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*The SUPPLY of GAS to the METROPOLIS.**By* HARRY CHUBB, ESQ.

[Read before the Statistical Society, 18th April, 1876.]

THE use of coal gas as a means of lighting has become so general, and the quantity required for such an enormous city as London, is now so large, that some statistics in connection with this important manufacture can scarcely fail to be of interest. The proper supply of gas having, indeed, become almost a necessity of civilised life, it may, perhaps, be assumed that interest will also be felt in the history of its introduction into London, and the constitution and obligations of the companies to whom the supply has been entrusted. It may further be presumed that no narrative can fail to be without interest which discloses from experience the policy which the Legislature seems inclined to adopt towards undertakings founded on private enterprise. This paper will therefore relate shortly the dealings of Parliament and the various local authorities of the metropolis from time to time with the several metropolitan gas companies.

London is at the present time supplied by nine companies, who have separate districts assigned to them. There were originally thirteen companies, but five of them have within the last few years amalgamated with others.*

These nine companies have seventeen manufactories, the sites of which have been selected chiefly for the facilities they afford of obtaining coals by water carriage.

The share and loan capital of the united companies amounts to rather more than 11 millions sterling, and the maximum rate of dividend allowed to be paid on the total share capital averages 8·8 per cent. (See Table I.)

There are in the aggregate upwards of a million and a half of tons of coal used every year in the manufacture of gas in the metropolis, and the quantity of gas consumed amounted in the past year to about 13 millions of thousands of cubic feet.

There are at present 54,119 lamps in the public streets in the metropolis lighted by means of gas; and the mains of all the companies, of various sizes, from 4 feet to 3 inches in diameter, reach the enormous length of upwards of 2,000 miles.

* Since this paper was written three other companies have amalgamated. The number of companies now supplying the metropolis with gas is therefore reduced to six.

This immense trade has risen up within the last sixty years. Coal gas had been used in the provinces on some special occasions, for the purposes of illumination, for a few years previously, and notably by Mr. James Watt at his celebrated Soho engine works, near Birmingham, but it was not until the year 1807 that any attempt was made to show that such a material could be applied with advantage for the purposes of lighting in the metropolis. In that year a small apparatus was set up in Pall Mall, and from it a few of the public lamps on one side of that street were supplied with gas in order to prove its practicability and its superiority over the system of lighting by the oil lamps then in use; but notwithstanding the undoubted success of that experiment, the scheme of thus lighting even the public thoroughfares was utterly condemned, and the use of gas in dwellings was denounced as unsafe, injurious, and impracticable.

Men of science joined in this opposition, and in ridiculing the idea as visionary. Even Sir Humphrey Davy, Sir Joseph Banks, and other celebrated men of the age, lent the powerful weight of their opinions and influence to check the proceeding, and so great was the prejudice against the introduction of the new system into London, that it seemed at one time to present an insurmountable obstacle to its further progress.

The inventors, or rather those who appropriated the invention and adapted it to practical use, were, however, so fully persuaded of the great benefit and the improvement which their system of lighting would effect, that they happily maintained their views, and ultimately, at great cost, and by dint of indomitable perseverance, worthy of all praise, prevailed with a sufficiently large section of the public to enable them to extend their operations.

In 1810, after two years of severe parliamentary struggle, against powerful opposition, an Act was obtained authorising His Majesty to grant a charter within three years to a company for the purpose of lighting a small portion of the metropolis with inflammable gas, and under the powers of that Act the existing Chartered Gas Light and Coke Company, the earliest of all the metropolitan gas companies, was established. That company lost no time in erecting a manufactory of very limited dimensions in Peter Street, Westminster, then a wretchedly swampy district, frequently overflowed by the Thames, and on the 31st December, 1813, they commenced operations by lighting the lamps on Westminster Bridge. This became so great an object of attraction that the bridge is said to have been quite a fashionable promenade whilst the novelty lasted.

The authorities of the small parish of St. Margaret's, Westminster, next applied to have their streets thus lighted, and on the

1st of April, 1814, the old oil lamps in that parish gave place to the more brilliant light produced by coal gas.

Notwithstanding the evident improvement effected by the new mode of lighting the streets, the prejudice against its admission into shops and dwellings continued; so much so that the company, in order to obtain a trial, had in the first instance to furnish all the needful fittings, and supply the gas, free of expense. For nearly two years there was little or no increase in the consumption—and in addition to the public prejudice, the difficulties the company had to contend with were many and serious, both in the manufacture and the distribution of their gas. Their apparatus was necessarily most imperfect, their acquaintance with the science of gas purification was very limited, and the mode of constructing wrought iron pipes by machinery being then unknown, the greatest difficulty was experienced in providing means for conveying gas from the mains in the streets to the houses to be supplied: for some time, indeed, old musket barrels attached to each other by screwing the muzzle of one into the breech of the other, were used for this purpose, and for many years afterwards when machine-made wrought iron pipes were introduced, they were called gun-barrel pipes from this circumstance. The cost of all fittings and material of every kind was also at that time so enormously high that the hindrances and embarrassments of the period must have been well nigh overwhelming. They were, however, overcome, and when the Chartered Company had surmounted the principal difficulties, and opposition to the use of gas had somewhat abated, other companies were formed, who soon began to erect works in different parts of the metropolis.

The next undertaking in succession to the Chartered, was the City of London Gas Company, which was incorporated in 1817, for the purpose, as its name implies, of supplying the city of London. Then came the Imperial Company, in 1821, seeking to serve the whole of the north side of London, north of Oxford Street and Holborn, and outside the city.

Afterwards the following ten companies were established, viz. :—

The Ratcliff, incorporated in	1823
„ Phoenix, „	'24
„ Independent, „	'29
„ Equitable, „	'31
„ South Metropolitan, incorporated in	'42
„ London, incorporated in	'44
„ Commercial, „	'47
„ Great Central, „	'48
„ Western, not incorporated, but commenced operations in.....	} '50
„ Surrey Consumers', incorporated in.....	
	'54

In all thirteen companies.

In the first instance the companies had no exclusive privileges conferred upon them as to the monopoly of the supply in any district; they were also unrestricted as to the price they might charge, as well as the rate of dividend they might pay their shareholders on the capital invested. (See Table II.) The quality of the gas to be supplied was also left to the option of the companies, who were in no way bound to furnish a supply unless it suited them to do so.

As to the exclusive right to the supply in any particular district, Parliament seems to have taken some pains at a very early period to define the mode in which gas should be introduced into London, inasmuch as they issued a commission in 1822 to inquire into this subject. This commission was presided over by the celebrated Sir William Congreve, who advocated strongly, and the commission adopted his views in this respect, that only one company should be allowed in any district of the metropolis. The wisdom of this advice has been amply proved by subsequent experience, but at the time the recommendation of the commission was not adopted, as although the companies were incorporated for the supply of certain defined districts, the exclusive supply of that area was not conferred upon them, and very soon, as soon indeed as it was proved that the speculation was unattended with risk, and that gas could be made and supplied at a profit, Parliament encouraged competitive undertakings by giving its sanction and approval to new companies; and, although the old companies had up to that time paid very indifferent dividends, as will be seen by reference to Table III, annexed, speculative investors were found willing to embark their capital in new undertakings empowered to supply districts already served, under the authority of Parliament, by the old companies.

In pursuance of this policy, the Independent Company was established, in 1829, to compete with the Imperial—the Equitable Company, in 1831, to compete with the Chartered—the London Company, in 1844, to compete with the Imperial, the Equitable, and the Chartered—the Great Central, in 1848, to compete with the two companies supplying the city—and the Surrey Consumers' in 1854, to compete with several companies on the south side of the Thames. The Western Company was also admitted by the several vestries, without parliamentary sanction, in 1850, to compete with the Chartered, the London, and the Imperial.

These several competitive companies were generally formed and promoted by bodies of consumers working in concert with the local authorities, through whom contracts were obtained at low prices for the supply of gas to the public lamps. In this manner a footing was gained in a district and competition secured.

