

Papers and Correspondence on Electric Lighting at the Retreat and problems in the electrical installation and equipment

Publication/Creation

1892 - 1893

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SILVANUS P. THOMPSON, D.Sc., F.R.S.,

Consulting Electric Engineer.

Technical College, Finsbury.

(City and Guilds of London Institute.)

Leonard St., City Road.

London, E.C.

June 9th 1893

Electric Lighting.

Dear Dr. Pierce:

I have gone through this matter carefully, and in particular through the points raised by Messrs. Shepherd & Watney.

On one matter only am I in uncertainty.

I suggested that you should change your switchboard arrangements; and I think indicated the kind of switchboard that I deemed preferable — one of the "E. P. S." Co's patterns. It is not clear whether this change was made, or whether Messrs. Shepherd & Watney's letter is merely pointing out additional defects in the old switchboard. I do not see any memorandum

The change was
not made, until
S & W had refused
to answer Retreat

that the changes were made; and therefore assume that their remarks apply to the old switchboard. I will deal with their numbered paragraphs in order.

(1.) I agree, and suggested to your engineer the use of a two-way switch to enable either set to be charged separately.

(2) This could only be by gross carelessness - and I do not think it has in fact occurred.

(3) This was a defect of the old switch board - not of the pattern I suggested to you in its place. If you have got a new one, I have not seen it since, and the criticism may be true of it too.

(4). I commented on this, and suggested to you that an additional piece of cable was required to carry the length from accumulators to the engine-house.

(5). This is true ... the remedy proposed by S. & W. of an auxiliary resistance will be the best under the circumstances.

(6). There may be some advantages in this, in protecting against the possible results of gross carelessness.

(7.) The remedy S. & W. propose for this is adequate.

Their recommendations in general seem to me sound: but I should be careful in adding soda to the cells.

Very little suffices.

(9)

With respect to P. & W's further letter H
I disagree with the reason alleged "Firstly" and
think it of little moment. Their "Secondly" is quite
to the point; and so is their letter I which
gives the true reason instead of the "firstly" of H

With their last sentence (letter I)
I fully concur. You ought not to have to
pay twice over for the items which, but
for Messrs. Hadon's mistakes, you would have
paid for but once.

With kind regards,

I am, yours ever truly,

Silv. P. Thompson

SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS"

71. Albion Street.

Leeds, May 4th 1893.

Dr. Bradford Peirce
The Rheostat Works.

Dear Sir

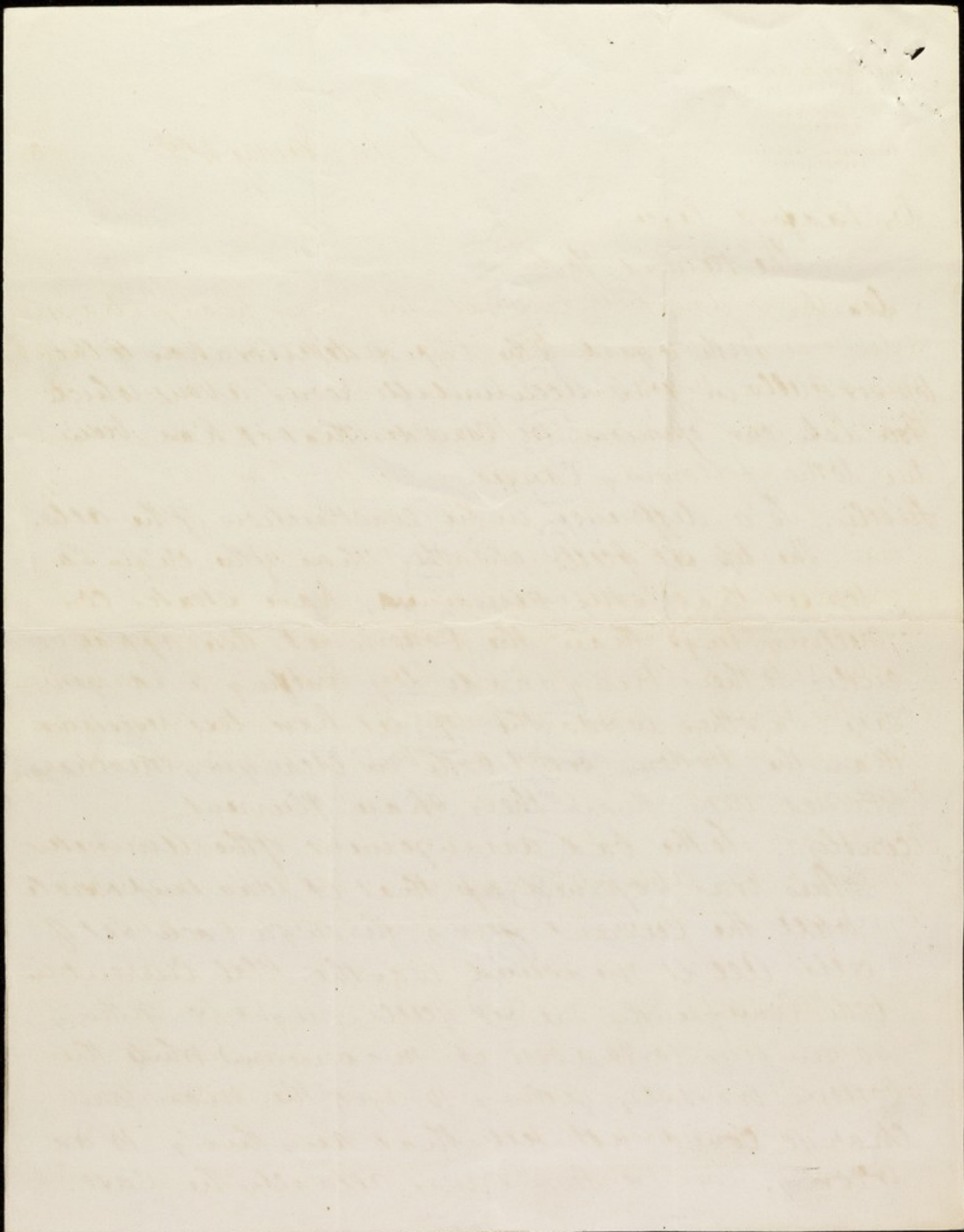
With regard to the rapid deterioration of the top set of cells in your Accumulator room, about which you ask our opinion, we consider that it has been due to the following causes.

Firstly. To a difference in the construction of the cells.

The top set of cells, or rather those of the original top set that still remain, have stouter connecting lugs than the bottom set, due apparently to their being made by halving a larger size. In other words the top set have less resistance than the bottom set & both in charging & discharging obtained more than their share of current.

Secondly. To the bad arrangement of the Ammeter.

This was so joined up that it was impossible to tell the current going through each set of cells. All it measured was the total current in both. Consequently one set of cells might be getting 40 amperes (or 10 above its maximum) while the bottom was only getting 10 & yet the man in charge could not tell that anything was wrong. This we found was actually the case.



SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS"

71. Albion Street.

Leeds, Letter Court. 1893.

There is no doubt but what the very heavy charges & discharges to which the top set of cells was subjected caused the buckling & destruction of the plates, & that the way in which the switchboard connections were arranged is responsible for this not being detected.

There are two other faults in connection with the switchboard which call for remarks.

The first is the bad design of the regulating switches which allowed the end cells to be short circuited whenever the switch was altered: the contact pieces were almost touching instead of being a considerable distance apart.

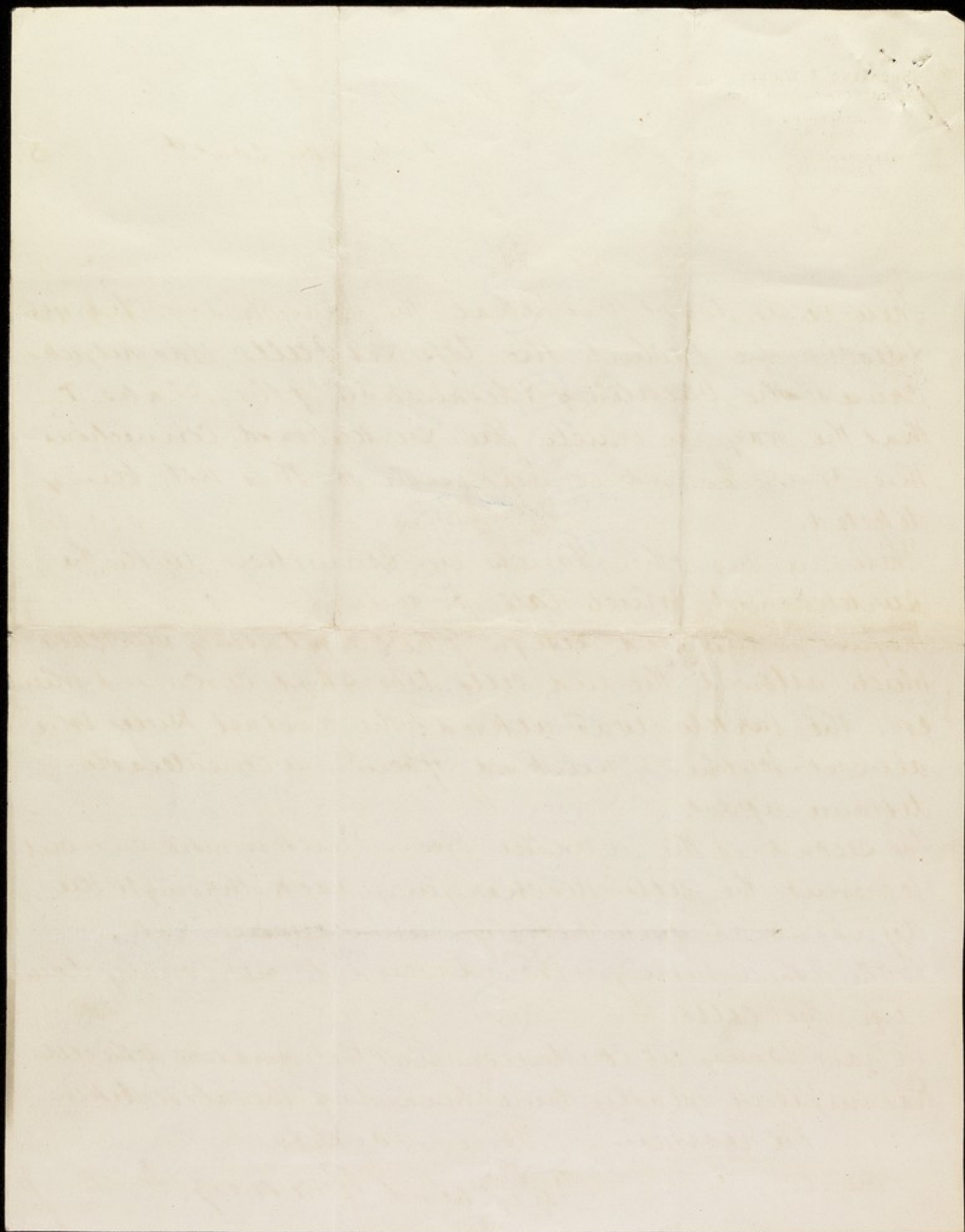
The second is the absence of an automatic cut out to prevent the cells discharging back through the dynamo at, quite possibly, an excessive rate.

Both of these things would tend to seriously damage the cells.

We have today in conclusion that the behavior of the cells has improved greatly since ^{we} remedied the above defects.

We remain, Yours faithfully,

Shepherd & Watney.



SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS"

71. Albion Street.

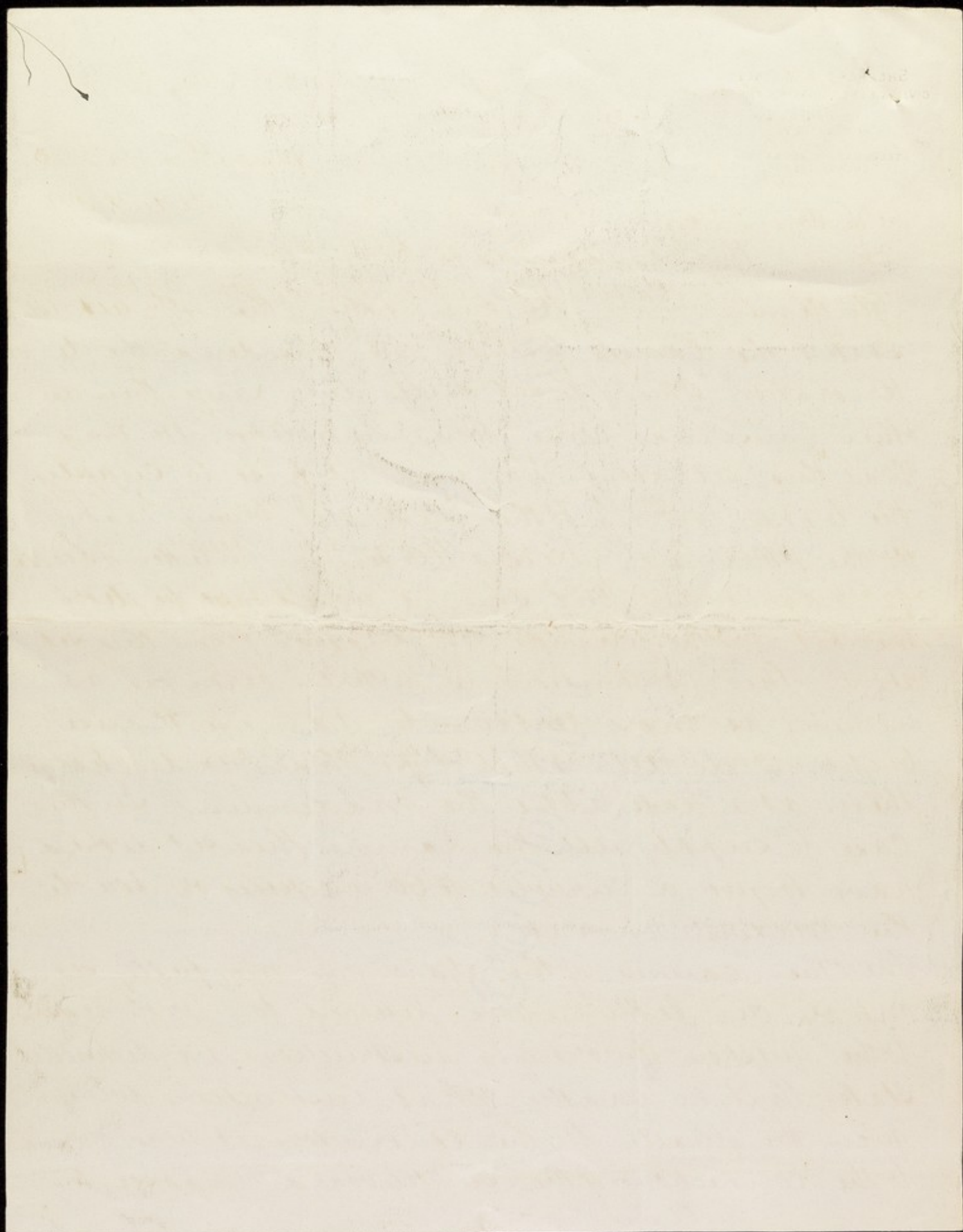
Leeds, June 1st 1893.

The Committee

The Theatre York

Gentlemen In our letter of the 4th inst. we stated the causes to which we considered the deterioration of the top set of cells due. Since then another cause has come to our knowledge. We find that this set alone was used at first to supply the lights owing to the acid not being ready for the other set. Messrs Haden in a letter of Dec 24 92 admit this but say it would not be detrimental for the lamps to be supplied from this set alone. This contention is utterly erroneous as nothing is more certain to damage & cause buckling in cells of this type than to discharge them at a rate above the maximum. In this case to supply all the lamps this set would have to give a current of 60 amperes or double the maximum rate. *? I think only 48.50 A. not more than 1 amp. per lamp.*

The other causes of the damage are fully set out in our letter above referred to. With regard to the question of working instructions we distinctly state that no matter what instructions were given originally by the contractors, it was, owing to the connections of the switchboard, impossible



to the attendant to discover whether the cells were working properly or not.

Consequently we consider that it would be perfectly fair & reasonable for you to deduct all expenses that may have been incurred on account of the damaged cells & also for remedying the switchboard connections.

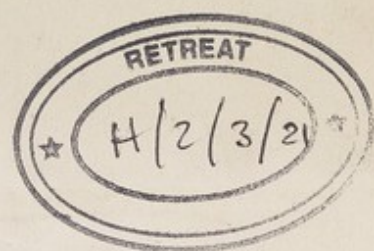
With regard to the former item there is the sum of \$23-14-7 & to the latter the sum of \$7-15-0 which is the sum actually spent in altering the switchboard & cell connections, being part of the sum spent on the last alterations under our supervision; the total coming to \$31-9-7.

We have not included in this sum the instruments which have just been fixed but which were absolutely necessary; we have simply put down those expenses which you have practically paid twice over. ✓

We remain

Yours faithfully

Shepherd Watney.



G. A. Haden & Son, Engineers.

B.

4, ALBERT SQUARE,
MANCHESTER.

December 20th 1892.

The Retreat - York

Electric Lighting

Mr. S. E. Woods

Dear Sir/ Referring to your letter of the 12th inst. we beg to say that we sent a competent man over last week to the Retreat, to make a thorough inspection of the accumulator Cells. He reports that he found the Battery in a very bad condition due to the sulphating and buckling of the plates, and short-circuiting of several of the sections.

The Battery has evidently been over-run, or has received insufficient charging, and too rapid and sudden discharging. Not only does the appearance of the plates denote this, but the density of the solution which is very low - 1.130 & 1.140. and the low E.M.F. of some of the Cells, all tend to show improper treatment.

The two sets do not appear to have been worked equally, as the plates in one set have lost more paste than the other. The Battery in its present state is unworkable, and as it is standing without any charge in it, immediate overhauling is necessary -

To put the whole into good
working order, including every expense
would cost from £50. to £60. depending
upon the number of plates which
might be found in such a state as to
warrant their being used again.

Yours faithfully
W. G. H. Haden
J. Blake

Answered Letter Book

281

G. N. Haden & Son, Engineers.

4, ALBERT SQUARE,
MANCHESTER.

December 22nd / 1892

— The Retreat - York —

Electric Lighting

W. S. E. Woods
Secretary

Dear Sir/ We are in receipt of
your letter of the 21st inst. relative to
the failure in the accumulator cells.

In the first place you say ever
since the installation of the Electric
light that the present Engineer - F. Parker -
has had entire charge of it. You have
overlooked the fact that Shaw the
former Engineer had charge of it
some considerable time before Parker.

Then with regard to the buckling
of the plates, this ought not to have
occurred, nor would it have done had
the Battery been worked properly, and
in accordance with instructions given -
The buckling proves that the Battery
has been improperly used, or it would
not have given out in so short a time.

We have several others in various
parts of the country that have been
in use longer than yours, without

showing any signs of wear or defect of any kind, and are running the lights as well now as when they were first fixed -

The 3 years guarantee was of course subject to the installation being properly used and attended to, but this has not been done - the cells have been under-charged and over-run; and the practice has been to keep switched on the whole of the lights in the Corridors and rooms, and then suddenly turn on the main switch, which would give the Cells such a shock as to cause the positive plates especially to buckle, and the paste to fall out of the grids; and short circuit the Battery - We surely cannot be held responsible for this - such treatment would ruin any Battery in a very short time -

Yours faithfully
W. G. H. Haden & Son
J. Blakey

answered
Letter Book 284

G. A. Haden & Son, Engineers.

4, ALBERT SQUARE,
MANCHESTER.

December 24th 1892.

The Retreat - York

Electric Lighting

Bedford Pierce Esq
Medical Supdt

Dear Sir / In reply to your favour of the 23rd inst, we beg to say that we have no desire to shirk our responsibility in this matter, but we cannot see how we can be held responsible for the cells being improperly used, as the cells themselves show they must have been; and which was reported in March last after Mr. Blake Junr's visit; as the accompanying copy of a letter written at the time will show - We certainly could not have given improper directions, which only upon such a supposition can we be held responsible for the state the cells are now in - Using one series of cells, as there was not sufficient acid sent for the other was no detriment to the cells; the only difference it would make would be in running the lights the shorter time with the one series or Battery, (which was the original intention) than with the two.

If the reason we assign for the failure be doubted, why not call in Dr. Silvanus P. Thompson and get his opinion.

We have no desire to cloak or evade anything, but are willing and anxious to deal with the thing upon its merits.

We received orders to do what was necessary 4 days after the following letter was written, thus virtually acknowledging the improper treatment the cells had been subjected to —

Yrs faithfully

Wm. G. H. Hadden & Son

H. Blake

Copy

Manchester
March 25th 1892.

A.

Dr. Baker

Dear Sir/

I was at the Retreat on Wednesday and examined the Electric Lighting Apparatus.

Everything was in first rate order except the storage cells which are in bad condition having lost much of their paste through ill-treatment. The cause of the paste being driven from the plates is that all the lights have been switched on suddenly at the main switch instead of this switch being turned on first, the lights being afterwards controlled by the small switches.

It is absolutely necessary that the cells should be cleaned out at once, and this can be done without interrupting the lighting of the Building —

I hope the order to put these cells right will not be delayed —

Yrs faithfully
(Signed) H. Blake

E

re AccumulatorsTo the Committee of the York Retreat.

Gentlemen:—

Having made an examination of the Accumulators at your establishment and considered the points put before me, I have the honour to report as follows:—

1) Some of the cells are in a very bad condition, and will require renewal of the positive plates (brown plates). Others require to be taken apart, cleaned, and the plates straightened. Others are in fair condition, and need nothing more than ordinary attention.

2) I see no evidence of ill-usage: but there has been obvious neglect, and failure in the past to attend to the proper rules of management: even now the acid in many of the cells has been left at an improper density.

3) Unless it was at the time when owing to lack of acid you were only using one set of cells, ~~I do not~~ the cells cannot, in my judgment, have been over-worked by too rapid a discharge. The Normal rate of discharge for cells of your size ("15 L") is 30 amperes each row, or 60 amperes the two rows together. Now your lamps cannot under any circumstances, even when all on, draw more than about 45 to 48 amperes.

4) In my experience it does not do any harm to cells in good condition to draw from them at once a current below the limit of "normal." The sudden turning on of the main-switch, if (as is very unlikely to occur) all the lamps are also all turned on individually, so drawing from the battery suddenly a current of 45 or 48 amperes, ought not to hurt a battery whose "normal" rate of discharge is 60 amperes. It could only hurt ~~them~~ cells if they were already in a poor condition; and would only hurt those ^{individual} cells that were already in a poor condition.

5.) Every day that your cells stand idle is detrimental to them. You ought at once to pick out the defective cells, and connect up together those that are still good, and charge them up a little over the point of "gassing" every day.

6.) Those of the defective cells that have had any considerable proportion of the paste squares displaced must have their plates renewed. When old plates are returned to the Electrical Power Storage Co (Milwall) new plates are sent in exchange at 1/6 each, or 12/3 for the complete set of 7 positive plates as made up into a "section" ready for immersion. If you procure single plates you may have some difficulty in finding a local plumber who is sufficiently skilled in "lead-burning" to attach them. They must not be soldered: the only proper mode of

attachment is by "burning" the lugs to the connecting piece across the top of the section.

(7) It seemed to me that there are some 15 or 20 cells that will thus require new positive sections. Probably no new negative plates will be needed, as these can all be restored by continued daily charging with a gentle current, unless indeed these also have lost their paste squares, which did not seem to me to be the case. The total cost of new plates I estimate therefore at from £9.3.8 to £12.5.0, unless, when the cells are taken down, and the plates removed from the acid it should be found that there are more than 20 cells damaged ~~in~~ in their positive plates. All doubtful cells should be overhauled and cleaned out.

(8) I am surprised that you have not got a printed set of instructions hung up on the wall for the guidance of the attendant. Such instructions have been issued by the E.P. S. Company for years past, and ought to have been furnished you by the Contractors. Without these your engineers cannot be expected to keep the cells in order.

