Extracts from the papers of Sir Charles Wheatstone

WHEATSTONE 3: Series of notes describing experiments to investigate the nature of electricity, magnetism and thermodynamics, [1834-1855]

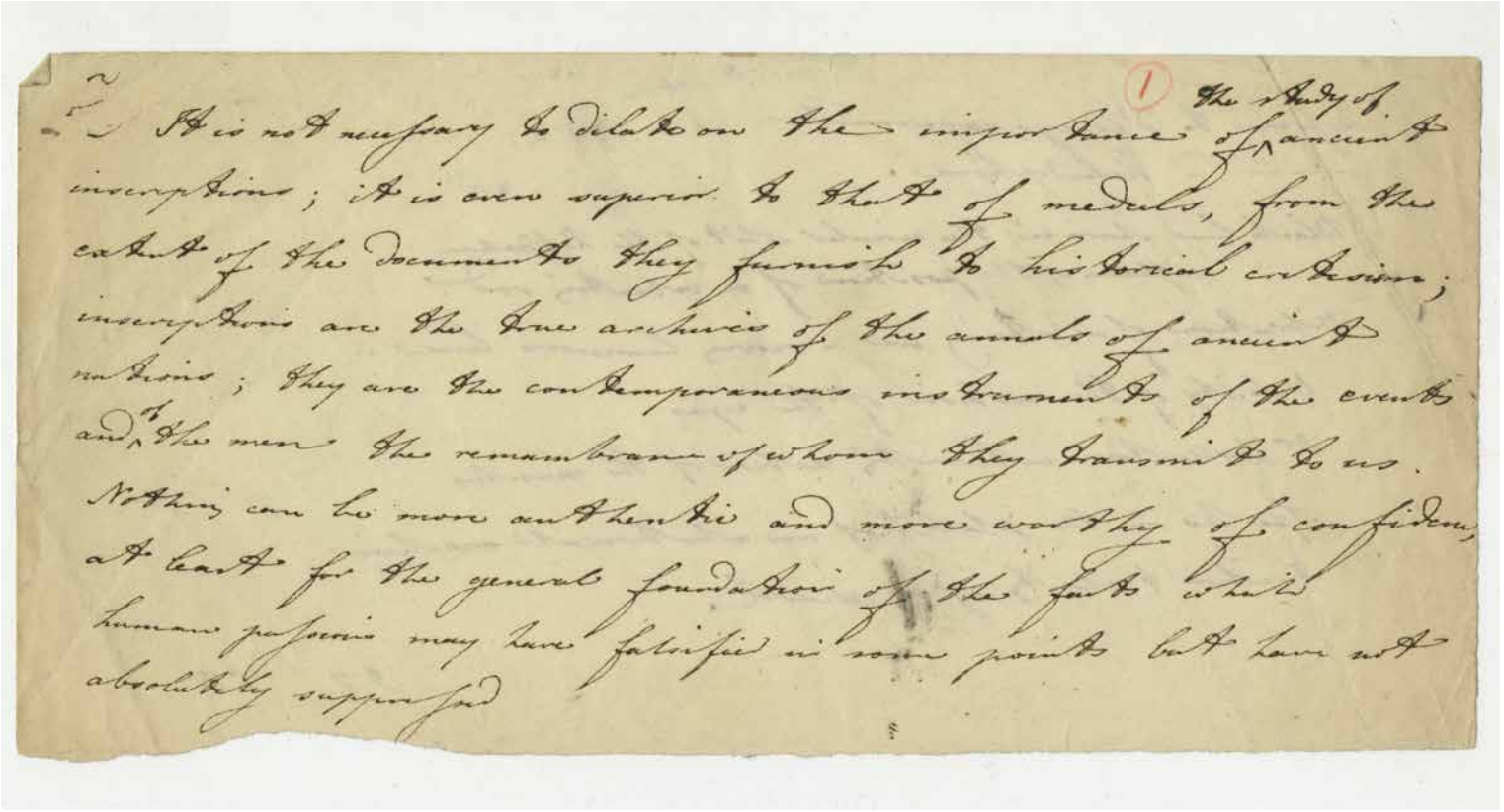
K/PP107/3/1/1-71

[1839-1870]

Series of outline experimental notes on aspects of electricity, including electrical induction of ebonite disks; the relationship between heat and electricity; papers entitled ‘experiments with the magneto-motor’, or dynamo, with comparison between different armature designs and modified reacting magnet, 1867; correspondence between (Charles) William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, and Charles Wheatstone, on resistance in electromagnetic coils, 1867; extracts from Proceedings of the Literary and Philosophical Society, Manchester, describing the pioneering work of William Siemens and Wheatstone in relation to the development of the dynamo, 1867. Also including occasional items of ephemera relating to the finances of the Wheatstone family and the assignment of rooms at King’s College London with extract from letter by Sir Robert Smirke (1790-1867), architect of King’s College London, 1839. With diagrams and sketches.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



1

The study of

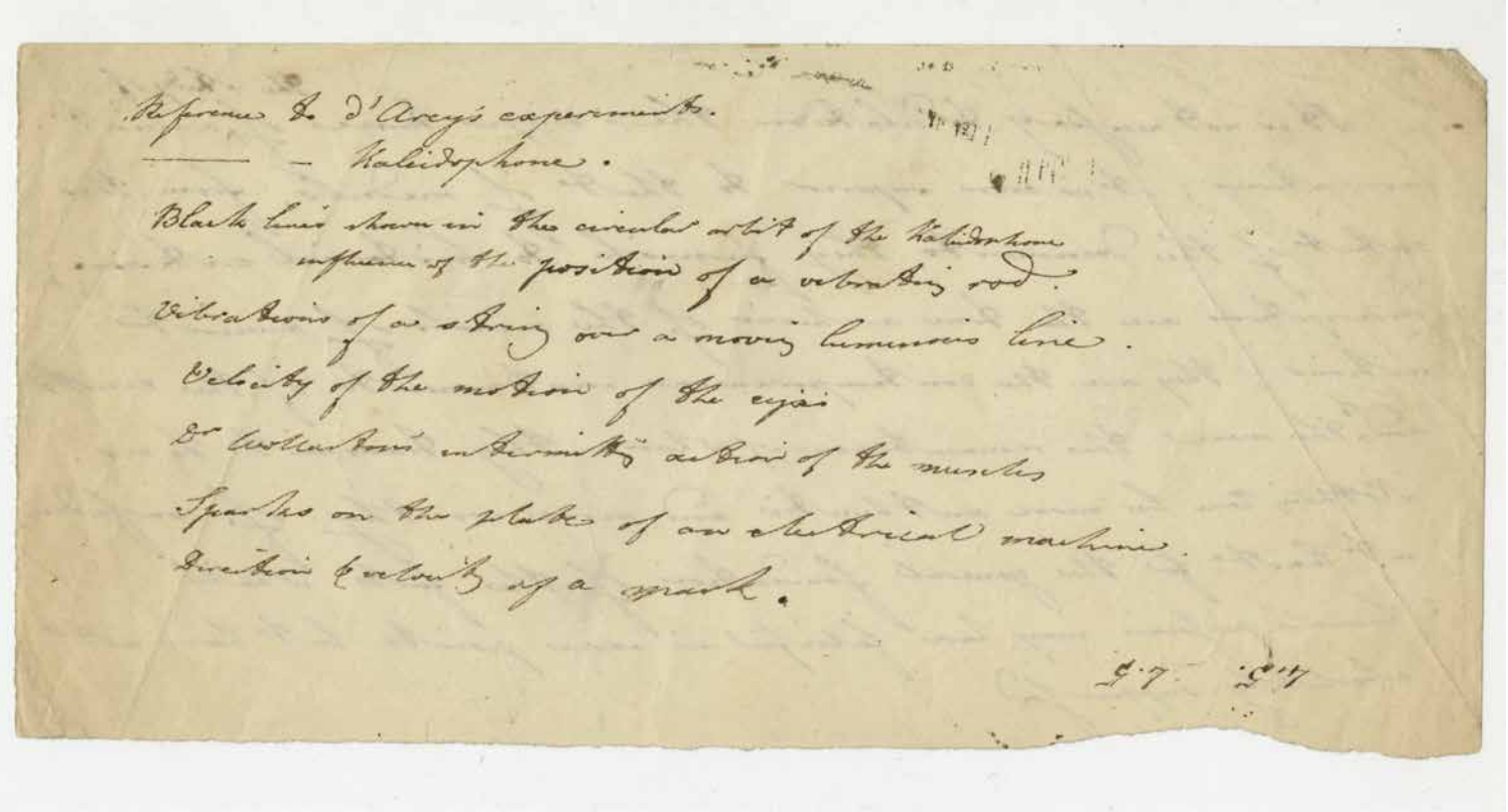
It is not necessary to dilate on the importance of ancient inscriptions; it is even superior to that of medals, from the earliest of the documents they furnish to historical evidence; inscriptions are the true archives of the annals of ancient nations; they are the contemporaneous instruments of the events and of the men the remembrance of whom they transmit to us. Nothing can be more authentic and more worthy of confidence at least for the general foundation of the facts which human passions may have falsified in some points but have not absolutely suppressed

K/PP107/3/1/1

Note on the importance of 'ancient inscriptions' on reverse of note on Wheatstone's 'kaleidophone', [1839-1870], page 1.

The Papers of Charles Wheatstone

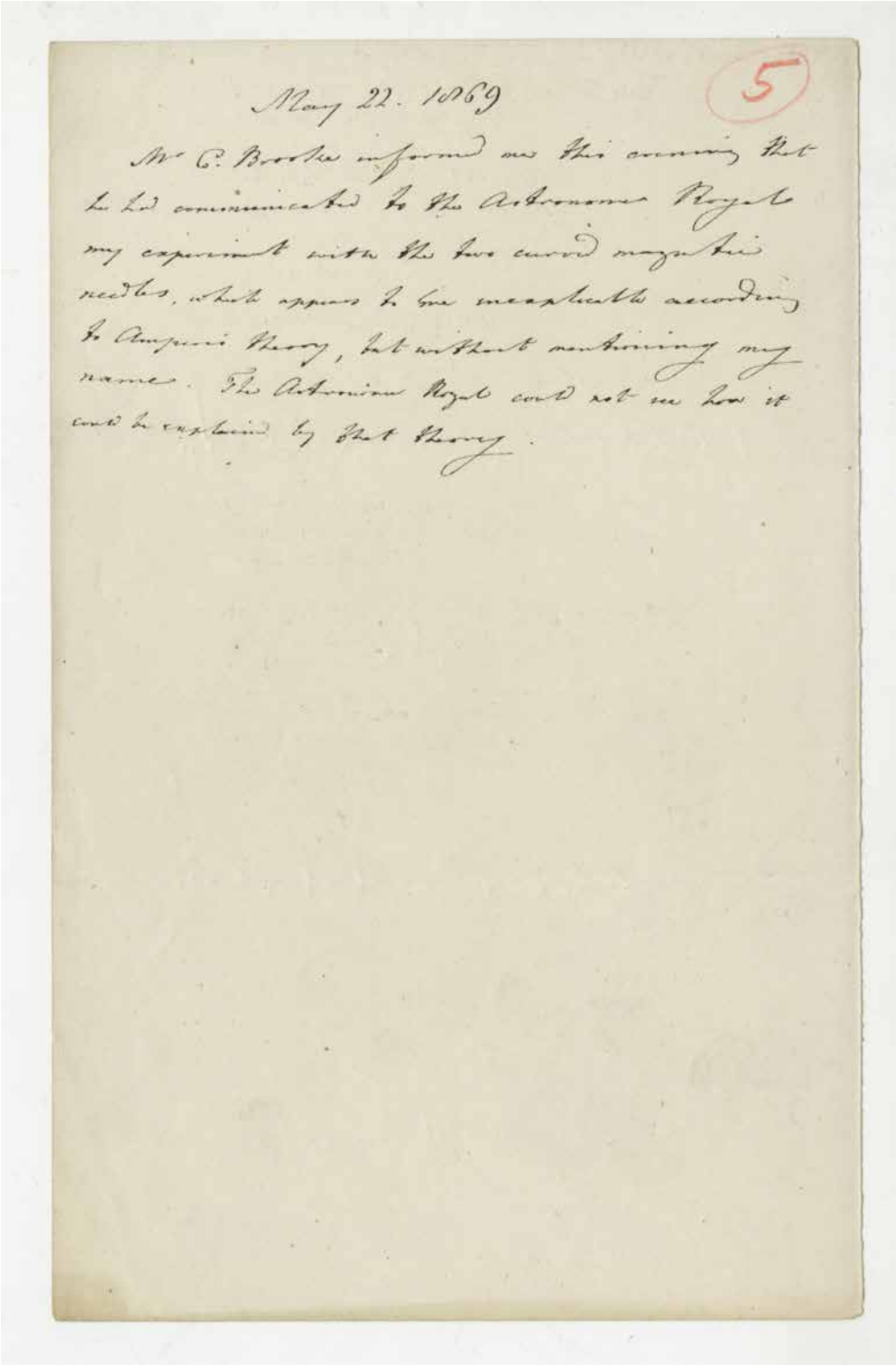
K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics


Reference to D'Arcy's experiments.
——— — Kaleidophone.
Black line shown in the circular orbit of the kaleidophone
influenced by the position of a vibrating rod.
Vibrations of a string on a moving luminous line.
Velocity of the motion of the eye in
or vibrations in a straight direction of the muscles
Sparks on the plates of an electrical machine.
Direction & velocity of a spark.