Under this system, which prevailed from 1830 to 1857, many of the public thoroughfares were occupied by the mains of as many as four different companies, each of whom required to open the roadways frequently to make connections with or to repair their respective mains. It was of course impossible to distinguish one set of mains from another, consequently one company would frequently obtain a supply for its customer from another company's main. It was also impossible to say, when there was any escape of gas, from which company's main the leakage might be, hence all the companies opened the ground, and the surface of the road was scarcely ever at rest. The companies incurred great loss from the outlay of capital for four sets of mains where one would have sufficed, as well as loss of gas by leakage, owing to the difficulty of keeping the mains in proper repair, and the public suffered great inconvenience from the confusion naturally resulting from such a system.

The result of this competition also, so far from cheapening the supply of gas to the public, only led to increased expenditure, and eventually to an arrangement between the competitive companies to charge an uniform price, and to make the best dividends they could on their capitals, a considerable amount of which had been expended uselessly in laying several sets of mains in competition with each other.

This led to the adoption by the companies themselves generally, in 1857, of the system recommended by Sir William Congreve, viz., of dividing London into districts, each to be supplied by one company, whereby they improved their own position without in the slightest degree prejudicing the interests of the public.

The argument, that by means of competition the public would get cheaper gas, is utterly fallacious, inasmuch as, according to a very true apothegm of the late Mr. Robert Stephenson, "when combination between two or three public companies is possible (their number being necessarily limited), competition is impossible;" for of course they will not long continue to ruin each other for the benefit of the public; nor are there any means of compelling them to do so. Moreover, experience has shown that since the abandonment of competition between the London gas companies, the price of their gas has been materially reduced, to the great advantage of the consumer, as might reasonably have been expected from the greater economy in the distribution of gas resulting from it.

The public, however, have a horror of the name of "monopoly," and therefore, as soon as the companies had resolved to divide London into districts between them, the consumers raised a great outcry, on the plea that hereafter the price of gas might be increased,

and that being at the mercy of only one company, the public would have no means of redress.

This agitation led to long inquiries before Parliamentary Committees in 1858, 1859, and 1860, and eventually to the passing of the Metropolis Gas Act of 1860, which distinctly recognised the wisdom of the course pursued by the companies, and the expediency of allowing only one company in each district of the metropolis, but at the same time it placed all the companies under most severe obligations and restrictions for the benefit of the public, both as to price, illuminating power, purity of their gas, the maximum rate of their dividend, and other matters, *as the condition of their enjoyment of a monopoly.*

The obligations imposed on the companies by the Act of 1860 were shortly as follows, viz.:—

The companies were bound under penalties to furnish an ample supply at all times to every one in the district requiring it, and practically to extend their mains whenever required in that district, either for the public or private supply.

They were restricted to the maximum price of 4s. 6d. per 1,000 cubic feet for 12-candle gas, except any extraordinary emergency should arise, when the Secretary of State for the Home Department had power to authorise an increase of price to the extent of not exceeding 5s. 6d. per 1,000.

They were subject to heavy penalties if their gas was at any time below the standards of illuminating power and purity fixed by the Act.

They were obliged to supply meters at fixed rentals.

They were to publish their accounts annually, with such details as the Home Secretary might require, so as to show distinctly the amount of profit they were making.

Their dividends were limited absolutely to 10 per cent. per annum. All surplus profits beyond the amount sufficient to pay dividends at that rate, and to form a reserve fund of a limited amount wherewith to maintain that rate of dividend, were to be applied in the reduction of the price for gas.

Quarter sessions, at the instance of any two consumers, had the power to order an investigation of any company's accounts at any time, and arbitrarily to reduce the price to be charged for gas if on such investigation it should appear that the companies' profits would admit of such reduction.

Such were the advantages conferred on the public by the Metropolis Gas Act of 1860, and such were the onerous obligations imposed on the companies as the price of the recognition of Parliament of the system of "districting" adopted by them.

The steady increase in the demand for gas, and the obligation

put on the companies to supply every one who might require it, compelled the companies to expend additional capital year by year in enlarging their manufactories and extending their mains, in order that they might be able to fulfil their obligations, and ere long, as the power granted to them of raising the necessary capital became exhausted, they had to apply to Parliament for additional powers. At such times they were strenuously opposed by the local authorities, that is, either the Corporation of London within the city, or the Metropolitan Board of Works outside the city, who pleaded that advantage should be taken of the opportunity afforded by the exigency of any company to extract some further conditions from it in favour of the public. This agitation reached a climax in 1866, when the local authorities pleaded that the Act of 1860 was more favourable towards the companies than was intended, and Parliament appointed a Special Committee to inquire into the question. This inquiry was followed by another Committee in 1867, presided over by the present Lord Cardwell, who, yielding to the views of the Opposition, recommended Parliament to empower the local authorities to erect works and supply gas in competition with the companies out of the public revenue, unless the companies would consent to accept his terms, which terms altered entirely the title and conditions upon the faith of which the shareholders had invested their money, and which title Lord Cardwell admitted, in the report his Committee made to the House, that Parliament could not justly deprive the companies of without their consent. The terms referred to were that an arbitrary initial price should be fixed for gas, viz., 3s. 9d. per 1,000 cubic feet, with an illuminating power of sixteen candles, and that if any company could pay 10 per cent. at that price in any year, they might do so; if they could not, they might in the following year call upon Government to appoint three commissioners to make inquiry. These commissioners were authorised to raise the price for one year, to an amount not exceeding 5s. 6d. per 1,000 feet, if they should think it right, so as to allow the company in that year to pay as near as may be, but not exceeding, 10 per cent. No year was to be supplemented by the excess of profits in any other, and the system of the reserve fund was altogether abolished. In like manner the local authorities were empowered to call in the aid of the commissioners for an inquiry, with a view to a reduction of price below 3s. 9d. per 1,000, in case they should consider that a less price than 3s. 9d. ought to pay 10 per cent. These powers were termed the "revision clauses." All the companies on this occasion refused the terms proposed.

Accordingly, in the next year, the Corporation promoted a Bill, following out Lord Cardwell's suggestion, for power to erect works and supply gas in the city in competition with the companies, at

the expense of the public rates, and in 1868 the same Committee, again under the presidency of Lord Cardwell, having repeated their threat that they would pass the Corporation Bill unless the terms referred to were accepted, the three companies supplying the city, who would most certainly have been utterly ruined by such unequal competition with the Corporation, were most reluctantly compelled to accept Lord Cardwell's conditions, which were accordingly incorporated into "the City of London Gas Act, 1868," and the three companies were amalgamated into one. The other companies, who were serving districts outside the city, and were not affected by the threat of competition by the local authorities, absolutely refused Lord Cardwell's terms, and Parliament happily modified those conditions in some important respects in the case of the Imperial Company in the next session (1869), when that company repeated their application for the means wherewith to comply with the obligations imposed upon them.

In the years 1872, 1873, and part of 1874, the coal famine occurred, when the cost of the material from which gas is produced rose from an average of 14s. to 32s. per ton, consequently the majority of the companies who remained under the Act of 1860, raised their prices of themselves, as they had the power to do, to enable them to meet the emergency; but the two larger companies, viz., the Chartered and the Imperial, who had no power to raise their prices of themselves, were obliged to submit their circumstances to the arbitration of Commissioners, under the revision clauses of the Acts of 1868 and 1869. The result of those appeals were wholly in favour of the companies, although the local authorities offered the most strenuous opposition to any increase of price above 3s. 9d. The Commissioners gave both companies authority to charge such an advance as they estimated would be sufficient to yield the maximum rate of dividend during the years of pressure, and no subsequent appeal having been necessary after 1874, the initial price of 3s. 9d. was resumed on the 1st January, 1875.

This result of the operation of the revision clauses, which originated with and were framed by the local authorities themselves, seems to have exasperated those bodies excessively. They insisted that the powers of revision were never intended to be the means of raising the price for gas, but only of reducing it; finding, however, that no one agreed with them in this view of the question, they resolved to endeavour to get the revision clauses repealed, and to devise some new scheme for the subjugation of the gas companies.

