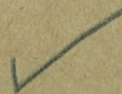


WASC ~~837~~

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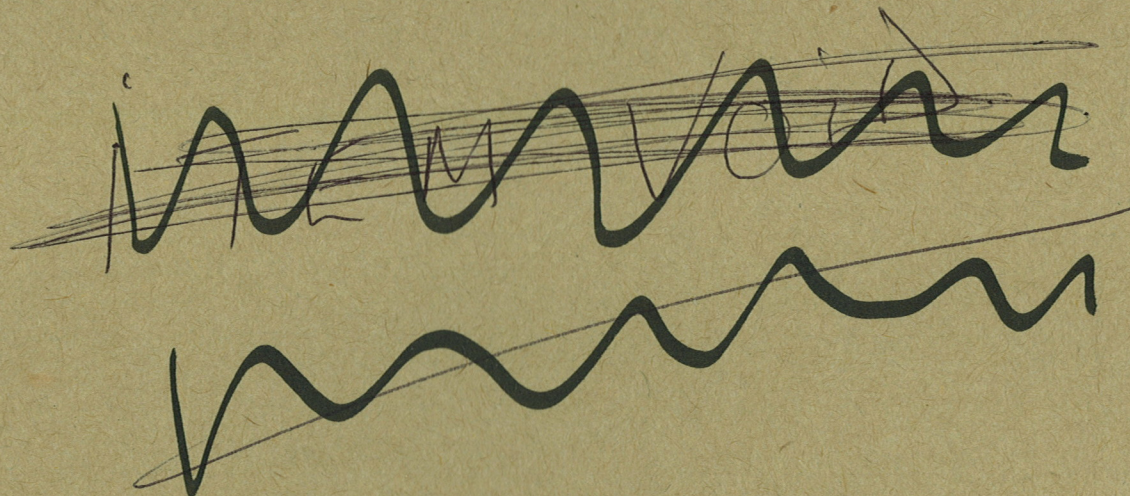


On Her Majesty's Service

WASC

WASC 859

~~Musical~~
Extracts from
Sir R. Robertson Diary



(incl.
Patent Date 1901)

WASC 859

Sir R. Robertson
Diary

MESSRS R. R. TATLOCK & READMAN,
EDINBURGH & GLASGOW.

TELEGRAPHIC ADDRESS, "TATLOCK, GLASGOW."
TELEPHONE NO. 74.

MR TATLOCK, 156 BATH STREET, GLASGOW;
DR READMAN, INDIA BUILDINGS, EDINBURGH.



City Analysts Laboratory,

156 Bath Street,
Glasgow, Oct. 20th 1891.

It gives me much pleasure to state
his high opinion I hold of his qualifications
of Mr. Robert Robertson, M.A., B.Sc. as an analytical
chemist. He has been an assistant in this
laboratory for the last 18 months, but he was
already an accomplished chemist when he joined.
His practice during this period has been very
extensive and of a varied character, including
the analysis of every commercial product, but
more particularly water, foods and drugs such as
are the subjects of the Food and Drugs Act,
in the examination and testing of which he
is now highly proficient. He is also an adept
in the use of the microscope.

I have no hesitation in saying
that he is eminently qualified in every respect
for the post of analyst under the Medical Officer
of Health to the County Council of Lanark.

Mr. Robertson's high character and
superior education greatly enhance his qualifications
for such a post, the duties of which I am certain
he would discharge in the most efficient and
creditable manner.

R. R. Tatlock, F.R.S.E., F.L.C., F.C.S.
Public Analyst for the Cities of
Glasgow and Perth; and for the
Burghs of Coatbridge, Pentlands, etc.

MESSRS R. R. TATLOCK & READMAN,
EDINBURGH & GLASGOW.

TELEGRAPHIC ADDRESS, "TATLOCK, GLASGOW."
TELEPHONE N^o 74.

MR TATLOCK, 156 BATH STREET, GLASGOW.
DR READMAN, INDIA BUILDINGS, EDINBURGH.



City Analysts Laboratory,

156, Bath Street,
Glasgow, 31st Decem 1891

It gives me much pleasure to state the high opinion I hold of the qualifications of Mr Robert Robertson, M. A; B. Sc. as a Chemist and Analyst. He studied at the University of St. Andrews, with distinction, after which he joined this Laboratory; and has devoted himself, during the last two years, to analytical and investigative work, for which he is eminently fitted, both on account of his personal qualities and his chemical education and training. His experience in technical and commercial analyses extends over a wide and varied field, and his work has always been characterised by accuracy and precision.

I am happy to be able to speak, also, from personal knowledge, of Mr Robertson's uprightness of character, industrious habits and gentlemanly demeanour, and while I cannot but speak in terms of the highest praise with regard to the excellence of his qualifications, work and character, I cannot but feel regret at the prospect of losing so valuable an assistant as he is.

R. R. Tatlock B. Sc. F.R.S.E. F.L.C. F.C.S.

Public Analyst and Gas Examiner
for the City of Glasgow.

In reply please
quote 483/39

ROYAL GUNPOWDER FACTORY,
WALTHAM ABBEY,

22nd January 1892

Sir,
Referring to your application dated the 2nd Inst. - for the post of Ass^t Chemist at this Factory - and to your testimonials as to ability and character.

I have pleasure in informing you that, the testimonials being considered satisfactory, you may join the Chemical Staff at this Factory -

You will receive a salary of 27^s/- - twenty seven shillings - week to commence with.

I shall be obliged by your stating when you will be able to join for duty here -

I am,
Sir,
Your obed^t Servant

H. A. [Signature]
Maj: Genl.
Sup^t: R.G.P.F.

Mr. Robt. Robertson,
156 Bath Street
Glasgow.

To Royal Gunpowder Factory,
Waltham Abbey - 9/2/1892

Testimonial - Tallock

appointment - letter of 21/1/92

mem: R.T. Thomson's brother James T. was
manager (code) at R.G.F.

189

1892

At Royal Gunpowder Factory
Waltham Abbey.

Partly in Laboratory;
partly learning manufacture
of nitroglycerine.

1893

Apart from factory work, doing extractions
of cellulose.

THE RECENT NITRO-GLYCERINE EXPLOSION.

THREE HEROES RECEIVE RECOGNITION.

A pleasing ceremony was performed at the Cordite Works on Wednesday, when Mr William T. Thomson (chemist in charge, Guncotton Factory), Mr Robert Robertson (chemist in charge, Nitro-Glycerine Factory), and Mr David Wright (foreman of nitro-glycerine) received tangible recognition for gallantry displayed by them at the lamentable explosion at the Nitro-Glycerine Works on the 7th of May, 1894. Not only did these gentlemen receive at the time the approbation of the Press and townsmen, but on Wednesday they were complimented for their prompt display of courage by Government officials of high standing who were visiting the factories. These officials were Lord Monkswell (Under Secretary of State for War), Mr Woodall, M.P. (Financial Secretary), Dr. Anderson, D.G.O.F., Colonel Sale, R.E., Dr. Kellner, Mr Brade (secretary to Lord Monkswell), Mr Gibson (private secretary to Mr Woodall), and Mr A. C. Strange (assistant private secretary to the Secretary of State). They were met by Colonel Ormsby (superintendent of the factory) and Captain Huleatt, R.E. (works department). After making a detour of the Gunpowder Works, the party arrived at the Cordite Works in the electric launch "The Spark," where they were met at the landing stage by Captain Nathan, Lieutenant Buckle, and Mr John Thomson (manager of Guncotton, Nitro-glycerine and Cordite Factories). A visit was paid to the guncotton department, after which the party assembled outside the laboratory and manager's office. Here were gathered Mr W. T. Thomson, Mr Robertson, Mr Wright, and Mr Barker, together with 200 employees. The scene was a pretty one. A capital view of the Abbey Church and town in the distance, and near at hand, the green pasture, the red buildings, and still closer, the gathering of men, some clad in bright red, others in black, whilst a third section was composed of blues and whites from the machinery department, not to speak of the sprinkling in the ordinary every day costume. Mr Woodall, M.P., stepped forward, and Colonel Ormsby introduced Mr Thomson, after which Mr Woodall said a pleasant duty devolved upon him in the absence of Mr Campbell-Bannerman. That right hon. gentleman had been unwell, and he would have been present, but that he thought that the journey would call for too much exertion. However, he (Mr Woodall) was glad to compliment the three gentlemen [Messrs. Thomson, Robertson, and Wright], who distinguished themselves on the 7th of May last year—in a way which he ventured to say was heroic—by

BARE PRESENCE OF MIND

in the discharge of duty, which probably had the effect of saving life and which was entirely effectual in preserving Government property. When engaged in processes which were necessarily dangerous they must realise constantly how important it was that every one engaged should be constantly attentive to every detail of duty, not only with regard to their own interest, but to the interests of those around them. The act performed by the three gentlemen before him would doubtless live in their grateful memories. He hoped that the recognition they would receive would not be called a reward, but would be a refreshing reminder of their deed, and act as a further stimulus—if such be required—in the further discharge of their duties. Probably all of them remembered the

RR's watch No 115614
 Sir J. Bennett.

WA
 Weekly
 Telegraph.

R. G. P. F.
 W.A.

7/5/1894

Presentation of
 good watch
 for "good service"
 at explosion 1894
 of nitro-glycerine
 on the 7th of May.

UNFORTUNATE AND MYSTERIOUS EXPLOSION
 which sent into instant eternity four of their fellow workers. The detonation that caused the explosion was clearly followed by a second explosion, so close that it was difficult to distinguish them. These left the mixing house standing. In this house was a quantity of explosive. Had that remained probably their would have been a third explosion, carrying mischief and injury in its train. The presence of mind to which he had referred; the instant courage, without hesitation or any feeling of danger, prompted these three gentlemen to go and drown the charge was most serviceable and most valuable. Mr Woodall then received from Colonel Ormsby a leather case in which was a gold demi-hunter watch, with gold albert chain attached. This he handed to Mr Thomson, at the same time expressing the pleasure it gave him to do so. A similar presentation was made to Mr Robertson, with a good wish, and also to Mr Wright. In handing the watch to the latter, Mr Woodall was understood to say that his (Mr Wright's) part was warmly and gratefully appreciated by those who were responsible. The officials then left the works amid loud cheers from the men. The watches were made at the establishment of Sir John Bennett, of Cheapside. Each bears an inscription like unto the following, respective of the name:—

Presented to
 W. T. THOMSON,
 In recognition of
 GOOD SERVICE
 At the Explosion of Nitro-Glycerine,
 At Royal Gunpowder Factory,
 7th May, 1894.