K/PP107/3/1/1
Note on Wheatstone's 'kaleidophone' on reverse of note on the importance of 'ancient inscriptions', [1839-1870], page 2.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



May 22. 1869 (5)

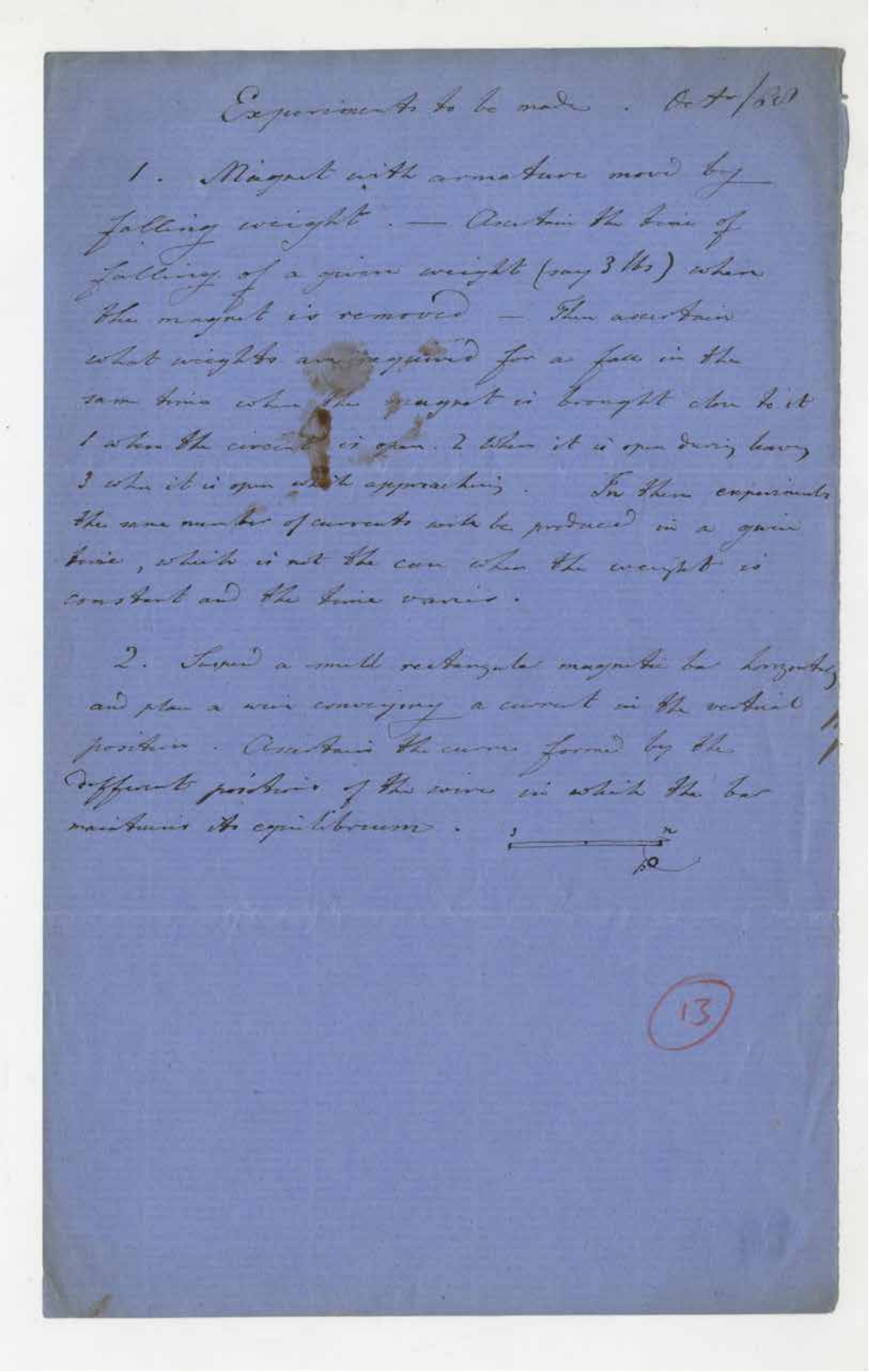
Mr C. Brooke informed me this evening that he had communicated to the Astronomer Royal my experiment with the two curved magnetic needles, which appears to me explicable according to Ampere's theory, but without mentioning my name. The Astronomer Royal could not see how it could be explained by that theory.

K/PP107/3/1/5

Note relating to communication between Charles Brooke (1804-1879), surgeon and inventor of measuring instruments, and George Biddell Airy (1801-1892), mathematician and Astronomer Royal, 1869 May 22.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



Experiments to be made. Oct/68

1. Magnet with armature moved by falling weight. — Ascertain the time of falling of a given weight (say 3 lbs) when the magnet is removed — Then ascertain what weights are required for a fall in the same time when the magnet is brought close to it 1 when the circuit is open. 2 when it is open during leaving 3 when it is open whilst approaching. For these experiments the same number of currents will be produced in a given time, which is not the case when the weight is constant and the time varies.

2. Suspend a small rectangular magnet by its longitudinal and place a wire conveying a current in the vertical position. Ascertain the curve formed by the different positions of the wire in which the bar maintains its equilibrium.

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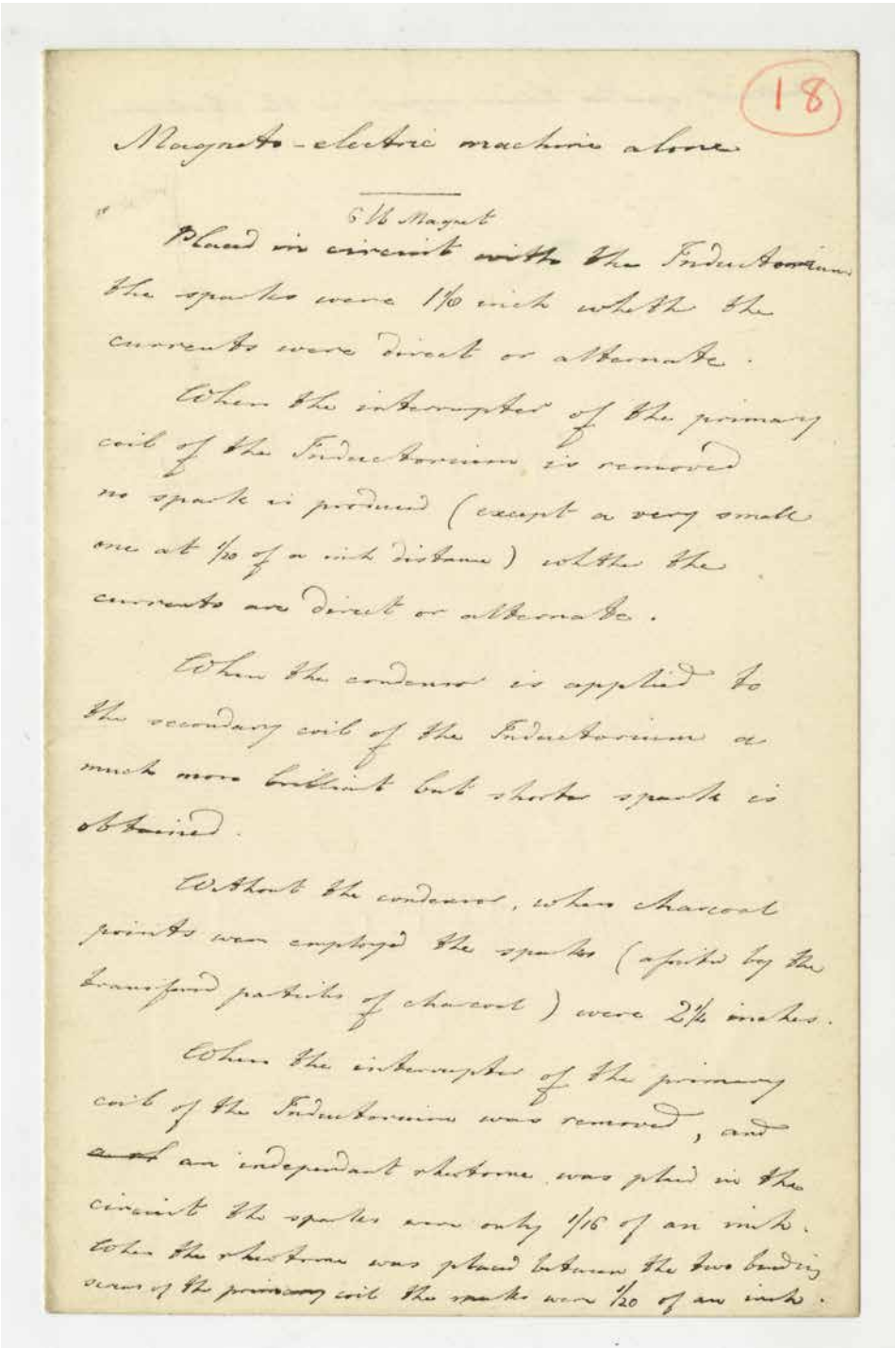
K/PP107/3/1/13

List of experiments to be made including using a magnet with armature moved by a falling weight, 1868 Oct.



(18)

Magneto-electric machine alone

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6 ℔ Magnet

Placed in circuit with the Inductorium the sparks were 1/10 inch whether the currents were direct or alternate.

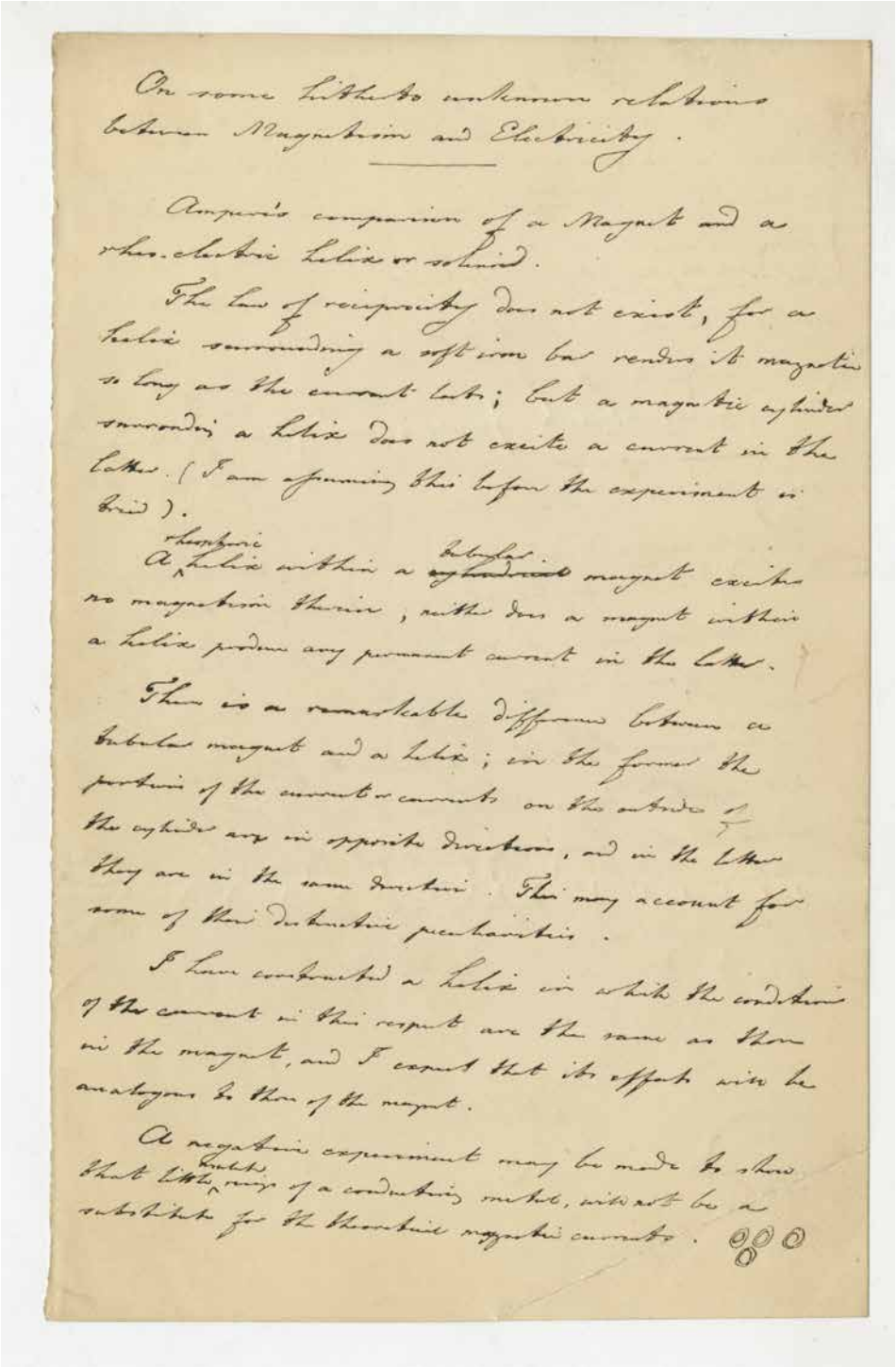
When the interrupter of the primary coil of the Inductorium is removed no spark is produced (except a very small one at 1/10 of a inch distance) whether the currents are direct or alternate.

When the condenser is applied to the secondary coil of the Inductorium a much more brilliant but shorter spark is obtained.

Without the condenser, when charcoal points were employed the sparks (caused by the transfered particles of charcoal) were 2½ inches.

When the interrupter of the primary coil of the Inductorium was removed, and an independant rheotome was placed in the circuit the sparks were only 1/16 of an inch. When the rheotome was placed between the two binding screws of the primary coil the sparks were 1/20 of an inch.

Brilliant sparks however appear in the rheotome



On some hitherto unknown relations between Magnetism and Electricity.

Ampère's comparison of a Magnet and a thermo-electric helix or solenoid.

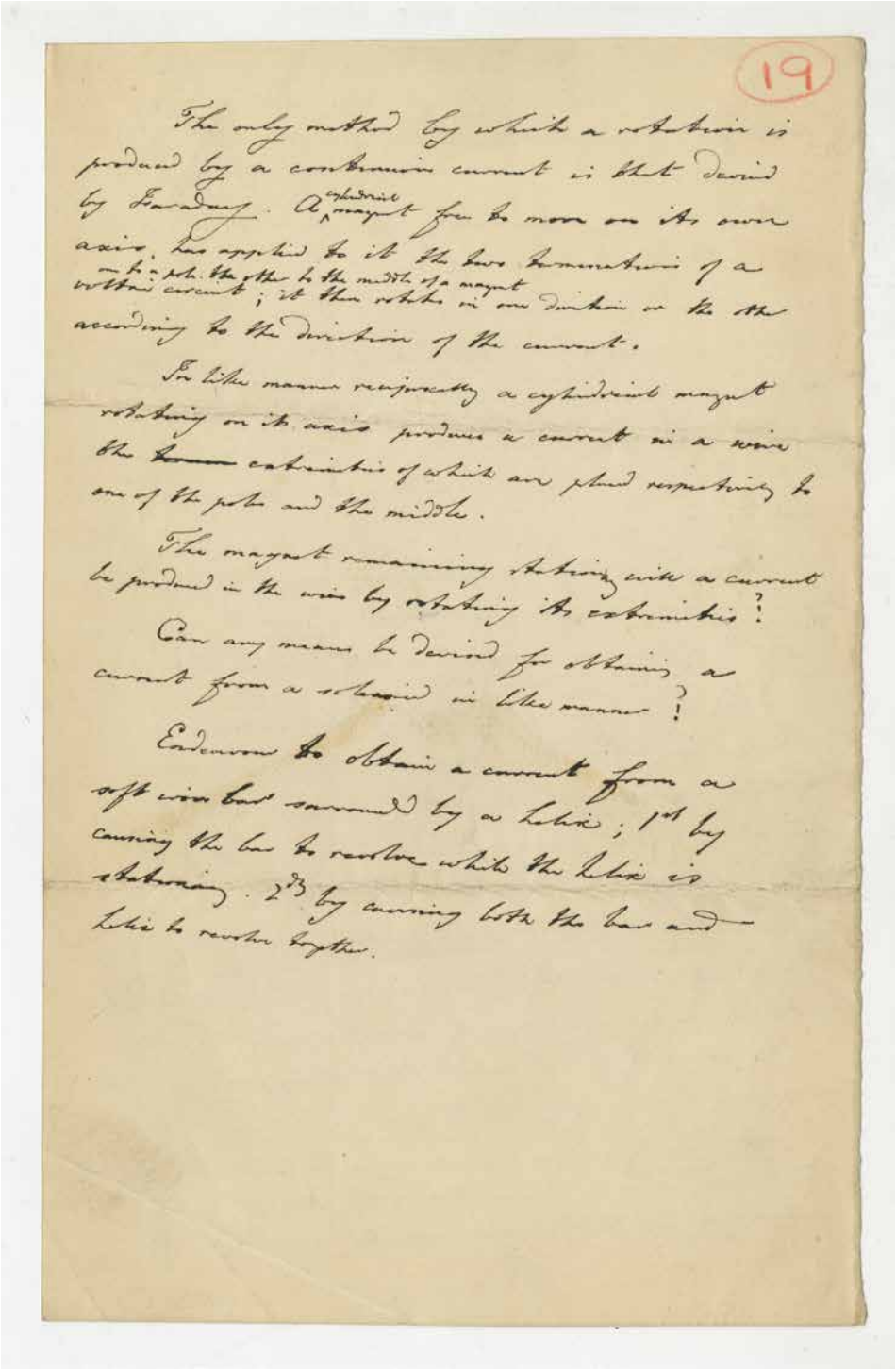
The law of reciprocity does not exist, for a helix surrounding a soft iron bar renders it magnetic so long as the current lasts; but a magnetic cylinder surrounding a helix does not excite a current in the latter. (I am assuming this before the experiment is tried).