Accordingly they lost no time in making another appeal to Parliament, and in the session of 1874-75 the Corporation of

London and the Metropolitan Board of Works unitedly promoted three Bills, the character of which it is difficult to name respectfully, viz.:—

No. 1. A Bill to enable those bodies to establish new gas manufactories, and to lay down duplicate mains all over London, involving a probable outlay of 10 millions sterling, so that they might manufacture and sell gas in competition with the existing companies over whom those bodies had the control, whilst they themselves were not to be subject to any control, or to any of the restrictions or obligations imposed on the companies.

No. 2. A Bill to enable those bodies to purchase the undertakings of the gas companies compulsorily, at prices fixed by the purchasers themselves.

No. 3. A Bill entitled a "Metropolis Gas Regulations Bill."

The real object of this last Bill was to repeal the revision clauses of the Acts of 1868-69 before referred to, and in their place to enact that the price of 3s. 9d. per 1,000 cubic feet should be the maximum price which any of the companies might hereafter charge without suffering the penalty of a reduction in the prescribed rate of their dividends, which it was proposed should be decreased by a quarter per cent. (be the maximum or prescribed rate 10, 7, or 5 per cent.) for every penny the companies might charge above 3s. 9d. per 1,000. Or in other words, the companies being compelled to supply gas were to be made to suffer in their dividends for any rise in the cost of coal or in the rate of wages, over which they could exercise no possible control—there was no provision in the Bill for any increase of dividend in case the price of gas was reduced. No. 1 Bill was to be used as *brutum fulmen* to compel the companies to surrender and to accept the unreasonable conditions of Bill No. 3; and No. 2 (the Purchase Bill) was to be kept in reserve so as to enable the public bodies to pick up the undertakings of the companies after they had been so depreciated by the operations of the Regulations Bill (No. 3) as to be a burden and a loss to the shareholders.

Such were the designs of our renowned Corporation of the City of London, aided by their brethren the Metropolitan Board of Works, but those designs were happily too transparent to be successful. The present Government gave the promoters no encouragement, so that they were fain to withdraw Bills Nos. 1 and 2, and as to Bill No. 3, the Chancellor of the Exchequer (Sir Stafford Northcote) said openly in the House on the second reading of that Bill, that the clause which proposed to reduce the dividends, if the price for gas exceeded 3s. 9d., "amounted to a "breach of faith, and was an unfair clause to be adopted. If that "clause were to be considered an essential principle of the Bill, the "House, he thought, would pause before it gave its consent."

Again, "It would be the duty of the Government to watch the Bill carefully when it came back from committee, and if that clause came back in its present shape, it would be impossible to allow the Bill to proceed any further."

With this warning on the part of the Government, the Bill was sent to a select committee, of whom Mr. W. E. Forster was the chairman. Whilst the Bill was under consideration, the Board of Trade adopted the very unusual course of addressing a letter to the Committee, suggesting that, in the opinion of the Board, the justice of the case would be met by allowing the dividends of the companies to rise, as well as fall, above or below the prescribed rates, inversely with any increase or decrease in the price of gas, 3*s.* 9*d.* per 1,000 being adopted as the initial price for gas equal to sixteen candles of illuminating power; and this suggestion the Committee adopted, by resolving to recommend the repeal of the revision clauses of 1868 and 1869, on the faith of which the companies had raised and invested more than two millions of capital, and to substitute in their stead the entirely novel legislation of making the companies suffer or gain in their dividends by the rise or fall in their price for gas, notwithstanding that the companies have no power whatever to control the price of the raw material from which such gas is to be made, and which they are compelled to supply, whatever loss they may thereby incur.

When this decision was announced, the companies, with one exception, withdrew from the Committee, with a view to an appeal to the House itself, but owing to the lateness in the session when the Committee reported the Bill, it did not reach the stage of being read a third time, and so dropped. But the Bill as passed by the Committee in the form here described, has been again brought in by the promoters in the present session; the shareholders of the metropolitan gas companies, however, are still disinclined to believe that the legislature will inflict upon them so grievous an injury, or exhibit so manifest a departure from good faith or sound policy towards private enterprise, as to force the Bill in question upon them.

It is true that at the present price of coal the companies can pay their maximum rates of dividend at the price of 3*s.* 9*d.* per 1,000 feet for 16-candle gas; and it may even be admitted that a reduction of price, which will enable the companies under the scheme to pay higher dividends than heretofore, is probable, under existing circumstances, but who can ensure that the present cost of coal will continue for another year? Or who will be bold enough to say that, if after the companies have once surrendered their parliamentary title, and having accepted the sliding scale scheme, are able, by a reduction in the price for gas, to pay more than their

existing maximum dividend, their adversaries will not immediately cry out that "the initial figure of 3*s.* 9*d.* is too high?" and, repeating their old tactics, plead that it is more favourable than was intended, and agitate for its reduction. There is, therefore, no finality in the proposed settlement, for experience has proved that when the companies seem to be prosperous a clamour is sure to arise, and according to the views of our local authorities, that state of prosperity would afford a sufficient reason for abridging the powers by which it had been occasioned.

The shareholders of the several companies by no means covet the supposed boon which is held out to them, of liberty to pay higher dividends than those already prescribed. The new scheme they say would obviously change entirely the character of their investment from a guaranteed stock, which it really is at present, into a speculative enterprise, wholly dependent upon the rise and fall in the cost of coal; they, therefore, decline the offer, which they consider to be wrong in principle.*

It is of course impossible in a paper of so limited dimensions to give more than the principal features, or a brief outline of the long series of conflicts which have taken place between the local authorities of the metropolis and the gas companies, and the part the legislature has taken in those proceedings; but sufficient, it is hoped, has been said, to convey clearly the main questions at issue, and the views of each of the parties concerned.

In seeking to find some justification for the attitude which the local authorities assume towards the companies, it must be admitted that the companies are certainly by no means popular bodies. One is accustomed to hear them spoken of everywhere, and by almost everyone, in the most opprobrious terms. They are accused among other things of being overbearing towards their customers—exactingly in their charges—supplying abominably bad gas—of being able in some way, how, no one else knows, to make meters register a much larger quantity of gas than can possibly have been consumed—of lighting the public streets most indifferently—of always disturbing the roadways in the streets unnecessarily, and never properly repairing them after disturbance—and of making fabulous profits out of the much injured consumer, which profits it is asserted are either distributed among the shareholders, in some occult way, far

* Since this paper was written the three companies lately amalgamated, viz., the Gaslight, the Imperial, and the Independent, who unitedly supply more than two-thirds of the metropolitan area north of the Thames, have consented to a compromise, by accepting the sliding scale scheme and relinquishing the revision clauses; also agreeing that when any additional share capital is raised it shall not be allotted among the shareholders at par, as usual, but shall be put up to auction, and sold to the highest bidder for the benefit of the undertaking.

in excess of their authorised dividends, or are spent recklessly in paying princely salaries to the directors and officials.

This selection from the catalogue of crimes attributed to the metropolitan gas companies are matters of almost general faith—but a few facts and words of explanation ought to satisfy any reasonable person that there is no foundation whatever for any one of these accusations.

The alleged overbearing conduct is probably due in some measure to the necessity which exists for the companies to ask their consumers to pay their accounts with some degree of punctuality. But the London companies in order to spare their customers as much trouble as possible, collect their accounts not monthly, as they do in many of the towns in the provinces, in all the continental cities, as well as in all the cities in the United States, but quarterly. No part of the duty connected with the management of a gas company is so trying as this collection of debts. In London the accounts of those residing in private dwellings, even in the wealthier districts, average only 11*l.* a-year, or 1*l.* 15*s.* in autumn quarter, and 3*l.* 15*s.* in winter, and as the companies have to pay for all the coals they consume, as well as the wages of the large number of men they employ, week by week, it is essential to economy and good management that the monies due to the companies should be collected as promptly as circumstances will admit. Experience has proved also that long credit results in bad debts; and, as a proof of the forbearance of London companies, it may be stated that their losses from bad debts amount to about 14,000*l.* a-year, or nearly one-half per cent. on the total amount of their receipts arising from the sale of gas. In the other cities referred to where the collection is made every month, and where no such forbearance is shown as in London, a bad debt is unknown.

