indifference to the fact that my watch, being magnetised, gains about three minutes a day, and my still greater depravity in not making sure whether it be two, three or four minutes. So, too, 'the shores strewn with the wreckage of fruitless inventions,' and the ideal system 'built upon a foundation of sand,' are calculated to raise a good-natured smile on the part even of those who most appreciate the beauty and ingenuity of the author's invention.

Mr. A. J. Lund opened the discussion with an expression of appreciation of the author's kind reference to his system. He thought the classification of electric clocks should be rather one of impelled, controlled, and synchronised by electricity. The last (his plan) was best, as giving the least inconvenience in case of a breakdown on the line. He mentioned the case of a client who had changed over from synchronised to impelled clocks, and was driven to distraction by the tap, tap, tap, every half minute, and reverted to the other system. Then there was the terrible question of battery power, it was all very well to say use your lines at half minute intervals instead of hourly, but how about the peg, peg, peg, at the batteries? Even with hourly use they had to be replaced from time to time. Batteries should not be put in cellars or cupboards for then they were sure to break down. It was absurd to talk of preferring a clock that did not go to one that was inaccurate: the former was not a clock at all. As for the prejudice created by failures, he thought one should read that the good sense of the British public had taken warning by them not to have anything to do with clocks driven from one point.

Mr. H. T. Harrison spoke of the frequent repairs necessary to the overhead lines of the Standard Time Company. The hour's interval permitted of these repairs being made, but with half minute signals there would be difficulties. With underground lines difficulties of wayleaves would come in, and he questioned whether it would pay to put down insulated cables. Ten shillings and sixpence was the interest on a very good clock indeed, and if the rental were diminished the profit might vanish. Moreover, cogged wheels were liable to wear out, so that the mechanism would need renewal from time to time. Mr. Raworth, in an amusing speech, suggested that apparently each inventor would rather we should stick to the old-fashioned clocks than use those of a rival. The new system did pay already in large hotels; and avoided the nuisance of the clock winder, who always contrived to come at the most inconvenient time. But—— He was in Paris lately and had just gone to bed thinking over the wickedness of that city and his own (relative) virtue, when 'TICK' went something rebuking his hypocrisy. He tried to ignore it, and was dropping off to sleep: the 'tick' was repeated. He found himself waiting for it, counting the ticks, trying every way of escape—and at last he had to get up and switch off the clock.

Mr. Bateman spoke in favour of the system from practical experience. He had been sceptical, knowing so many electric clocks that would go for three minutes and stop

for three days. On one occasion he had found one of these clocks some minutes wrong. He made enquiries and found that its click had interrupted fatally a tender scene in some private theatricals and the actors had insisted on having it stopped. Then it had been set again by the *church* clock. He had stopped the click by putting in a bit of felt. Once the kitchen clock had fallen down and hung suspended by the wires, the cook being afraid to touch it lest she should get a shock, but it continued to go rightly all the time. He had used Obach cells for twenty-two months and they showed no sign of giving out.

Mr. Stockall's speech was mainly in reply to Mr. Lund, and in assertion of some rival system. He pleaded guilty to having put up for a Belgian firm the set of clocks, one of which had nearly driven Mr. Lund's client (a very irritable gentleman) distracted. That one was disconnected, the others were going now. He had hung his hat on the hand of one of Mr. Hope Jones' faceless clocks and had thereby put it wrong. He wanted a battery that would not wear out, and appealed to the members of the Institution to provide it. Mr. Worthington, secretary to the Institution of Mechanical Engineers, gave evidence that the clocks there were now working fairly well, though they had had some trouble with them at first, due to ill laid wires. The President also spoke in their favour: he was not mad *yet*, though he had the clocks in his private room at Finsbury as well as throughout the college. He ingenuously confessed that so long as they used their own batteries there was trouble, but when Mr. Hope-Jones insisted on his own all went well.

Professor Ayrton wanted to know whether the variation in the time taken to lift the weight might not get the standard wrong: he was told that a maintaining spring was provided, though it was really unnecessary. Mr. Frodsham and Captain Acland also spoke, the former backing up Mr. Lund's system, and speaking of the trouble with batteries; the latter supporting Mr. Hope Jones' system. His own electrical clock had only stopped once, and that was because it had got quite choked up with dust, earwigs, and spiders during his absence from home. When he first returned it was still going in spite of this state of things. Mr. Hope Jones briefly replied. He defended his classification of clocks, maintained that 120 of his contacts took less out of a battery than one of Mr. Lund's, told Mr. Stockall that the hands of the clock would normally be behind glass (out of the way of casual hats), and complained that Mr. Worthington had damned him with faint praise.

