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Official Notice.

DRAFT BY-LAWS.

AS FINALLY SETTLED BY THE COUNCIL.

TAKE NOTICE that in pursuance of the provisions of Clause 37 of the Charter a General Meeting of the Society will be held at the House of the Royal Society of Arts, John Street, Adelphi, London, on Friday, the 13th day of March, 1908, at 3.30 o'clock in the afternoon, for the purpose of considering and adopting the draft By-laws, which, after due consideration of the observations received from members in response to the invitation in that behalf, have been finally settled by the Council, and a print of such finally settled By-laws was sent to each Member of the Society in the January 31st number of the JOURNAL.

By order of the Council.

CHARLES G. CRESSWELL, *Secretary.*

Liverpool Section.

THE HUNTER MEMORIAL LECTURE will be delivered by Sir Oliver Lodge, F.R.S., Principal of the Birmingham University, on "The Structure of the Atom," on Thursday, 12th March, 1908, at 8 p.m., in the Theatre of the Chemical Department of the University of Liverpool.

London Section.

Meeting held on Monday, Jan. 6, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE CHAIRMAN expressed in feeling terms the great loss the Section had sustained in the death of the Hon. Treasurer of the Society, Mr. Samuel Hall.

Owing to illness, a paper prepared by the Chairman, Mr. R. J. Friswell, entitled "Preparation of paratoluidine from mixed toluidines by means of paratoluidine hydrate," could not be read.

Dr. Lewkowitsch gave an address dealing with the Origin of Petroleum.

Newcastle Section.

Meeting held at Armstrong College, on Thursday, January 16th, 1908.

MR. N. H. MARTIN IN THE CHAIR.

NOTES ON THE PROXIMATE CONSTITUENTS OF COAL.

BY PROFESSOR P. PHILLIPS BEDSON.

It is now some eight years since in a note read before the North of England Institute of Mining Engineers I drew attention to the remarkable solvent action of pyridine on coal. Subsequently, at my suggestion, Mr. J. Baker undertook the examination of the action of this solvent on different classes of coal, the results of this investigation were communicated to the same Society. The method employed by Baker consisted in submitting a weighed amount of the finely divided coal to the action of pyridine in a Soxhlet extraction apparatus for several hours. From the pyridine solution, after removal of the greater portion of the solvent by distillation under reduced pressure, the dissolved matter was precipitated by dilute hydrochloric acid, filtered off, washed, dried, and weighed. The portion undissolved by the pyridine was also washed to free it from pyridine, then dried and weighed. The coals examined by Baker were four in number and represented different classes of coal. A sample of anthracite from South Wales yielded practically nothing to pyridine, whilst from a bituminous coal, viz., that of the Hutton Seam in the

County of Durham, and sold as a gas coal, as much as 20.4 per cent. was extracted; another bituminous coal, viz., the coal from the Brockwell Seam in the same county, and one highly prized for its coking properties, gave an extract amounting to 11.5 per cent. of its weight. The fourth coal examined was one from New Zealand, resembling brown coal in composition, and, like the coals of that class, contains a considerable proportion of moisture. The loss in weight of this coal when treated with pyridine amounted to 21.4 per cent., which, when the water removed is deducted, represents an extract of coal substance of some 5.65 per cent. The pyridine solutions are dark red to brown in colour, and in some instances exhibited a green fluorescent.

The extracts in each case were found to be rich in volatile constituents, and in the coking assay gave highly intumescent cokes, whereas the residues left after extraction were almost devoid of coking properties. In the case of the coking coal from the Brockwell Seam, the portion insoluble in pyridine had not completely lost the caking power, but yielded a coke much less bulky than that left by the original coal. I informed Dr. Carrick Anderson, of Glasgow, who had made a complete examination of the coals of the Scotch Coal Fields, of this action of pyridine, and in 1902 (this J., 1902, 242), he published the results of an investigation of the coals of Bengal and Japan, in which he also gave an account of the results obtained by submitting these and also some Scotch coals to extraction with pyridine. In general terms, Dr. Carrick Anderson confirmed the experience of Mr. Baker and myself. Recently my attention has been directed to this question, and at my request Mr. Herbert Blair has examined a number of coals of different types, and also certain allied substances.