(9). As your cells have now been standing for some time idle, whenever they are re-arranged and coupled up for charging, you must be very careful that at the first charging you do not attempt to force a strong current through them. Keep on a weak current of 5 or 8 amperes only, for 2 or 3 hours at first, otherwise the cells will not come back

into proper working order. After that the charging current may be increased.

10) When in daily work your engineer should be instructed to see that he does not stop charging until in every cell there is bubbling from the grey plates (negatives) as well as from the brown plates (positives).

11) As to acid, several points arise. It is of utmost importance to keep the density right by continual inspection. You could probably restore ~~around~~ the acid ~~to~~ to proper density most cheaply by arranging with some such firm as Messrs. Clarke, Butterfield & Co. of York; who must however guarantee to observe two conditions: - (a) that the acid employed is manufactured from native sulphur and not from pyrites; and does not contain arsenic: (b) that never shall any strong acid be poured into the cells to bring up the density: all mixing of strong acid should be done in separate vessels, and the mixture allowed to cool before putting into the cells.

I am, Gentlemen,

Yours faithfully

Silv. P. Thompson

Jan. 7. 1893

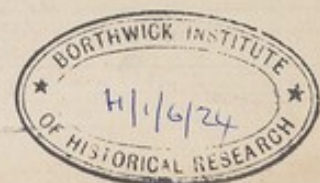
10. The first part of the paper is devoted to a general survey of the history of the subject.

The second part is devoted to a detailed examination of the various theories which have been advanced to explain the origin of the subject.

The third part is devoted to a detailed examination of the various theories which have been advanced to explain the origin of the subject.

The fourth part is devoted to a detailed examination of the various theories which have been advanced to explain the origin of the subject.

The fifth part is devoted to a detailed examination of the various theories which have been advanced to explain the origin of the subject.



the plates in "sections" ready
put together, rather than buy
single plates to be "burned" on to the
connectors. You will see that
if you had to renew the positives
of the whole 52 cells, it would
only cost you $52 \times 12\frac{1}{3}$, or £31.17.0,
and I doubt if you will want any
~~front~~ negative (grey) plates — unless
perhaps in those 2 cells where there
are curious growths. The acid of those
2 cells should be thrown away.

Yours faithfully

Silv. P. Thompson

£31.17.0

MORLAND,
CHISLETT ROAD,
WEST HAMPSTEAD. N.W.

Jan 8. 1893

Dear D. Pierce:

With this I send you
my Report. It is in copying ink,
so that you can take a copy for
me. I have no press here, and
I don't want to delay sending till
tomorrow.

I feel sure that the
actual cost of renewal of plates
will be under £15: and
probably you can get the acid
right for, say, £4 more or
less. I advise you to procure

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West Haverhill, N.H.
August 1st 1881
MORLAND
CHURCH ROAD

MORLAND,
CHISLETT ROAD,
WEST HAMPSTEAD. N.W.



TELEGRAPHIC ADDRESS:
HADEN, MANCHESTER.

G. N. HADEN & SON.

4, Albert Square,

MANCHESTER.

Aug. 10th/1893.

The Redhead - York

Dear Sir, Herewith we return
Professor Thompson's report, which
we have carefully perused, and
note that he is quite of our
opinion, for he says in the
second paragraph. "We are
convinced of ill usage, but
there has been obvious neglect
and failure in the past to
attend to the proper rules of
management &c." - We can only
repeat what we said when
you were here (viz) that we
shall be quite willing to put
them into good working order

for the net cost of doing it,
without profit or commission
of any kind. We think this
said between the Committee
and ourselves - Professor
Thompson clearly says
there has been obvious
neglect and failure in
the past &c, and he does
not say there is anything
inherently bad in the
cells themselves, or wrong
in the way they have
been arranged, so we
think we are asking for
only what is fair and
right between us -

Yours faithfully
Wm. J. Blake

Dr. Bedford Price

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WIMBORNE

CHURCH

NO. 1. HAD. 1. 5. 50.

WIMBORNE

J. H. HOLMES & CO
Electric Light Engineers

ALSO AT
17, COLEMAN ST LONDON
AND
ORIEL CHAMBERS, LIVERPOOL.
AND
27, BOTHWELL STREET, GLASGOW.

Portland Road.
Newcastle upon Tyne.

TELEGRAPHIC ADDRESSES—
{ HOLMES, NEWCASTLE ON TYNE.
VERMILIONETTE, LONDON.
CURRENT, LIVERPOOL.
EFFICIENCY, GLASGOW.

9th February 1893.

Mr. Samuel Wedmore.

The Retreat.

York.

Dear Sir;

We thank you for your enquiry of yesterday's date and have pleasure in quoting you for one Amperemeter of the permanent magnet type to shew the direction as well as the amount of current and to read up to 50 amperes £3.3.0 Three Pounds, three shillings.

One voltmeter of Gravity type to read to 60 volts £3.3.0 Three Pounds three shillings, less 5% discount for cash.

Esteeming your orders,

We remain

Yours truly.

Acknowledged

J. H. Holmes

HOLMES & SON
STATIONERS & PRINTERS
10, ABchurch Lane, LONDON, E.C. 4

H. H. HOLMES & SON
STATIONERS & PRINTERS
10, ABchurch Lane, LONDON, E.C. 4

27 FEBRUARY 1911

Mr. Samuel Pedmore,

The Rectory,

1001.

Dear Sir,

We thank you for your order of yesterday's date and have pleasure in quoting you for one hundred of the permanent water mark to show the direction as well as the amount of current and to read up to 50 degrees 10.0

Three pounds, three shillings.

One hundred of gravity have been sent to you with 25.0

Three pounds three shillings, less 5% discount for cash.

Reserving your orders.

Yours truly,

H. H. Holmes & Son

H. H. Holmes & Son

H. H. Holmes & Son

Contractors to British Foreign and Colonial Government Departments.

E. P. S.
ACCUMULATORS.
Highest and Only Awards.

Gold Medal:- Brussels 1888.
Gold Medal:- Paris 1887.
Gold Medal:- London 1886.
Diploma of Honour:- London 1886.
Diploma of Honour:- London 1882.

TELEGRAMS:- TELEPHONE:-
Storage, London. N° 338.

WORKS:-
MILLWALL, E.

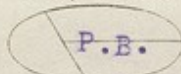


ELECTRICAL POWER STORAGE COMPANY LIMITED.

4 Great Winchester Street.

London February 6th. 1893.
E C

Please quote reference



in your reply.

Enclosures

Metce Agreeet Form
Sheet from Report Book

Mr Samuel Headmore
House Steward,
"The Retreat",
Y O R K.

Dear Sir,

We thank you for yours of the 3rd. inst., re
the Maintenance of your Battery.

The workman that we have had with you, is not competent to
give us the full report of your installation, such as would en-
able us to quote you for Maintenance. We will have pleasure in
sending our Maintenance Superintend to inspect your installation,
and quoting you on his report.

Should you accept our quotation, we make no charge for
his visit and report; but in the event of your not accepting it,
your only liability in the matter, would be first class fares to and
from London.

We may say for your guidance, that the figure at which we

THE ELECTRICAL POWER CORPORATION LIMITED

100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

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Mr. Samuel H. Brown
House 2, 2nd Floor
"The Battery"
N. Y. C.

Dear Sir,

We thank you for your letter of the 2nd inst., re

the maintenance of your Battery.

The statement that we have had with you is not competent to

give us the full report of your installation, as we would not

like us to do so for maintenance. We will have pleasure in

sending our Maintenance Department to inspect your installation.

and putting you on his report.

Should you except our quotation, we make no charge for

his visit and report; but in the event of your not accepting it,

your only liability in the matter, would be first class fares to and

from London.

We may say for your guidance, that the first report we

Mr Samuel Headmore

(2)

6-2-93.

could undertake the maintenance of your battery, would be in the neighbourhood of fifteen per cent on the gross list price, namely, £23-10-0 (twenty three pounds ten shillings) per annum from the date of installation of the battery.

We have pleasure in enclosing a copy of our Standard Maintenance Agreement Form, that you may see the conditions under which we undertake this work, and also a copy of the Report Form which your man would have to fill in weekly under Condition 4.

Awaiting your instructions,

We remain Dear Sir,

Yours faithfully

THE
ELECTRICAL POWER STORAGE Co., Ltd.

F. King

MANAGER.

on the other hand the maintenance of your battery, which is in the
neighborhood of fifteen percent on the gross list price, under
ly, 1934-10-6 (twenty three pounds and six ounces) common iron
the date of installation of the battery.

We have pleasure in enclosing a copy of our standard
maintenance Agreement Form, and you may see the conditions under
which we undertake this work, and also a copy of the new design
which our men would have to fill in with your battery.

Respectfully,
Awaiting your instructions,

We remain, Sir,

Yours truly,

E. H. King

Agreement made this

day of _____ between the
ELECTRICAL POWER STORAGE COMPANY, LIMITED,
of the one part, and

hereinafter called the Customer, of the other
part.

Whereby it is hereby Agreed that the ELECTRICAL
POWER STORAGE COMPANY, LIMITED, shall maintain the Storage
Battery belonging to the Customer, and situate at

(which Battery consists
of _____ Cells _____ Type), in working order during a period of
_____ years from the date hereof upon the terms herein contained, subject
to the conditions endorsed hereon. During the said period the customer
shall pay to the ELECTRICAL POWER STORAGE COMPANY, LIMITED, the
sum of £

_____ per annum, to be paid by four equal quarterly instalments, payable
upon the usual quarter days. If any of such instalments shall remain
unpaid for seven days after the same shall be due, or if the customer
shall not comply with any of the conditions endorsed hereon, then the
ELECTRICAL POWER STORAGE COMPANY, LIMITED, may, by notice in
writing, terminate this agreement, and thenceforth the said Storage
Battery shall be held by the Customer at his own risk, and all
responsibility on the part of the ELECTRICAL POWER STORAGE COM-
PANY, LIMITED, shall absolutely cease.

*The District
York.*

CONDITIONS OF STORAGE BATTERY MAINTENANCE.

1. **INSPECTION.**—The Company will inspect the Storage Battery periodically, and will from time to time give in writing such general instructions to the Customer as may be necessary.

The Customer shall be responsible for the proper execution of such instructions and shall give to the Company's representative every facility to inspect the Battery, and shall on request certify the correctness of the workmen's time sheets, and shall also give reasonable assistance and information.

2. **POWER.**—The Customer shall provide all the Electrical energy which may from time to time be found necessary or expedient on the advice of the Company.

3. **ELECTROLYTE.**—The Customer shall add water only, as and when necessary, so as to keep the plates at least $\frac{3}{4}$ of an inch below the level of the liquid.

4. **E. M. F.**—The Electromotive Force of each cell during discharge at a stated current, preferably the maximum current for the size of cell as well as the Specific Gravity of the Electrolyte, must be registered in indelible writing at least once a week on the form supplied for such purpose by the Company. (Such form is supplied free of charge but the Customer shall immediately post to the Company the records of each test.)

5. **REPAIRS, &c.**—The Company will clean out and repair cells, remove worn materials, replacing same with new as and when required. All material as and when removed from the battery shall become absolutely the property of the Company.

The Company shall not be liable for any damage which may be caused or incurred through unforeseen accident or abnormal circumstances or conditions.

NOTE.—The Battery to be considered in good working order so long as it shall give 60 per cent. of its specified working capacity.

6. **FREIGHT.**—The Customer shall pay carriage on all new material supplied for the purposes of the last clause, and also the carriage on returned empties, but the Company shall be responsible for all disbursements in connection with old material removed from the battery.

7. **TERMINATION.**—As per clause 1, the Company's Inspector will give from time to time the best advice possible, and repeated neglect of such advice by the customer shall be deemed to be non-compliance with these conditions.

8. **OUTPUT.**—The specified working capacity of the Battery to which this agreement refers to be ampères for hours, the final E. M. F. to be not less than volts.

REPORT ON E.P.S. ACCUMULATORS.

Date _____

In the Installation at _____

No. of Cells _____ Type _____ Date of Erection _____

Commencement of Test _____ Total E.M.F. _____ Amps. _____

Completion of Test _____ Total E.M.F. _____ Amps. _____

The Test to be taken during the last hour or two of discharge.