As to the alleged high price charged in London, the inhabitant who makes such a complaint can be scarcely aware that in no city in the world outside of England is the supply of gas so good as to quality, or so cheap as to price.

In London, the normal price is at the rate of 3*s.* 9*d.* per 1,000 cubic feet for gas equal to sixteen sperm candles in illuminating power. In the undermentioned cities, where the quality is much inferior, the price is as follows, viz. :—

	<i>s.</i>	<i>d.</i>	
Paris	6	7½	per 1,000
Berlin	4	3½	„
Amsterdam.....	5	—	„
Vienna	5	8½	„
New York	10	—	„
The other cities in the United States....	12	—	„

In some of the northern cities of England and Scotland, which

are situated close to the coal fields, and where the cost of labour, land, and material, is much less than in London, those cities may have gas cheaper and of a higher illuminating power than London; but in order to institute a fair comparison between them, the circumstances under which the same is supplied in each should be duly weighed and considered.

The standard of illuminating power for the gas supplied in London has been fixed at sixteen candles, for the reason that no higher illuminating power can be produced without the use of a very large quantity of rich "cannel" coal. Even 16-candle quality requires the admixture of nearly 10 per cent. of that coal with about 90 per cent. of certain descriptions of Durham coal. Good cannel is becoming very scarce, and therefore costly, and the coke which is produced from it is of very inferior quality. The price of cannel has gone up nearly 50 per cent. within the last few years; the owners of it are very few in number; and it is obvious that if the illuminating power in London were raised so as to compel the companies to employ that description of coal exclusively, or even in much larger quantities than at present, they would be placed at the mercy of the cannel coal owners, and it would be utterly impossible to supply gas in London at anything like the present prices.

It has been stated, in an earlier part of this paper, that the quantity of coal now consumed by the London companies amounts to 1,500,000 tons per annum, and it will be seen by reference to Table IV, at the end of this paper, that the total yield of cannel of all kinds amounts to no more than 1,418,176 tons per annum, a large portion of which is quite unfit for the purpose of gas manufacture.

The maximum quantity of sulphur and ammonia allowed to be present in gas in London (no trace of sulphuretted hydrogen is permitted) is fixed from time to time, according to circumstances, by three scientific gentlemen, selected and appointed for the purpose by the Board of Trade, who are called gas referees, and in proof of the high position and qualification of those referees for the office they hold, it may be sufficient to mention that Professor Tyndall is one of them. The duty of ascertaining whether the companies comply with the requirements of the Acts and of the referees, both as to illuminating power and purity, is vested in the Corporation of London within the city and the Metropolitan Board of Works outside the city, and both of these bodies employ skilled chemists of a high class to test the gas continuously day by day, whilst it is being delivered out for consumption, in testing houses in various places about London, which the companies are bound to provide and fit up at their expense with all necessary apparatus and appliances,

and to give the requisite supply of gas for the purpose free of cost. The penalties to which the companies are liable for any infringement of the standards, however limited may be the degree of excess, for any period of the day, are very severe, and it is further enacted, by way of additional torture, that every penalty which may be incurred shall not be payable out of the ordinary expenses of the company, but shall be absolutely deducted from the dividends of the shareholders. The public bodies referred to, whose disposition towards the gas companies cannot be characterised as amicable, are watchful beyond the possibility of evading them, even if it were desired, and they would apparently be only too happy if they could catch the companies tripping; but in spite of their inclinations, they are compelled day by day to admit and certify, as they do, that the gas supplied is invariably not only equal to but above the standard as respects its illuminating power, and several degrees below the maxima fixed for the impurities.

As to the disturbance of the roadways in the streets, the most convenient and appropriate place in which the gas mains might be laid is undoubtedly underneath the pavement of the side walks, as in most foreign cities, but in London the cellars of the houses extend underneath the whole of the side pavements, the arches of which are so near the surface as not to admit of the pipes being laid between them and the pavement; and after any roadways may have been disturbed for the necessary main laying, the local vestries refuse to allow the companies to make good the surface; they claim to do this work themselves, with a view, apparently, of making some profit out of the companies by so doing. The vestries, and not the companies, are therefore answerable for any defects in the restoration of the roadways, if such there be, after main laying. The vestries are also responsible for all the odium which attaches to any defective lighting of the public thoroughfares; the companies merely provide and supply the gas, whilst the vestries determine the number and position of the lamps, as well as the size of the burner which regulates the quantity of gas to be supplied, and for which they are to pay; so that, if through the parsimony of the local authorities the street lamps are not sufficiently numerous, or the size of the gas flame is not so large as it ought to be, the companies are in no way to blame; they are, in fact, powerless to make it otherwise. Comparing London and Paris in this respect, it may be sufficient to state that in the former, the area of which is 77,997 acres, there are 54,119 public lamps, whilst in the latter there are 38,498 in an area of 19,299 acres.

A very slight acquaintance with the mechanical contrivance of a gas meter ought to satisfy any impartial mind that by no human ingenuity can it be wilfully driven onward, so as to oblige the

consumer to take more gas than he desires, or to register more than he actually burns. If a meter errs at all—and every machine is to a certain extent imperfect—the liability so to err is in favour of the consumer. But the legislature has not been unmindful of those who feel dissatisfied, and feel also disqualified to look into this matter for themselves; official inspectors of meters and official meter-testing offices are provided in several convenient places in the metropolis, where impartial and skilled evidence may be speedily obtained at a trifling expense.

With respect to the dividends and expenditure of the companies, it is evidently not generally known that the companies who supply the larger part of the metropolis are placed under the active inspection of an official auditor, who is appointed by the Board of Trade for the express purpose of examining their accounts and of finding out whether any irregularity occurs. This auditor is a very different person from the ordinary and often incompetent shareholders' auditor, who readily accepts specious explanations and is willing to make things pleasant. The Government official takes nothing for granted; he likes his power, and uses it; he holds a continuous examination and makes minute inquiry; he is armed with supreme authority to disallow any item he may consider improper either in principle or detail, and he is actually authorised to prevent the declaration of any dividend which he considers has not been duly earned or is not lawfully payable. It is difficult, therefore, to conceive how more stringent precautions could be devised, or a state of things under which it would be more impossible for the companies to delude the public, even if they desired to do so, than under the existing law; and it may be added that the companies referred to, confident in their own integrity, willingly consented to submit themselves to these safeguards and precautions in favour of the consumer, in the hope that thereby they might disarm suspicion and gain confidence.

The increase in the consumption of gas throughout London is fairly illustrated by Table V appended, relating to the extensive district of the Imperial Company, over a period of twenty-five years ending 1874, during which the annual consumption has increased fourfold, and the quantity consumed on the day of the greatest demand in each year, which is always on the day preceding Christmas-day, has increased at a still larger ratio, being more than fivefold. It is for this day of the greatest demand, which in the case of the Imperial exceeds any other day by about two millions of cubic feet, that the capabilities of the several companies' works must be prepared and maintained, and this of necessity involves the outlay of a very large amount of capital for works which are required for the service of this limited season of the year only.

The increase of consumption it will be seen is still steadily going on, although the rate has fallen off somewhat during the last five years; there are, however, a very large number of houses yet to be supplied, especially those of the working classes.