An examination of the different constituent parts of the Busby Seam Coal, from Boitley, County Durham, viz., the "Bright Coal" and the "dant," showed that whilst the former yielded some 19.38 per cent. to pyridine, from the latter only a fraction of a per cent. was dissolved. These values were obtained by weighing the residue left undissolved by the pyridine, after it had been washed with dilute hydrochloric acid and water and then dried, and the difference in weight before and after extraction taken to represent the amount dissolved out. This procedure was adopted, as it was found that the solid matter was not completely precipitated from the pyridine solution by treatment with hydrochloric acid.

The proportion extracted by pyridine shows "dant" to be similar to anthracite, containing very little, if any, soluble matter, a similarity which is borne out by the comparison of the proximate analysis of the two. The volatile matter in the "dant" was found to be 9.92 per cent., whilst in the anthracite used by Baker the proportion was 8.23 per cent. The "bright coal" resembles very nearly the Hutton Seam coal, both in the amount dissolved by pyridine and in the proportion of volatile matter yielded on assay.

With the object of obtaining further information as to the solvent action of pyridine on different classes of coal, samples of six coals were procured from the Redhaugh Gas Works, through the kindness of Mr. Hardie, the Manager, who also supplied us with the average results obtained with these coals under actual working conditions in the gas retorts.

In the extraction of these coals with pyridine the method of treatment was modified, as follows: The coal, after sampling, is finely ground and passed through a sieve, 30 meshes to the linear inch. Five grms. of the coal are mixed with sand, in amount sufficient to make a column rising to the top of the syphon tube of a Soxhlet apparatus. The coal and sand rest on a layer of broken clay pipe stems and a pad of absorbent wool. The Soxhlet tube was fitted to a round-bottom flask, holding the pyridine, and to the tube was attached a reversed condenser. The distillation of the solvent and its percolation through the coal was allowed to proceed for several hours until it was judged to be complete, by the absence of colour in the pyridine flowing through

the siphon tube. The solution was then brought into an evaporating basin and the pyridine evaporated off in a good current of air, the dried residue was then broken up and the heating in the water bath continued until the odour of pyridine had disappeared. The basin and contents were then weighed and from the weighings the amount of extract ascertained. In this manner fairly concordant results are obtained.

In the tables below are given the results of these experiments, also the proximate analyses of the coals, as made in the Laboratory and also as deduced from the results obtained in working at the Gas Works.

TABLE I.
Results obtained in Gas Works.

Mark.	Yield of gas in cubic feet per ton.	Illuminating power of gas in candles.	Yield of coke, per ton.	Percentage of ashes in coke.
A	11381	16.63	13.55	8.53
B	11392	16.50	13.51	8.92
C	11646	16.40	13.73	8.50
D	11108	16.00	14.25	7.80
E	10913	16.39	13.36	10.80
F	10730	15.76	13.20	15.12

"None of the coals are really very bad, but the last are the worst two we get. We would call A and B good, C and D medium and E and F bad." This conclusion is in the main borne out by the proximate analyses of those coals, as shown in Table II., the proportion of volatile matter in E does not, however, justify its association with F. Again, from Table III., it is seen that the percentages of extract and of volatile matter are not far removed from one another, and if arranged in the order of the percentage of extract the coal, E, falls out of its order, just as it does when the coals are arranged according to the proportion of volatile matter. But such statistical consideration can be very readily pushed too far, and the proximate assay of a coal while it is useful for many purposes the information it affords as regards the composition of a coal is after all not great. There appears, at first sight, to be some approximation between the proportion extracted by pyridine and the volatile matter, as indicated in Table II., in which the numbers in the last line give the quotient of the percentage of fixed carbon divided by extract, which approximates somewhat to the factor c/v . In the case of the Cannel coals no such relationship is evident. But even in a series of coals, which are industrially grouped together as "gas coals," it would be futile to try and

TABLE II.
Proximate Analysis of Coals.—Based on Gas Works Results (I).—On Laboratory Results (II).

	A.		B.		C.		D.		E.		F.	
	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.
Molsture	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
	32.25	0.79	32.45	0.68	31.35	—	28.75	—	—	—	—	2.62
Volatile matter ..	31.10	33.10	33.28	31.01	31.01	31.7	33.20	32.65	33.55	30.87	30.87	30.87
Fixed carbon	61.97	61.48	61.53	62.21	62.72	59.81	65.69	63.04	58.59	58.79	56.40	58.76
Ash	5.78	4.43	6.02	3.83	5.83	8.28	5.50	5.25	7.21	7.56	10.05	7.75
Fixed carbon Vol. matter	1.92	1.76	1.80	1.82	2.00	1.87	2.28	1.98	1.76	1.74	1.68	1.75
Fixed carbon C Extract E		1.90		1.85		2.43		2.76		1.96		2.60

TABLE III.