A thermoelectric helix within a tubular ~~cylindrical~~ magnet excites no magnetism therein, neither does a magnet within a helix produce any permanent current in the latter.

There is a remarkable difference between a tubular magnet and a helix; in the former the portions of the current or currents on the outside of the cylinder are in opposite directions, and in the latter they are in the same direction. This may account for some of their distinctive peculiarities.

I have constructed a helix in which the conditions of the current in this respect are the same as those in the magnet, and I expect that its effects will be analogous to those of the magnet.

A negative experiment may be made to show that little rings of a conducting metal, will not be a substitute for the theoretical magnetic currents.



19

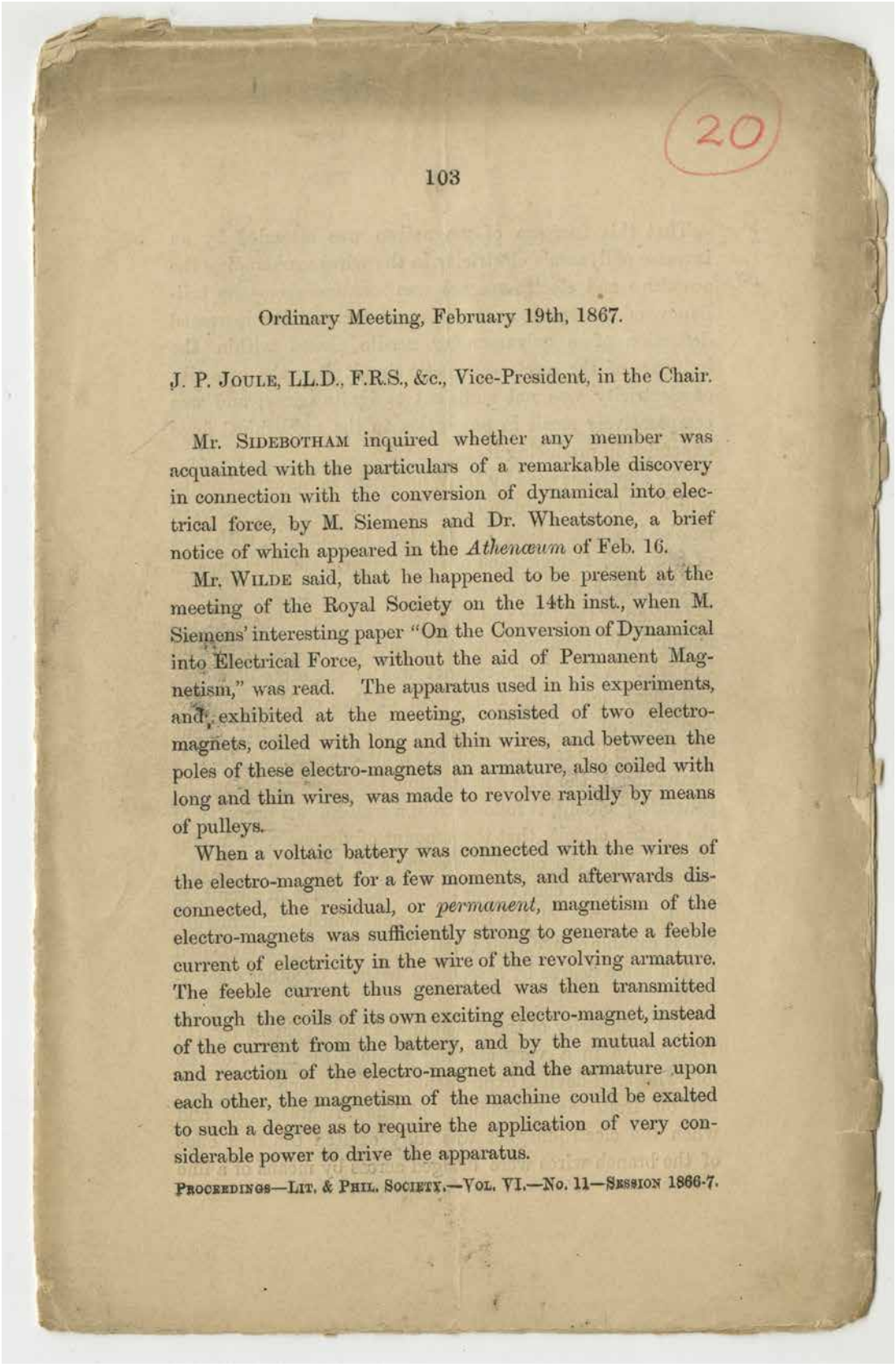
The only method by which a rotation is produced by a continuous current is that devised by Faraday. A cylindrical magnet free to move on its own axis, has applied to it the two terminations of a voltaic circuit; it then rotates in one direction or the other according to the direction of the current.

In like manner reciprocally a cylindrical magnet rotating on its axis produces a current in a wire the extremities of which are placed respectively in one of the pole and the middle.

The magnet remaining stationary with a current be produced in the wire by rotating its extremities?

Can any means be devised for obtaining a current from a rotation in like manner?

Endeavour to obtain a current from a soft iron bar surrounded by a helix; 1st by causing the bar to revolve while the helix is stationary. 2d by causing both the bar and helix to revolve together.



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Ordinary Meeting, February 19th, 1867.

J. P. Joule, LL.D., F.R.S., &c., Vice-President, in the Chair.

Mr. Sidebotham inquired whether any member was acquainted with the particulars of a remarkable discovery in connection with the conversion of dynamical into electrical force, by M. Siemens and Dr. Wheatstone, a brief notice of which appeared in the *Athenæum* of Feb. 16.

Mr. Wilde said, that he happened to be present at the meeting of the Royal Society on the 14th inst., when M. Siemens' interesting paper "On the Conversion of Dynamical into Electrical Force, without the aid of Permanent Magnetism," was read. The apparatus used in his experiments, and exhibited at the meeting, consisted of two electro-magnets, coiled with long and thin wires, and between the poles of these electro-magnets an armature, also coiled with long and thin wires, was made to revolve rapidly by means of pulleys.

When a voltaic battery was connected with the wires of the electro-magnet for a few moments, and afterwards disconnected, the residual, or *permanent*, magnetism of the electro-magnets was sufficiently strong to generate a feeble current of electricity in the wire of the revolving armature. The feeble current thus generated was then transmitted through the coils of its own exciting electro-magnet, instead of the current from the battery, and by the mutual action and reaction of the electro-magnet and the armature upon each other, the magnetism of the machine could be exalted to such a degree as to require the application of very considerable power to drive the apparatus.

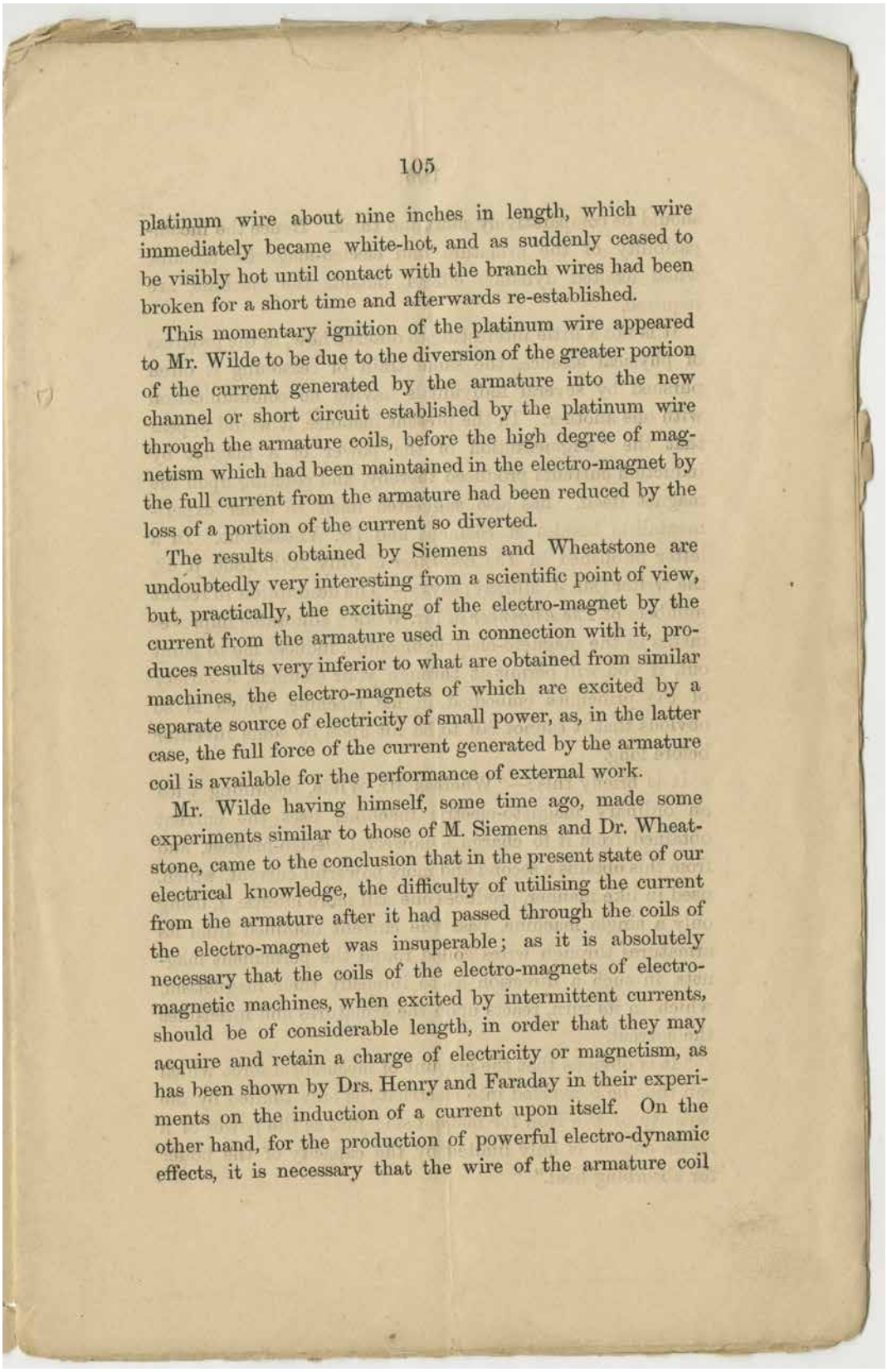
K/PP107/3/1/20
Offprint from the Proceedings of the Literary and Philosophical Society of Manchester, Ordinary Meeting chaired by James Prescott Joule (1818-1889), physicist, describing the pioneering work of Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, and Wheatstone in relation to the development of the dynamo, page 103, 1867 Feb 19.

That this increase of magnetism was attended by an increase of dynamic electricity in the wires surrounding the armature and electro-magnet was manifest from the brilliancy of the spark at the commutator and the increased deflection of a galvanometer needle placed within the influence of the electro-magnetic circuit; but the quantity of electricity was not sufficient to ignite wires; and was comparatively small in proportion to the mechanical force expended in producing it.

The apparatus used by Dr. Wheatstone in his experiments, which was also shown in operation at the meeting, was very similar in construction, and identical in principle, with that of Siemens', though each of these experimentalists appears to have worked out his results independently.

Instead of the long and thin wire used by Siemens in his machine, Wheatstone employed coils of thicker wires, and the wire on the electro-magnet was of the same diameter, and about eight times the length of that on the armature. The coils of the electro-magnet had consequently about eight times the resistance of the armature circuit. In this arrangement, the wire surrounding the armature being the generating circuit, it follows from a well-known property of the electric circuit, that the amount of dynamic, or useful effect, which the current is capable of exerting when the resistance of the coils of the electro-magnets is in circuit, is about one-ninth of the total amount which the armature coil is capable of evolving when the electro-magnet is excited to the same degree by a separate battery or other electro-motor.

This peculiarity of the machine was made evident by Dr. Wheatstone in a very striking manner by means of the following well-devised experiment:—Two branch wires were led off from the extremities of the armature coil, and when the electro-magnet was fully excited the free ends of the branch wires were bridged across by means of a fine



platinum wire about nine inches in length, which wire immediately became white-hot, and as suddenly ceased to be visibly hot until contact with the branch wires had been broken for a short time and afterwards re-established.

This momentary ignition of the platinum wire appeared to Mr. Wilde to be due to the diversion of the greater portion of the current generated by the armature into the new channel or short circuit established by the platinum wire through the armature coils, before the high degree of magnetism which had been maintained in the electro-magnet by the full current from the armature had been reduced by the loss of a portion of the current so diverted.

The results obtained by Siemens and Wheatstone are undoubtedly very interesting from a scientific point of view, but, practically, the exciting of the electro-magnet by the current from the armature used in connection with it, produces results very inferior to what are obtained from similar machines, the electro-magnets of which are excited by a separate source of electricity of small power, as, in the latter case, the full force of the current generated by the armature coil is available for the performance of external work.

Mr. Wilde having himself, some time ago, made some experiments similar to those of M. Siemens and Dr. Wheatstone, came to the conclusion that in the present state of our electrical knowledge, the difficulty of utilising the current from the armature after it had passed through the coils of the electro-magnet was insuperable; as it is absolutely necessary that the coils of the electro-magnets of electro-magnetic machines, when excited by intermittent currents, should be of considerable length, in order that they may acquire and retain a charge of electricity or magnetism, as has been shown by Drs. Henry and Faraday in their experiments on the induction of a current upon itself. On the other hand, for the production of powerful electro-dynamic effects, it is necessary that the wire of the armature coil

K/PP107/3/1/20
Offprint from the Proceedings of the Literary and Philosophical Society of Manchester, Ordinary Meeting chaired by James Prescott Joule (1818-1889), physicist, describing the pioneering work of Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, and Wheatstone in relation to the development of the dynamo, page 105, 1867 Feb 19.

should be comparatively short and thick. Hence the incompatibility of the armature and electro-magnetic circuits, when exalted dynamic effects, outside the machine, are required.

It is not a little interesting to observe how, in the progress of physical science, the same train of reasoning is often pursued by several individuals having no communication with one another. In the present instance, it would appear that the "augmentation of the power of a magnet by induction currents produced thereby, and reacting upon the magnet itself," has also suggested itself to other experimentalists besides M. Siemens and Dr. Wheatstone. In a letter published in *The Engineer* of July 20th, 1866, p. 42, the writer (Mr. J. Murray) says:—"The description in recent numbers of *The Engineer* of Mr. Wilde's admirable improvements in the magneto-electric machine, induces me to point out, if you will permit it through your columns, a variety of the principles embodied in his machine, which is so obvious that it cannot fail to be hit upon by some inventor before long."

It is briefly this:—"Whereas Mr. Wilde, beginning with an ordinary magneto-electric machine, uses the current obtained from it to charge a powerful electro-magnet, and from this obtains a second and more powerful current, which, used in like manner, produces one still more intense, I, using only a single machine, pass the current obtained from its armatures through wires coiled round the permanent magnets, in such a direction as to intensify their magnetism, which, in its turn, reacts upon the armatures and intensifies the current.