That class, indeed, in London do not as a rule avail themselves of the use of gas in their dwellings, and by no means to the extent they do in the northern towns of England or in Scotland. For example, in the well-to-do parishes of Marylebone and Paddington, in London, the number of inhabited houses supplied with gas are 73 and 80 per cent. respectively of the whole number, whilst in Bethnal Green 27 per cent. only of the dwellings are thus supplied, and in the northern towns of England, as well as in Scotland, the number of one-light meters, which is essentially the poor man's meter, greatly exceed those used in London. Very few of the small dwellings in London indeed have any gas fittings in them, the poor for the most part still use the common dip candle, or a paraffin lamp, when some manufacture is carried on which requires an extra amount of light; and yet it will be seen from a very interesting Table (VI) appended to this paper that, adopting the common standard of a sperm candle for comparison, the quality of gas now sold in London at 3s. 9d. per 1,000 cubic feet, will give 52 hours of light for 1d., whilst a dip candle at 6d. per pound will give only 5 hours and 45 minutes of the same light for that money.

The working classes of London, therefore, require to be educated in this particular among other things relating to the economy of living, and it is satisfactory to notice that in the new dwellings for artisans, and in some of the model lodging houses lately erected, the promoters of those excellent institutions are doing their best to this end by fitting the several rooms with the needful appliances, so that the occupiers may avail themselves of the cheapest mode of obtaining artificial light.

It only remains to refer to a question which has been the subject of much discussion of late, viz., whether it is desirable or not that the supply of gas should be taken from the companies and placed in the hands of the municipal authorities. The fact that the supply is of necessity a monopoly, that economy may be effected by uniting the districts of the companies into one, and that the roads, which are occupied by the mains and pipes of the companies, are under municipal control, would seem to commend the proposal; and probably if London had been under the government of a municipal council worthy of the name, representative in its character, and possessing the confidence of the community, the gas supply would long since have been entrusted to that body. There are many precedents for so doing—several of the large towns in England, and Manchester especially, may be referred to,

where the duty has been most efficiently performed by the municipalities for many years; and there is no reason why a competent committee of a municipal council in the metropolis could not conduct the operations now fulfilled by the directors of the several companies with equal skill, although, if proof is needed that the task is not beyond their powers, certainly no such enormous undertaking, as that involved in the manufacture and distribution of gas for the whole of London, is to be found elsewhere.

The companies can have no desire to retain the work in their hands, if the municipality desires to acquire their undertakings, provided only that their property is fairly purchased, and the transfer is effected on equitable terms. The shareholders in those companies are, however, greatly alarmed, and naturally apprehensive, at the views which the authorities have expressed as to what they consider to be equitable terms for a compulsory sale. In a letter from the late chairman of the Metropolitan Board of Works to Sir Stafford Northcote, as President of the Board of Trade in 1866, when the former was requested to communicate to the Government the opinion of the Metropolitan Board as to the terms upon which authority should be given to that Board to purchase the property of the companies, he deliberately states "that looking at the *present* market value of the gas shares, and "to the fact that their (the companies') security is an uncertain "one, the Board resolve that it would be *fair* and *proper* that the "Bill for the purpose of purchase should provide for the enforced "sale of the properties of the companies by the payment to the "shareholders of a dividend of *only 6 per cent.*" Now the properties referred to, it should be borne in mind, were then earning and paying authorised dividends at the rate of 10 per cent., and they had been doing so with regularity for many years previously; and in an earlier part of the same letter the chairman of the Metropolitan Board gives it as the reason for requiring an alteration of the then existing law, that the operation of that law "practically secured to "the companies a guaranteed dividend of 10 per cent."

Again, as lately as last year, the Bill promoted by the Metropolitan Board for power to purchase compulsorily the undertakings of the companies, proposed that the price to be given for the same should be the average market value of the shares of the companies during the three previous years, throughout the whole of which period it was notorious that the violent agitation which had been raging against the companies had had the effect of depreciating the value of their shares from 30 to 40 per cent. The case of the Imperial Company may be stated as fairly illustrating the mode in which the shareholders in all the companies would have been dealt with under this proposal. The average price of the Imperial

Company's stock during the three years selected for the average was little more than 166*l.*, but the price at which the same stock was freely selling in the market shortly before the Bill was brought into the House was about 182*l.*, and since the agitation has abated the price has risen to upwards of 200*l.*

These are the only occasions on which the Metropolitan Board have openly and officially stated what they consider to be equitable terms for a compulsory purchase of the undertakings of the London gas companies, terms which, it is scarcely needful to say, do not accord with the views of the shareholders, and which they fully believe the legislature will never compel them to accept, notwithstanding that the sacrifice of the property of the comparatively smaller number of shareholders for the benefit of the much larger body of consumers has met with, and, perhaps, will always meet with, a certain amount of support both in and out of Parliament.

APPENDIX.

TABLE I.—*Statement of the Share and Loan Capital of the Metropolitan Gas Companies on the 31st December, 1875, showing the Average Maximum Rate of Dividend each Company is allowed to Pay on the Share Capital then employed.*

Company.	Capital Employed.			Average Maximum Dividend per Cent. on Share Capital Employed.
	Share.	Loan.	Total.	
	£	£	£	
Gas Light	3,349,998	813,500	4,163,498	8'9
Imperial	2,854,182	498,000	3,352,182	8'4
Independent	255,000	—	255,000	8'9
Commercial	450,000	—	450,000	10'0
Ratcliff	100,000	15,670	115,670	10'0
London	751,602	137,642	889,244	8'0
Phoenix	855,000	175,000	1,060,000	8'6
South Metropolitan	430,000	—	430,000	10'0
Surrey Consumers'	229,995	60,000	289,995	10'0
Total	9,305,777	1,699,812	11,005,589	8'8

TABLE II.—*Metropolitan Gas Companies. Prices Charged by the several Companies for Gas at their Commencement.*

Name of Company.	Date of Establishment.	Date of Incorporation.	Prices Charged for Gas, per 1,000 Feet, at the Commencement.	
			s. d.	
Chartered	—	1810	{ In 1823 when meters were first used }	15 —
City of London	—	'17		15 —
Imperial	—	'21	'26	15 —
Ratcliff	—	'23	'29	12 6
Phoenix	—	'24	'24	15 —
Independent	1826	'29	'29	12 —
Equitable	—	'31	'31	12 —
South Metropolitan	1834	'42	'34	11 —
London	'33	'44	'34	9 —
Commercial	—	'47	'50	5 —
Great Central	—	'48	'48	4 —
Western	1850	—	'50	{ 8 — Cannel gas
Surrey Consumers'	—	1854	'54	

Note.—Gas was originally supplied at per burner. There were but few meters in use between 1821 and 1825; they did not come into general use till about 1830.

TABLE III.—*Showing the Rates of Dividend Paid by the earlier Metropolitan Gas Companies in the commencement of their Undertakings.*

Year.	Chartered Company, Incorporated in 1810.	Imperial Company, Incorporated in 1821.	Phoenix Company, Incorporated in 1824.	Independent Company, Incorporated in 1829.
	Per cent.	Per cent.	Per cent.	Per cent.
1811.....	Nil	—	—	—
'12.....	"	—	—	—
'13.....	"	—	—	—
'14.....	"	—	—	—
'15.....	"	—	—	—
'16.....	"	—	—	—
'17.....	6	—	—	—
'18.....	8	—	—	—
'19.....	8	—	—	—
'20.....	8	—	—	—
'21.....	8	Nil	—	—
'22.....	8	"	—	—
'23.....	7½	"	—	—
'24.....	7	2	Nil	—
'25.....	6½	4	5	—
'26.....	6	5	5	—
'27.....	6	3½	5½	—
'28.....	6	Nil	6	—
'29.....	6	5	6	—
'30.....	6	5	6	5
'31.....	6	5	6	6
'32.....	6	5	6	6
'33.....	6	5	6	6
'34.....	6	5	4½	8
'35.....	6	5	3	9
'36.....	6	5	3	9
'37.....	6	5	3	9
'38.....	6	5	3½	9
'39.....	6	5	4	9
'40.....	6	5½	5	9

TABLE IV.—*Showing the Total Quantity of Cannel of all kinds Produced in 1865 by all the Collieries in the United Kingdom, as ascertained by Mr. Robert Hunt, F.R.S., Keeper of Mining Records in the Government School of Mines in Jermyn Street.*

	Tons.
England	946,175
Wales	150,000
Scotland	322,000
	1,418,176
Of which there were used for distilla- tion for coal oil	250,000
	1,168,176

Note.—The above table, although referring to the year 1865, may be taken as fairly representing the yield of cannel of all kinds in the year 1875, with the exception, perhaps, of Scotland, where there may have been some increase.