	Pyridine extract.	Pyridine extract, "ashless coal."	Volatile matter, "ashless coal."	Volatile matter.
	Per cent.	Per cent.	Per cent.	Per cent.
A	32.36	33.86	35.69	34.10
B	33.59	34.93	34.60	33.28
C	24.58	26.9	34.78	31.91
D	22.81	24.08	33.47	31.7
E	29.07	32.42	36.30	33.65
F	22.53	24.43	33.48	30.87

Four other coals, described as "Cannels," were treated in the same way, as also was a sample of the Broxburn Oil Shale. The results obtained together with those of the proximate analysis are given in Table IV.

TABLE IV.

	Pyridine extract.	Volatile matter.	Fixed carbon.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.
Cannel coal.....	6.95	49.62	39.83	10.53
(Blaydon Burn)	8.31	37.43	56.28	5.91
(Canadian)	26.05	49.90	49.32	0.78
(Parkgate Seam, Barns- ley)	28.90	34.37	63.52	2.11
Broxburn shale	1.59	29.7	0.51	64.79

In forwarding the samples of coal, Mr. Hardie, speaking of the experience gained in the gas works, states that

make any deductions from these numbers. For, as we know, identity in chemical composition is so frequently associated with differences in chemical behaviour and physical properties, that the problem is not a purely statistical one. In connection with the facts elicited by a proximate assay of coal may be cited the observation recorded by Muck in his "Chemie der Steinkohlen," 1891, p. 5, which demonstrates what very different results are obtained when cellulose, starch, and gum are heated in a closed platinum crucible under like conditions. The coke-like residue obtained in each case is not alone different in appearance and other physical properties, but also the amount yielded is different, cellulose yielding 6.71 per cent., starch 11.30 per cent. and gum 20.42 per cent. of fixed carbon. Dr. Smythe, in an account of the examination of peaty deposits from a pit-fall at Tantobie, County Durham, published in the Proceedings of the University of Durham Philosophical Society (Vol. II., pt. 6), gives the results of his proximate analysis of cellulose and starch, showing these substances to be very different in the proportion of fixed carbon they yielded. Dr. Smythe, in this paper referred to, gives some interesting observations on the results obtained by treating this peaty deposit with pyridine. The chief interest in the use of pyridine as a solvent of coal centres in the possibility that its application may lead to an extension of our knowledge of the proximate constituents of coal, a problem to the solution of which many have directed their attention; and I shall be pardoned if in what I have to say I on this occasion deal only with those attempts which have come within my own personal experience. In an interim Report of the Committee of Section B of the British Association, published in 1894, is given an account of some observations on the action of solvents,

such as ether, alcohol, benzene, petroleum ether and aniline on a bituminous coal, *viz.*, Hutton Seam Coal from the County of Durham. These solvents certainly dissolve a little from the coal, giving coloured and fluorescent solutions. From this report it would appear that oxidation with an aqueous solution of potassium permanganate promised to give more satisfactory results, but the difficulties experienced in obtaining pure products from the dark, almost black, alkaline solutions which result from this oxidation, led to this method of attack being abandoned. In the second report of this Committee, presented to Section B at the Liverpool Meeting, 1896, is given an account of the investigation by Dr. Smythe of the compounds formed by the action of a mixture of hydrochloric acid and potassium chlorate upon a bituminous coal. Some years previously, Cross and Bevan (Phil. Mag. V. XIII. 328) had shown that Wigan coal is attacked by chlorine, with the production of a chlorinated derivative similar to that obtained by them from lignified fibres; further these chemists showed that the coal substance is so profoundly changed by the action of dilute hydrochloric acid and potassium chlorate as to be subsequently entirely soluble in alkalis. The prolonged boiling of the finely ground bituminous coal with dilute hydrochloric acid to which potassium chlorate is added from time to time converts the greater portion of the coal into a brown solid, which is considerably heavier than the coal taken, and from which 30–35 per cent. is dissolved by alcohol or acetone.