After the officials had left the scene the men dispersed, some to their work and others to their homes. Thus ended a pleasant ceremony, which is bright side to a dark page in the history of the Royal Gunpowder Factory.

Killed: Bennie, Chemist
 Foreman Pembert
 Foreman H.G.
 a workman

W.T. Thomson, Asst Manager
 R.R. Chemist in charge
 D. Wright - a workman
 in H.G. (afterwards Foreman)

R.P.F.
COA.

Reading for D.Sc. - at home.

1895

R.G. PF.
WA

Reading for D. Se

1896

St. Andrews University

D.Sc. (by examination) 26/3/1897

Fellow of Institute of Chemistry

(and by examination) 21/8/1897

at Rq PTF
Waltham Abbey

The Times 29.3.1897

UNIVERSITY INTELLIGENCE.

ST. ANDREWS, MARCH 26.

The Winter Session of St. Andrews University was closed to-day, by the annual Graduation Ceremony, which took place in the new Library-hall. Principal Donaldson, Vice-Chancellor of the University, presided.

The honorary degree of Doctor of Divinity was conferred upon the Rev. J. E. H. Thomson, B.D., Safed, *in absentia*; and upon the Rev. T. Vincent Lyons, principal of the Baptist College, Rawdon, Leeds. The honorary degree of Doctor of Laws was conferred upon James Webster Darty, solicitor, Dundee; George Dunn, M.A., her Majesty's Inspector of Schools for Fife, Edinburgh; H. S. Hesketh, Professor of Engineering in University College, Liverpool; John Scott Keltie, secretary to the Royal Geographical Society, and editor of the "Statesman's Year-book," London; and the Rev. Canon Alfred Merle Norman, M.A., D.C.L., F.R.S., the Rectory, Houghton-le-Spring, *in absentia*.

The following degrees were also conferred:—
Doctor of Medicine.—Charles Grinling Dunn, M.B.C.S. Eng., L.R.C.P. Ed., L.S.A. Lond., London; Richard Buxton, M.B.C.S. Eng., F.R.C.S. Ed., M.R.C.P. Ed., D.P.H.L., Liverpool; Thomas Arthur Dixon, M.B.C.S. Eng., L.R.C.P. Ed., surgeon-major, A.M.P.; Edward Morton Garstang, M.B.C.S. Eng., L.R.C.P. Ed., Bolton; Walter Robert Hadver, M.B.C.S. Eng., L.R.C.P. Ed., L.S.A. Lond., Glasgow.
M.A.—Thomas S. Cargill, Anstruther, with Third-class Hon. in Classics; William Ewan, Broughty Ferry, with Third-class Hon. in Classics; Christian M. Brown, St. Andrews; Katherine O. Caird, Montrose; John Cargill, Anstruther; John B. Chalmers, Coupar Angus; Alexander P. Cunningham, Campbeltown; John B. Cunningham, Campbeltown; Annie Davidson, Peterhead; Norman O. Keith, Dundee; Annie Lloyd-Evans, Warwick; Robert H. Mackay, Brechin; William A. Mackenzie, Grantown; Walter G. Mair, Rathven; James Mitchell, Perth; David Munro, Littlehampton; Robert Nelson, Thornhill; Jessy T. Philip, Dundee; Jane C. C. Reid, Arbroath; Margaret Rust, Arbroath; W. Fulton Spiers, Dundee; Thomas P. Wylie, Dundee.

The Guthrie scholarship, the highest prize in the University, has been awarded to Mr. John G. Laing, M.A., Cameron-bridge. The scholarship is tenable for four years, and is of the value of £100 the first year, and £50 for each of the three following years. According to the conditions, the Guthrie scholar must continue his studies at Oxford or Cambridge or, with the consent of the trustees, at a foreign University.

... Nelson, B.A., ... L.R.C.P. Ed., L.S.A. Lond., ... Alexander Malloch, L.R.C.P. Ed., L.R.C.S. Ed., Barrow-in-Furness; Howell Williams, M.B.C.S. Eng., L.R.C.P. Ed., Richmond, Yorkshire; Roland Philip Williams, L.R.C.P. Ed., L.R.C.S. Ed., D.P.H.L., Holyhead.

D.Sc.—Robert Robertson, M.A., B.Sc., Cupar.
B.Sc.—Robert H. Constorphine, Arbroath; William Pitkenny, New Scone; Andrew Thom, M.A., Cupar.

B.A.—James B. Allan, M.A., Dumfries; John Boyd, M.A., Kirriemuir, *in absentia*; Norman M. Cam, M.A., Forfar; William Cooper, B.A., Melbourne, *in absentia*; Hugh Menzies, M.A., Laithly; Walter Cotton Page, B.A., Andover; John Barton, M.A., Perth.

M.A.—William S. Morrison, Laureate, with First-class Hon. in Mathematics; William B. Taylor, St. Andrews, with First-class Hon. in Classics; Edwin J. Brechin, Dundee, with Second-class Hon. in Geography; Marshall P. Constable, Dundee, with Second-class Hon. in Classics; Frank S. Wade, Warwick, with Second-class Hon. in Mathematics; Francis H.

1897

W. H. Stoyles R.R. to
W. H. Stoyles 98

R.R.
W. H. Stoyles



[Specially drawn for THE SUNDAY TIMES by Hanslip Fletcher.

When so much of historic London has been bombed, it is pleasant to see this drawing of Temple Bar, which has figured so prominently in London history and now reposes peacefully at Waltham Cross.

WEDNESDAY, AUGUST 24, 1898.

CHURCH WEDDING AT CUPAR. STOYLE ROBERTSON.

The marriage of Mr W. H. Stoyles, Inland Revenue, Dumfries (late Inland Revenue, Cupar), with Miss Agnes R. Robertson, eldest daughter of one of the oldest and best known residents in Cupar, Dr Robertson, dental surgeon, was celebrated in St James' Episcopal Church, Cupar, this (Wednesday) afternoon. The church was charmingly decorated. The altar and altar rails were adorned with white roses, marguerites, lilies, and carnations. Red and pink roses, geraniums, clematis, and ferns were woven round the candelabra with much effect. Palms and pot plants were placed in the chancel, and the rails in front of the organ were covered with roses, tropaeolums, and Virginian creeper. Trails of ivy interlaced the wrought iron work above the chancel, while the pulpit in the body of the church were similarly embellished. The pulpit was attractively decked with sweet peas of three shades, which were tastefully hung in sprays down

from the top. The bride, who was given away by her father, was attired in a walking-dress of white fancy sicilian, with white satin tucked yoke, embroidered chiffon bertha, and pearl and satin trimmings. She wore a hat of white satin straw trimmed with white chiffon and ostrich plumes, and carried a bouquet of white gladioli and white heather. The bridesmaids—Misses J. I. and Andé Robertson (sisters of the bride), Miss Stoyles, Southport (sister of the bridegroom), Miss Ella Russell and Miss Cecily Robertson (cousins of the bride)—were costumed in fine white spotted muslin over pink, with transparent yokes and sleeves, and with fichus, sashes, and frills of muslin. Their hats were composed of white chiffon with pink wings in front and roses behind. They carried spray bouquets of pink and white sweet peas, and wore gold brooches with pearl and turquoise hearts, the gift of the bridegroom. Mrs Robertson (mother of the bride) was handsomely gowned in black silk, trimmed jet, and wearing a Mechlin lace fichu. Her bonnet was of black jet with pink chiffon and osprey, and she carried a bouquet of crimson and maize-roses. Mrs Russell, Edenfield, wore rich black satin, bonnet of turquoise velvet, bouquet pink

and white; Mrs G. B. Robertson, black silk with cream lace, bonnet black and green with cream plumes; Miss Russell, Railway Cottage, black silk, bonnet black with pale green chiffon; Mrs Henderson, Perth, salmon pink moiré blouse, hat black and pink, pink bouquet; Miss Robertson, Marionfield, white figured silk blouse, white and black hat, scarlet bouquet; Mrs Stenhouse, Blsmere, cream fancy muslin over pale blue, pale blue hat with pink roses, bouquet pink; Mrs Broome, pale blue satin, trimmed white, white and blue hat, white bouquet; Mrs Clarke, black and purple; Miss Lillie, Craik, yellow silk blouse, trimmed black, black and yellow hat; Miss Brown, Bervie, black and white toilette; Miss Morris, Elie, black and white.

Rev. C. E. Cooke performed the ceremony, assisted by the Rev. Mr Natrass. Mr Broome, the organist, played an opening voluntary Lohengrin's "Bridal March," which was followed by the hymn, "The voice that breathed o'er Eden," as the procession moved up the aisle. The psalm, "Blessed are all they that fear the Lord," was then sung, after which came the anthem, Barnby's "O Perfect Love." At the conclusion, Stainer's "Sevenfold Amen" was sung by the choir, and as the register was being signed in the vestry Mr Broome played an arrangement of his own—"Wedding Bells." Mendelssohn's "Wedding March" pealed forth as the bridal procession left the church. Mr A. Russell Lillie, Edinburgh, supported the bridegroom as best man. After the service the wedding party reassembled in the Royal Hotel, where a reception was held by Dr and Mrs Robertson. In the course of the afternoon Mr and Mrs Stoye left on their way to the Highlands. The bride took her departure in a gown of purple cloth, with white moiré and chiffon bodice adornments. She wore a toque of several shades of purple velvet with jewelled crown, lavender chiffon rosettes and osprey, and her travelling cape was of the clan Robertson tartan. Dr and Mrs Robertson are this evening entertaining a large company of friends to a dance in the Royal Hotel, the hall of which has been nicely decorated by Mr and Mrs Joiner.