The quantity of cannel used by the metropolitan gas companies in the year 1875, for the purpose of enriching the gas made from Durham coal, amounted to 84,310 tons.

TABLE V.—*Imperial Gas Company. Table Showing the Rate of Increase in the Demand for Gas from 1850 to 1874 inclusive, over the same Area of Supply.*

Year.	Total Quantity Delivered during the Year.	Increase per Cent.			Largest Quantity Delivered in One Day in the Year.
		One Year.	Five Years.	Ten Years.	
	Cubic feet.				Cubic feet.
1850	898,031,942	5·9	43·1	100·4	4,193,000
'51	984,631,416	9·6	41·9	112·0	4,866,000
'52	1,102,680,708	12·0	43·1	131·4	4,993,000
'53	1,236,861,400	12·2	52·1	149·6	6,178,000
'54	1,318,349,000	6·6	55·5	141·9	6,657,000
'55	1,460,391,000	10·8	62·6	132·7	7,531,000
'56	1,548,347,000	6·0	57·0	125·3	7,710,000
'57	1,608,306,000	3·9	45·8	108·7	7,800,000
'58	1,692,336,000	5·2	36·8	108·1	8,545,000
'59	1,808,960,000	6·9	37·2	113·4	9,811,000
1860	1,981,913,000	9·6	35·7	120·7	10,008,000
'61	2,038,887,000	2·9	31·7	112·3	9,662,000*
'62	2,153,909,000	5·6	33·9	95·3	11,203,000
'63	2,212,411,000	2·7	30·7	78·9	11,585,000
'64	2,463,989,000	11·3	36·2	86·8	13,087,000
'65	2,637,222,000	7·0	33·0	80·5	14,254,000
'66	2,838,701,000	7·1	39·2	83·4	15,724,000
'67	2,992,832,000	5·4	38·9	86·1	15,971,000
'68	3,019,000,000	0·9	36·5	78·5	17,023,000
'69	3,169,444,000	5·0	28·6	75·2	17,396,000
1870	3,364,524,000	6·2	27·6	69·7	19,603,000
'71	3,559,857,000	5·8	25·4	74·6	20,394,000
'72	3,661,583,000	2·9	22·3	70·0	19,953,000
'73	3,856,018,000	5·3	27·7	74·3	19,879,000
'74	3,998,059,000	3·7	26·1	62·8	23,352,000

* This falling off is attributed to the death of the Prince Consort, which occurred on the 16th December in this year.

Note.—5 per cent. at compound interest = 63 per cent. in ten years.

6	„	= 79	„
7	„	= 96	„

TABLE VI.—*Comparative Cost of Illumination by Different Lighting Materials in common use; showing the Hour of Duration for each Penny. The Light Reduced to Equal One Standard Sperm Candle.*

Description of Material.	Price in London.		Hours Light for One Penny.	
	s.	d.		
Standard sperm candle per lb.	2	—	2 ^h	15 ^m
Best wax candle "	2	—	2	15
Sperm oil in moderator per gal.	9	6	2	24
Belmont sperm candle per lb.	1	3	2	54
Stella or Burmese wax "	1	3	3	15
Petrolin candles "	1	6	4	30
Composite candles, No. 1 "	—	11	4	10
" 3 "	—	8	5	30
Common dip candles "	—	6	5	45
Almond oil in moderator per gal.	9	3	6	—
Colza "	5	—	9	15
Paraffin oil lamp "	3	—	19	11
Common gas..... per 1,000 ft.	3	9	52	—

Note.—The writer is indebted for the above table to Mr. George Glover, of the Ranelagh Works, Pimlico, the manufacturer of the celebrated dry meter, the experiments for which table were made under Mr. Glover's personal superintendence.

DISCUSSION *on* MR. CHUBB'S PAPER.

PROFESSOR LEONE LEVI asked how much of the directors' fees, salaries of clerks, and other expenses of keeping up the offices would be economised if the Corporation were to purchase the whole interest of the companies. He imagined that a great deal of waste now occurred in consequence of the existence of so many companies, and that much expenditure might be saved were the whole provision of gas to the Metropolis entrusted to the Corporation or Board of Works. If he was well-informed, in Manchester the Corporation was producing gas at a cheaper rate than the London companies did, although Manchester was at some distance from the Newcastle coal-fields. The paper was defective in this respect that it did not give an opportunity of comparing one place with another or one method of dealing with another. The author assumed that the gas companies were to work at a guaranteed stock of 10 per cent. That of course was the maximum to begin with, but the paper did not give the dividend actually made by all the companies from year to year; in some cases it was 6 and in some cases 7 per cent. From 1830 the Chartered company divided only 6 per cent. If that were so, there was apparently nothing unjust in Sir John Thwaite's proposal to take 6 per cent. as a basis. The question resolved itself into a consumers' question—whether the consumers would be benefited by the Corporation or the Board of Works having the entire gas supply in their own hands, rather than it should be in the hands of companies making a monopoly. The paper was in his opinion written entirely from a monopolist's point of view. It was very useful as far as it went, but he was sorry to see that it did not contain such elements as would lead to a fruitful discussion.

Mr. PATTERSON thought with Professor Levi that the author should have added some further statistics to the paper. In regard to the Professor's requiring Mr. Chubb to supply some statistics showing the gain to be obtained by the public by the transference of the gas to the municipality, no gain such as the Professor looked forward to was to be expected in the case of two such companies as the Imperial and the Chartered, supplying two-thirds of all London. The difficulty was before sufficiently great of superintending each of these companies' works efficiently; and by putting the two together and reducing the number of directors he did not believe that they would be better managed than they had been separately. The only advantage he saw was that by shutting up badly situated companies' gas works in London there would be a great economy. Some works in London had been badly situated for the supply of coal, which was an essential element, and by taking them out to such places as Beckton and Kensal Green, where the supply of coal is more accessible, doubtless economy would be the result; but he did not look forward to any economy from the mere amalgama-

tion of administration. If the Municipal bodies expected any gain in that direction he did not think their expectations would be realised.

Mr. CHUBB, in answer to a question by Dr. Farr, stated he was quite right in assuming from Table No. III that there was no dividend earned by the Chartered Company from 1812 until 1817. The first dividend paid was in 1817, and that was 6 per cent., then it was 8 per cent. for a few years, and afterwards, as far as the table is carried, it became nearly a steady 6 per cent. (Dr. Farr: They paid a dividend every year?) Yes. In 1860 they paid 10 per cent., and since that the percentage has been the same. That might be complained of, but it was authorised, and the money was invested on the condition that such a price might be charged, as would with due care and management yield a dividend at the rate of 10 per cent. He had not the least objection to admit that the paper was written from the companies' point of view, nor had he any objection to state the total amount paid to the directors and auditors of all the companies, and in the salaries of the officers of the companies. If the companies were reduced to one undertaking, of course there need not be so many officials. The directors' salaries were 0·40 of a penny on every 1,000 feet of gas—the salaries of the whole staff of clerks and secretaries of the companies amounted to 0·45 of a penny. He had some difficulty when writing the paper in restraining himself from giving more particulars, but owing to the extent of the question he had been compelled to condense, yet he hoped that some suggestions would be given to him for future use. He had endeavoured to post himself up to the end of last year, but he had failed because the accounts of the companies were not all complete. Manchester had been alluded to as one of the places with which a comparison should be made. There was undoubtedly better gas there than in London and a less price was charged. Three shillings in the city and 3s. 6d. in the outlying districts. Manchester was situated on the borders of the Wigan coalfield, in which district the best cannel is obtained, and coal is procured at a much cheaper rate at Manchester than in London; but for many years Manchester charged a higher price for gas than was charged in London. When the London price was 4s. 6d., Manchester was charging 6s., and at that time they used all the surplus profits to pay off their capital. They reduced it year by year until they had now a very reduced amount of capital to pay interest upon. They also raised their capital at 4 per cent. interest, and by that means they had very little interest to charge upon capital investments. The actual working expenses of the Metropolitan companies, or at Manchester indeed, really differed very little except from local circumstances. Some of the Metropolitan companies had reduced their capital in earlier times in the same way as that to which he had alluded. The companies then spent their increased profit in enlarging their mains and in other works, instead of raising additional share capital for the purpose, and there was in such cases less capital to pay interest upon. The South Metropolitan, for instance, wanted only 11d. per thousand to pay their maximum dividend, whereas other companies who had not