No. of Cell.	Sp. Gr. of Acid.	E.M.F. Volts.	No. of Cells.	Sp. Gr. of Acid.	E.M.F. Volts.	No. of Cell.	Sp. Gr. of Acid.	E.M.F. Volts.	No. of Cell.	Sp. Gr. of Acid.	E.M.F. Volts.
1			19			37			55		
2			20			38			56		
3			21			39			57		
4			22			40			58		
5			23			41			59		
6			24			42			60		
7			25			43			61		
8			26			44			62		
9			27			45			63		
10			28			46			64		
11			29			47			65		
12			30			48			66		
13			31			49			67		
14			32			50			68		
15			33			51			69		
16			34			52			70		
17			35			53			71		
18			36			54			72		

Signature _____

REPORT ON THE ACCOUNTS

FOR THE YEAR 1900

IN THE

REVENUE

DEPARTMENT

FOR THE YEAR 1900

THE

COMMISSIONER

OF THE

REVENUE

DEPARTMENT

FOR THE YEAR 1900

IN THE

REVENUE

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DEPARTMENT

FOR THE YEAR 1900

Report

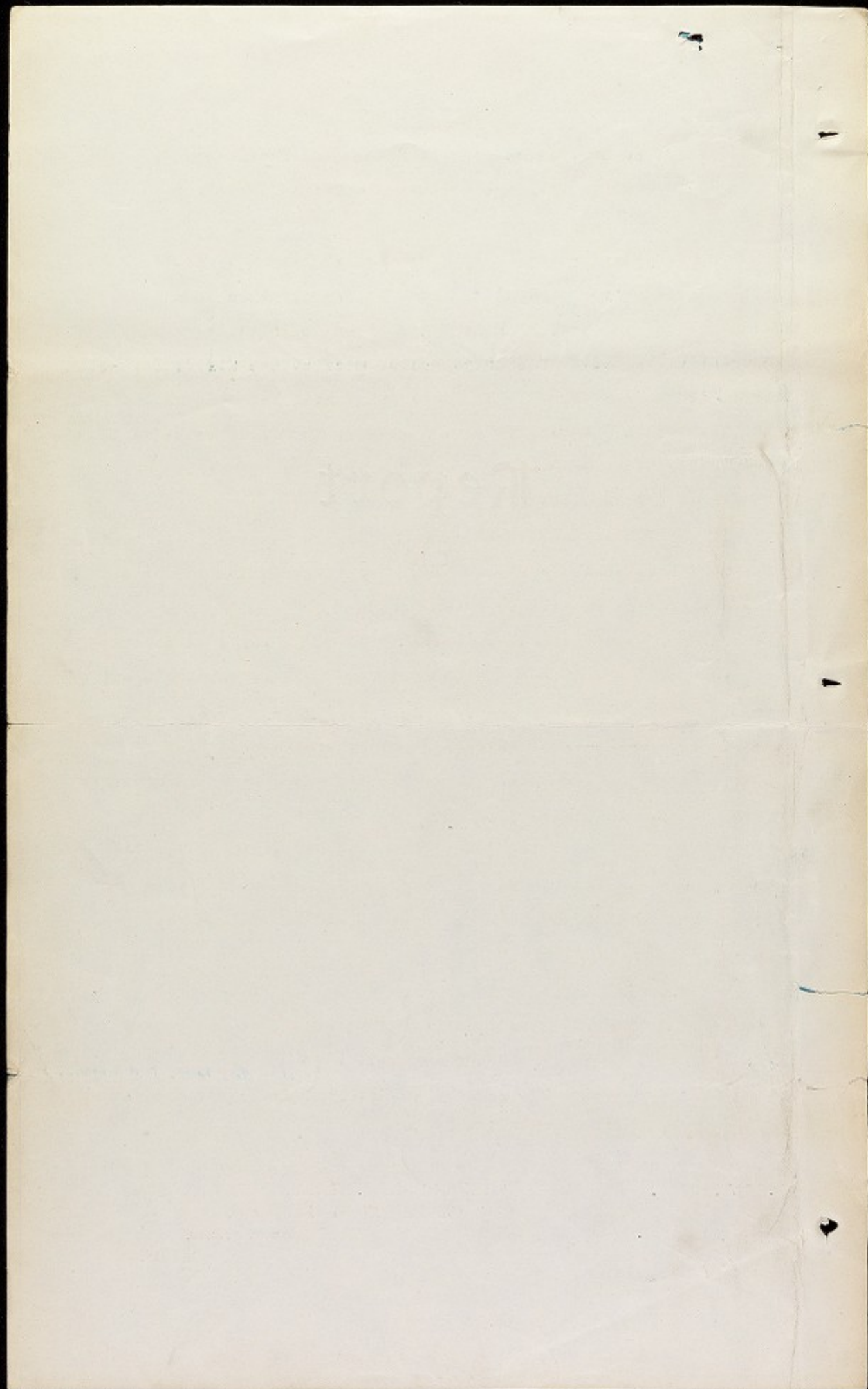
ON

ELECTRIC INSTALLATION AT THE RETREAT,

YORK.

Feb. 13th, 1892.

SHEPHERD & WATNEY,
Civil and Electrical Engineers,
71, ALBION STREET,
LEEDS.



Report on arrangement of the Electrical Plant and
method of running the same at the Retreat, YORK.

- - - - -

The Plant consists of a Manchester dynamo by Mather & Platt, driven by a Marshall's steam engine situated in a house close to the boilers: from here a pair of 19/16 cables convey the current to two sets of storage cells, made by the E.P.S. Co, which are fixed in a room about 40 yards away: Each set consists of 26-15 L cells: In the next room to the cells is fixed the switchboard from which all the circuits are controlled and from which the house mains start.

A plan of the connections of this switchboard, as traced out by us, is shewn in the accompanying diagram, and also a plan of the connections we advise.

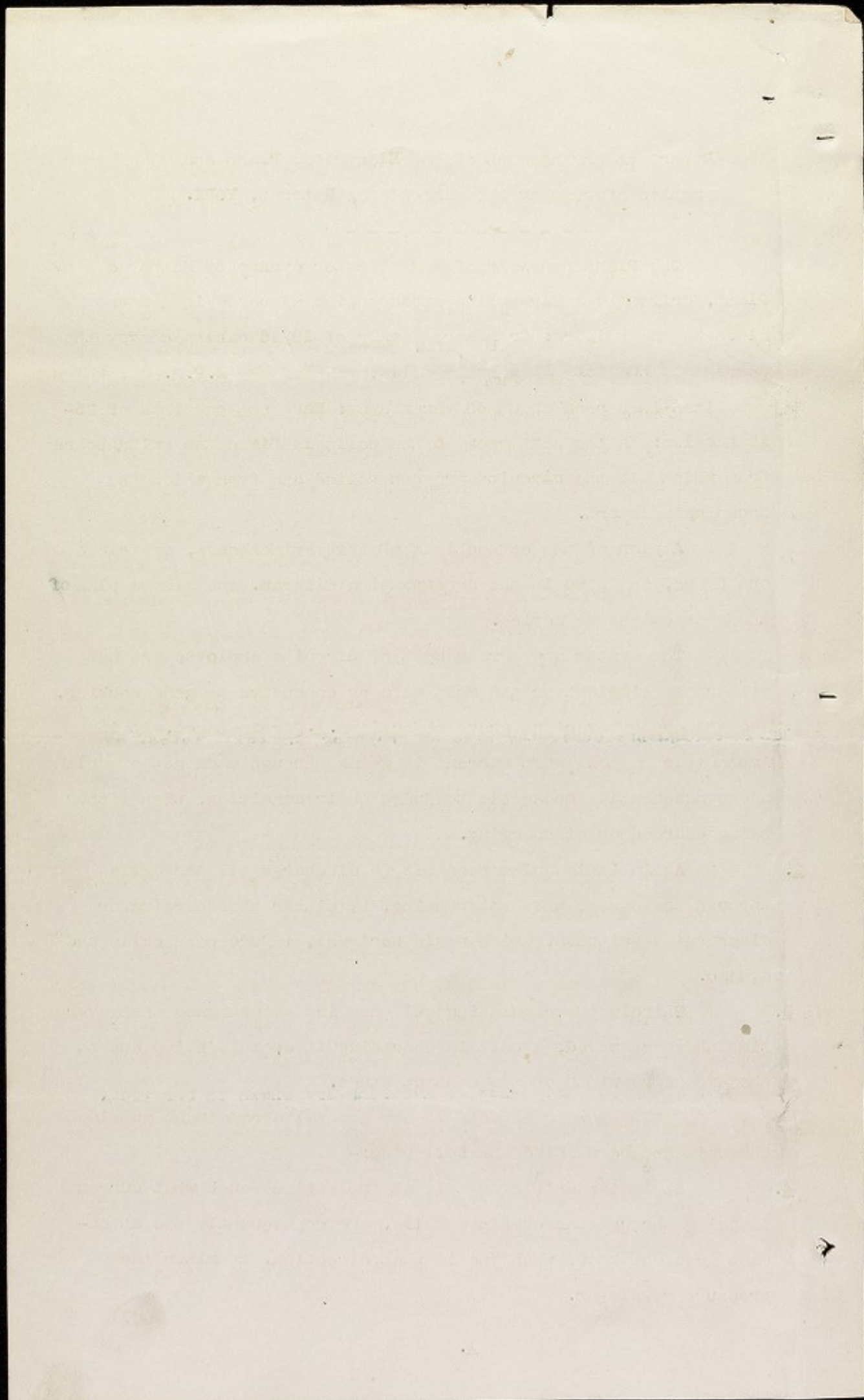
The system and arrangement of circuits employed are not either the simplest or the most safe or conducive to good working, and are open to various grave objections. 1. For instance, it is impossible to tell what current is going through each set of cells and consequently impossible to judge their condition, when either being charged or discharging.

2. Again it is quite possible to discharge all the cells through the dynamo when not running, by either the charging or discharging switches, which would seriously injure both cells and dynamo.

3. Thirdly the regulating switches are so designed that every time they are moved, a cell is shortcircuited; this being due to the excessive width of the contact studs. *(S.P.T. never saw these if they are not. But nothing?)*

Coming now to defects in the general arrangement outside the switchboard we find the following:-

4. It is impossible to tell at the engine house what current is going through the combined cells, and consequently the attendant does not know, when and in what direction, to alter the pressure regulator. ✓



5. The lamps under the present arrangement cannot be run at their proper voltage either direct from the dynamo or when the dynamo is charging the cells and lighting the lamps at the same time. The lamps are for 50 volts and as the lowest dynamo voltage, under the conditions stated, that can be obtained is about 60 volts, this excess of 10 volts above the normal will seriously affect the life of the lamps.

6. There is no automatic cut out in the circuit anywhere and consequently the cells when nearly fully discharged are liable to discharge back through the dynamo thereby wasting the power that has been stored.

7. There is no easy means, owing to the last five of each set being joined together, of charging each set of cells independently which should be the case, as it may often be necessary to give one set an independent charge.

8. Owing to the fact that the dynamo will not give quite a high enough pressure, the time of charging the cells takes, especially towards the end of the charge, considerably longer than it otherwise should: the maximum current it is possible to send through the cells being about 25 instead of 60 amperes.

9. There is no fuse in the dynamo house to protect the dynamo should anything happen to the circuit outside.

The simplest means of remedying these defects having regard to both cost and efficiency are in our opinion the following:

1&2. May both be remedied by altering the connections at the back of the switchboard and running an extra 12' of cable into the accumulator house: these new connections are shown in our plan.

3. The studs should be taken out and filed down so that there is at least $\frac{1}{2}$ " between them. ✓

4. An ammeter reading from 15 to 100 amperes should be fixed in the engine room close to the voltmeter. ✓

5. A thick wire resistance of german silver should be fixed in the switchboard room and connected to the lamp circuit. It ✓

The first part of the report is devoted to a general description of the project and its objectives. It is followed by a detailed account of the methods used in the study, including the selection of subjects and the procedures for data collection and analysis. The results of the study are then presented in a series of tables and figures, which are accompanied by a discussion of their significance. Finally, the report concludes with a summary of the findings and some suggestions for further research.