The following is a list of the presents:—Dr R. Robertson, Waltham Abbey, cheque; Miss J. Robertson, china tea set; Miss Russell, Railway Cottage, cheque; Mr J. Russell, Glasgow, cheque; Rev. J. and Mrs Brown, Mauch, Bervie, fruit knives and forks; Mr D. H. Russell, London, cheque; Mrs D. H. Russell, London, wolf's skin rug; Mr G. B. and Mrs Robertson, 35 Bonnygate, Queen Anne silver tea service; Mr and Mrs A. Russell, Edenfield, drawn thread work tablecloth and serviettes; Miss Russell, Edenfield, cushion; Mr Alfred Russell, Edenfield, umbrella; Mr and Mrs Lillie, Schoolhouse, Craik, silver cake basket; Miss Lillie, butter knives and jelly spoons; Mr R. Lillie, London, picture; Mr H. Lillie, Cupar, silver toast rack; Mr A. R. Lillie, Edinburgh, pair of bronze stork candelabra; Miss Brown, Dundee, pair carver rests; Mr J. Brown, Cumbernauld, brass kettle on stand; Mrs Watson, London, silver tea spoons; Mrs Lawrence, St Andrews, linen; Miss Hepburn, St Andrews, linen; Mrs Peat, Straiton, cheque; Mr Ritchie, Newport, pair of Dresden china ornaments; Mrs Sommerville, Newport, carved oak tray, tray cloth, and d'oyleys; Mrs Clark, Crossgate, blotter (morocco); Miss Clark, Crossgate, work basket; Mr and Mrs Wilson, Newport, hand bag and purse; Mrs and Miss Morgan, Newburgh, linen; Mrs Robertson and family, Marionfield, Royal Worcester afternoon tea service, silver spoons and poker work tray; Mr and Mrs Stenhouse, Blsmere, drawn thread work linen; Mrs Lawrence, Glasgow, white silk pin cushion; Mr and Mrs J. Innes, Rosemount, "Ivanhoe"; Mr George Innes, Bonnygate, album; Mrs Whyte, Edinburgh, silver butter dish; A Friend, satin eiderdown quilt; Miss Parker, Crossgate, cheque; Miss Wallace, Lebanon, yellow silk table centre;

Miss Hill, Cupar, pair of pillow shams; Miss Simpson, Bervie, pair of ornaments; Miss O. Clark, Edinburgh, paper knife; Mr A. Clark, India, pair of silver salt cellars; Mrs Hood, Castlefield, pair of silver salt cellars; Mrs Christie and family, Dairsie Mains, pair of silver butter dishes; Mrs J. A. Welch, Bonnygate, cheese dish; Misses Reekie, Bonnygate, photo frames, pair of ornaments, and tablecloth; Mrs Reekie, Bonnygate, d'oyleys; Mrs Cochrane, Newburgh, satin work-bag; Misses Orichton, Logan Bank, volume of Longfellow; Mr and Mrs Walker, Bonnygate, carpet-sweeper; Miss Johnston, Glasgow, pair of vases; Mrs Brakenridge, Westlands, pair of vases; Mr and Mrs J. Brown, Bonnygate, pair of slippers; Mr and Mrs Fox, Cromer Villa, brass crumb tray and brush; Mr and Mrs Carswell, Blackbyside, silver cruet; Miss Storrar, Burnbank, plush photo stand; Miss Whimster, Montrose, pair of jelly spoons; Mrs Robson, Scarborough, hand-painted table centre; Mrs Broome, Cupar, pair of Japanese vases; Rev. D. and Mrs Lawrence, Broughy-Perry, vase; Mrs Rintoul, Waltham Abbey, pair of Burmese vases; Mr Rintoul, Waltham Abbey, coffee-tière; Miss Henderson, Elie, tray cloth; Mrs Melville, St Andrews, six serviettes; Mrs Stoye, Southport, dinner service; Miss Galloway, Crossgate, Cupar, two views of Cupar; Mrs Macqueen, Elderslie, pair of mats; Mrs Borrowman, Bonnygate, hand mirror; Mr and Mrs Henderson, Perth, silver cruet; Miss Henderson, Perth, hot water jug; Harold, Mabel, and Marjorie Henderson, three vases; Miss Hogben, Bonvil, double photo frame; Miss A. Spence, Arbuthnot Manse, pair of embroidered pillow-slips; Hon. Mrs Baillie, London, photo and frame; Miss Sarah Walker, Eden Place, antimacassar; Mr R. and Miss Cicely Robertson, small drawing-room clock; Miss Darling, Westpark, hand-painted opal; Mr Mackie, Inland Revenue, silver fruit-knife; Miss E. Ward, Derby, hand-painted panel; Mrs Fairbairn, Cupar, tablecloth; Mrs Archibald, Cupar, linen; Miss Ramsay, Cupar, bread plate and knife; Mr and Mrs R. Bets, Bonnygate, lamp; Misses Duncan, Bonnygate, side-board cloth; Miss Slight, Nottingham, pair of lace curtains; Mr Greig, Johannesburg, silver afternoon tea stand (Shrewsbury); Rev. Mr Natrass, Cupar, volume of Tennyson; Miss Findlay, Bonnygate, work-bag; Miss Strath, Crossgate, view of Roslin chapel; Mrs Brunton, N. Queensferry, clock; Master John Robertson, silver thimble; Mr A. and Miss E. Morris, Elie, silver cake knife and fork; Rev. C. E. and Mrs Cooke, pair of pictures; Mrs Hogben, Bonvil, plush work-bag; Miss Innes, Rosemount, polter work cabinet.

CUPAR ORCHESTRAL SOCIETY.

This association of amateur instrumentalists scored a distinct success by the concert given by them in the Corn Exchange on Thursday evening. The programme was one well fitted to test their quality. Six selections representative of the classic, the Scotch, the Italian, and Hungarian schools were given, and in every case the execution called for little but commendation. The strings were exceptionally strong and tuneful; and although the brasses and flutes (the latter especially) were not always faultless, they invariably came into line with telling effect as the piece progressed. A capital rendering was given in the first half of the evening to an overture ("Marionetten," by Gurliitt), a Russian Mazurka, and Mendelssohn's march, "Cornelius"; but it was in the second part of the programme that the resources of the orchestra seemed to shine to best advantage. The "Don Giovanni" overture was taken at a spirited tempo, and brilliantly rendered; while Michael's "Czardas" awakened recollections of the Blue Hungarian Band's recent performance in the town. But around the closing overture, "Guy Mannering," hung pleasanter memories still. The presence at one of the double basses of the venerable President of the Society, Dr Robertson (the Nestor of violinists in Cupar, if not in Fife), served but to accentuate the pleasure with which this beautiful composition was once more heard.

Under the auspices of the Doctor and his former talented coadjutor—the late Mr Jonathan Greig—Bishop's overture to "Guy Mannering" was wont to be as familiar among us in the days of the old "Philharmonic" as *Peter Noster*. But enjoyable and interesting as were the performances then, it can hardly be gainsaid that the rendering by the younger generation on Thursday evening put the old society in the shade. Barring an excusable tendency among the second violins to straggle in "Wandering Willie," the performance left absolutely nothing to be desired. The crescendos and fortissimos were given with splendid effect, and the piano playing was admirable. To Miss Bessie G. Mitchell, who had the honour of occupying the leaders' desk, was entrusted the charming solo, "Donald"; and it need only be said that in roundness of tone, delicacy of phrasing, and accuracy of touch, the haunting air could hardly have been better played. The concert, orchestrally, was a complete success, and does Mr J. M. Cooper—the young and talented conductor—infinite credit. He wielded the baton with decision throughout and held his varied forces steadily in hand.

The vocal part of the concert was contributed by two gentlemen of established reputation—Dr Snaddon, Cupar, and Mr David Beveridge, Kettle, and by a young lady—Miss Annie B. Carswell (daughter of the late tenant of Blackbyside), who was heard for the first time in Cupar after a successful course of study abroad. High anticipations had been formed of Miss Carswell's singing, and it is no exaggeration to say that these were more than realized. More powerful sopranos one may easily find; but for purity of tone, artistic finish, and sweetness of expression—particularly in pianissimo passages—Miss Carswell has few rivals. Her rendering of "Ye Men of Gaza," from *Samson*, was a splendid example of the oratorio method; while Cowen's pretty song, "The Swallows," gave scope for that power of expression which Miss Carswell uses to such great advantage. Her finest effort was "Afton Water," which was sung with a sweetness and pathos that hushed the large audience into impressive stillness. Needless to say, the accomplished vocalist had no cause to complain of lack of appreciation. She was enthusiastically cheered for every song. On one of the occasions she merely bowed her acknowledgments; but on the other two she sang again, her first song being the pretty German ballad, "Damon," by Max Staage, and her second being Marchesi's "La Poilette"—a favourite Italian operatic air which Miss Carswell sang in a way worthy of a *prima donna*. Dr Snaddon and Mr Beveridge also put the audience in the best of spirits by their powerful and effective singing. Each contributed a couple of songs—the Doctor giving a splendid rendering of "The Tar's Lass," and Mr Beveridge stirring up a good deal of Celtic fervour by his rousing interpretation of "Macgregor's Gathering." It was, however, when the two strong vocalists combined in a duet that they made the deepest impression. Substituting Cooke's grand old duet "Love and War" for the number stated on the programme, they entered into the spirit of the piece with genuine gusto and gave quite a brilliant rendering of the rollicking, laughter-provoking melody—the latter half of which they had to repeat in response to an irresistible encore. The piano accompaniments to all the singing were tastefully given by Miss Storrar.

At the close of the concert, Provost Macqueen stepped from the front benches on to the platform, and in the course of a few well-chosen and cordially-applauded sentences described the concert as eminently worthy of the county town, and congratulated all concerned, and particularly Dr Robertson and Mr Cooper, on the success attained.

The audience was one of the largest that has within recent years "assisted" at a local concert, and included representatives of many families from a wide district around.



190

at R.G.P.F., Waltham Abbey
Left manufacture of N.G. to be
chemist in charge of Laboratory
R.G.P.F.

1901

Acetone Recovery

Pat. 25994 of 19/12/1901 - Process

Pat. 25993 of 18/12/1901 - Apparatus
by R.R. & W. Pintard. for Process

This apparatus was made at home
consisted of zig-zag descending fibres
in a tall box. Solution of
sodium sulphate descended the
fibres taking out the acetone
from its solution in air. The
liquid at the foot of the tower
could be distilled for acetone
with little decomposition.