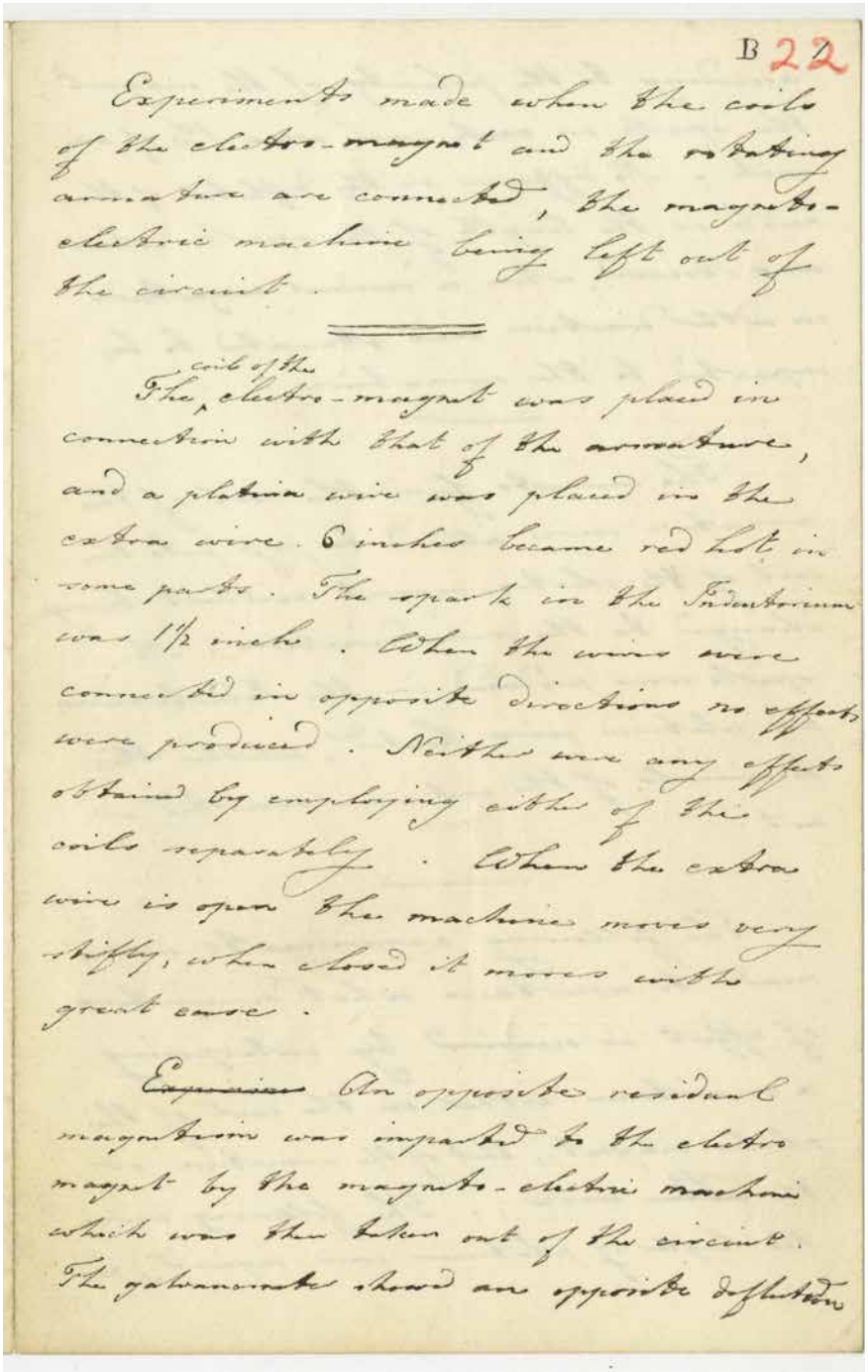
"It is obvious that the amount of mechanical force which can thus be converted into electricity is only limited by the capacity of the iron for magnetism; just as the power of a steam engine is only limited by the capacity of the boiler for absorbing heat."

Mr. Wilde has also received a letter on the subject of his recent experiments in magnetism from Mr. Moses G. Farmer, of Salem, Mass., United States, dated November 9th, 1866, in which he says that he had obtained an increase of 31 per cent. in the power of a magneto-electric machine, by transmitting the current from the armature through coils of wire surrounding pieces of soft iron forming the prolonged extremities of the permanent magnets of the machine. Mr. Farmer, in the same letter, adds:—"I have built a small machine in which a current from the thermo battery excites the electro-magnet of your machine to start it, and after the machine is in action, a branch from the current of the magnets passes through its own electro-magnet, and this supplies the magnetism required. It is not exactly like a person standing in a basket and trying to lift himself—because the electricity proceeds from the conversion of the mechanical energy, which must be continually supplied. Neither can it in any wise be likened to the various schemes for producing perpetual motion; but depends on the principle, that the actual energy of the mechanical force, conjointly with the potential energy of the magnet, can develope a greater amount of potential energy than is originally resident in the magnet, or, in other words, it is a method of converting part of the actual energy of the prime mover into the potential energy of magnetism."

Mr. W. L. Dickinson, having discovered an error in his calculation of the Occultation of Aldebaran (see Proceedings, December 11th, 1866, page 47), communicated the following results of the corrected computation.

Calculation for the Observatory of Robert Worthington, Esq., F.R.A.S., Crumpsall, near Manchester, Lat. 53° 30′ 50·0″ N., Long. $0^h\ 8^m\ 56{\cdot}16^s$ W.

The Occultation of Aldebaran by the Moon, January 16, 1867:—

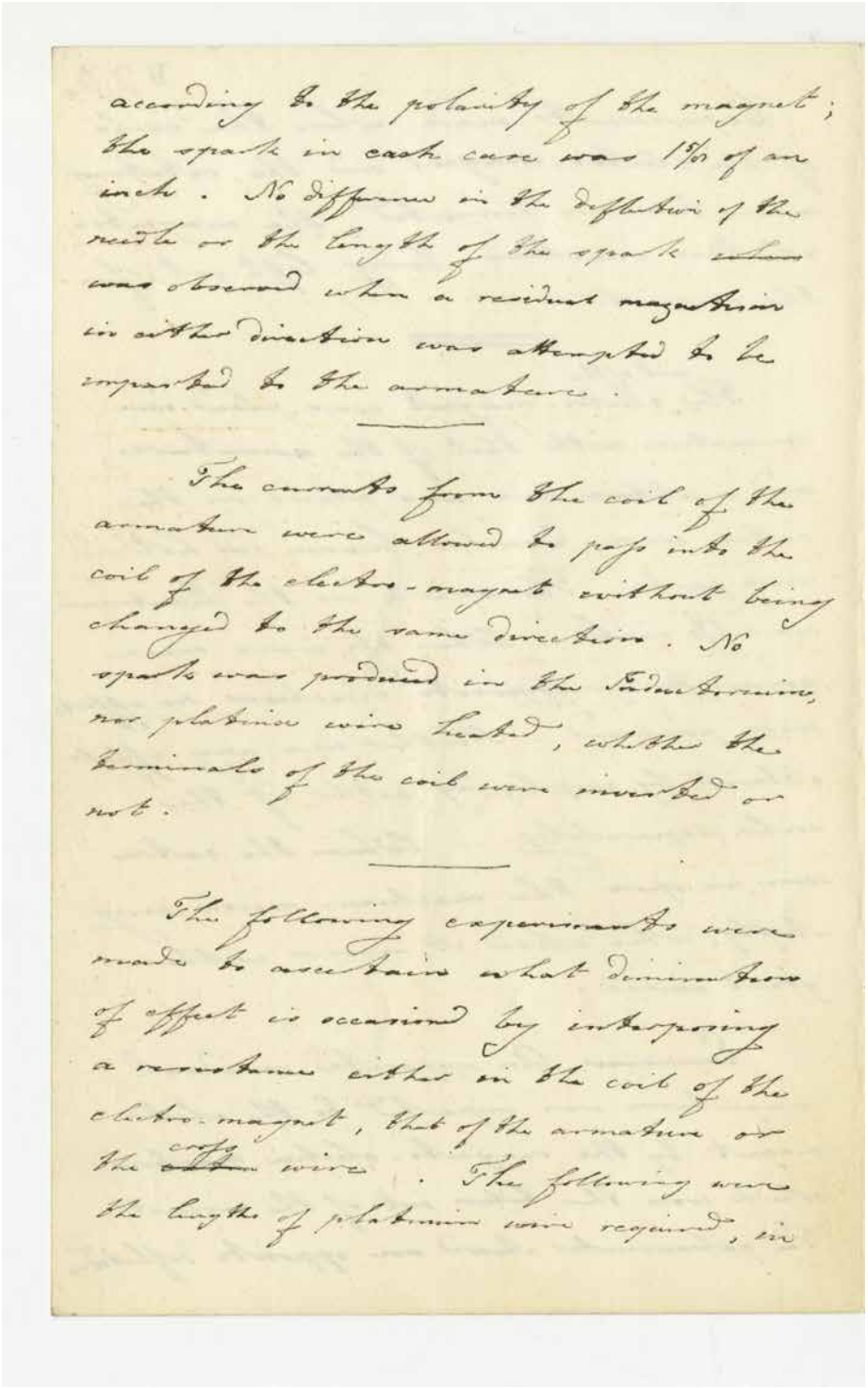


B 22

Experiments made when the coils of the electro-magnet and the rotating armature are connected, the magneto-electric machine being left out of the circuit.

The coil of the electro-magnet was placed in connection with that of the armature, and a platina wire was placed in the extra wire. 6 inches became red hot in some parts. The spark in the Striatorium was 1/2 inch. When the wires were connected in opposite directions no effects were produced. Neither were any effects obtained by employing either of the coils separately. When the extra wire is open the machine moves very stiffly, when closed it moves with great ease.

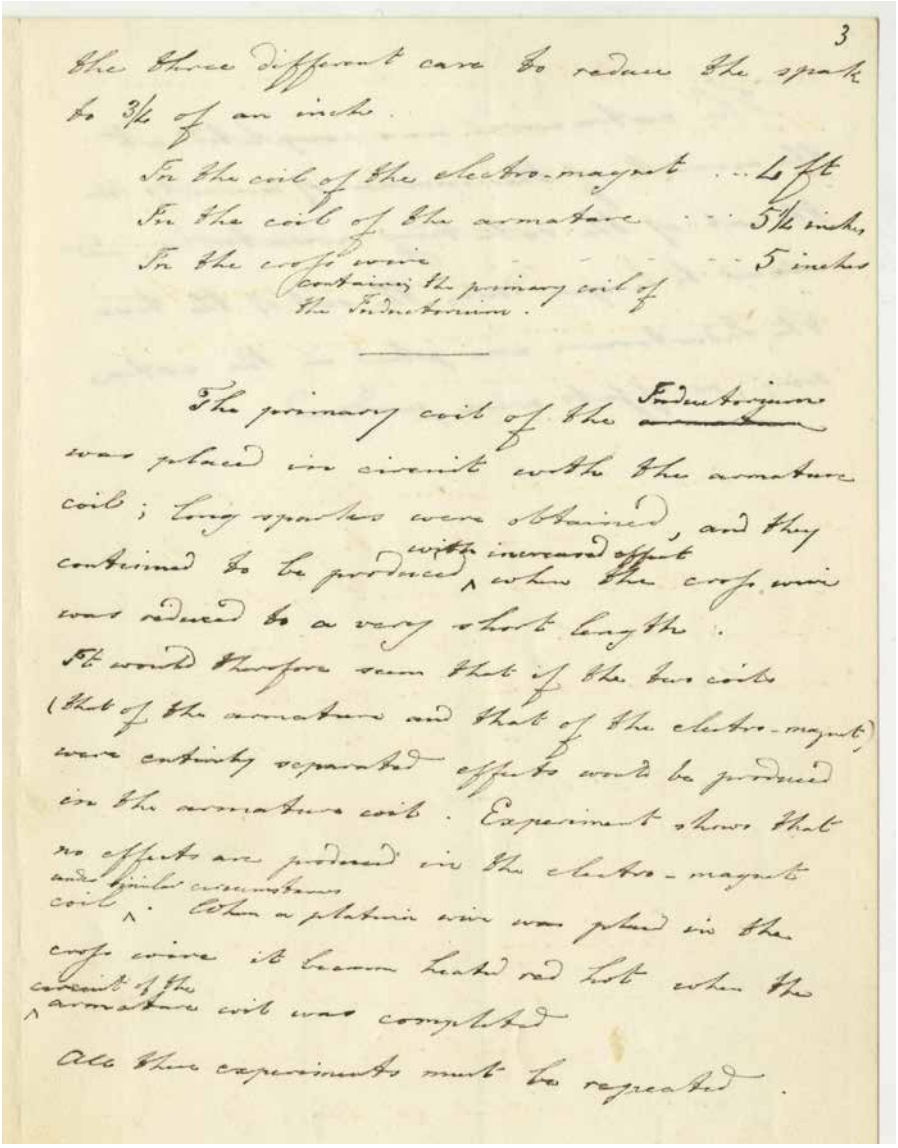
~~Experiments~~ An opposite residual magnetism was imparted to the electro magnet by the magneto-electric machine which was then taken out of the circuit. The galvanometer showed an opposite deflection



according to the polarity of the magnet; the spark in each case was 1/10 of an inch. No difference in the deflection of the needle or the length of the spark either was observed when a resistant magnetism in either direction was attempted to be imparted to the armature.

The currents from the coil of the armature were allowed to pass into the coil of the electro-magnet without being changed to the same direction. No sparks was produced in the Induction, nor platinum wire heated, whether the terminals of the coil were inverted or not.

The following experiments were made to ascertain what diminution of effect is occasioned by interposing a resistance either in the coil of the electro-magnet, that of the armature or the ~~cross~~ wire. The following were the lengths of platinum wire required, in



3

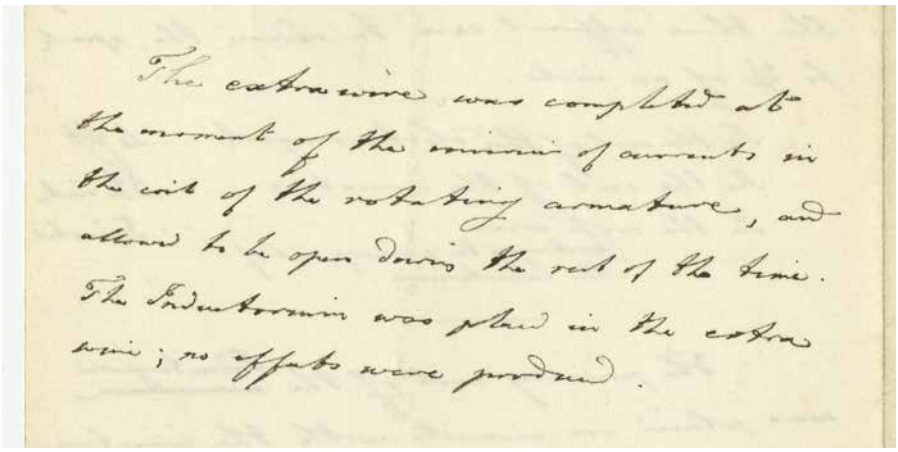
the three different care to reduce the spark to 3/4 of an inch.

For the coil of the electro-magnet ... 4 ft
For the coil of the armature ... 5/8 inches
For the cross wire ... 5 inches
containing the primary coil of the Inductorium.