The project was carried out over a period of six months, during which time a total of 120 subjects were recruited and tested. The subjects were selected from a variety of sources, including local schools, community centers, and social service agencies. They were all of legal age and had no known mental or physical disorders. The procedures for data collection and analysis were designed to ensure the reliability and validity of the results. The data were collected using a series of standardized tests and questionnaires, and were analyzed using a variety of statistical techniques. The results of the study are presented in a series of tables and figures, which are accompanied by a discussion of their significance. Finally, the report concludes with a summary of the findings and some suggestions for further research.

The findings of the study indicate that there is a significant relationship between the variables studied. This relationship is most evident in the data from the first group of subjects, who showed a strong positive correlation between the two variables. This finding is consistent with the hypothesis that was tested in the study. The data from the second group of subjects, however, showed a weaker correlation, which may be due to a variety of factors, including differences in the subjects' characteristics and the procedures used in the study. Further research is needed to clarify the relationship between the variables and to determine the factors that influence it.

In conclusion, the study has provided valuable information about the relationship between the variables studied. The findings suggest that there is a significant relationship between the variables, at least in the first group of subjects. This information can be used to inform future research and to develop interventions that are based on the findings of the study.

should be provided with an adjustable switch so that the pressure at the lamps may be decreased to the amount required.

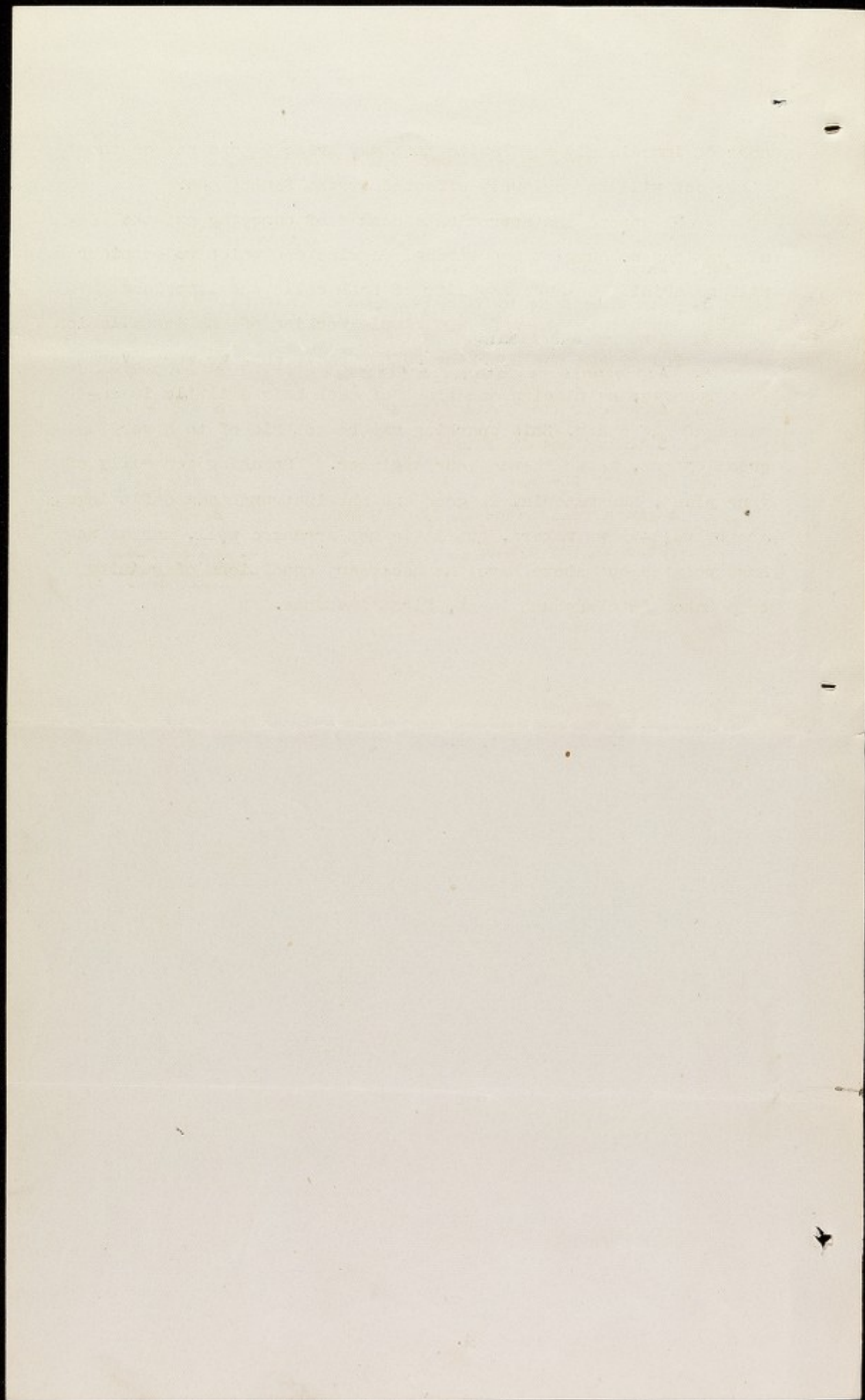
6. An automatic cut out should be fixed in the switchboard room and connected to the cell circuit just at the discharge regulator. At the end of the charge this automatically breaks the circuit and stops the current. ✓
7. A small plug switch should be fixed in each of the short pieces of 7/15 cable that join the last five cells of each set together. By pulling these plugs out, each set of cells is quite independent and can be charged or discharged separately. ✓ but -
8. The only way to raise the pressure of the dynamo is to increase slightly its speed. The simplest way to do this is to put a slightly smaller pulley on the dynamo, say a 6½ inch instead of as at present a 7 inch. This would raise the voltage sufficiently to enable the final part of the charge to be carried out with the full current, and so greatly reduce the time it takes to charge the cells. As with this increased speed the voltage at the commencement of the charge would be excessive, it would be necessary to insert a resistance in the shutⁿ circuit in addition to the one already fixed. Unless the present voltage of the dynamo is increased in this way we do not think it will be possible for you to charge the cells and run the lamps at the same time.
9. A main fuse should be fixed close to the dynamo.

Condition of the Cells. As before stated there are two sets of Cells, each set composed of 26 cells 15 L type. The top set of Cells are rather badly "sulphated" i.e. covered with a white deposit of lead sulphate, which is harmful both to the life and capacity of the Cell. We should recommend treating at any rate the worst of these cells with a little strong solution of soda, which is a well known method of getting rid of the sulphate, and improving the condition of the cell. The bottom set of cells seems in good condition and has a slightly higher voltage than the top set. With two sets of cells in parallel it is most essential to

correct immediately any faults that may arise in one set or the other set will be seriously affected by the faulty one.

We append the approximate ~~cost~~ of carrying out the alterations we suggest and strongly advise and which we consider will materially enhance the life of both cells and lamps and greatly conduce to the safe and simple working of the installation

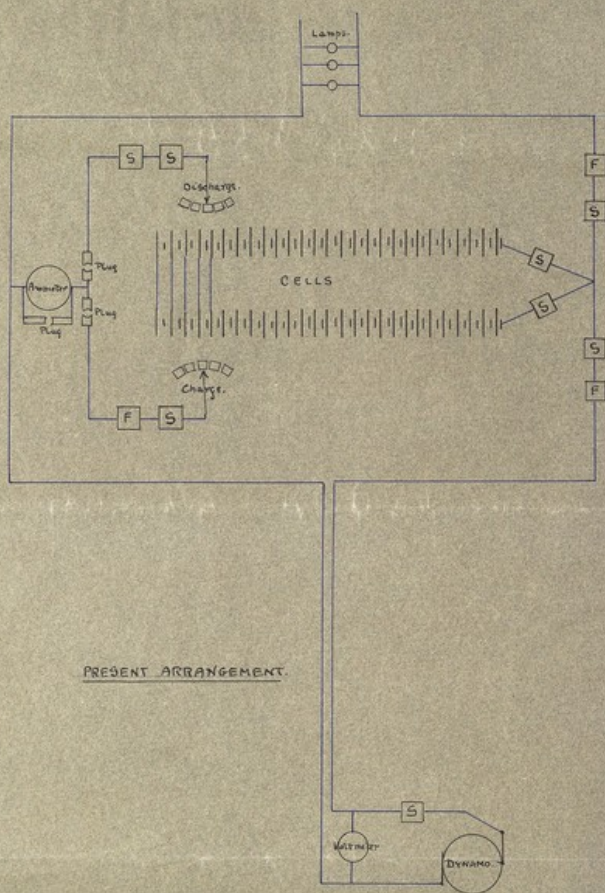
The dynamo was sparking rather badly when we were over last Tuesday; by placing one brush of each pair a little in advance of the other, this sparking may be got rid of to a very great extent, as we shewed your engineer. Speaking generally of your plant, the material is good and the instruments and fittings are by well-known makers, but it is not arranged well, nor as we have pointed out above have the necessary conditions of running been taken into account in the first instance.



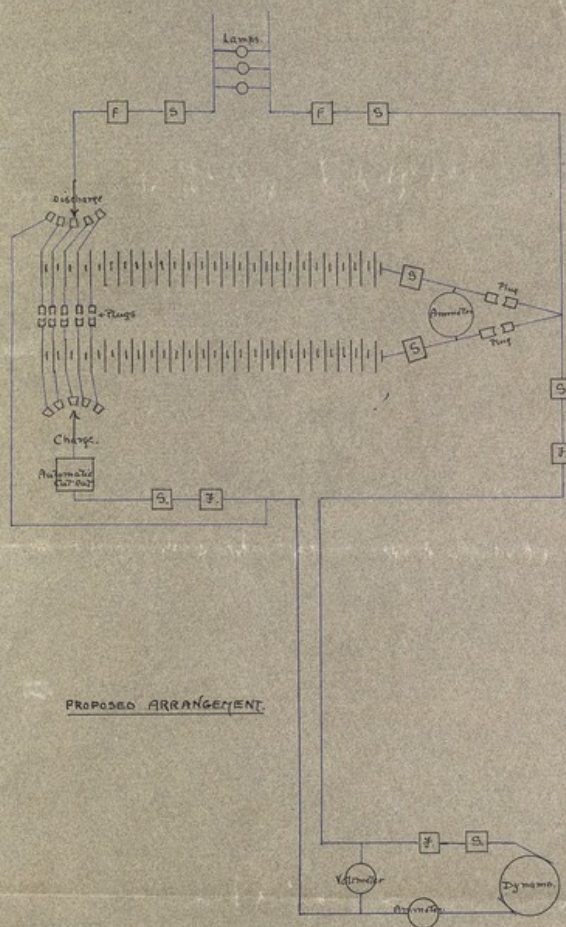
Approximate cost of alterations.

	£	s	d
1 & 2. Man's time and expenses	2	0	0
3. Could be done by your own man.			
4. Ammeter and fixing.	4	0	0
5. Adjustable resistance & fixing.	6	0	0
6. Automatic cut out & fixing	3	5	0
7. 5 thirty ampere plugs.	2	10	0
8. Smaller pulley.	2	10	0
& extra resistance in shunt circuit	2	10	0
9. Fuse at the dynamo.		15	0
	<u>£23</u>	<u>10</u>	<u>0</u>

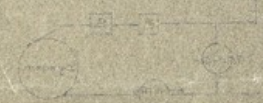
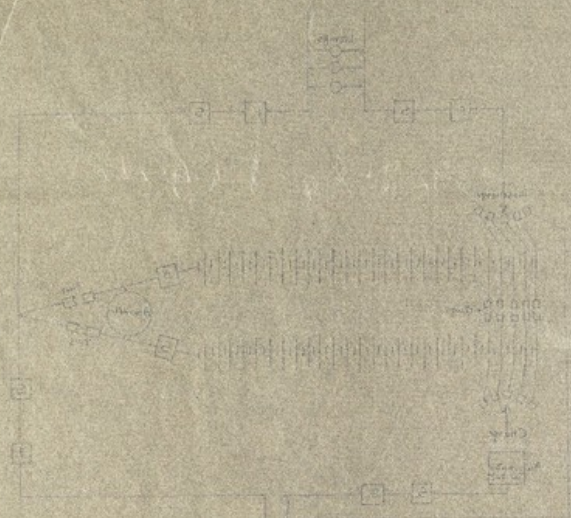
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100-100-100



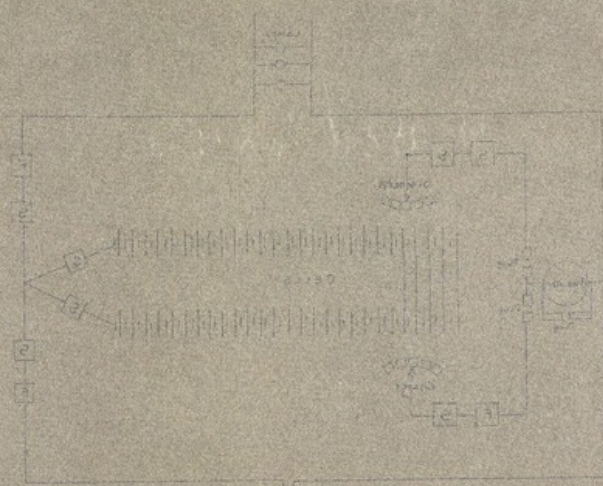
PRESENT ARRANGEMENT.