[Engaged to Kathleen
Stammers Stammers
on 10/10/01]

After a demonstration of the process in the
R.G.P.F. (see photos) a full scale Acetone Recovery
plant linked up to all cordite stores was
erected and worked at the R.G.P.F. & at the
R.N.C.F. at Holton Heath; also at Curtis & Harner's
cordite factory at Cliffe.

The above account gives further details.

Acetone Patents taken out in 1901 by Sir Robert Robertson and Mr. Rintoul.

These Patents are rather peculiar in this respect, that the process was entirely worked out and completely demonstrated in the private laboratory before the Patentees applied for permission to patent. Permission was given and patents taken out at the expense of the Patentees. Demonstrations were made in the R.G.P.F. which were entirely satisfactory, and the Patentees claimed an award under K.R. This was refused until experience of three years' work on the manufacturing scale was available by the Government. The Patentees contended that sufficient knowledge was already available, but this was over-ruled.

The Patentees were called upon to assign to Government & Government then paid patent fees which which up until now had been disbursed by Patentees.

After a delay of 6 or 7 years Government agreed to grant an award and gave £4,000 less £233 Income Tax to the Patentees in satisfaction of all claims, it being privately understood that if this was ^{WT} accepted no further offer would be made. The Patentees protested against the amount of the deduction of Income Tax, but without success.

Government was asked, and agreed, to permit of the use of these patents for the recovery of acetone if for non Governmental purposes, and for the use of the plant for non Governmental purposes.

A licence was granted to a maker of plant to make the plant for the recovery of acetone, and to charge certain sums for quantities of acetone recovered; all for non Governmental purposes. The Secretary of State issued the licence to this firm, but contracted out a share of the proceeds.

The Patentees reaped the advantage of the manufacture of plant for non Governmental purposes to a slight extent only, as their other business prevented them exploiting in the matter. They also reaped the advantage of obtaining Royalty on Cordite made by a private firm, this cordite being made not for British Government. — a small sum.

Moore's Modern Methods Ltd., London, E.C.4



To repeat order state Plain White, Size 10" x 8"

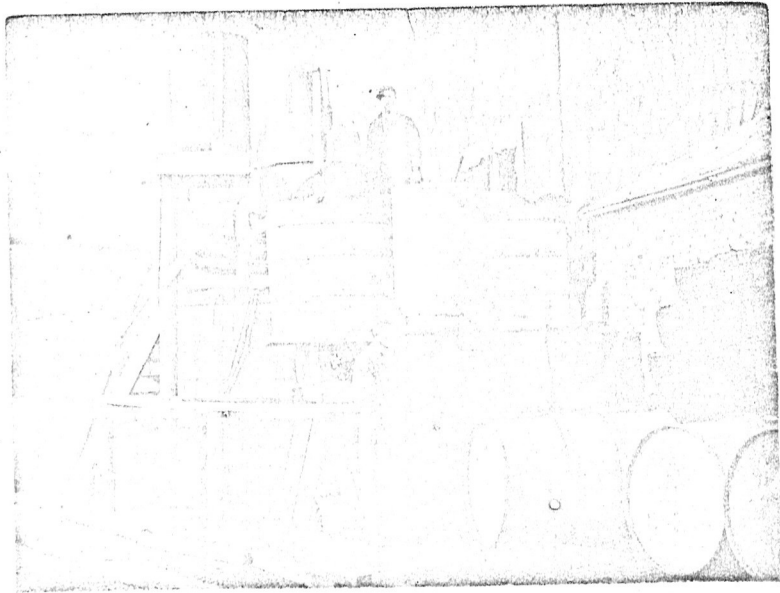
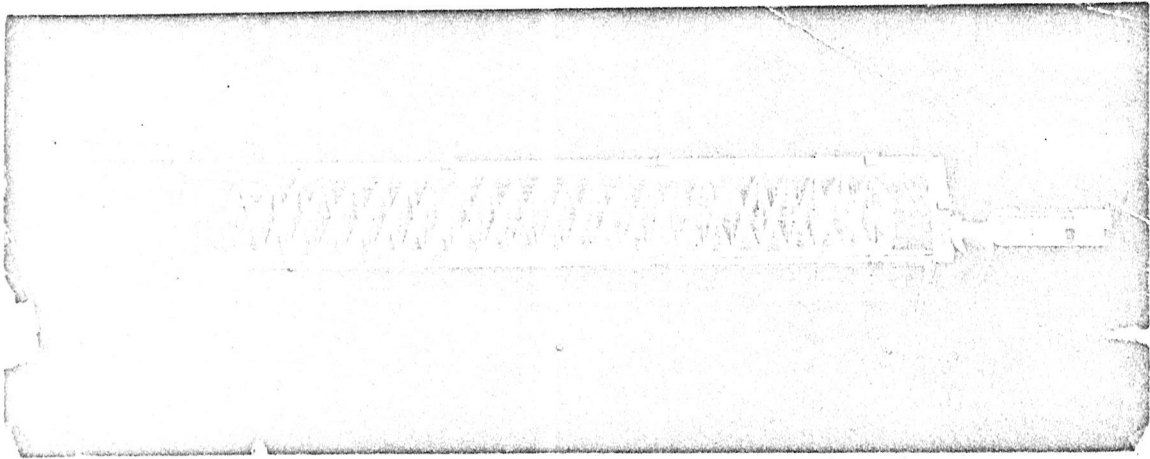
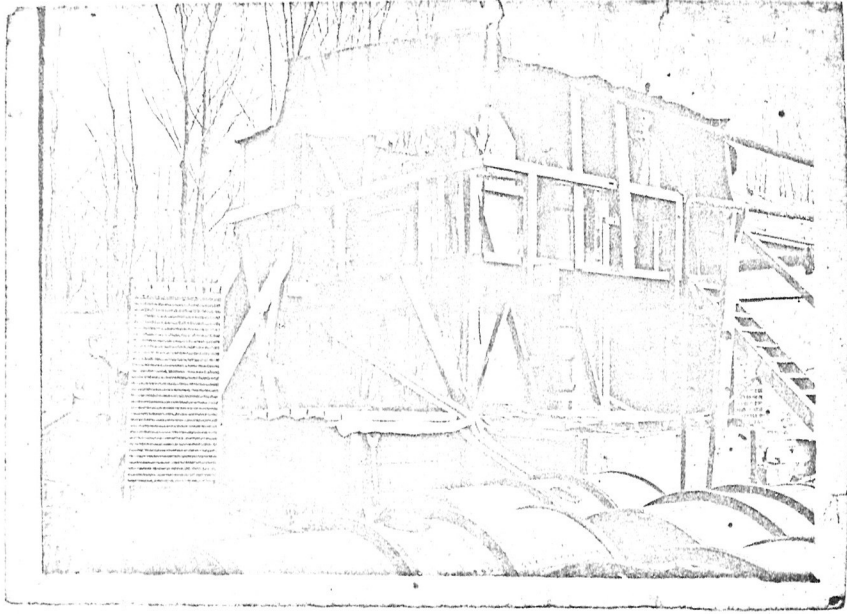
The Private Firm used the 3-acetone process, paid Royalty to the Government for the use of the Patent, ^{for Cordite} such Royalty being retained by the Government.

^{Permission}
As regards foreign patents ~~the~~ provision was given to the Patentees to take out foreign patents, and these were taken out in America, Germany, France, Italy, for all purposes. In point of fact only one of these matured in America for recovery of acetone from celluloid from which a certain amount of Royalty was obtained.

Government has refused to reconsider the question of an advance on the previous sum allocated in virtue of larger usage than was originally contemplated.



Acetone Recovery from Cordite Stoves
1901



ac R.Q.P.F.

Waltham Abbey.

Published: "The Will Test for Nitrocellulose"

J.C.S. 9, 21, 81 (1902)

190

Investigations were made on Will's method. It was applied to normal gullstones and to unstable ones showing a marked difference in rate of disengagement of nitrogen. The effect of boiling the gullstone was also shown, & the deleterious effect of steaming nitrocellulose powder.



Kathleen
Stannus
Stannus

Robert
Robertson

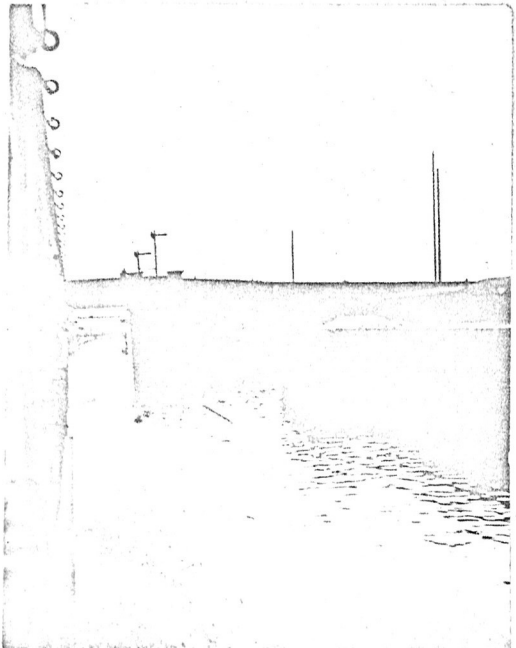
1902

"Blessed are the dead which die in the Lord."
 Feb, 17. Euphemia Robertson, Aged 71.

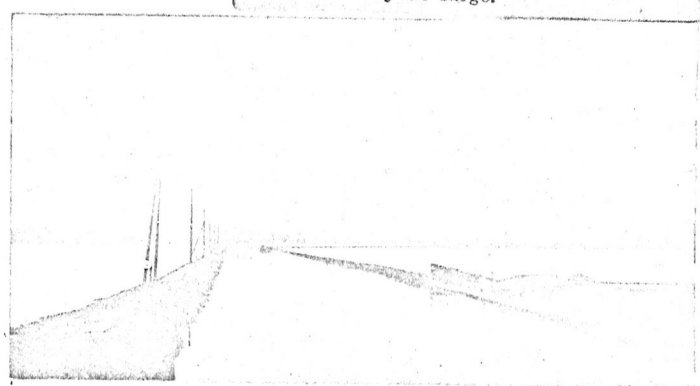
IN MEMORIAM.

ALL that was mortal of Euphemia Robertson was laid to rest on the afternoon of Tuesday, 17th February. In her the church on earth has lost an earnest and devoted member. Few were the Sundays on which, when in health, she was not in her seat in church, worshipping among the congregation, joining in the services she loved so well. The deepest sympathy of all who knew her goes out to her husband and her children in their bereavement. And many were the friends
 costumes for the ball that was to have been held in the evening time, and may now have an opportunity of wearing them.