Amongst other formal announcements at the beginning of the proceedings was the important one that petitions, signed by over fifty persons in each case, had been received from Newcastle, Dublin, and Glasgow, desiring that those places be constituted local centres. This the Council had seen fit to do, so that now there will be four local centres, the fourth being at Cape Town. It was also announced that a sum of £1,437 had been transferred from the General Fund of the Institution to the Building Fund, which now amounted to £7,000.

It has come at last. For years I have been waiting to hear of a well authenticated case of a fire in a private house due to electric light wires. Plenty of such cases reach us from America, and now and again one hears of bits of jerry wiring that ought to start a fire, but till last Tuesday I never met with an actual occurrence of the kind. Then I found in the *Times* a letter from Mr. Montague Crackanthorpe, Q.C., graphically describing how rings of blue smoke came up through the cracks in his drawing-room floor, how his foot went through the carpet and a spurt of flame burst out from the space. His account of how a small leak between the wires in the wood casing under the floor developed into a serious leak, and thence into an arc, would do credit to an expert, and the only traces of the amateur are in the words 'blow *out* the safety fuse,' and in his use of 'arc-light' where we should say 'arc.' Happily the damage was not very great and the fire was easily extinguished. Mr. Crackanthorpe does not seem to be particularly indignant, but he is resolved never again to use wood casing or to allow his wires to be run under the boards. He thinks it preferable to run them buried in asbestos plaster, but perhaps should he consult Mr. Bathurst he may discover a more excellent way. Further, he is resolved to have his wiring tested at least every year for leakage, whether between the leads or to earth.

A friend sends me the following verses giving his impression of Thursday's proceedings. He may well call his sapphics 'jumpy,' but the source of his inspiration is more than sufficient excuse:—

This is the song of the Hiccough, the chant of the synchronised clockwork,
Foe to retaining one's wool, fatal to organised thought;
Deadly to wooing of slumber by 'Wrath' (someone called him) in Paris
Lying awake in his bed, thinking how bad were his friends.
(Really to handle this subject requireth a good jumpy sapphic;
Slow elegiacs can not deal with a torrent of clicks.)

Down came sanguine Jones to mighty George Street,
Rigged up his clockwork, rattled all the keepers
(Those of his magnets, not those of his audience,
Though they were wanted).

His were the best clocks ('Hic!' went a timepiece),
His never broke down ('Rats!' clicked a magnet),
Other men's clocks were truthful as an expert
Witness in the Law Courts.

Up jumped Lund in a state of indignation,
Talked about his own clocks, emphasised with unction.
(Emphasis suggestive of luscious lumps of green fat
Floating in the turtle.)

Thereafter went we down to see the photos,
Chuckled over C—n, chortled over P—y,
Thence to 'soothe our nerves,' deranged by constant click, click:
Leaving them debating.

It is useless to disguise the fact that the recent shortcomings of the Metropolitan Electric Supply Corporation, and, to a less extent, of other electrical concerns, have caused widespread discontent, nor can it be denied that want of foresight and other mismanagement are partly responsible for the difficulties. The excuses offered are reasonably valid, but there should be no need of excuse. From every side, and in papers of every class, the grumblers are heard, and we may take their indignation as an indication of the hitherto reasonable confidence that electric light users have had in the uninterrupted continuity of supply. Of the leader in the *Times* I wrote last week. The *Journal of Gas Lighting* is, of course, exultant and foresees a speedy return to the use of gas, first as a stand-by, then altogether. The wish is, doubtless, father to the thought. 'Dagonet,' in the *Referee*, says that when he moves into another house he will have no telephone nor any electric light; but 'Dagonet' was always a creature of moods; he *may* go back to gas; I make bold to say that he will not stick to it, if only for the sake of his precious health. The *Engineer* is content to preach patience to the consumer and to lecture the supply companies on their devotion to Welsh coal. The crisis is certainly serious, but it is equally certain that it will pass, never, I hope, to be repeated. The most satisfactory thing about the whole matter is that the difficulty is mainly due to an enormous and unprecedently rapid increase in the demand for electric light and power. That does not look like electricity being played not.

Meteor.