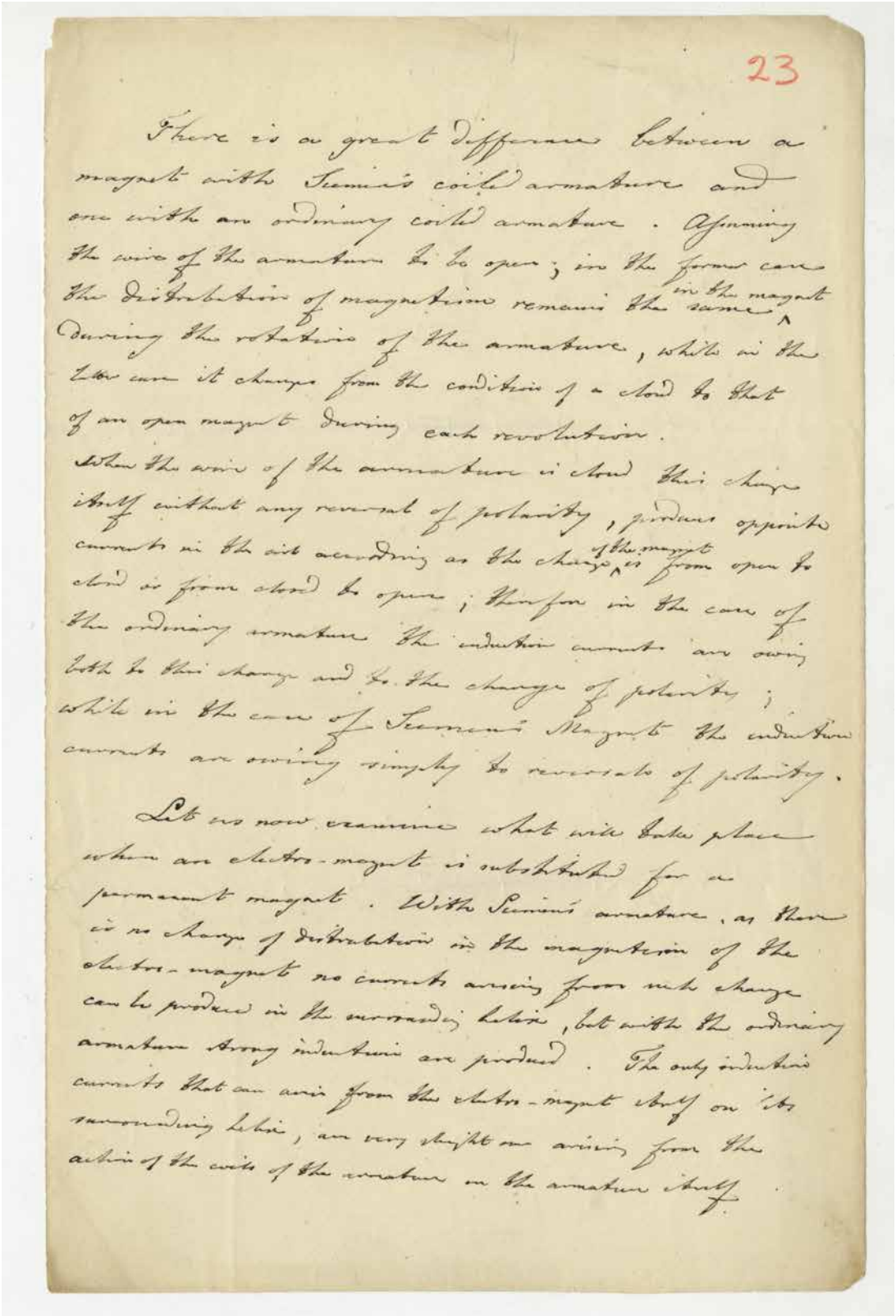
The primary coil of the ~~Inductorium~~ armature was placed in circuit with the armature coil; long sparks were obtained, and they continued to be produced with increased effect when the cross wire was reduced to a very short length.

It would therefore seem that if the two coils (that of the armature and that of the electro-magnet) were entirely separated effects would be produced in the armature coil. Experiment shows that no effects are produced in the electro-magnet and finite circumstances coil. When a platinia wire was placed in the cross wire it became heated red hot when the circuit of the armature coil was completed

All these experiments must be repeated.



The extra wire was completed at the moment of the cessation of currents in the coil of the rotating armature, and allowed to be open during the rest of the time. The Inductorium was placed in the extra wire; no effects were produced.



23

There is a great difference between a magnet with Siemens's coiled armature and one with an ordinary coiled armature. Assuming the wire of the armature to be open; in the former case the distribution of magnetism remains the same in the magnet during the rotation of the armature, while in the latter case it changes from the condition of a steel to that of an open magnet during each revolution.

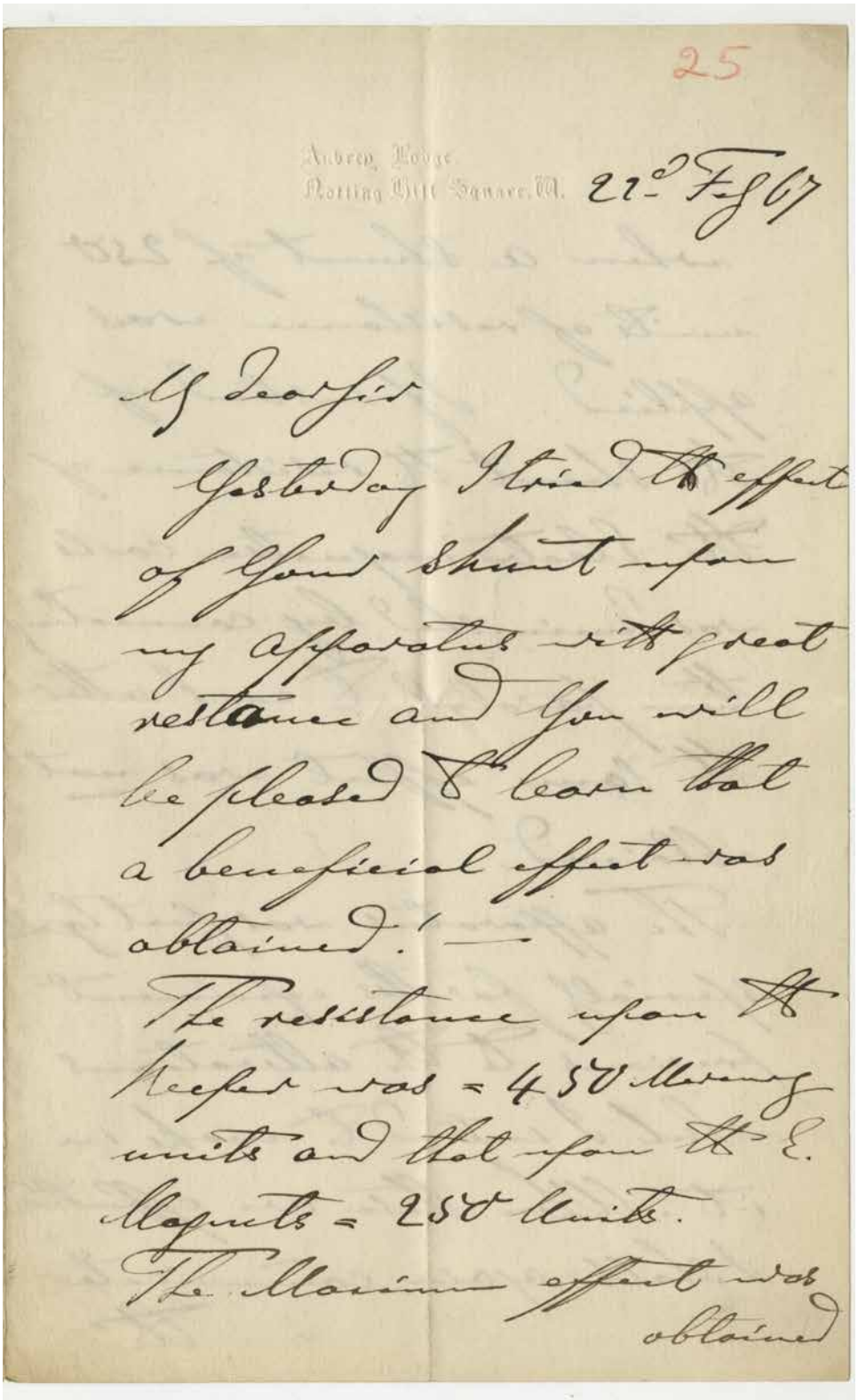
When the wire of the armature is closed this change itself without any reversal of polarity, produces opposite currents in the air according as the change of the magnet is from open to steel or from steel to open; therefore in the case of the ordinary armature the induction currents are owing both to this change and to the change of polarity; while in the case of Siemens's Magnet the induction currents are owing simply to reversals of polarity.

Let us now examine what will take place when an electro-magnet is substituted for a permanent magnet. With Siemens's armature, as there is no change of distribution in the magnetism of the electro-magnet no currents arising from such change can be produced in the surrounding helix, but with the ordinary armature strong inductive are produced. The only inductive currents that can arise from the electro-magnet itself on the surrounding helix, are very slight ones arising from the action of the coils of the armature on the armature itself.

K/PP107/3/1/23
Notes describing a coiled armature and magnet proposed by Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, [1867].

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



25

Asbrey Lodge
Notting Hill Square W. 22nd Feb 67

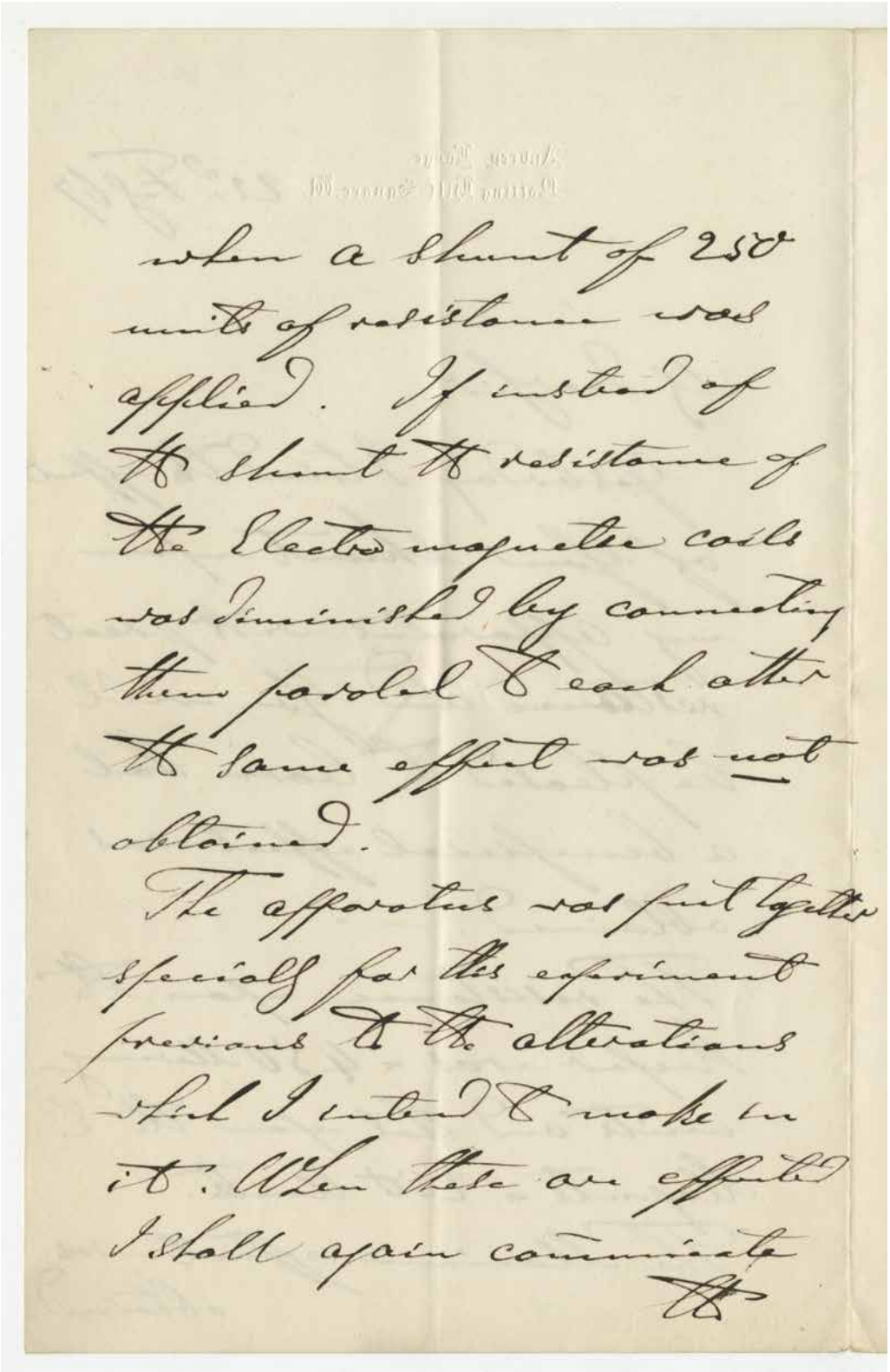
My dear Sir

Yesterday I tried the effect of your shunt upon my apparatus with great resistance and you will be pleased to learn that a beneficial effect was obtained! —

The resistance upon the keeper was = 450 Mercury units and that upon the E. Magnets = 250 Units.