Much sorrow is being expressed at the death of Mrs Robertson, wife of Dr J. Robertson, Cupar, who passed away on Saturday, after some months of illness. Of a genial and kindly disposition, with an un-failing fund of humour, she was greatly esteemed by all who came in contact with her, and her loss will be felt not only by her family and by St James' Episcopal Church, of which she was an earnest worker, but by the community at large.



Train in Waltham Cross Station



Waltham Marshes - Lee River.

Great Flood at Waltham 17/6



1903	Rainfall	Inches
June	9	0.46
	19	0.07
	20	0.84
Total =		6.13
Rainfall for June 1902 =		4.00
"	"	1901 = 0.38
"	"	1900 = 2.04
"	"	1899 = 0.83
		23/6/03

my mother died 17/2/1903, aged 71

married 7/4/1903
at Streatham

at R.F.F. Waltham Abbey

Royal Gunpowder Factory
Waltham Abbey

190

Presented by the Staff
of the Main Laboratory
to

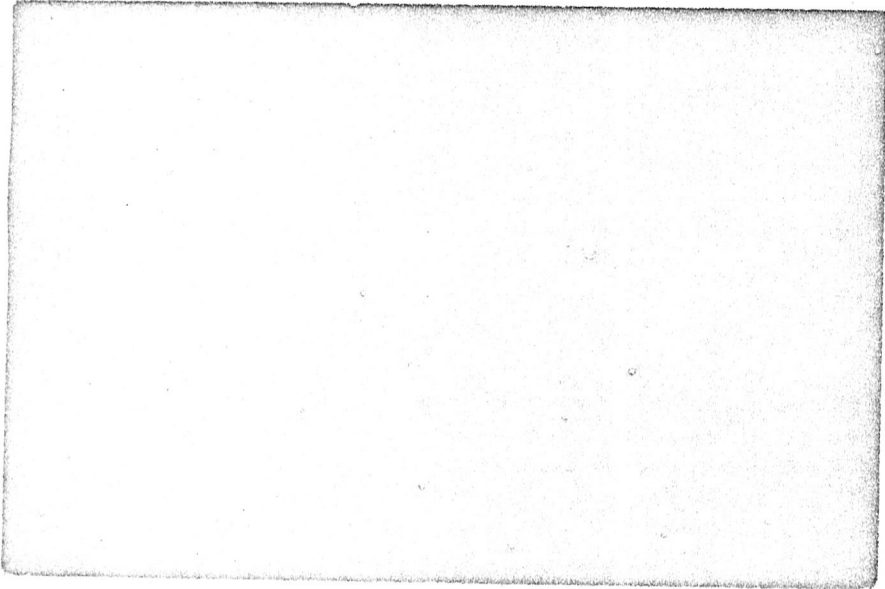
Dr Robert Robertson
on the occasion of
his marriage
April 1903
Arthur Marshall
Wm Barbour.
S.S. Napper
to Blanchard



main laboratory - Longwalk R.F.F.
during great flood 17/6/1903



ALEXANDER MACDOUGALL, JUN.,
"OAKHURST,"
'XMAS, 1916. WESTCOMBE PARK, S.E.



9 Sewall St. W.A.



House at Waltham Abbey where
we lived 1903 to 1907

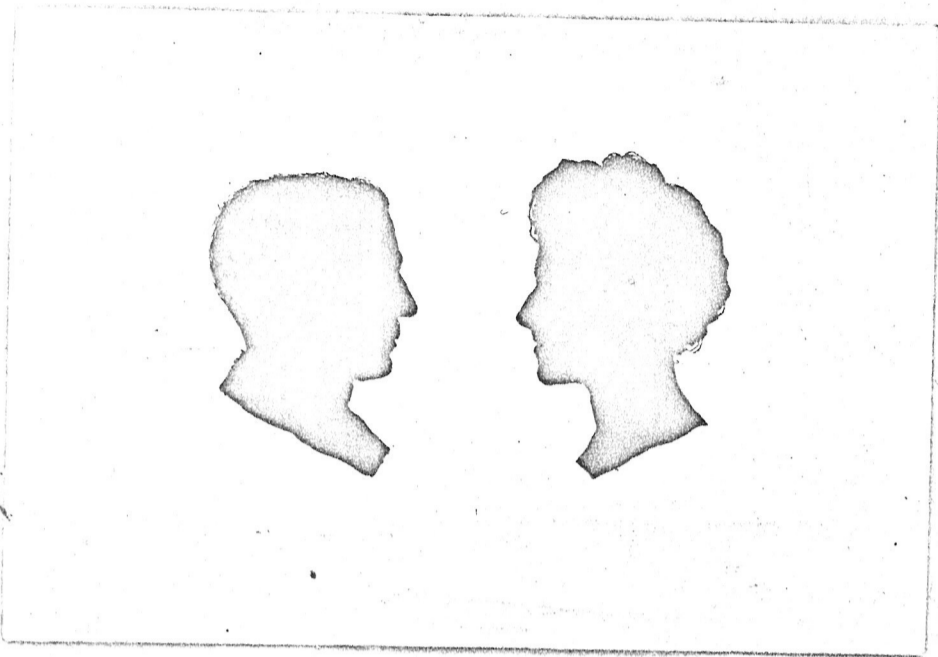
[See "Wedding Book" for guests, etc.]



P. R. as Ramesses II
 Head dress made by
 Henry ~~H. H. S.~~ Holiday.
 Dress designed by
 H. H. S. & made by K. S. R.
 Ank & fauchal headdress
 & staff made by H. H. S.



K. S. R. as wife of Ramesses II
 ornament on dress
 designed by H. H. S.
 Dress of uncture
 head-dress made by K. S. R.



1904



FIRST ANNUAL DINNER.



LATE MEMBERS OF THE STAFF

OF THE

Glasgow City Analysts'
Laboratories.



SATURDAY EVENING, December 3rd, 1904.



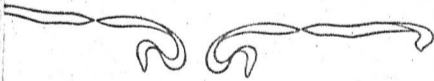
CHARTERHOUSE HOTEL,
CHARTERHOUSE SQUARE, E.C.



Roll Call.



- HORATIO BALLANTYNE.
- JAMES D. DOUGALL.
- COLIN GORDON.
- WILLIAM MacKEAN.
- WILLIAM RINTOUL.
- ROBERT ROBERTSON.
- ANDREW SCOTT.
- D. A. SUTHERLAND.
- W. G. TARBET.
- JAMES M. THOMSON.
- WILLIAM T. THOMSON.
- JOHN A. WILLIAMSON.



190



The Weekly Telegraph

FOR
WALTHAM ABBEY, CHESHUNT, AND DISTRICT.

And General Advertiser for West Essex,
South Herts, and North Middlesex.

ON HIS MAJESTY'S SERVICE.—Lieutenant-colonel Nathan, R.A., superintendent of the R.G.P.F., accompanied by Dr. R. Robertson, M.A., F.I.C., chief chemist at the R.G.P.F., has been ordered to India in response to a request by the Indian Government for expert advice as to the storage of cordite. They left London on Wednesday night to secure berths on the "Persia," which sails from Marseilles for India this (Friday) evening. It is expected that the special mission upon which Colonel Nathan and Dr. Robertson will be engaged will necessitate their presence in India for two or three months. During the absence of Colonel Nathan, Captain Hope will act as superintendent of the R.G.P.F.

Sept 28th 06.

See note
"Visit to
India"

Visit to India - with Sir Frederick Nathan to investigate Storage of Cordite,
3 days' notice - spent in getting apparatus (silvered vessels, etc.)
arranged and clothes.

Sept. 1906 Left England → Marseilles. P.O. "Persia" to Bombay
(arrived 15/10/06). 19/10/06 - Arrived Aruvankadu.
Stayed with Capt. Sturrock, R.A.

190

The attached memorandum by Sir F. Nathan
gives the position before we went to India. The
scientific part is an account of the work
of R.R. in the Laboratory of the R.G.P.F. during
the preceding four or five years.

Published: Purifying and stabilizing gun cotton
J.S.C.S. 25 (1906). The importance of a first boiling
in the acid condition for ultimate stability of the G/C is proved.
This has become universal standard practice as the acid
by hydrolysis breaks up the sulphuric esters. Especially alkaline
boiling follows.

[See Guttman's Book of arts 2/2/08
Nathan, R.S. 1909 - h. 5
Bene 7/12/1944 "Cover stabilisation
of cellulose nitrate is the classical
method for getting stable nitrates"
R.S. Daynes et al. President's Memoirs.

Waltham Telegraph.
WALTHAM ABBEY.

28 11.06.
THE WALTHAM ABBEY FREE REGISTRY OFFICE FOR
SERVANTS, carried on so many years by Mrs Stone,
has been taken over by Mrs Threadgold, of
Repository, Highbridge-street, Waltham
Servants wanting situations and ladies requir-
servants should apply to above address. Cooks,
Housemaids, and Generals Wanted.—Advt.

"PEELING'S TEA ALL PEOPLE PLEASE," especially
the "WALTHAM BLEND," now reduced to 1s 6d. A
delicious and money-saving article. Try a sample.
—Advt.