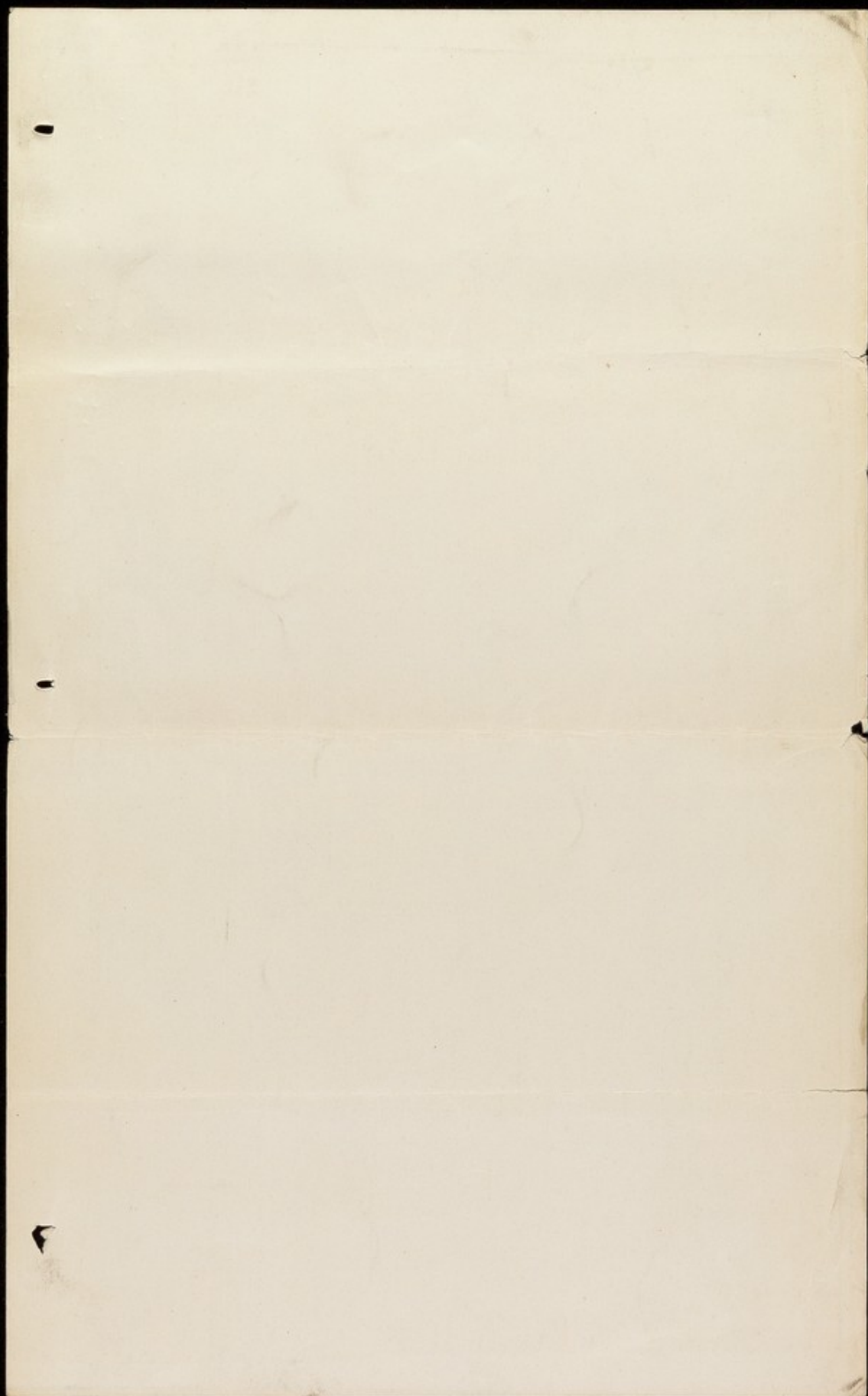
PROPOSED ARRANGEMENT.



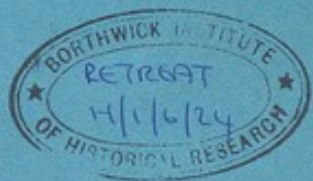
1000000 1000000



1000000 1000000



Handwritten:
L. J. ...
C. ...



SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS"

71. Albion Street.

Leeds.

March 16th 1893.

CE

Mr Bedford Pierce

The Theatre York

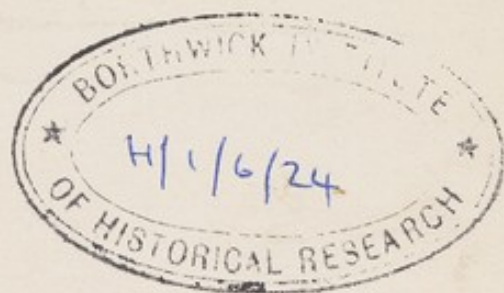
Dear Sir

We have accepted Messrs
Arthur Wallis' price of £17: they
will send a man over next Monday
morning when Mr Watney will
also be there.

We remain

Yours sincerely

Shepherd & Watney.



Draft letter to
Haden & Son re Electric Lighting

I am desirous to inform you that since receipt of your letter of Dec. 26. 92, and our reply of Jan. 14. 93, the Electric Apparatus has been put in order.

Finding the Switchboard required alteration, and that we needed technical advice we consulted Messrs. Shepherd & Watney of Leeds, whose Report of Feb. 18.th 1893, I now enclose for your perusal. This Report was adopted by the Committee and the recommendations therein made were carried out by Messrs. Cuttriss ^{Wallis & Co.} & Walker. The Cells are now working satisfactorily.

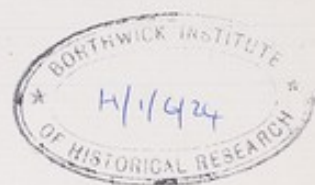
I also enclose two letters from Messrs. Shepherd & Watney dated May 4.th & June 1.st 1893, together with Professor Silvanus Thompson's reply of June 9.th to Dr. Pierce, after having perused Messrs. Shepherd & Watney's Report & letters.

The Committee are now satisfied that very grave defects existed under the original installation and they consider that, (having regard to your undertaking that the work in its entirety should be approved by Prof. S. Thompson, not only when completed but also during the currency of the three years guaranteed by you.) they are entitled to make a fair & reasonable reduction from your account. They desire me to

^{enclose a cheque for} say that they are prepared, without prejudice, to pay your account, ~~subject to the deduction of the sum of~~ ^{the amount suggested for deductions} £31. 9. 7 as proposed by Messrs. Shepherd & Watney, & approved by Professor S. Thompson.

~~I enclose cheque accordingly, & annex particulars at foot.~~

Haden's ac		185. 3. 4
E. P. Storage Co's ac	23. 14. 7	
Shepherd & Watney's ac	<u>7. 15. 0</u>	31. 9. 7
	£	<u>153. 13. 9</u>



Draft letter to

Haden & Son,

re Electric Lighting.

Supply actual
date

receipt of I am desired to inform you that since ~~our~~
~~your letter of~~ ~~our reply of~~
~~last communication to you~~, the Electric apparatus
has been put in order ~~by the Electric Power Storage~~
&

Anding the Switchboard required alteration ~~and~~
+ that we needed technical advice we
Consulted Messrs. Shepherd & Watney of Leeds, whose
Feb 15/93 4 letters May 4 & June 1, 1893 ~~Report~~ This
Report I now enclose for your perusal. ~~This~~ Report
was adopted by the Committee, and the recommendations
therein made were carried out by Messrs. Cuttriss
& Walker. The Cells are now working satisfac-
torily.

I also enclose two letters from Messrs. Shepherd & Watney
dated May 4 & June 1 1893
together with Prof. Silvanus Thompson's Reply June 9
to Dr. Pierce, after having perused Messrs. Shepherd &
Watney's Report & letters.

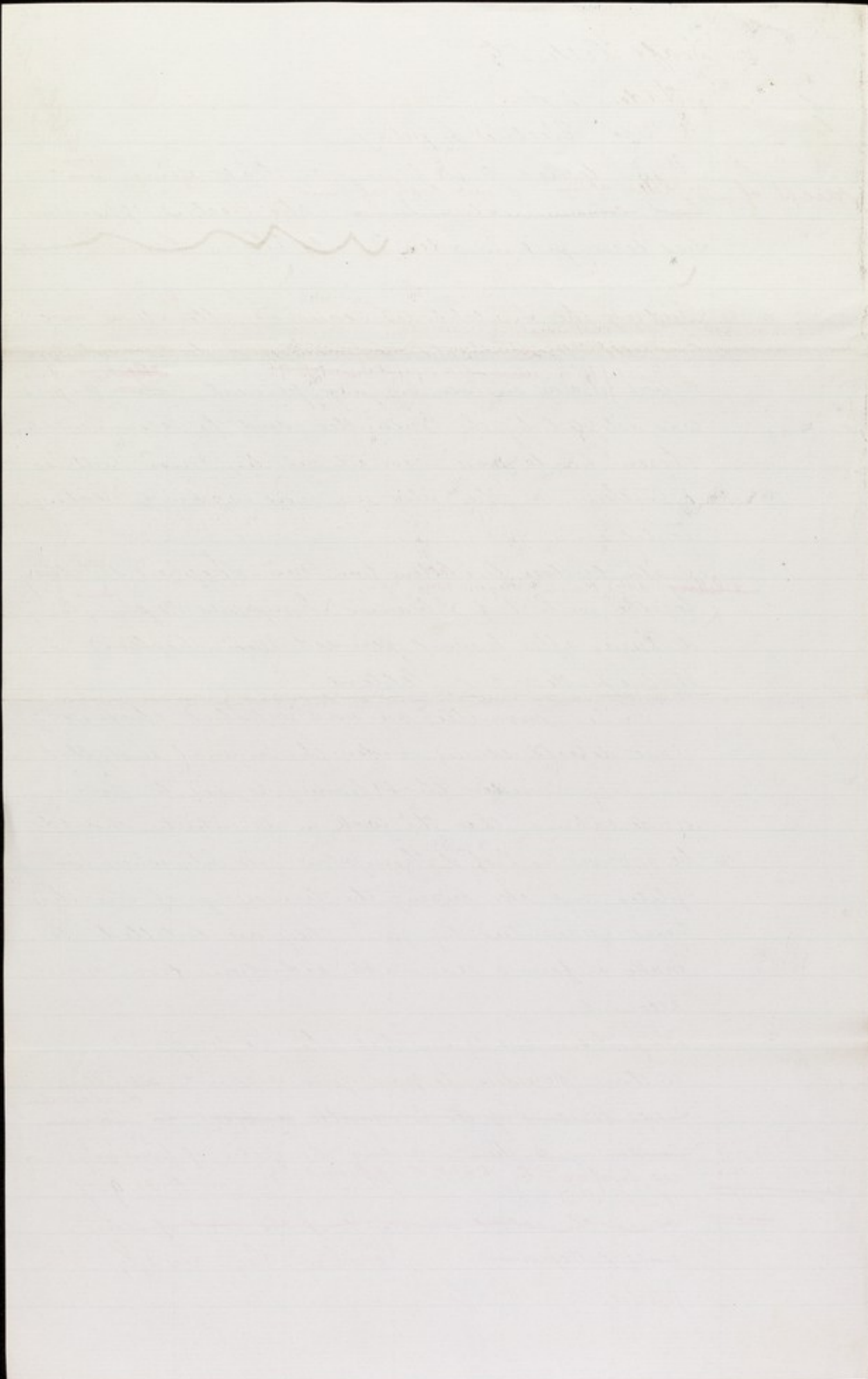
The Committee are now satisfied that very
grave defects existed under the original installation,
and they consider that (having regard to your
undertaking that the work in its entirety should
be approved by Prof. S. Thompson, not only when com-
pleted, but also during the currency of the three
years guaranteed by you) they are entitled to
make a fair & reasonable reduction from your
account.