The Maximum effect was obtained

K/PP107/3/1/25
Letter from Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, regarding tests on his self-excited generator based Wheatstone's suggestion of shunting the field winding, 1867 Feb 22, page 1.



when a shunt of 250
units of resistance was
applied. If instead of
the shunt the resistance of
the Electro magnetic coils
was diminished by connecting
them parallel to each other
the same effect was not
obtained.
The apparatus was put together
specially for this experiment
previous to the alterations
that I intend to make in
it. When these are effected
I shall again communicate

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The Papers of Charles Wheatstone

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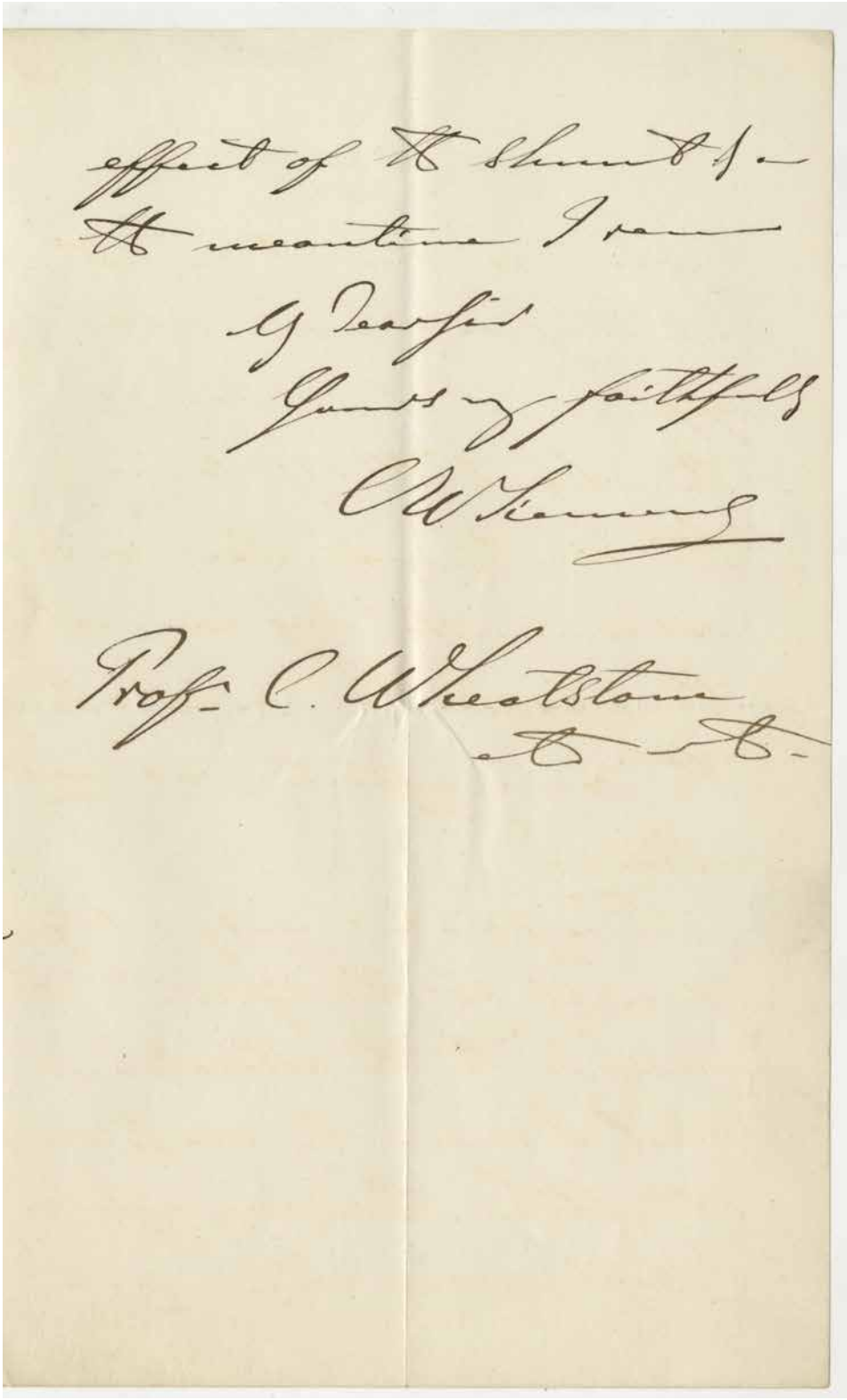


K/PP107/3/1/25

Letter from Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, regarding tests on his self-excited generator based Wheatstone's suggestion of shunting the field winding, 1867 Feb 22, page 3.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics

30

Experiments to be made with the reacting magnet (Aug/67)

I shall call the electro-magnet with the smaller resistance EM1, and that with the larger resistance EM2. I shall also call the revolving armature A1 and the occasional armature A3.

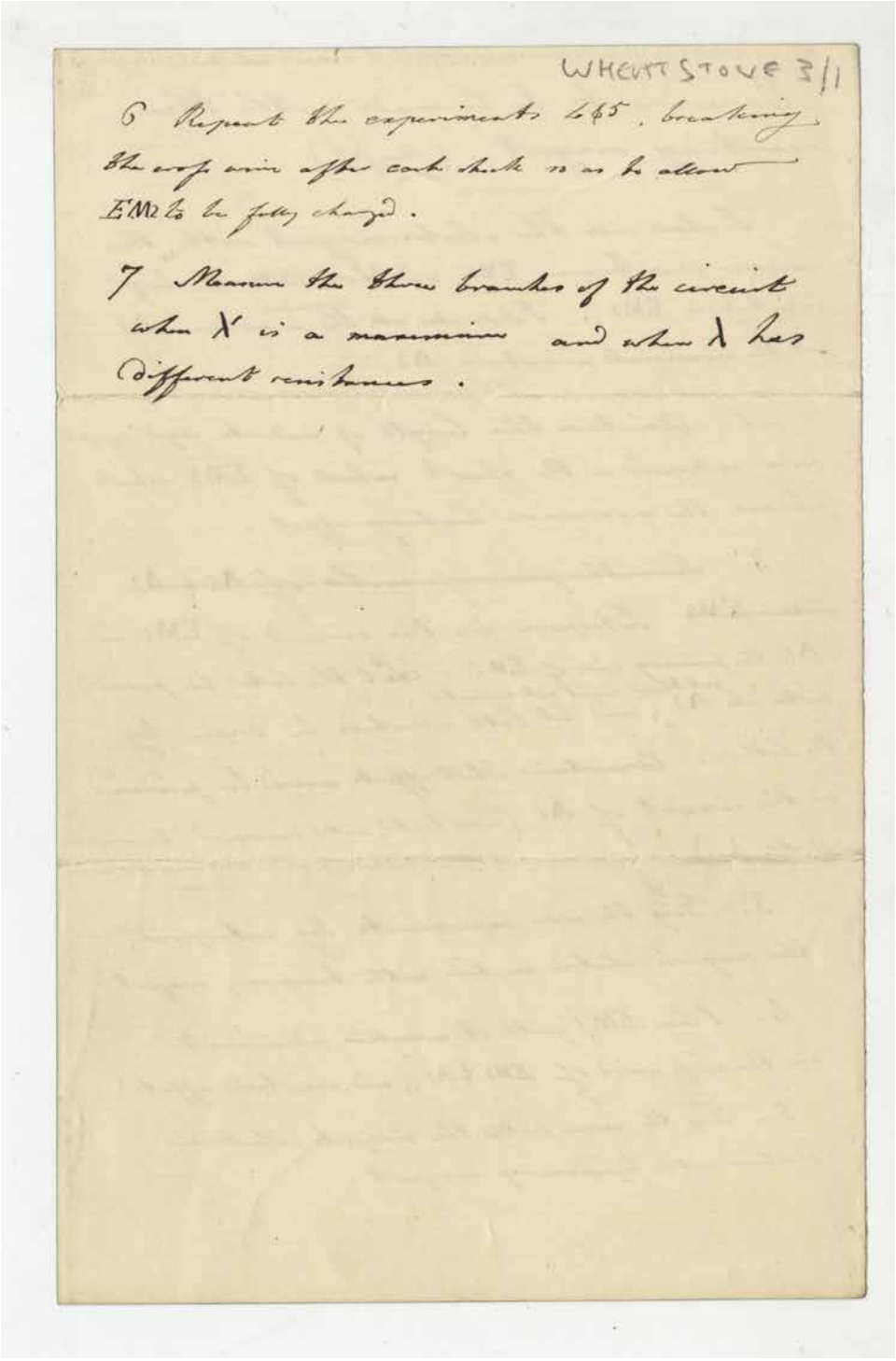
1. Ascertain the length of moderate sized copper wire interposed in the shunt ~~wheel~~ of EM2 which produces the maximum heating effect.

2 ~~Join the primary coils of A1 & A2 with EM2~~ Interpose in the circuit of EM2 and A1 the primary coil of EM1. Let the latter be provided with its A2, but their wires not connected, and let both armatures be driven by the lathe. Ascertain what effects would be produced in the circuit of A1 (wire heated, water decomposed, luminous effects &c).

3. Try the same experiments by interposing the magneto-electric machine with temporary magnet.

4. Place EM1 with its armature independent in the cross wire of EM2 & A1, and ascertain effects.

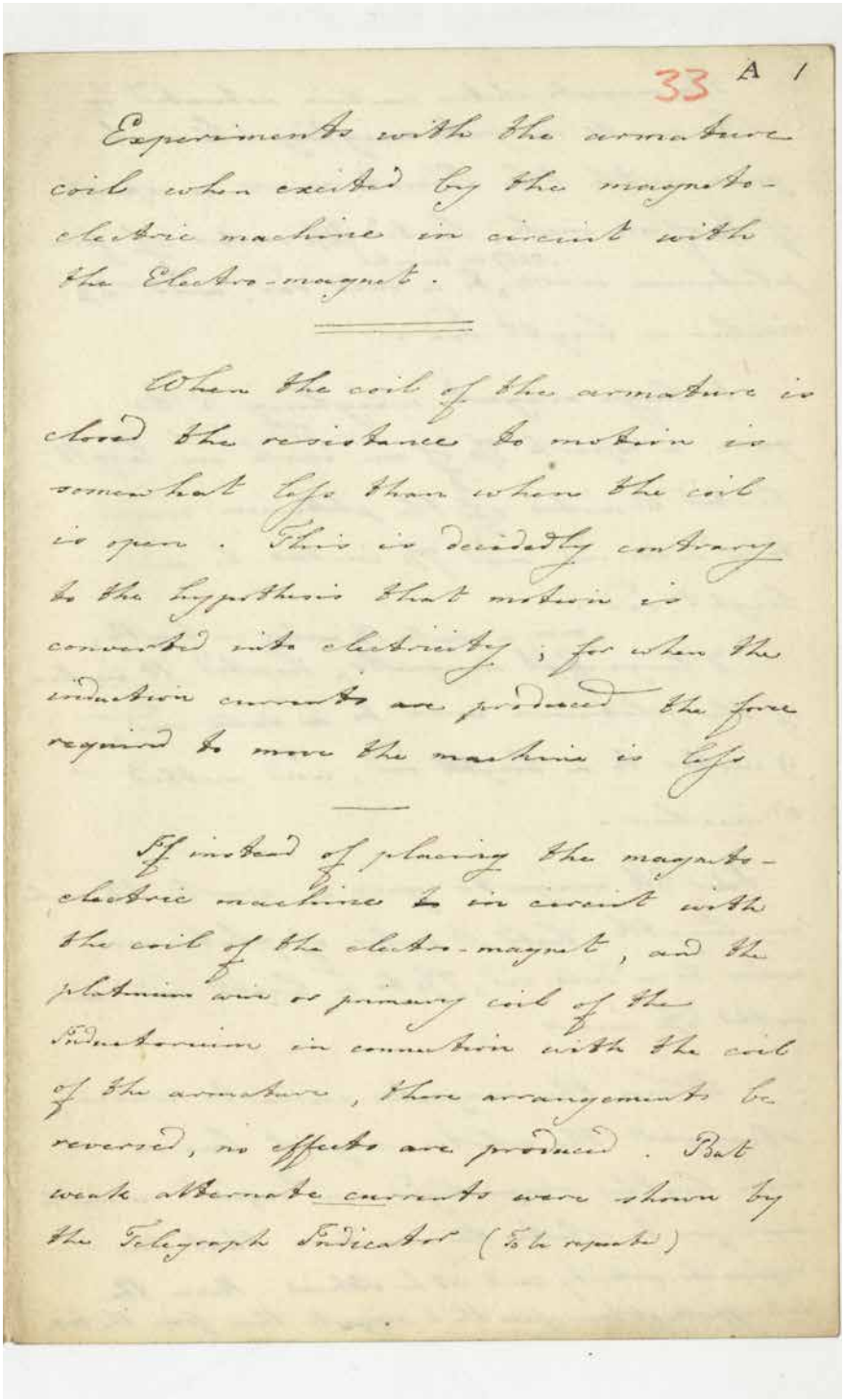
5. Try the same with the magneto-electric machine with temporary magnet.



WHEATSTONE 3/1

6 Repeat the experiments 4 & 5, breaking the wire after each shock so as to allow E M to be fully charged.

7 Measure the three branches of the circuit when λ is a maximum and when λ has different resistances.

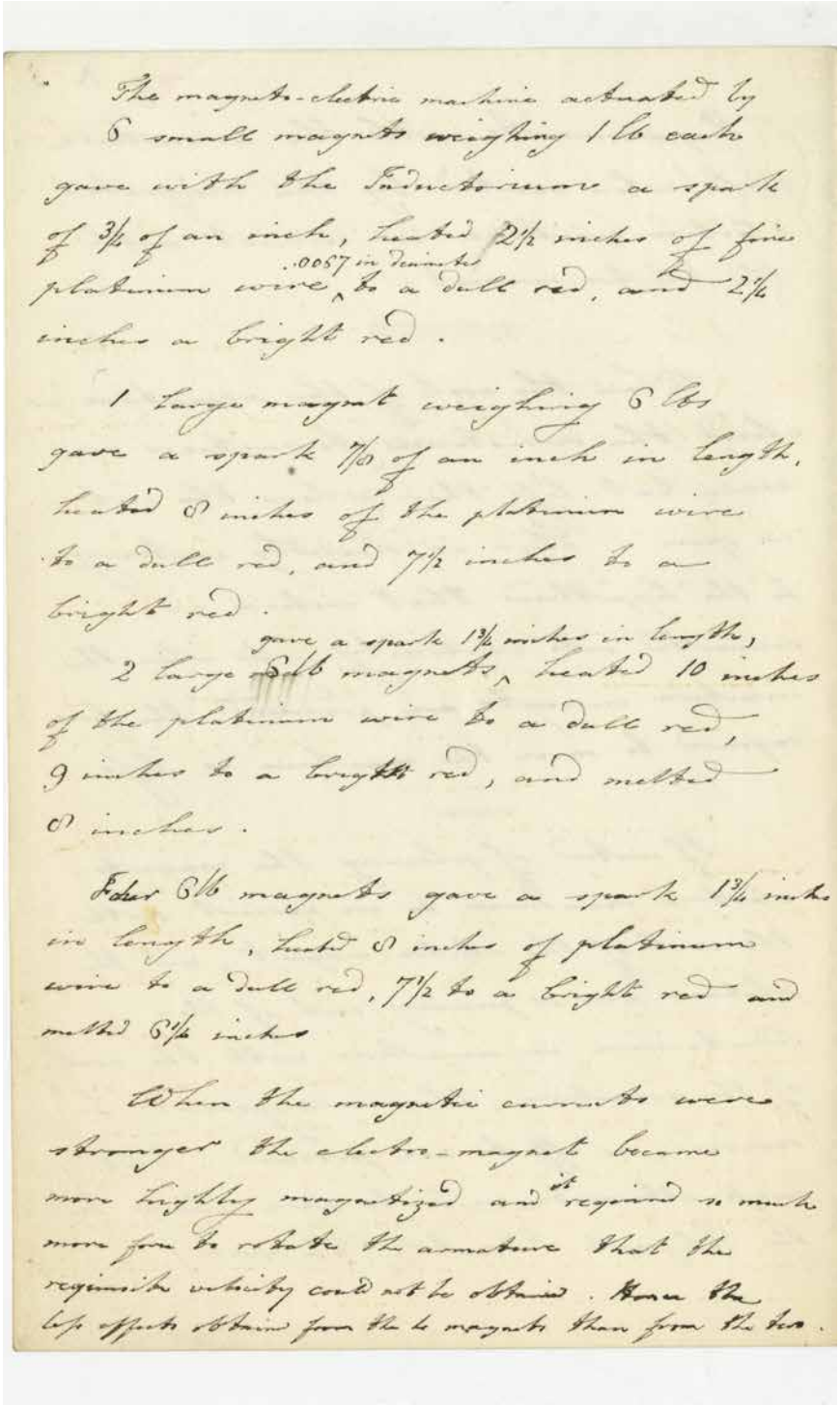


33 A 1

Experiments with the armature coil when excited by the magneto-electric machine in circuit with the Electro-magnet.