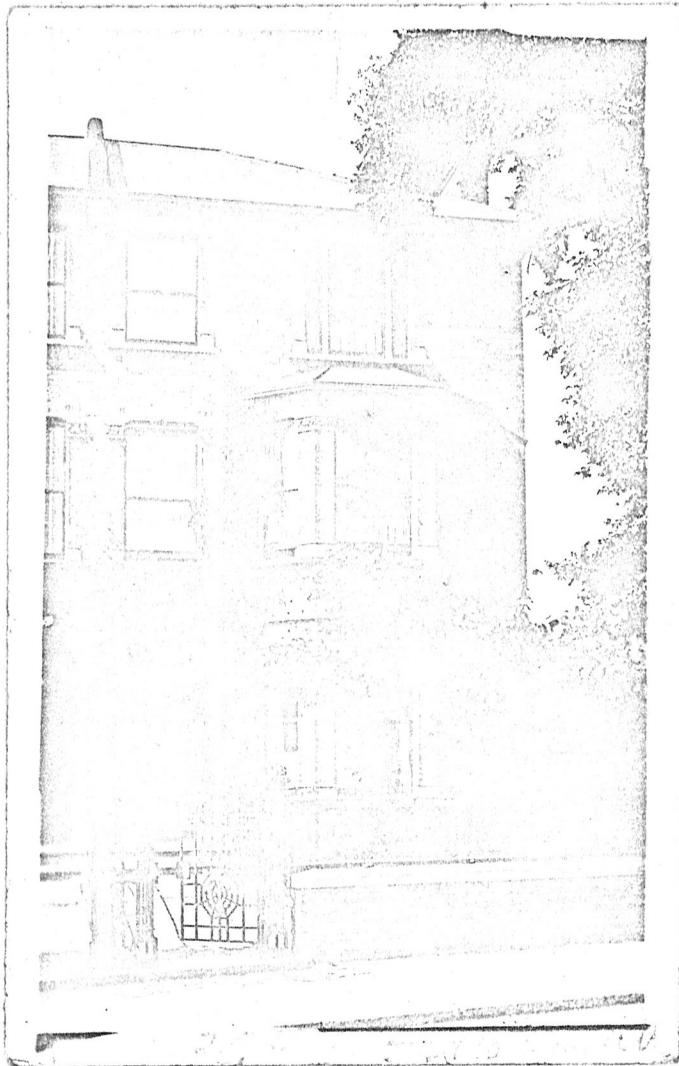
A FOREST FIRE.—At Epping Petty Sessions, on
Friday, Alfred Williams, labourer, of Waltham
Abbey, was fined 10s for making a fire in Epping
Forest on 5th August.

ON HIS MAJESTY'S SERVICE.—Lieutenant-colonel
Nathan, R.A., superintendent of the R.G.P.F.,
accompanied by Dr. R. Robertson, M.A., F.I.C.,
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the R.C.

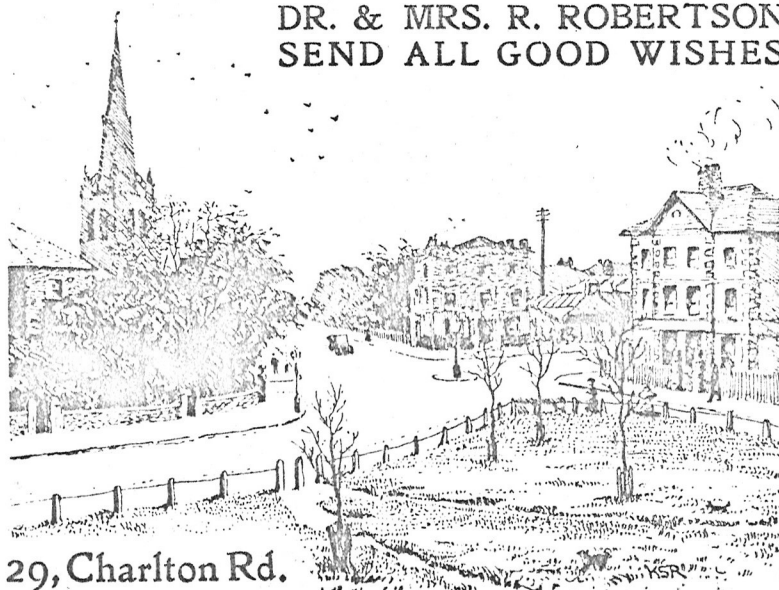


1906 Aruvankadu - Nilgiris -
Dec. India.

R.R. J.C. Burnham
manager



DR. & MRS. R. ROBERTSON
SEND ALL GOOD WISHES



29, Charlton Rd.
Blackheath, S.E.

COPY

6

India

R. G. P. P.

22.9.06.

Dear Donaldson,

This report was completed before I had heard of the Ferrossopore explosions. It embodies my views on the question up to date.

In view of these further explosions of Lot 189 cordite cartridges at Ferrossopore, I am strongly of opinion that no time should be lost in destroying all cordite cartridges that at the special examination in 1904, were found "to have their covers completely rotten", see paras 4 & 19 "Proceedings" pages 6 & 8.

Yours sincerely,

(Signed) F. NATHAN

all
37 - short

C.S.O.F.

1. I have received a copy of the Proceedings of the Board of Investigation on the explosions of the 7th & 15th April, 1906, at Hyderabad (Sind), together with Major General Mahon's covering letter, and Major Babington's remarks.
2. A careful study of the papers leaves little doubt in my mind that both explosions were brought about by the gradual decomposition & eventual spontaneous ignition of the Cordite. I can find no other possible cause in the evidence at our disposal.
3. The only arguments against spontaneous ignition are those based (a) on the heat test results, (b) on the coincidence that ignition occurred in two separate cases within 9 days of one another, and (c) on the fact that Sergt. Purkis did not notice anything wrong, or any peculiar smell when he was in the magazines about 3 hours before the explosion of the 7th April, & 23 hours before the explosion of the 15th April.

4. (a) The Heat test results.

The available heat tests of the Hyderabad Cordite are as follows:-

March, 1903.....	6 minutes
September, 1903.....	8 minutes
March, 1904.....	5½ minutes, &
March, 1905.....	10 minutes

(See "Proceedings", page 6). It might be argued that a cordite which in 2 years recovered from a heat test of 5½ minutes to one of 10 minutes, which latter test was of a sample taken only a fortnight before the explosion, could not be in a dangerous condition. Moreover, it appears that a metal lined case was found in the Magazine nine days after the second explosion, containing some cartridges of the same lot (No.161) as those which exploded. Samples of Cordite from these cartridges when tested by Mr. Burnham, gave a heat test at 160° immediately after grinding of 9½ to 11 minutes, and after exposure in the ground condition for 24 hours, the heat test was 14 minutes. (See "Proceedings" page 9).

5. The value of the periodical heat tests as indicative of the stability of the cordite is however much discounted by the fact that the cartridges from which the periodical samples were drawn for the tests, were all kept in a metal lined case with other samples, the case itself being stored separately in the Magazine.
6. Cordite which has been subjected to very prolonged storage in a hot dry climate, such as exists at Hyderabad, has, undoubtedly, undergone a general deterioration.
7. As evidence of the diminished stability of cordite which has been stored in India for some years, the case of the Cordites kept at Dum Dum & Lahore, in accordance with O.C. Programme No. 1095 may be cited. The final tests of these Cordites after they had been in India for a period of about 6 years, are given in O.C. Report No.1143.

The smell and appearance of the Cordites were reported as being normal, the heat tests of the materials stored in Dum-Dum were all over 7 minutes, and those from Lahore over 14 minutes. The results were considered satisfactory, note being made of the somewhat greater deterioration as regards heat test in a climate which is at the same time moist and warm.

From certain experiments made here on some of this Cordite after its return to England, it is considered that the material while not being in an unstable or dangerous condition, has certainly a diminished capacity for enduring storage.

8. Now, although the bulk of a lot of Cordite or batch of Cordite cartridges, may still be some way removed from a condition of spontaneous ignition, as indicated by the heat test of samples, decomposition in some relatively infinitesimal portion may have proceeded up to spontaneous ignition point. As the quantity of Cordite taken for the heat test is a minute fraction only of the bulk, it is obvious that the chances in favour of the sample being from the relatively stable portion, are very great indeed.
9. As illustrating this point, the following case may be cited of a very local decomposition of some Cordite which had been subjected here to heat for some years.
10. Weighed and measured samples of various sizes of Cordite were placed on trays in a Tray Stove in January 1906, to test the effect on them of a temperature of 100°F. The samples were removed periodically for weighing & measuring, but no heat tests or analyses were made until April 1906. After this Analyses were made annually. The analysis made early in 1906 showed that the N/C had been reduced from about 58% to about 26%; the average heat test was 13 minutes at 130°F. When drawing the samples from the stove for analysis, it was observed that one of the sticks of Size 30 was decomposing badly at one end. The portion attacked extended for about 1½ inches from the end & was strongly acid, it had a reddish translucent appearance, and tended to split up longitudinally. The heat test of the other end of the stick was 15 minutes at 130°F. when freshly ground, and 20 minutes at 130°F. after 24 hours exposure. It must be remembered that this Cordite was not enclosed at all, so that the volatile products of decomposition had been free to escape without, therefore, reacting on the Cordite.
11. (b) The coincidence of ignition occurring in two cases within 9 days of one another.

That two cases of spontaneous ignition of Cordite in one locality should have occurred within 9 days of each other, is undoubtedly a somewhat remarkable coincidence.

12. The close proximity in point of time of the two explosions is, however, it appears to me, an argument in favour of both being the result of spontaneous ignition, as it would be a still more remarkable coincidence if the ignitions in both cases had been brought about by some cause altogether external to the Cordite itself, as to which the published evidence & facts give no clue whatsoever.
13. I think that a very possible explanation of spontaneous ignition being the cause in both cases is that some of the Cordite close to that which exploded on the 7th April, and itself already in a somewhat advanced stage of instability, was adversely affected by the heat & exposure to which it was subjected, and its final decomposition thereby accelerated.
14. (c) The fact that Sergt. Purkis noticed nothing wrong nor any unusual smell.

It would at first sight seem probable that if when Sergt. Purkis was in the Magazine on the 7th April the Cordite was in such an advanced stage of decomposition as to be within 3 hours of spontaneous ignition, he would have noticed nitrous fumes.

It must, however, be remembered, that the cartridges were enclosed in a practically hermetically sealed case, so that the escape of fumes, unless they were very abundant would hardly have been possible, and on the other hand if they had been very abundant about that time, they would probably have developed sufficient force to have opened the case, and the Cordite would then have been within possibly a few minutes of the ignition point.

In the case of the explosion in the Khartoum Magazine on the 20th February 1906, which was apparently due to the spontaneous

ignition of some ballistite, no fumes were noticed when the Magazine was last visited before the explosion. In this instance the visit was 21 hours before the explosion, but the ballistite was stored in boxes, presumably not hermetically closed.

17. Again, in the experiment:- "To ascertain the behaviour of Cordite if heated to destruction", (O.C. Programme 1000), the Cordite (10 lb. Size 3 $\frac{1}{2}$) was enclosed in a tin cylinder with loosely fitting lid. Although this Cordite was very closely watched, nitrous fumes do not seem to have been noticeable till about 8 $\frac{1}{2}$ hours before the explosion, & in this case both the Cordite & its environment were known to be at a temperature of over 200°F. which would have much accelerated the final explosion after the first development of nitrous fumes.