They desire me to say that they are prepared,
without prejudice, to pay your account ~~at the~~
~~next meeting of the Committee subject to your~~ ~~the deducting~~

Consenting to their deducting the sum of £31.9.7
as proposed by S.W. & approved by Prof. S.T. (or £31.9.7) ?

being the actual amount of the cost of the
useful repairs. I enclose this accordingly - James
particulars at foot.

S.P.S.C. 23.11.7
S.W. 7.15.0
Haden 7.17.7
37.6.7



re. Electric Lighting.

The Retreat

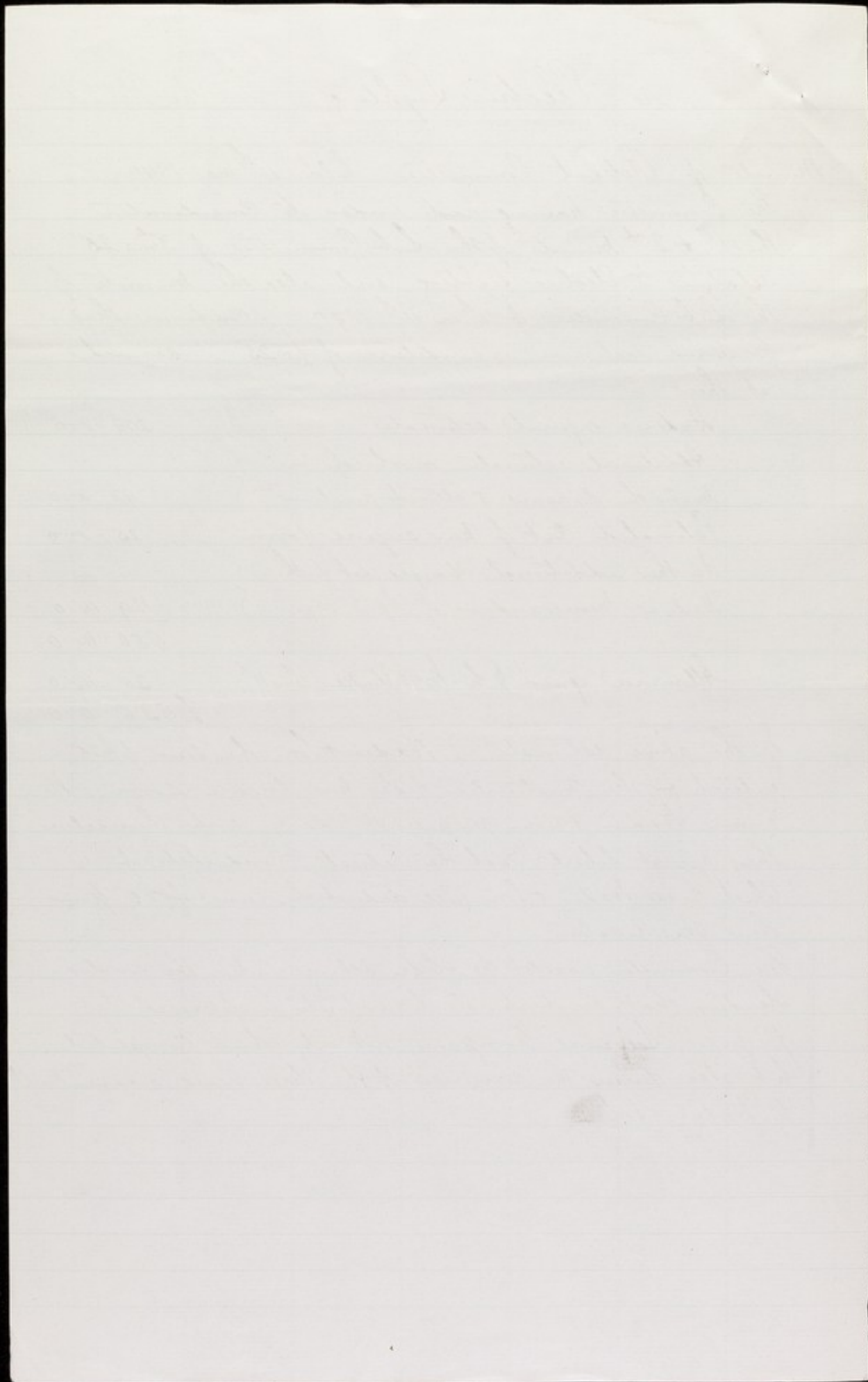
Minutes of Retreat-Committee held 4th mo. 1890.

The Committee having had under its Consideration the 1st + 2nd Minutes of the Sub Committee of 3rd mo 25th relative to Electric Lighting, and also the Minutes of the Sub Committee of 4th mo 11th 1890 Confirm the proposed inclusive expenditure of £525 - arrived at thus :-

Haden's original estimate	298. 0. 0
Additional estimate involved in } moving the dynamo to altered position	98. 0. 0
Estimated Cost of new engine room	25. 0. 0
Further additional charges set forth in } Haden's Memorandum of Ap. 3. 1890	129. 14. 0
	550. 14. 0
Allowance agreed to by Mr Blake 4 th mo 11 th	25. 14. 0
	£525. 0. 0

In the above estimate of Haden & Son the sum of £25 is entered for the Construction of the new engine room. If however Haden & Son prefer not to do this work themselves they are at liberty to ask the Retreat to undertake it, in which case Haden & Son will deduct the sum of £25 from their Specification -

The Committee accept the whole scheme upon the understanding that the work in its entirety is approved by Professor Silvanus Thompson, not only when completed but also during the currency of the three years guaranteed by Haden & Son -



Repairs to accumulators

Mr. Blake's Report -

(copy) A
see end of D.

Repairs again required.

Haden & Son's letter

B.

" offer
to repair

Mr Woods reminds

Haden's reply

C

Haden & Son's letter

D

Dr. Pierce

Repaired April 1892 at a cost
of £7.17.2. Haden's of -

March 25 1892

"Had lost much of their power thro ill-usage"
"The lights had been switched on too suddenly"
(This was not contradicted at the time but
both Prof Thompson & Mr Watney say that
sudden switching is not at all injurious).

Dec. 1892.

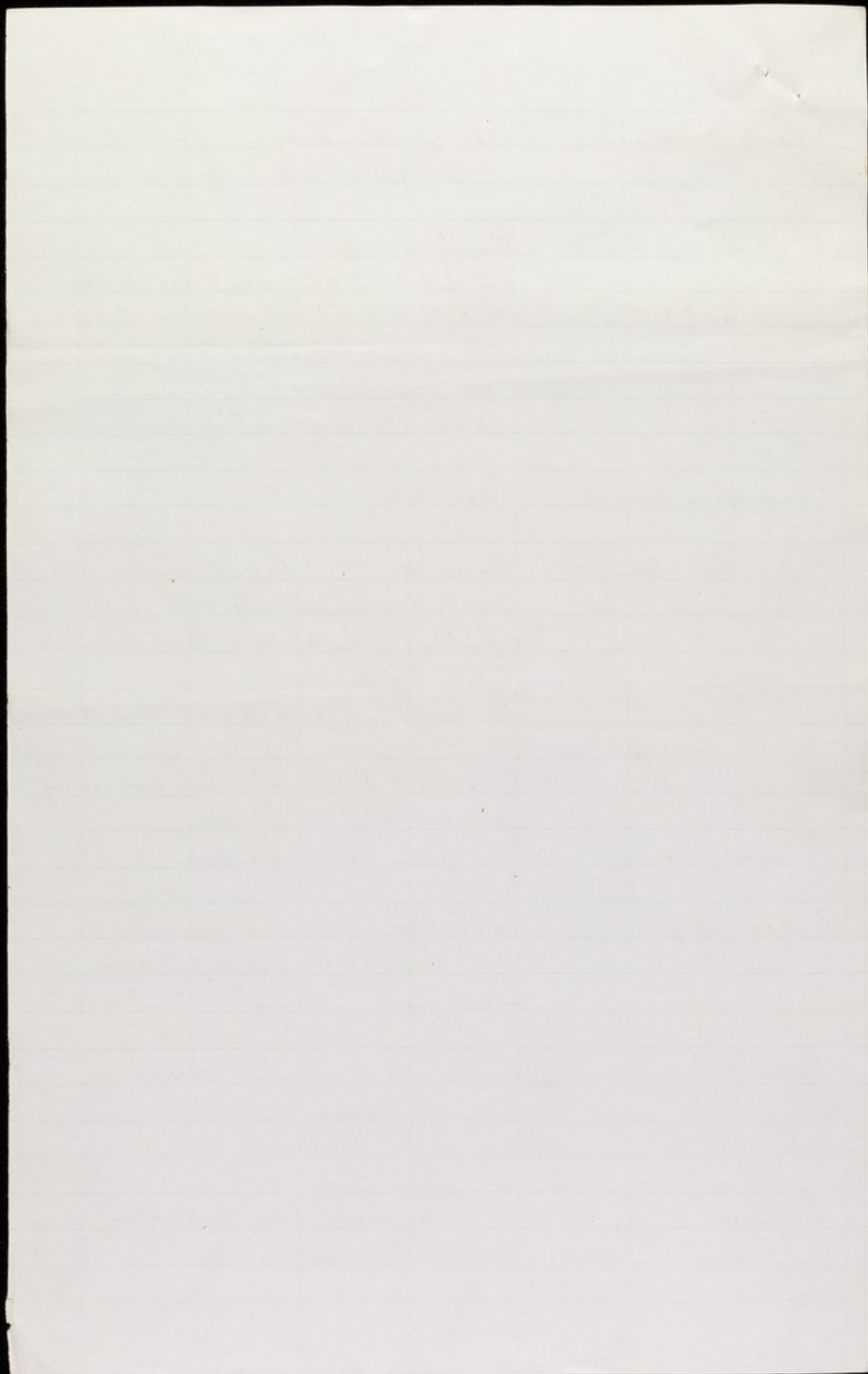
Dec. 20 1892. Reports battery in a
very bad condition due to the sulphating
& buckling of the plates & short circuiting
of several of the plates.
"The battery in its present state unworkable"

the battery & put the whole into good working
order at a cost of from £50 to £60.
them of the 3 yrs guarantee.

Dec. 22. 1892. "The 3 yrs guarantee was of
course subject to the installation being
properly used" "this has not been done"

Dec 24. 1892²/ Suggest calling in
Prof. Thompson.

goes to Manchester to see Haden & Son Dec 30.



Prof. Thompson's

E

Report on the state of the cells & how to repair them.
(Cause of defects not fully dealt with.)

- no evidence of ill-usage - there had been obvious neglect & failure to attend to the proper rules of management.

- Cells could not have been overworked by too rapid discharge -

- defective cells, about 20 in number must have their plates renewed -

- probably no new ^{negative (grey)} positive plates required.

- Estimated cost from £9.3.8 to £12.5.0. for material.

Electric Power Storage Co.

Repairs cost £23.14.7

Shepherd & Watney Consulted.

F

Report dated Feb 18 1892.

Minute of Committee

Feb. 1893. The Engineers Sub-Committee is authorised to carry out these additions, (S & W's report) if on consideration they think best to do so.

Contract price - of alterations

G

Shepherd & Watney's letter - Mar. 14. 1893.
Cuttriss Wallis £17.0.0 exclusive of labour - estimated that cost £23.10.0

Cause of breakdown -

H

S & W's letter May 4th 1893.