When the coil of the armature is closed the resistance to motion is somewhat less than when the coil is open. This is decidedly contrary to the hypothesis that motion is converted into electricity; for when the induction currents are produced the force required to move the machine is less

If instead of placing the magneto-electric machine in circuit with the coil of the electro-magnet, and the platinum wire or primary coil of the Inductorium in connection with the coil of the armature, these arrangements be reversed, no effects are produced. But weak Alternate currents were shown by the Telegraph Indicator (5th reports)



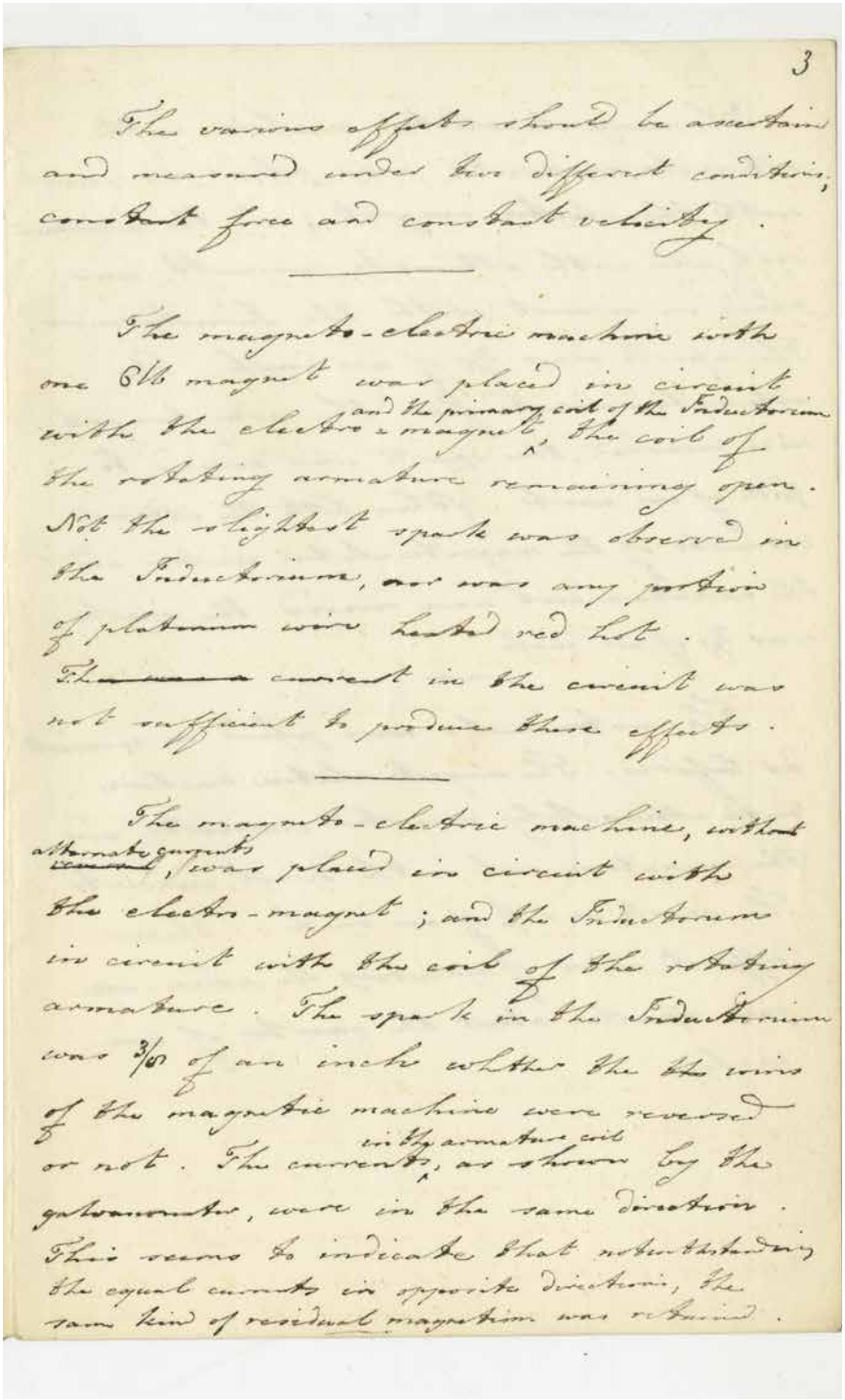
The magneto-electric machine actuated by 6 small magnets weighing 1 lb each gave with the Inductorium a spark of 3/4 of an inch, heated 2½ inches of fine platinum wire .0057 in Diameter to a dull red, and 2¼ inches a bright red.

1 large magnet weighing 6 lbs gave a spark 7/10 of an inch in length, heated 8 inches of the platinum wire to a dull red, and 7½ inches to a bright red.

2 large 6 lb magnets, gave a spark 1¾ inches in length, heated 10 inches of the platinum wire to a dull red, 9 inches to a bright red, and melted 8 inches.

Four 6 lb magnets gave a spark 1¾ inches in length, heated 8 inches of platinum wire to a dull red, 7½ to a bright red and melted 6¼ inches

When the magnetic currents were stronger the electro-magnet became more highly magnetized and it required so much more force to rotate the armature that the requisite velocity could not be obtained. Hence the best effects obtain from the 6 magnets than from the two.



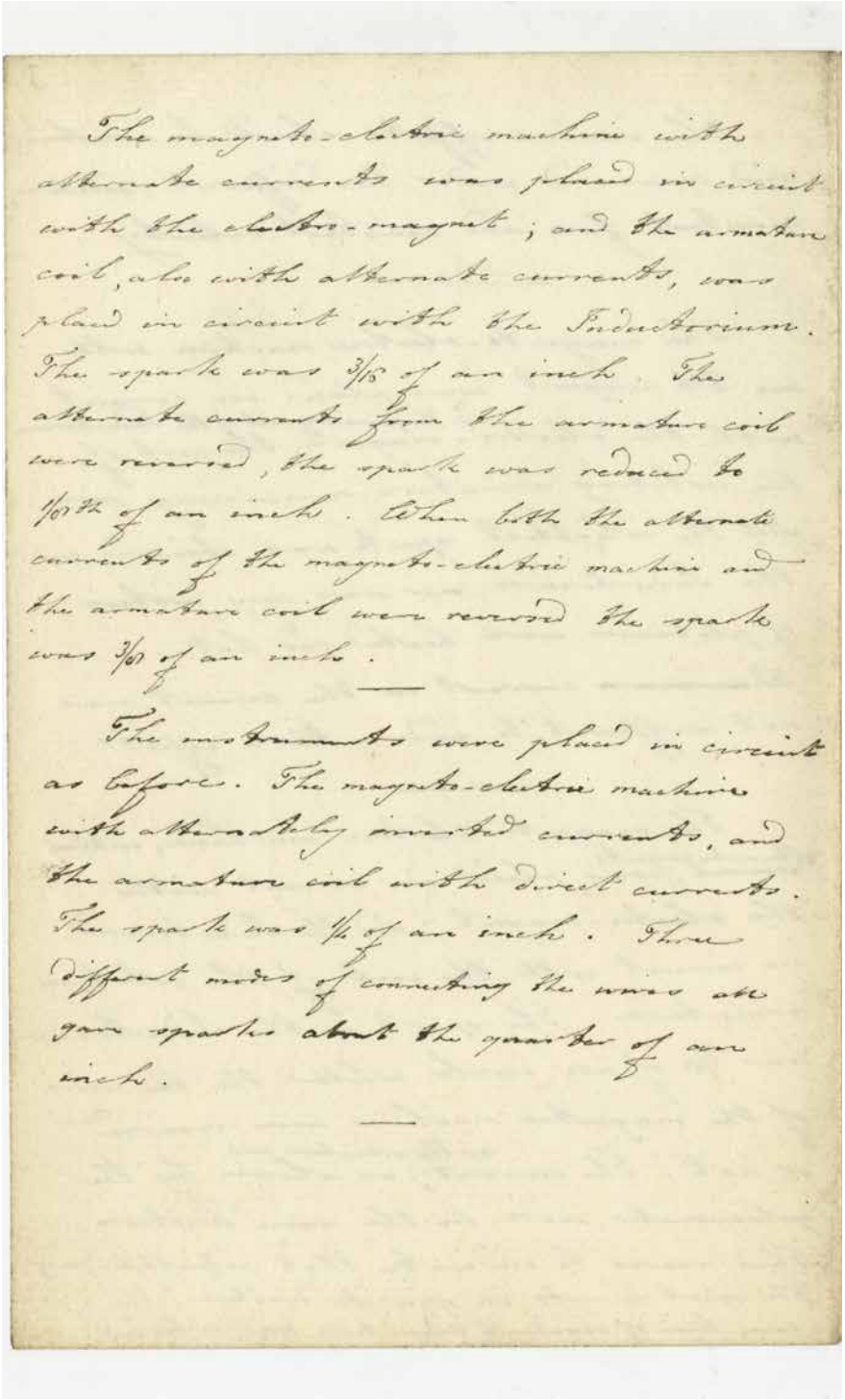
3

The various effects should be ascertained and measured under two different conditions, constant force and constant velocity.

The magneto-electric machine with one 6lb magnet was placed in circuit with the electro-magnet and the primary coil of the Inductorium, the coil of the rotating armature remaining open. Not the slightest spark was observed in the Inductorium, nor was any portion of platinum wire heated red hot. The current in the circuit was not sufficient to produce these effects.

The magneto-electric machine, without alternate magnets, was placed in circuit with the electro-magnet; and the Inductorium in circuit with the coil of the rotating armature. The spark in the Inductorium was 3/8 of an inch whether the the wires of the magnetic machine were reversed or not. The currents in the armature coil, as shown by the galvanometer, were in the same direction. This seems to indicate that notwithstanding the equal currents in opposite directions, the same kind of residual magnetism was retained.

K/PP107/3/1/33
Draft paper describing experiments conducted with an armature coil excited by a magneto-electric machine in a circuit with the electro-magnet, [1867], page 3.



The magneto-electric machine with alternate currents was placed in circuit with the electro-magnet; and the armature coil, also with alternate currents, was placed in circuit with the Inductorium. The spark was 3/8 of an inch. The alternate currents from the armature coil were reversed, the spark was reduced to 1/64 of an inch. When both the alternate currents of the magneto-electric machine and the armature coil were reversed the spark was 3/10 of an inch.

—

The instruments were placed in circuit as before. The magneto-electric machine with alternately inverted currents, and the armature coil with direct currents. The spark was 1/4 of an inch. Three different modes of connecting the wires all gave sparks about the quarter of an inch.

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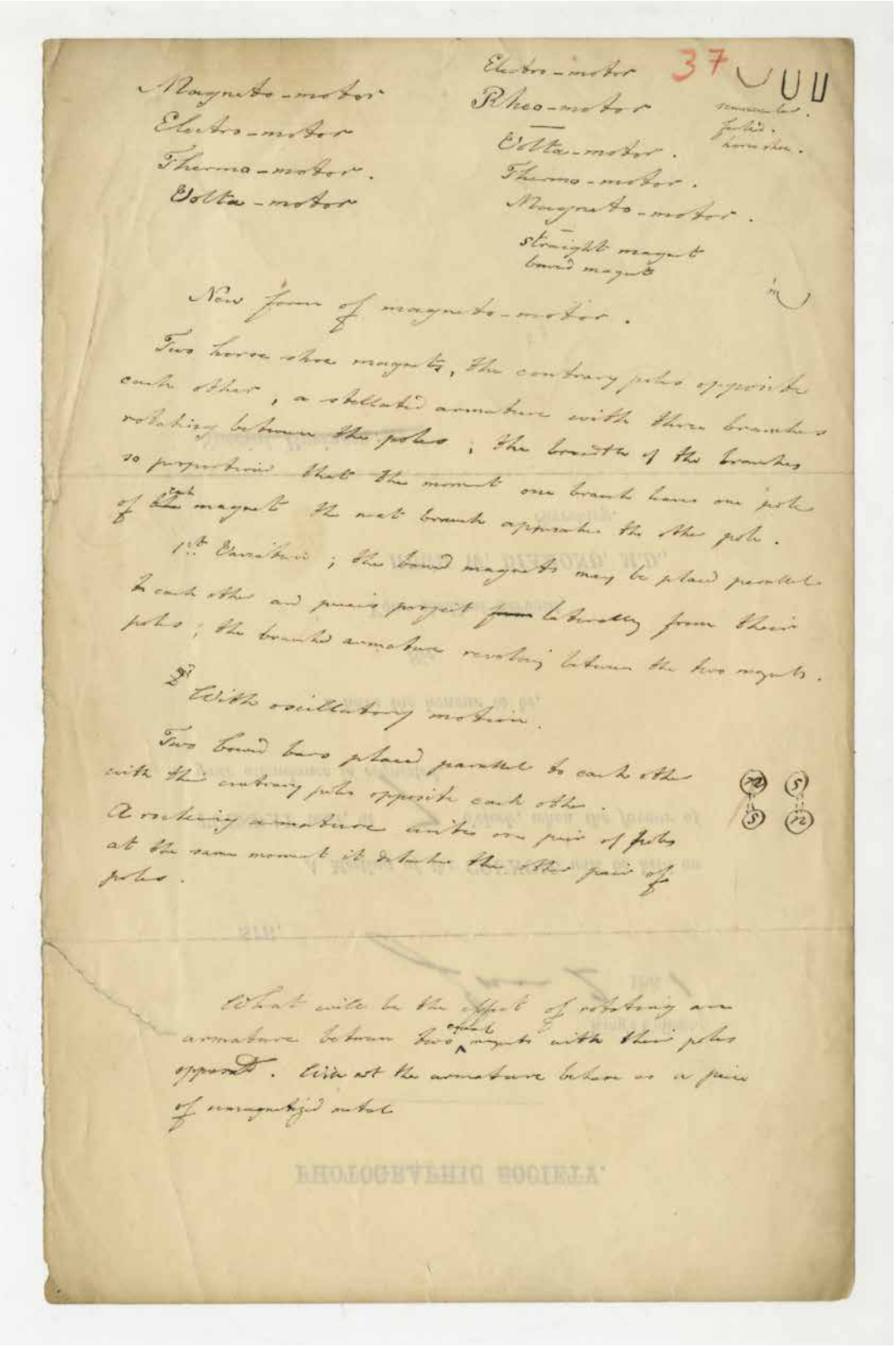
K/PP107/3/1/33
Draft paper describing experiments conducted with an armature coil excited by a magneto-electric machine in a circuit with the electro-magnet, [1867], page 4.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



Magneto-motor
Electro-motor
Thermo-motor.
Volta-motor

Electro-motor
Rheo-motor
Volta-motor.
Thermo-motor.
Magneto-motor.
Straight magnet
bent magnet

37

New form of magneto-motor.

Two horse shoe magnets, the contrary poles opposite each other, a shielded armature with three branches rotating between the poles; the breadth of the branches so proportion that the moment one branch leaves one pole of the magnet the next branch approaches the other pole.