18. I therefore think that, on the whole, it is not very surprising that Sergt. Purkis did not notice anything in the way of fumes when he visited the Magazine on the morning of the 7th April.

In the case of the explosion of the 15th April, the last visit paid by Sergt. Purkis to the Magazine was 28 hours before the explosion took place.

19. The following conclusions may I consider be drawn from the preceding remarks, in support of the view that the explosions of the 7th & 15th April were due to the spontaneous ignition of Cordite Lot 181.

20. 1. The heat tests of Lot 181 both before & after the explosions are not by any means conclusive evidence of the stability of every portion of the whole Lot, or of the batch of cartridges.

2. The fact that two explosions, both probably of the same lot of Cordite, took place within nine days of one another, is a coincidence pointing however rather to spontaneous ignition than to something independent of the Cordite itself, as being the cause of both explosions.

3. That Sergt. Purkis did not notice anything abnormal in the Magazines when he visited them about 3 hours & 28 hours respectively, before the actual explosions occurred, is not a fact of much importance as against spontaneous ignition being the cause of the explosions.

21. Granting then that the explosions were due to the spontaneous ignition of the Cordite Lot 181, what were the causes which may have induced it?

22. These cases may be conveniently considered under the following heads:-

(a) Prolonged storage of Cordite at an elevated temperature.

1. Normal decomposition of cordite under the influence of heat.

2. Decomposition produced artificially by heat.

3. Effect of storage on Lot 181.

(b) The operation of recovering the cartridges in 1904-05.

(c) Some defect in the Cordite itself.

(d) The effect of the silk cloth cartridge bags.

(e) Action of the gunpowder priming on the Cordite.

PK

(a) Prolonged storage of Cordite at an elevated temperature.

23. 1. Normal decomposition of Cordite under the influence of heat.

In connection with the keeping of Cordite, especially in warm climates, it should be recognised that a normal or intrinsic decomposition of the Cordite is continually proceeding, rise in temperature accelerating the decomposition in a very marked degree. The rate of this decomposition has been most fully worked out for the Guncotton constituent of Cordite. An example of the rate of this decomposition for a sible Waltham Abbey guncotton may be given. The guncotton was subjected to a temperature of 65°C. for a period of 48 weeks, when it was found that the loss in nitrogen amounted to 0.21% or 0.23% per year.

In a similar experiment described by Dr. Will in his "Untersuchungen über die stabilität von Nitrocellulose", 2 Mitteilung, guncotton lost 0.33% after a period of 15 months at 75°C. Founded on the results of experiments with his well known test in which guncotton was heated in a stream of carbon dioxide to temperatures of 125°-160°C., Dr. Will gives a logarithmic expression connecting disengagement of nitrogen with temperature. For the above temperature range in which experimental data were obtained, the law holds good that for every 5 degrees Centigrade the disengagement of nitrogen is doubled. At lower temperature the formula would point to an even greater increase for a rise of 5 degrees, amounting to nearly a four-fold quantity of nitrogen disengaged at temperatures of about 40°C. All this is, of course, based on the complete and continuous removal of the volatile products of decomposition, a condition which did not obtain in either the experiment at 65°C. or that at 75°C. quoted above. In these the conditions are favourable to a more rapid decomposition, as the volatile products which catalytically accelerate it would only gradually escape, and, as a matter of fact, the disengagement in both cases is greater than Will's formula indicates. Assuming, however, the three to fourfold difference for 5 degrees, it might be deduced from the loss in nitrogen reckoned as nitric acid would amount to the significant figures of 0.1% on the guncotton at 45°C. (113°F.) or 0.025% at 40°C. (104°F). But to a much greater extent will the decomposition be hastened in the case of guncotton gelatinised as it is in Cordite, for here there is much less chance of the elimination of those volatile products which act as accelerators of decomposition from the substance of the explosive, while again their retention is favoured by the enclosed condition of the material in its case. To quote Dr. Will: "For gelatinised nitrocellulose" (and this applies also to Cordite) absolute figures "can have no claim to notice, because no volatile decomposition products can be given off from tightly-packed ammunition; they remain enclosed in the gelatinised mass and hasten the decomposition in a manner which cannot be calculated."

From what has been said, the importance that a few degrees may have in accelerating the decomposition of guncotton is evident, and there is reason to believe that the other main constituent of Cordite, the nitroglycerine, may possibly behave in a similar manner.

24. The mineral jelly up to a certain point exercises a very distinct preservative effect on cordite, but as the decomposition is always going on it must be recognised that cordite prepared from even unexceptional materials is not a substance which is capable of indefinite storage in a warm environment.

2. Decomposition produced artificially by heat.

That heat alone is capable of producing the decomposition & spontaneous ignition of cordite, was proved by the result of the experiment carried out in accordance with O.C. Programme 1090, referred to above. In this experiment, the temperature at which the cordite was kept was about 200°F., and the cordite was enclosed so that the heat produced by any internal decomposition was, as far as possible, retained. A rise in the temperature of the cordite itself

above that of its environment, occurred 36 days after the start of the experiment, the actual explosion taking place on the same day, about 11 hours after the rise in temperature.

26. 3. Effect of storage on Lot 181.

Passing now to a consideration of the actual cordite in question, it would appear from the evidence given before the Board, that the cordite of Lot 181 had shown undoubted evidence of deterioration, and might be looked upon with a certain amount of suspicion; thus the heat test in 1904 was only 5½ minutes; at 100°F. (See "Proceedings", page 33) the cloth bags in 1905 were found to be much discoloured & rotten (See "Proceedings", page 25) and also a very powerful smell, which might be due to nitrous acid, was noticed in the cartridges during the operation of renewing the cartridge bags - (See "Proceedings", page 25). As the climate of this station is very warm for a certain part of the year, and as the previous storage from 1895, the date of the arrival of the cartridges in India, to 1899 when they were sent to Hyderabad, may have been in an equally warm or warmer station, it is quite possible, in view of the preceding remarks, that the conditions of this long keeping in a warm environment may have brought about the decomposition in the cordite itself, which ultimately led to its spontaneous ignition.

(b) The operation of recovering the cartridges in 1904-05

27. The operation of recovering in 1904-05 the cartridges of Lots 180 & 181, was carried out in tents, the temperature in which is reported to have been between 100°F. & 110°F. (see "Proceedings", p.p. 7 & 25), and although the cartridges, according to the evidence, were not exposed in the tent for more than 1½ hours, it is possible that during at least a portion of that time the cordite may have been exposed to direct sunlight, which would in its already deteriorated condition have further injuriously affected it.

(c) Some defect in the Cordite itself.

28. Tables are attached giving the details of materials used for the manufacture of this cordite. Cordite was being made at this time, the summer of 1898, partly from gun-cotton & nitroglycerine manufactured in the R.G.P.F., and partly from "paste" supplied from private firms. This "paste" consisted of R.G.P.F. gun-cotton impregnated with nitroglycerine made by the private firm. In the case of the Lot 181 in question, 15% of the total paste employed was supplied by the British Explosives Syndicate, Pitsea. No record can be given of the tests to which the nitroglycerine used in the Pitsea paste was subjected.

29. Considering the details of manufacture and tests given by the R.G.P.F. materials, there is nothing which would not be considered normal at the present day, with the exception perhaps of the acetone, which, although it was within the specification at that time, would now, under the revised specification & stricter demands for purity, be considered of somewhat inferior quality, but would not be considered to effect deterioration of the cordite.

30. As regards the paste received from Pitsea, this was tested by the heat test at 170°F. and in all cases satisfactory heat tests of over 10 minutes were obtained. At the same time it has since been elicited from private information that this factory experienced considerable difficulty in obtaining good heat tests of the nitroglycerine used in the preparation of this paste. This difficulty may have been connected with the fact since ascertained that the water used in that factory for washing nitroglycerine was drawn from a stagnant pond, and was much contaminated with organic matter and sulphide.

There exists, therefore, a possibility that the nitroglycerine used at this time by this firm was not of the highest degree of

purity, and that traces of sulphides may have been incorporated with the paste, and that these might gradually oxidise to sulphuric acid, and so promote decomposition.

32. On the other hand, however, an analysis of the components of the other lots of cordite from which cartridges had been made & which at the special examination of all cordite cartridges in India in 1904, were found to have deteriorated, (see "Proceedings" page 8, para.19), shows that some of these lots, Lots 179 & 180 for instance, were composed wholly of Waltham Abbey ingredients, of the stability & purity of which there is no question.

33. (d) The effect of the silk cloth cartridge bags.

As regards the use of silk cloth bags, the fact that the bags are reported (see "Proceedings", page 25) to have blazed up brightly & burned very quickly, would seem to show that they were impregnated with nitroglycerine, while the yellow colour of the bags would point to nitrous acid.

34. In cases which have come before the Ordnance Committee, (e.g., O.C. Minute 51239) nitric acid is found associated with rotten bags, and the diazotising effect of & the yellow coloration produced by nitrous acid on silk have been observed; see Journal of the Society of Chemical Industry 1892, page 439, & 1893 page 428.

35. Owing to the want of aeration, the nitroglycerine and nitric & nitrous acids from the normal decomposition of cordite would be distributed in a finely divided form among the fibres of the silk, a condition which under the influence of heat would appear to be one favourable to the decomposition of the nitroglycerine, without taking into account any chemical action between the silk & the nitrous acid, the possibility of which exists, or the instability of any product formed by this reaction. This is a matter distinct from the effect of the evolved nitrous acid on the cordite itself.

(e) Action of the gunpowder priming on the Cordite.

36. The possible effect of keeping cordite in proximity to gunpowder was discussed in the "Joint Report by Chemists R.G.P.F. after consideration of O.C. Report No.1127, on the Explosion of 6-inch G.P. Cordite cartridges in a Magazine on board H.M.S. Revenge" (See Appendix III O.C. Report No.1150). A programme of experiments to ascertain amongst other things the effect of keeping cordite in proximity to gunpowder was drawn up, (see Appendix IV of the same report) but was abandoned, as suitable materials for certain of the experiments could not be obtained (See O.C. Minute 51942 I). It is for consideration whether that portion of the programme referring to this particular point, should not be undertaken.