"

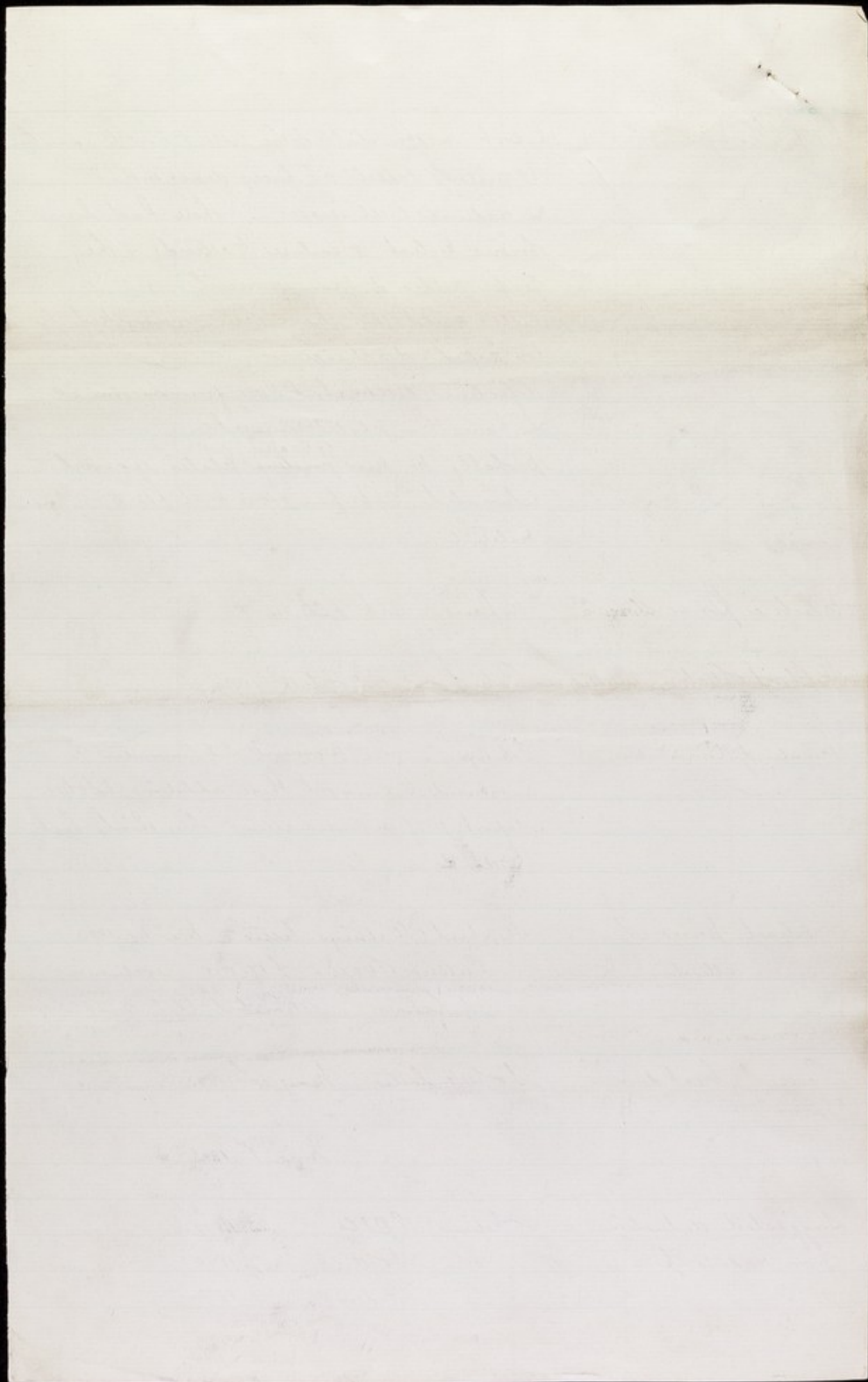
I

"

June 1st 1893

Suggested deduction from Haden's £ -

Repairs	Eps. Co.	23.14.7
"	S & W.	7.15.0
"	Haden	7.17.2
		<u>39.6.9</u>



17, BROOMHALL ROAD
SHEFFIELD.

6. VI. 93.

Dear Richard Thompson

I forward ^{papers} re proposed
deduction from students' arc for
electric lighting faults, clearly
^{my} to ^{be} ^{my} ^{be} attributable to neglect
on their part in the first

Construction

after perusal I would
suggest you instruct the
Retreat office to forward the
^{to Prof Thompson}
papers for his comment -
when unless he takes any
serious objection. I propose

17 BROOMHALL ROAD
SHEFFIELD
a letter shall be addressed
to Messrs Stodden, setting forth
the grounds for the allowance
enclosing cheque for the balance
of them are, less. £39.6.9.

I write under great
pressure.

I am arranging with
JB Hutchinson to visit the
Retreat on Saturday to pass
the Engineering work and
alterations.

Yours sincerely,
Charles Norman

SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS"

71. Albion Street,

Leeds.

May 15th 1893

Mr Bedford Pierce

The Retreat York

Dear Sir

Your letter of the 13th 10 has
We regret today we have been
unable to get in the Contractor's
account yet, although we wrote
to them immediately on receipt
of Mr Woods letter.

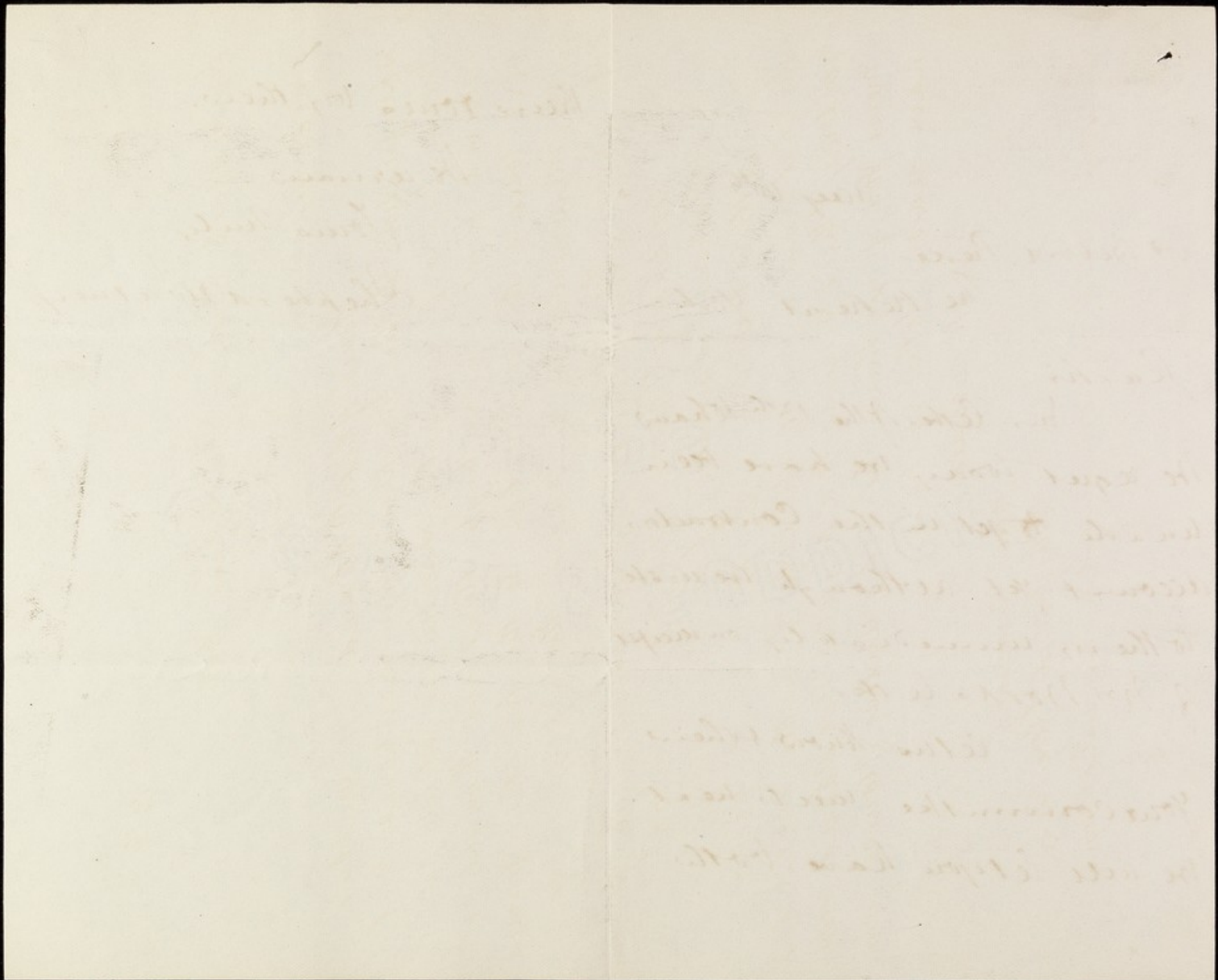
If you will let us know when
your Committee meets next
we will let you have both

their notes by then.

We remain

Yours truly

Shepherd & Watney.



SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS."

71. Albion Street.

Leeds, March 14th 1893.

Dr Bradford Piece The Retreat York.

Dear Sir.

Yours of the 13th to hand. We sent our specification to the two firms you mentioned but Messrs Blakey Emmott's ~~was~~ tender, which we received first was so high that we thought it best to send a specification to the two other firms you mentioned so as to have their prices also.

We append the tenders.

Messrs Blakey Emmott No £ 36-8-0.

— Woodhouse & Rawson. £ 27-10-0

— Ullathorne & Edmundson £ 19-15-0

— Atkiss Wallis & Co £ 17-0-0

will supply a man

at 1/3^d per hour

10 1/2^d " "

1/3^d " "

1/3^d " "

The last named are quite able to do the work satisfactorily & their price is reasonable. We should recommend you giving them the work, unless of course you have reasons to the contrary.

We remain

Yours sincerely

Shepherd & Watney.

The work could be commenced immediately.

THE FIRST OF MAY
1864
NEW YORK

My dear Sir

I have the honor to acknowledge the receipt of your letter of the 28th inst.

and in reply to inform you that the same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully,
Yours truly,
J. M. Smith

SHEPHERD & WATNEY,
CIVIL & ELECTRICAL ENGINEERS.

J. SHEPHERD.
T. S. WATNEY.

TELEGRAPHIC ADDRESS:-
"ENERGY, LEEDS."

71. Albion Street.

Leeds, March 1st 1893.

Dr. Bedford Price The Retreat
Fosk.

Dear Sir

Yours of the 28th to hand. (1) With regard to the speeding of the dynamo, we will, at your request to you, leave this question over till we are over the next time, when we will look into the matter more closely. We still incline however to our plan of altering the dynamo pulley as being the cheapest & most satisfactory remedy. Your governor is a Hartneels 'expansion' governor whereas Pickering's is a 'throttle' governor & could not be easily applied. If a new pulley were made it would of course fit both the armatures you mention just as the present one does.

(2) The alterations we proposed will certainly tend to increase the life of the cells & very greatly diminish the working expenses connected with them.

One set of cells would not hold a sufficient amount of electricity to supply the lamps, unless you ran the engine very much later. Each set will keep 25 lamps burning for about 9 to 10 hours. Supposing you only used one set you would then have to be careful that you did not have more than 25 lamps burning at once & that these lamps

were not on for more than say 9 1/2 hours.
There is nothing to prevent you using one set only
if you are able to always keep to these conditions.
You cannot use a smaller number than one
set; i.e. 26 cells.

(3). We certainly think it would be an advantage
to write out a specification for the supply of the
instruments & fittings we recommended & get
tenders for the same: the actual labour would
have to be left over, as no firm could very well
quote for that.

(4). We should recommend the following firms
{ Blakely, Emmott & Co. - Halifax.
Ullathorne & Edmondson, Bradford.
Wordhouse & Banson - London & Bradford.
Cuthiss & Wallis Ltd. - Leeds.

— Holmes of Newcastle we do not recommend but
we would send them a specification if you wish
it.

We will proceed with the specifications.

Yours faithfully

Shepherd & Watson.