From the material dissolved in alcohol by treatment with various solvents, chlorinated compounds were obtained, the composition of which indicate the following formulae:— $C_{30}H_{22}Cl_3O_{10}$, $C_{24}H_{18}Cl_4O_9$. The first of these was obtained by extraction of the acetone extract of the oxidised coal with benzene, the second was obtained from the residue insoluble in benzene by extraction with hot alcohol, and from the portion still undissolved two other complex chlorinated compounds were obtained. The acid liquors of marked yellow colour contained in addition to potassium chloride, etc., organic compounds from which by dissolution in acetone a yellow liquid having the composition, $C_{35}H_{28}Cl_4O_{20}$, was isolated.

In a report printed for the Commissioners of the 1851 Exhibition, Dr. Smythe, as an 1851 Exhibition Scholar, gave an account of the results of an investigation of the proximate constituents of brown coal, which he had carried out in the University of Göttingen. The brown coal used was obtained from Brühl, near Cologne; in its behaviour to hydrochloric acid and potassium chlorate brown coal does not differ very markedly from a bituminous coal, and compounds of a similar character to those mentioned above were obtained. It should be stated that a notable difference was observed, in the fact that the oxidised product of brown coal weighed considerably less than the coal itself. These chlorinated oxidation products are complex bodies, decidedly acidic in properties. The investigation of these reactions yielded very little, if any, information as to their constitution. In the report of Dr. Smythe's work at Göttingen, from which I have quoted, another method of attacking the problem of the nature of the proximate constituents of brown coal is described. This consisted in submitting the coal to a thorough exhaustion with solvents. Of this work Dr. Smythe gives the following account. "The solvents were used in the following order:—Benzene, chloroform, alcohol, ethyl ether, petroleum ether, acetone. The ether, petroleum ether, and acetone extracts were very small. The benzene extract amounted to 3 per cent. of the coal taken, the chloroform extract to 1.8 per cent. and the alcohol extract to 2.4 per cent. The colour of these solutions varied from yellow to deep reddish brown. The alcoholic extract could only be obtained as a gluey mass of dark brown colour, the solution possessing a splendid deep red colour. The chloroform solution had a deep brown colour; on pouring into petroleum ether brown flocks separated, which on drying and powdering gave a dark brown powder. This melts at 94° C. with slight decomposition.

Analysis of two specimens, purified several times by precipitation from solutions, gave the following mean

figures:—Carbon, 76.45 per cent.; hydrogen, 9.91 per cent.; oxygen, 13.64 per cent. Calculated for $C_{16}H_{24}O_2$:—Carbon, 76.26 per cent.; hydrogen, 10.17 per cent.; oxygen, 13.56 per cent.

The benzene extract, like the above, does not contain either nitrogen or sulphur. The solution possesses a reddish brown colour, and by pouring into petroleum ether, brown flocks are precipitated.

Treatment with ethyl ether gives two portions. The one soluble in ether is a brown amorphous powder melting at 135° to 140° C. A portion of this, purified by precipitation of its benzene solution with petroleum ether, was analysed. The figures agree fairly well with those calculated for the formula, $C_{14}H_{18}O_2$.

That portion of the benzene extract insoluble in ether is much lighter in colour. It melts at 80 degs. to 83 degs. and at a high temperature is capable of volatilization. The mean results of two analyses were:—Carbon, 77.75 per cent.; hydrogen, 11.77 per cent.; oxygen, 10.48 per cent.

After these last analyses had been made it was discovered that this portion of the extract yields something to boiling acetone. Accordingly this portion was extracted with that solvent, and a pale yellow substance dissolved out, melting at 78° to 80° C. The residue melts at 82° to 86° C. Analyses of this portion of the benzene extract, insoluble in ether but soluble in acetone, gave carbon, 79.37 and 79.09 per cent.; hydrogen, 12.75 and 12.92 per cent.