37. The preceding considerations & facts, as tending to show that the Hyderabad explosions were due to the spontaneous decomposition of Lot 131, may be summarised as follows:-

1. A normal or intrinsic decomposition of cordite is continually proceeding, rise in temperature accelerating the decomposition in a very marked degree.
2. The rate of this decomposition has been most fully worked out for gun-cotton, and the importance of a few extra degrees of temperature in accelerating this decomposition has been shown.
3. There is reason to believe that nitroglycerine may possibly behave in a similar manner.
4. It must therefore be recognised that cordite prepared from even unexceptionable materials, is not a substance which is capable of indefinite storage in a warm environment.

5. The spontaneous decomposition by means of heat, and subsequent explosion of a sample of cordite, has been produced experimentally.
 6. The history of Lot 181 showed that it had deteriorated, and this deterioration may possibly have been accelerated by exposure during the operation of recovering in 1904-05, the cartridges into which it had been originally made up.
 7. There is a possibility that the nitroglycerine made at Pitsea for a portion of the lot was not above suspicion.
 8. The condition of the original bags in which the cordite was made up, showed that they had absorbed nitroglycerine & nitrous and nitric acids from the normal decomposition of the cordite, and this nitroglycerine would therefore be in a physical condition favourable to its decomposition under the influence of heat.
 9. Gunpowder kept in proximity to Cordite may have a deteriorating effect on the latter; this is, however, a matter requiring further investigation.
38. The circumstances of these explosions, and the facts brought to light at the enquiries give rise to certain considerations.
 39. Foremost amongst them is the undoubted undesirability of storing nitro-explosives & gunpowder in the same magazine. I am aware that this procedure is allowed by the Magazine Regulations both of this country & of India, but I have always been strongly opposed to the practice. It is, I think, very probable that if no gunpowder had been in the magazine on the 15th April, the disastrous results arising from the eventual explosion of the gunpowder, would not have been experienced.
 40. The method of sampling was not in accordance with the regulations, and the samples heat tested did not therefore probably represent the condition of the bulk of the cordite. It is also doubtful whether the aeration of the samples taken for heat tests, due to the transport & subsequent exposure & handling at the Cordite Factory, does not tend to give better heat test results than the true condition of the cordite warrants.
 41. The prolonged storage of cordite under such climatic conditions as occur in India, is much to be deprecated. It is most desirable that cordite should be used up more quickly than seems to be the practice at present, if this is at all possible.
 42. The unfavourable conditions of storage are I consider further aggravated, particularly when it is of such long duration, by the nature of the packages in which cordite cartridges appear to be stored, and there is little doubt, I think, that some system of periodical aeration of cordite would be very beneficial. Periodical aeration is preferable to continuous aeration, as a case designed to give the latter would probably be objectionable from other points of view, & the gradual loss of nitroglycerine which would result from continuous aeration would eventually affect ballistics.
 43. Systematic periodical aeration of cordite, stored in what are practically hermetically sealed packages, would, on the other hand, eliminate the volatile oxides of nitrogen which are gradually formed, without any practical loss of nitroglycerine.
 44. Some calculations have been made regarding the possible loss of nitroglycerine by frequent aeration. It has been shown in the course of some experiments in the Laboratory here, that the vapour tension of nitroglycerine is much the same as that of mercury for a temperature of 70°C. Assuming this will hold for slightly lower temperatures - as the molecular weights are similar - vapour

tensions of nitroglycerine may be taken as those of mercury, given by Ramsay & Young:-

		<u>In m.m. Hg.</u>
At 30°C.	= 86°F.	0.003
40°C.	= 104°F.	.008
50°C.	= 122°F.	.015
60°C.	= 140°F.	.029

and taking 3916 cb.in. as capacity of case, 1503 cb.in. as volume of cordite, the air space is 2313 cb.in. = 38 litres. The volume of nitroglycerine in the saturated air of this case at 40°C. would be 0.0004 litre or 0.004 gr. W/G. The cordite present weighs 88 lb. = 40,000 grams. There is therefore in the air of the case 0.0001% of the weight of the cordite. To make a difference of 0.1% in the composition of the cordite, air would have to be changed 10,000 times at a temperature of 40°C. It is evident from this, that a good deal of aeration could be done without affecting the composition of the cordite.

45. It must however not be forgotten that aeration must not be considered sufficient to preserve cordite indefinitely at a high temperature, for in the first place some of the volatile products of decomposition still remain in the cordite, and would be with difficulty eliminated; and in the second place, non-volatile products of decomposition will remain, and exercise a catalytic acceleration on the rate of decomposition. The difficulty of eliminating volatile matter from cordite is illustrated in the drying process, while the extreme tardiness with which volatile matter present in varying proportion at different depths, in sticks of cordite, tends to uniformity of distribution, has been brought out in the course of experiments carried on here (See R.G.P.F. Annual Report 1905-6, p.67,68).

46. The effect of the explosion on the 7th April of the cartridges in a single metal lined case, on the walls of the magazine, was to blow them out. The case contained about 88 lb. of cordite, this would produce about 1100 cubic feet of gas. The size of the building was 101 ft. by 41½ feet (see Appendix O, "Proceedings", page 43), by say, 15 feet high, the capacity was therefore 63,000 cubic feet. The pressure inside the building was therefore increased by 1/57th or 1/4 lb. per square inch, or 36 lb. per square foot. The superficial area of the end wall is say 622 square feet. The additional pressure brought to bear on each of the end walls by the sudden evolution of gas was therefore 622 X 36 lb. = 10 tons approximately. This sudden inflation of the building was, apparently, too great for the end walls to stand.

47. I am glad to learn from the concluding paragraph of General Schon's covering minute of the 5th July 1906, that steps are being taken to (1) aerate and examine all cordite in India which has been closed for a longer period than one year; (2) to examine at the Cordite Factory some whole cases of cordite which have been longest in store; (3) to discuss the desirability of local examination of cordite, instead of sending samples to the Cordite Factory for the purpose; (4) to amend the Indian Magazine Regulations; and, what is I consider the most important of all, (5) to separate cordite & gunpowder in magazines, pending the completion of the investigations now in hand in India.

48. I trust that the storage of nitro-explosives & gunpowder in separate magazines, separated from one another & from other buildings by the regulation distances will be decided upon as a permanent regulation, that every possible effort will be made to prevent the storage of cordite in India for anything like the same length of time as, from the reports under consideration, appears now to be the practice, and that regulations will be framed for the systematic periodical aeration of all cordite stored in what are practically hermetically sealed cases.

(Signed) F. NATHAN.
Superintendent, Lt. Colonel, R.A.
R.G.P.F.

22/9/06.

At Cordite Factory
Arawankadu
Madrass
India

19/10/06 to 22/12/06

Coonoor - Trichinopoly - Masana - Tuticorin -
Colombo - Kandy.

27/12/06 Left Colombo on "Koslovavia"

12/1/07 - Marseilles

13/1/07 - Calais - Waltham Abbey.

See Diary Visit to India

Appointed to Crosswith
Superintendent Chemical
Research Dept 7/4/07
Superintending Chemist
30/5/07

"REPORT ON CORDITE STORED IN INDIA
and on board Her. Ships"

By Lt. Col. Sir Frederick Kellard, R.A. and

Dr. Robert Robertson, M.A., F.I.C. Feb 4

1907

This gives my theory of the mode of deterioration of cordite;
effective conditions in Indian magazines; tests for
determining the condition of cordite (Silver's Vessel Test) &
the examination of Indian cordites.

The theory is based on the intrinsic decomposition of
gun cotton (giving no. & see J.C.S. 1907) and of nitroglycerine
(giving no. - see J.C.S. 1909) the combination of no. & mineral
jelly and the temperature coefficient of base-catalysed cordite.
The ~~few~~ times during which cordites of Kason thermal
history failed in the S.V. test were remarkably close to
those predicted according to a temperature coefficient which
had been worked out.

[See published account of this by Sir F. Kellard in
R.I. Discourse of 29/1/1909 "Improvements in Production
and Application of gun cotton & nitroglycerine" - especially
pp. 12, 13, 14 & 15.]

Published: P.R.S. A 79 320 (1907) Constants of explosion of cordite.
This deals with calorimetry of cordites nos I & II.
J.C.S. 91 761 (1907) - with S.S. Happer - Estimation of nitrogen
peroxide (spectroscopically)
J.C.S. 91 764 (1907) with S.S. Happer - Evolution of nitrogen
peroxide in the decomposition of gun cotton.

CUPAR NEWS.

MR FLEMING BREMNER, son of the late Chief Constable, has been appointed by the United States Government a notary public in and for the first judicial district of the Canal Zone, Isthmus of Panama.

DR ROBERT ROBERTSON, M.A., D.Sc., F.I.C., F.C.S., an old St. Andrews student, has just been appointed Superintendent of Chemical Research at Woolwich. It may be remembered that Colonel Sir Frederic Wathan and Dr Robertson were sent on a special mission to India last autumn to give expert advice on the storage of cordite. For the last fifteen years Dr Robertson has been attached to the Royal Gunpowder Factory, Waltham Abbey. Dr R. Robertson is a son of Dr J. A. Robertson, Bonnygate, Cupar.

Fife Herald 3/4/07

DR. ROBERT ROBERTSON, M.A., D.Sc., F.I.C., F.C.S., has just been appointed Superintendent of Chemical Research at Woolwich. Dr. Robertson has been connected with the Royal Gunpowder Factory for the last 15 years, having been in charge of the manufacture of nitro-glycerine, and latterly of the laboratory and research. It will be remembered that when Sir Frederick Nathan, R.A., was sent on a special mission to India last autumn to report on the storage of cordite there he was accompanied by Dr. Robertson.

*Waltham Abbey Weekly
Telegraph, 5/4/07*

Thursday 26th May

TEL. BATTLE 2722.

COURTLAND,
BATTLE HILL,
BATTLE, SUSSEX.

Dearest Robert ~~son~~,

Looking forward to seeing
you next week.

Herewith copy of Mum & Dad's
arrangements which I have acknowledged.
I have a list of RR's papers, ^(reprints)
obits. etc. (which I once sent to you I
think), will bring it with me in
case Th. M. I. would like any
duplicates.

In haste,

Love,
John.

XX