so reduced their capital wanted 1s. 3*d.* One other company only wanted 9*d.* per thousand; there were in fact special circumstances in almost every company which really required explanation, and which affected the price charged by the company for their gas. He was glad to give that explanation in order to show that it was not economy of working, but that there were other circumstances which affected the price charged for gas to a far greater degree.

In answer to a question, Mr. Chubb stated that the Metropolitan companies were practically guaranteed dividends of 10 per cent. The Act required the companies to supply gas of a certain quality to everyone who demanded it, and subjected them to penalties if they did not do so. It provided that they might charge such a price within limits, 5s. 6*d.* being the limit, to pay 10 per cent. on their capital, and not only so, but they would be allowed to put by a reserve fund year by year to the extent of 10 per cent. on the capital raised, which fund is stated to be for the purpose of equalising and insuring the payment of dividends at the maximum rate. This was complained of by the Metropolitan Board of Works; practically it amounted to a guaranteed dividend. Since he had written the paper, the two companies alluded to by Mr. Patterson and one of the smaller companies had been amalgamated. The United Company had adopted the scheme that the dividend of 10 per cent. should rise and fall with the price, although he still maintained that the scheme was wrong in principle. However, it had been accepted, and a large portion of the metropolis would now be supplied with gas upon that basis, namely, that if the price were reduced a penny per thousand feet the Company might pay one quarter per cent. higher dividend, and if, on the other hand, the price were raised a penny, there would be a quarter per cent. less dividend.

Mr. HYDE CLARKE said that Mr. Chubb stated that he had been compelled by circumstances to compress a large fund of information in order to give a clear view on the present occasion. It would, therefore, be worth while to turn back to the early sketch which Mr. Chubb had given of the history of gas, and of the obstacles to be met with, because that had a wider bearing. One might be inclined to believe that gas was opposed in the first instance by men of science, but by careful perusal it would be found that there were other circumstances which influenced the delay of its introduction and progress. All charlatanism was put forward under the plea that gas and other useful inventions had been opposed by men of science. If Mr. Chubb would give the information with which he was so conversant, it would be found that a great part of the opposition that was made to the introduction of the gas companies was in consequence of the statements of Mr. Windsor, the projector. At the time Mr. Windsor issued his prospectus of what he called The National Light and Heat Company, he proposed to abolish every vested interest. He was to prevent anybody from burning a candle, and compel him to be supplied with gas from Mr. Windsor's National Light and Heat Company; and the whole cooking of every cottager in the country was to be performed by

gas. Each 100*l.* share was to pay several hundreds a-year. Men less ardent than Mr. Windsor were less disposed to accept that prospectus. Mr. Chubb himself had given a corrective in the picture he had drawn of the mechanical expedients that were then available. It would be remembered that on account of the difficulties in the manufacture of iron pipes and tubing, the water-mains of London at that time—those of the New River Company for instance—were made out of trunks of trees bored through and inserted in each other, and in the same way as Mr. Chubb had pointed out old gun-barrels were largely used up for gas fittings. Besides, there was a serious explosion of a gasometer in London. There was an impossibility at that time of working out the scheme of such a projector as Mr. Windsor, and while Sir Humphrey Davy and other men of science could not deny what they were carrying out in their own laboratories, namely, the practicability of illuminating with gas, they hesitated at that stage to carry out the scheme of Mr. Windsor and others, and that is what should be borne in mind and due allowance made for. Besides that, there were a number of vested interests at that period. The streets were lighted with train oil, and there was the competition of the Greenland fisheries that exercised a considerable influence to be contended with. There was also a great question at that time as to whether coal itself was the best material for making gas. Oil gas had been tried in London and Dublin, and on account of the great expense of the fittings there was an experiment made that instead of supplying it by means of the inconvenient and expensive fittings and mains, it should be supplied like milk or beer to the houses or shops of the people. That was actually done for some considerable period by the Portable Gas Company. A cylinder was taken into the shop, and gas was conveyed from the cylinder to the counter of the shop by a small pipe from the top. At that period this was a feasible undertaking, however absurd it might seem now. Through an improvement in the fittings, the diminution in the price of coal, and the improvements in the manufacture of gas, the price of coal-gas was reduced, and there was an end for the time of portable or compressed gas, but now at length it was in use for railway carriages. His remarks were rather intended as a supplement to what Mr. Chubb had said, because people were apt sometimes to be misled as to the actual events that had influenced the career of such undertakings. Mr. Chubb had spoken of the price of gas, but at the time he was speaking of, the price of gas was 28*s.*, and afterwards it was subjected to the enormous reduction to 21*s.*, as it was considered. Economical considerations had a greater influence in the development of an invention than the simple beauty of the invention in the first instance.

Mr. GEORGE LIVESEY, referring to Mr. Chubb's statement that the South Metropolitan charged a higher price in years gone by than others in order to reduce their capital, said that that company had never charged a higher price than their neighbours. Previous to 1848 there was a competition all over London, and all the companies were obliged to charge the same price. In 1848 the

price was 6s. per thousand. Sir John Thwaites (then Mr. Thwaites) undertook an agitation to reduce this from 6s. to 4s., and the gas companies then, as they had at other times, showed themselves a pig-headed lot, and refused to make any reduction whatever. The result of this was that the Great Central Company was started in the north of London, and the Surrey Consumers' in the south, and there was a reduction to 4s. The competition went on for some years, but in 1853 it was found that this competition would not do, and the companies resolved to divide their districts. This suggestion came from Mr. Thwaites. At Michaelmas, 1853, the London and Phoenix, the Surrey Consumers', and the South Metropolitan divided the South of London between them. The reduction from 6s. to 4s. reduced the dividends of the South Metropolitan from 6 to 5 per cent. for two or three years, and immediately on the districting taking place the price went to 4s. 6d., and the dividends began to rise. Looking at that fact, it could not be said that the price of gas had been reduced so much during the last twenty-five years. The gas itself after all was not so much better, but the improvement in it was due to a great extent to the alteration of the burners. He could not see the justice of companies being guaranteed 10 per cent. He did not agree with Mr. Chubb that they were absolutely guaranteed 10 per cent., but they were practically guaranteed this amount. The fact of their having a monopoly of the district to themselves, and of their having a price to cover all contingencies, gave them the power to secure to themselves 10 per cent. He hardly thought that it was the intention of the legislature to give an absolute guarantee of 10 per cent., for it said in the Act that the dividend should not exceed 10 per cent., as was the case with railway companies. As to the sliding scale, he contended that it was not fair in such a crisis as the gas companies had passed through lately, when coal went up enormously in price, that the whole extra charge should be laid on the consumers. No ordinary tradesman was able to do it. The railway companies raised their fares, and they also reduced their dividends to some extent. But the gas companies did not diminish their profits; they made the same dividend in the year of famine as in the year of plenty. The Newcastle Company and the Brighton Company were limited to 3s. 6d. per thousand previous to the coal famine, but when it came upon them this was found to be a very hard price, and they applied to Parliament to increase their price. Lord Redesdale passed a resolution that any company applying for an increase of its maximum price should not pay more than 5 per cent. so long as it charged a higher rate than the maximum price fixed under the Act. The Newcastle and the Brighton Companies got power to charge a higher price, and they went up to 4s. for one year, and then they reduced it to 3s. 6d. They were not willing to suffer such a reduction of dividend, and that brought their price down. He thought that to cut down the dividend from 10 per cent. to 5 per cent. was a hard matter indeed; but he thought the sliding scale principle was a most fair one. The only objection made to it was that if it were adopted and the companies were paying 11 and 12 per cent. the public would make an