An attempt was made to distil that portion of the benzene extract insoluble in ether. Under a pressure of 8 mm. the distillation proceeds very slowly, the temperature rising from 300° to 350° C. The distillate consisted of a small quantity of amber coloured liquid, which readily solidified to a light yellow waxy solid. This was dissolved in benzene, and the solution allowed to evaporate spontaneously. A white solid was thus obtained melting at 77° to 80°. Dissolving again in a mixture of benzene and petroleum ether it separated out on evaporation of the solvent as a perfectly white solid, melting at 81° to 82°, and exhibiting imperfectly formed radiating crystals. After drying on a porous plate in a vacuum, it contained carbon, 79.18 per cent.; hydrogen, 13.04 per cent. This is obviously the same compound as that obtained by extracting the benzene extract with acetone. These analyses accord fairly well with the formula, $C_{13}H_{26}O$.

The oxidation of the coal left after thorough exhaustion with solvents has been studied. As before, the oxidation products are very complex. The action of potassium chlorate and hydrochloric acid is powerful, though slow. In general, we may say that after oxidation for 30 hours the oxidised mass weighs 70 per cent. of the original, and of this oxidised product some 75 per cent. is soluble in acetone or alcohol. The acid oxidised filtrate was shaken out with ether, as before. After evaporation of the ether, a brownish yellow acid was obtained, which was distilled in vacuo. The distillate on standing deposited crystals which melt at 80° to 88°, and these are at present under examination. After several fractionations of the liquid decanted from these crystals, a liquid portion was obtained boiling at 192° to 194° under ordinary pressure. The odour of this portion recalled that of chloroacetic acid. Conversion into the amide has given well defined crystals at present under examination. The solid product from the oxidised coal was extracted in succession with benzene, chloroform, ether and alcohol. The benzene solution was precipitated by petroleum ether. In this way, a light brown flocculent precipitate is obtained, which, unfortunately, always dries to a resin. The chloroform extract was purified several times by precipitation of its solution with petroleum ether. It is thus obtained in the form of a light brown homogeneous powder. The following figures were obtained on analysis:—Carbon, 44.11 per cent.; hydrogen, 3.30 per cent.; chlorine, 31.78 per cent.

The ethereal extract gave a yellowish brown powder. This was purified as far as possible, by precipitation from its solutions, dried on a porous tile in vacuo and analysed. The formula, $C_{22}H_{18}Cl_4O_{10}$, was deduced from these results.

The alcohol extract is the only one which contains nitrogen. It has not yet been analysed. All attempts to obtain these compounds in a crystalline form have hitherto failed. There can hardly be any doubt that the chloroform extract is a mixture, and it is probable that the ethereal extract is also a mixture. It is evident that these chlorinated acids are similar to those obtained from bituminous coal."

Since I first observed the remarkable solvent action of pyridine on coal, the investigation of the extracted material has been pursued in a somewhat intermittent manner in the laboratory of this College; latterly I have been successful in enlisting the interest of Mr. Herbert Blair, who has taken up this subject in a way which promises to lead some way towards the goal of the solution of the problem as to the nature of the proximate constituents of coal. This communication of the results which Mr. Blair has so far obtained, must be regarded in the light of a preliminary note, and has been rendered necessary by the fact that this subject is receiving attention elsewhere. Recently my attention was drawn by the reference in Meyer's *Jahrbuch der Chemie*, 1906, 314, to an article in the *Zeit. angew. Chem.*, 1906, 657, by E. Donath, dealing with the subject of coal, from the point of view of the nature of its constituents. Donath refers to Baker's results, but gives a reference to some American Journal as the source of his information, and states that Baker examined American coals. It is evident that this knowledge of Baker's work has been gained from some abstract of the original paper. Donath, however, goes on to state that he reserves to himself the examination of the materials extracted from coal by pyridine. That Donath should have expressed his determination to undertake the investigation of these bodies is a matter of satisfaction, but the right of reserving to himself this field of inquiry can scarcely be considered to arise, for if such a question of reservation were to be made, then possibly I might be expected to raise it. The field is large enough and the material to be examined sufficiently diverse to allow of a number of workers, and considering the nature of the problem and the little progress that has been made towards its solution in the past, the greater number of chemists actively engaged on this subject the nearer will be the time when a satisfactory answer can be given to the question of what is coal.