outcry. He believed if the sliding scale were adopted it would be to the interest of the companies to increase their business very largely. He (Mr. Livesey) had read the reports of the Manchester Corporation every year, and they gave an account of the number of meters fixed. The number last year was over 60,000, but upwards of 30,000 were for two lights, thus showing that half their customers were of the working class. It had not been to the interest of the London companies to supply the working classes, but if they increased their business by every means in their power, they could increase the number of consumers by at least 20 per cent. In that case he should not mind having 1 per cent. bad debts, instead of half per cent. As to the auditing, he was bound to agree with all that Mr. Chubb had said about the Government auditor, but no auditor could go to the works and see what should be appropriated to revenue and what to capital. It would be to the companies' interest to keep down their capital and supply their customers well. Of the capital of the South Metropolitan Company there was nearly 80,000*l.* wasted or lost originally. From 1840 up to 1850 that company paid a dividend averaging 6 per cent., and used their surplus profits in recouping the loss of their capital. He maintained that the capital of the South Metropolitan Company was as much as it ought to be; and to say that it had been made by charging the consumers a higher price was not in accordance with the fact. In reference to the advantages to be obtained by the municipal authorities having the gas supply in their own hands, they could not perhaps improve on the management, but one of the greatest advantages would be that they would raise all future capital on something not exceeding 4 per cent. In reference to the question of closing the old works alluded to by Mr. Patterson, if some of those works were placed more conveniently for coal they would be more advantageous than the new ones, owing to the good market for coke.

Dr. FARR thought the paper was of great interest and full of information, and as a compromise had been made between the Metropolitan and the great gas companies, and these had come to terms with the Board of Trade, he hoped that Mr. Chubb would give as full information as he could in relation to the London gas companies. Ten per cent. was no doubt high, but not too high if the capital had been raised from the first and exposed to all the risk that had been referred to. In the early part of his paper Mr. Chubb said that a great addition was made to capital in 1830 and in 1840; certain capital was exposed to no risk at all. All the railway companies and other companies that raised money now raised it on guaranteed dividends, and had no difficulty in getting capital at 4 or 5 per cent. Taking the water and gas companies together, their capital was about 20,000,000*l.*, on which there was a profit, taking everything into account, of 1,600,000*l.* If the *Metropolitan* Board could raise capital in the same way there would be 800,000*l.* to spare. That 800,000*l.* was really a tax on the consumers in London now. It was very questionable, looking at it from his point of view, whether the House of Commons should have

the power of permitting companies like these to tax London to such a large extent as 800,000*l.* a-year. He himself was strongly disposed to think that it would have been a better bargain if the Metropolitan Board had taken the supply of gas and water into its own hands, and if there had been a proper municipal organisation. If anything is done, the most perfect justice should be displayed towards the companies and their officials. The Society would feel obliged to Mr. Chubb if he will inform them the amount of capital engaged in the companies since 1840, and also, as far as he can, the dividends that had been obtained from them up to the present time.

Rev. Mr. DOXSEY asked Mr. Chubb if he would append to his paper a list of the prices charged by the different companies, and his opinion as to their reasons for such charges. During the time of the coal famine, the South Metropolitan, who, he thought, dealt liberally with its customers, were charging only 3*s.* per thousand, while he was under the impression that some of the other companies were charging 4*s.* and 4*s.* 6*d.*, and in some parts of London 5*s.* He was in hopes that the discussion would have turned in the direction of the consumers' point of view. He thought that the chief advantage which would, *primâ facie*, result from the management of the gas works by the Metropolitan Board, would be the bringing of the interests both of the consumers and the companies into accord, inasmuch as there would be no advantage in charging more than the mere cost of the coal and the expenses. If Mr. Chubb would kindly consider this in completing his paper, he would add much to the obligation the Society was under to him for supplying his valuable paper.

Mr. TOM ABERCROMBIE HEDLEY said he had for twenty or thirty years advocated the adoption of the sliding scale. Some companies were managed better than others, and he considered the great blot on the present system of legislation was that it gave all the companies, whether badly or well conducted, the one maximum dividend. The London companies had, he asserted, only been liberal, as they had been compelled to be liberal. The one cry of the companies had been, "The price of gas cannot be reduced," but as soon as one company reduced the price every other company followed. By the adoption of the sliding scale the public would, he believed, soon see a very considerable reduction in the price of gas. In the case of the London Gaslight Company, he knew that the first two or three issues of their capital were entirely wasted, and the consumers in that part of London supplied by that company were now paying 10 per cent. interest on works now of no use to them. The 50*l.* shares of that company, which now were selling at 87*l.*, were to be bought thirty years ago at 2*l.* per share; and on those 2*l.* shares people were now getting their 10 per cent. As to the illuminating power of the gas, it was worse now than it was twenty years ago. The burner by which they used to test the gas formerly showed that it was equal to 12 candles, but, by an improvement in the burner, gas now called 15-candle gas was, ten years ago, called 12-candle gas.

Instead of the illuminating power of the gas in London having improved, a certain improvement had been effected in the burner by which its quality was determined.

Mr. A. H. SMEE asked if it was not a fact that the hands of the committee who assembled to fix the price of gas were not practically tied, on account of the Government imposing a statutory dividend of 10 per cent. He believed that the committee also found that the companies could raise capital to the extent of 20,000*l.* or 30,000*l.*, upon which consumers would have to pay 10 per cent., even if they expended their capital for building a wall round their premises. He thought that the tendency of the legislature had been to encourage the companies in expending money on useless works rather than to cheapen the price of gas. Speaking as a chemist, he thought the companies were quite justified in employing the best burners.

Mr. MILLAR asked if it would not be possible to give some information as to the quantity of the cannel coal since the year 1865, as since that time, no doubt for some reason, the quantity of the coal raised had been very much increased.

Mr. CHUBB in reply said with reference to the table relating to cannel coal, Mr. Hunt had been employed by the Metropolitan gas companies in 1865, to visit all the collieries in the kingdom for the purpose of procuring the information for them, and it would be both difficult and expensive to obtain the like particulars up to a later date. With respect to the South Metropolitan, it had been candidly admitted that they had reduced their capital—and no doubt one of the gentlemen who had spoken knew best how it had been done—and by that means they were enabled to charge less for their gas. This placed that company in a much more favourable position with the public than the other companies, which was injurious to the latter. He admitted that there had been defective legislation in some respects in relation to gas companies, and that some of them had not been wise in their generation. It should be borne in mind when it was said that the Central Company had greatly reduced the prices charged by all the city companies for gas, that those companies during the time the prices were so reduced by the Great Central paid little or no dividend. The same reduction of dividend took place with the companies on the south side of the Thames, when the Surrey Consumers' Company was established. He admitted that many more tables might be added to the paper, and he promised to endeavour to add to them, and to make the present ones more complete. With reference to the assertion that the gas was not so good now as it was twenty years ago, he would point out that the burner then used for testing gas was not defined in any way. He believed, on the contrary, and it was generally admitted, that the gas was better now than it was then; and that it is rigidly tested at the present time there could be no doubt. He did not deny that some capital had been wasted at the commencement of some of the undertakings, but it was uninten-

tionally wasted, as in the case of railway companies, who often put up stations or works that are afterwards found to be useless. Many objections to the old law were met by the present Act. It had been said that there was not so much sulphur originally in gas as there was now, but the present means of discovering sulphur in gas was greatly improved to what it formerly was.