For the purposes of his investigation Mr. Herbert Blair selected the "bright coal" from the Busby Seam, of the Boitley Colliery, to which reference has already been made, and of which the proximate analysis is given in a communication to this Section by F. G. Trobridge (this J., 1906, 1129). The bright coal separated mechanically from the "dant" or "mother of coal," was reduced to a fine powder, then mixed with sand and the mixture filled into a large Soxhlet apparatus constructed of copper, with a copper vessel attached of about half a gallon capacity in which the pyridine was vaporised. The working of this apparatus did not prove altogether satisfactory, and it was, therefore, decided to use a method of extraction by percolation in the cold. For this purpose a charge of 8 lb. of the finely ground coal mixed with sand was introduced into a percolator, in which the coal and sand rested upon a layer of broken glass, etc., covered by a layer of absorbent wool. The pyridine solution was next concentrated on a water-bath under reduced pressure, and the recovered pyridine used over again in the percolator. Repeating these operations from day to day for several weeks, ultimately a concentrated solution of the extract was obtained, from which after the pyridine had been driven off completely, a dark resinous scaly solid was obtained in quantity sufficient for further work. This residue was next thoroughly incorporated with sand and the mixture dried in a steam bath, the dried mixture was then introduced into a percolator and submitted to the action of the following solvents, used in the order named: petroleum ether, ethyl ether (sp. gr. 0.717), absolute alcohol, chloroform. As this work is still in progress detailed results would be out of place, but in general terms it may be stated that the several extracts have been treated as follows. The solvent having been removed by distillation, the residue

is treated with dilute sulphuric acid and distilled in steam. The distillate examined for any volatile organic substance, the acid liquor decanted off and examined, the residue insoluble in the acid solution was next treated with caustic potash and distilled in steam. The steam distillate, the alkaline solution and the insoluble residue in the retort are all separately examined.

Treated in this manner, the petroleum ether extract gives a substance volatile in steam, imparting to the water distillate a reddish colour, the distillate extracted with ether gives a viscous red liquid from which by distillation under reduced pressure a liquid is obtained which ultimately crystallises to form transparent red crystals, melting at 65° C. The portion of the petroleum ether extract non-volatile in steam is a brown solid, which can be distilled under reduced pressure.

The ether extract consists of a brown resinous solid, but in the treatment of this extract as described above, it has yielded small quantities of a substance volatile in steam, and of a basic and an acidic substance.

A complete account of the results of the examination of the substances obtained from the several extracts is reserved for a future communication.

DETERMINATION OF ARSENIC BY THE GUIZEIT METHOD.

BY CHARLES ROBERT SANGER.

With reference to the note by T. F. Harvey on this subject (this J., Dec. 16, 1907, p. 1226), I regret that his communication of 1905 was not accessible to me. I wish to point out, however, that our method (this J., 1907, p. 1115) differs essentially from the one he describes, in that the stain is in the form of a band, and is not deposited as a spot or disc.

Obituary.

RICHARD JOHN FRISWELL,

R. J. Friswell was an original member of this Society. He was born Feb. 24th, 1849, and was the elder son of the late James Hain Friswell, the author, essayist, and poet. He was educated at King's College School, and became a pupil of Blanchard, the art photographer. Feeling the need of chemical knowledge, he entered the Royal College of Chemistry, as a student under Professor E. Frankland. In 1868-9 he joined R. Meldola in photographing the spectra of the metals, and in assisting in the work of solar research for Professor Lockyer in the physical laboratory of South Kensington. He went with Lockyer to India to observe the eclipse of 1871. Friswell was the editor of the *Journal of the Photographic Society* until Feb., 1877. He took a leading part with Professor Edw. Frankland and others, in promoting the formation of the Institute of Chemistry, which ever afterwards engaged much of his attention. He served during two periods on the Council of the Chemical Society. From 1874 to the end of 1900, he acted as chemist on the staff of Messrs. Brooke, Simpson and Spiller at their Atlas Colour Works, Hackney Wick, ultimately becoming managing director. He then superintended the erection of the British Uralite Company's factory at Higham, near Gravesend. In 1902, he opened a consulting practice and laboratory in London. In 1906, Friswell was elected Chairman of the London Section. Taken ill on New Year's Eve with pleuro-pneumonia and enteric fever, he died after five weeks' suffering, on Feb. 6th.

In conjunction with A. J. Greenaway (*Chem. Soc. Trans.*, 1877, ii., 251) he published a "Note on thallous platino-cyanide." In 1904, Friswell published a paper entitled "Some intramolecular and originally reversible changes extending over prolonged periods of time" (this J., 1904, 275), besides others in conjunction with A. G. Green (this J., 1885, 740, and 1897, 671).