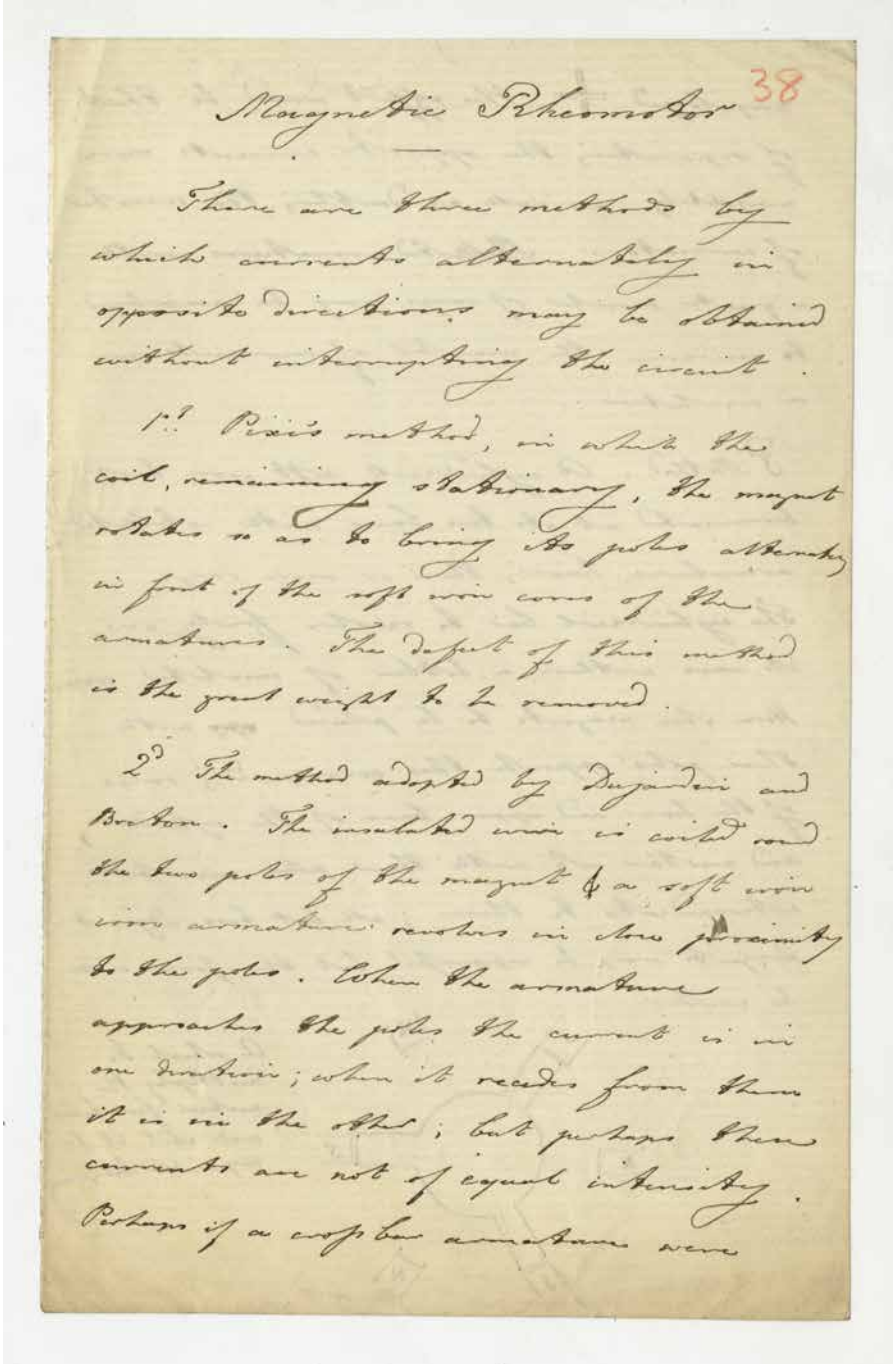
1st Variation; the bent magnets may be placed parallel to each other and their poles project laterally from their poles; the branched armature rotating between the two magnets.

2d With oscillatory motion.

Two bent bars placed parallel to each other with the contrary poles opposite each other. A rocking armature unites one pair of poles at the same moment it detaches the other pair of poles.

What will be the effect of rotating an armature between two magnets with their poles opposed. Will not the armature behave as a piece of magnetized metal

K/PP107/3/1/37
Notes including list of potential names for Wheatstone's new form of 'magneto-motor' [possibly his self-exciting generator, demonstrated to the Royal Society in 1867] including 'volta-motor' and 'rheo-motor', [1867].



Magnetic Rheomotor 38

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There are three methods by which currents alternately in opposite directions may be obtained without interrupting the circuit.

1st Pixii's method, in which the coil, remaining stationary, the magnet rotates so as to bring its poles alternately in front of the soft iron cores of the armatures. The defect of this method is the great weight to be removed.

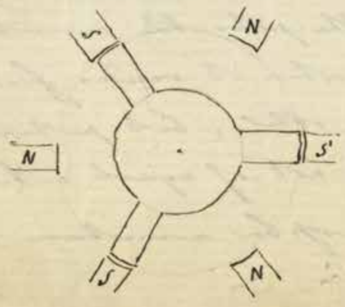
2d The method adopted by Dujardin and Breton. The insulated wire is coiled round the two poles of the magnet & a soft iron armature revolves in close proximity to the poles. When the armature approaches the poles the current is in one direction; when it recedes from them it is in the other; but perhaps these currents are not of equal intensity. Perhaps if a cross bar armature were

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics

employed ╫. The effect would be that of separating the opposite currents more completely as well as doubling the number of currents. Stellated armatures with a greater number of rays may be employed to increase the number of currents in a revolution.

3^d Method. A cylindrical soft iron bar terminated at its two bases with stellated armatures having three or more rays. The cylindrical bar to revolve freely on its axis within a bobbin of insulated wire. Three shoe magnets to be placed ~~[illegible]~~ with their poles opposite the corresponding rays of the lower and upper base of the cylinder, and another set with their poles inverted intermediate to them; all but two adjacent magnets may be suppressed but the force will be weaker

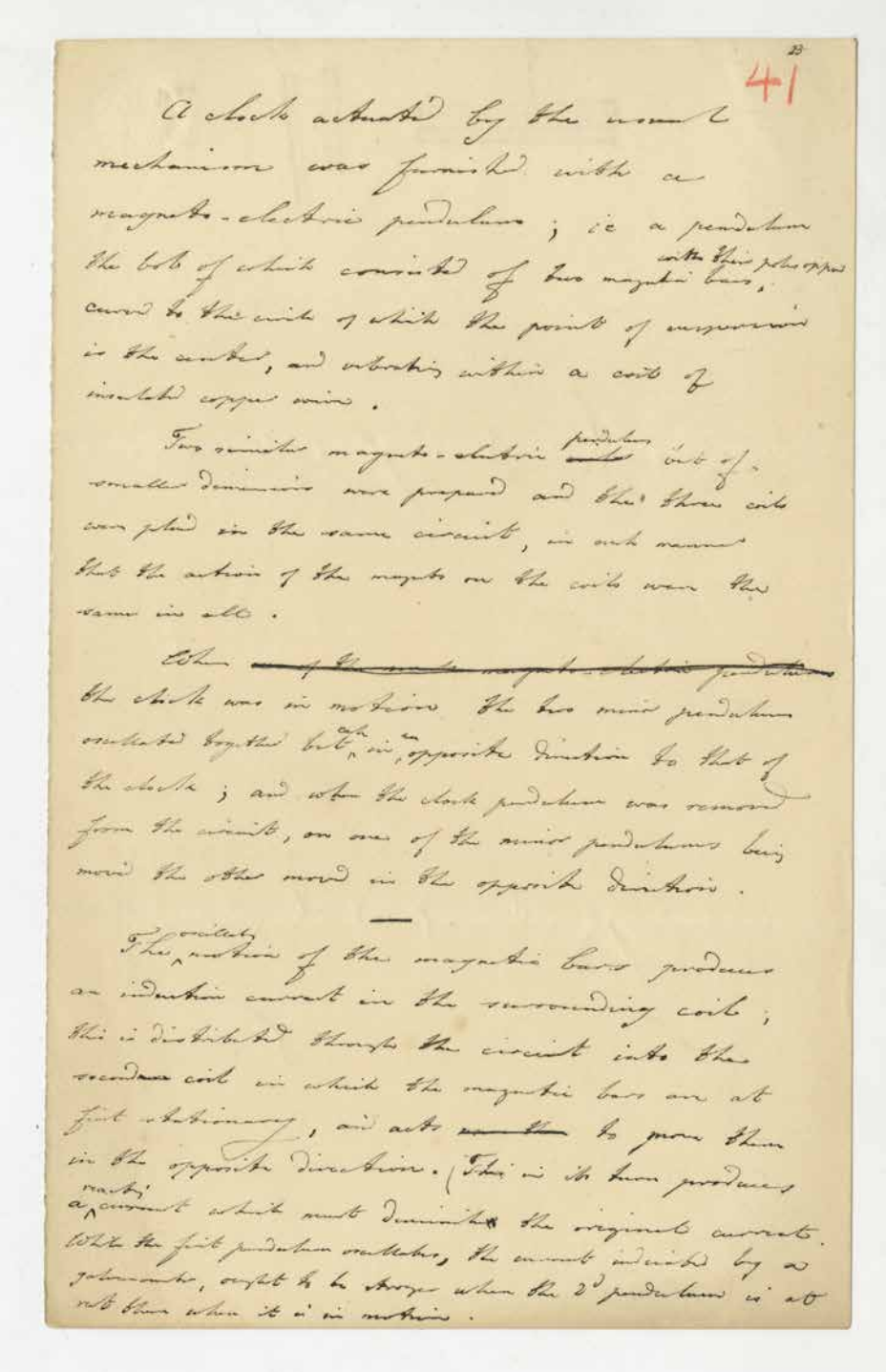


A wheel to multiply the motion five times will suit it for my watch telegraph

K/PP107/3/1/38

Notes with sketch diagrams describing different methods of obtaining currents alternately in opposite directions without breaking the circuit using a 'magnetic rheomotor' [possibly his self-exciting generator, demonstrated to the Royal Society in 1867], [1867], page 2.

King's College London Archives



23

41

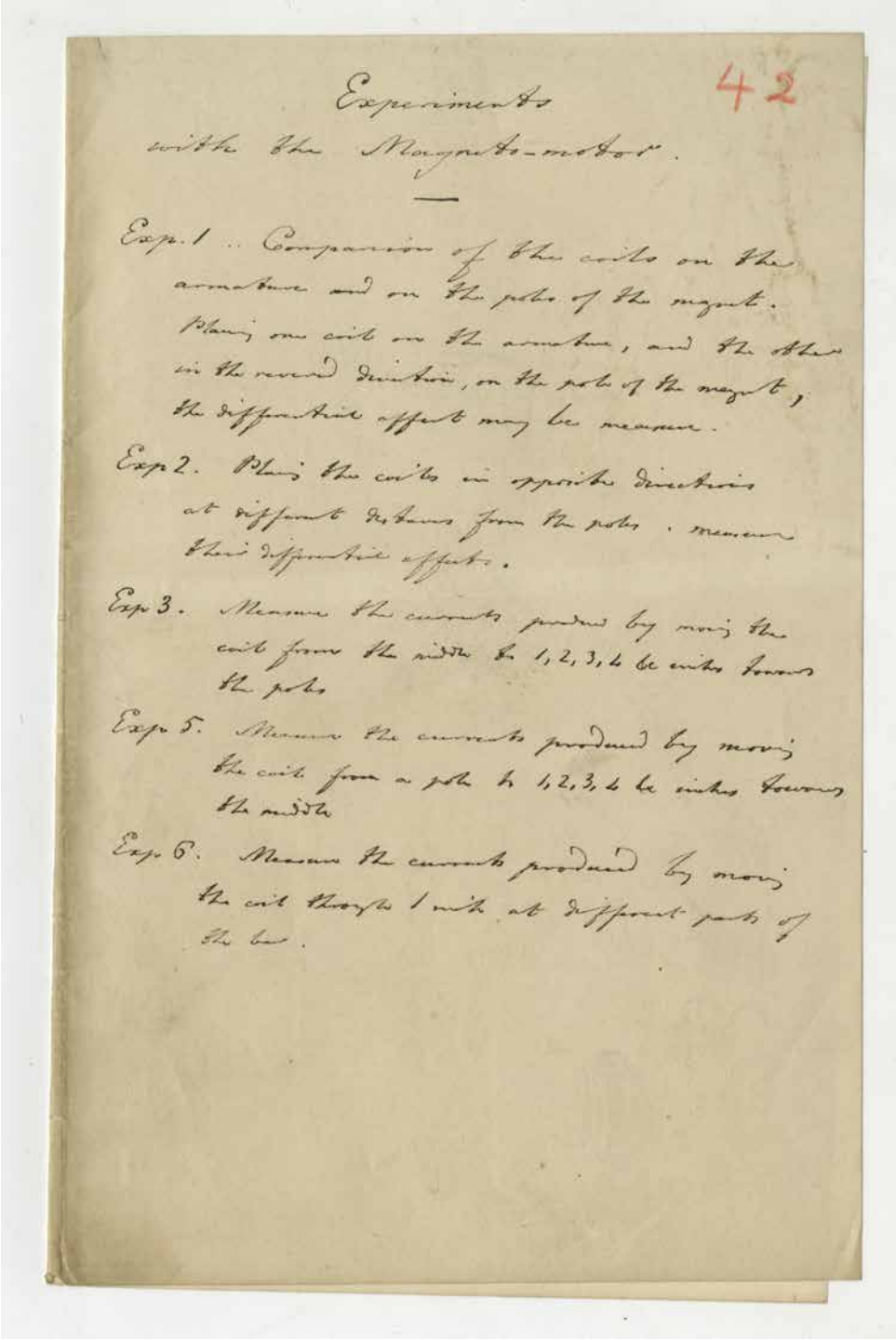
A clock actuated by the mean mechanism was furnished with a magneto-electric pendulum; i.e. a pendulum the bob of which consisted of two magnetic bars, with their poles opposed to the coils of which the points of suspension is the centre, and vibrating within a coil of insulated copper wire.

Two similar magneto-electric pendulums but of smaller dimensions were prepared and these three coils were placed in the same circuit, in such manner that the action of the magnets on the coils were the same in all.

When ~~of the magneto-electric pendulum~~ the clock was in motion the two minor pendulums oscillated together but in opposite direction to that of the clock; and when the clock pendulum was removed from the circuit, one of the minor pendulums being moved the other moved in the opposite direction.

—

The oscillation of the magnetic bars produces an induction current in the surrounding coils; this is distributed through the circuit into the secondary coil in which the magnetic bars are at first stationary, and acts ~~on them~~ to move them in the opposite direction. (This in its turn produces a reacting current which must diminish the original current. With the first pendulum oscillating, the current indicated by a galvanometer, ought to be stronger when the 2d pendulum is not at rest than when it is in motion.



42

Experiments
with the Magneto-motor.

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Exp. 1 .. Comparison of the coils on the armature and on the poles of the magnet. Placing one coil on the armature, and the other in the reverse direction, on the pole of the magnet, the differential effect may be measured.

Exp 2. Place the coils in opposite directions at different distances from the poles. measure their differential effects.

Exp 3. Measure the currents produced by moving the coil from the middle to 1, 2, 3, 4 be inches towards the poles

Exp 5. Measure the currents produced by moving the coil from a pole to 1, 2, 3, 4 be inches towards the middle

Exp 6. Measure the currents produced by moving the coil through 1 inch at different parts of the bar.

K/PP107/3/1/42
List of experiments to be conducted using a 'Magneto-motor', [1865-1870].

44

Magneto Electricity

Ascertain whether the removal of the armature from the poles produces a smaller or greater effect ~~that~~ in a coil, than moving the same coil from the pole to the middle of the magnet

Repeat the experiments with the coil sliding on the magnet with the standard galvanometer without torsion.

A solenoid outside a bar of soft iron magnetizes it, within a hollow bar it produces no effect. A magnet inside a helix produces no permanent effect, if the helix were placed inside of the magnet would a permanent current be produced in the former?
Probably not for were this experiment to succeed we should have perpetual motion.

When a solenoid is placed within a hollow soft iron is not momentary magnetism induced at the moments of making and breaking the current?

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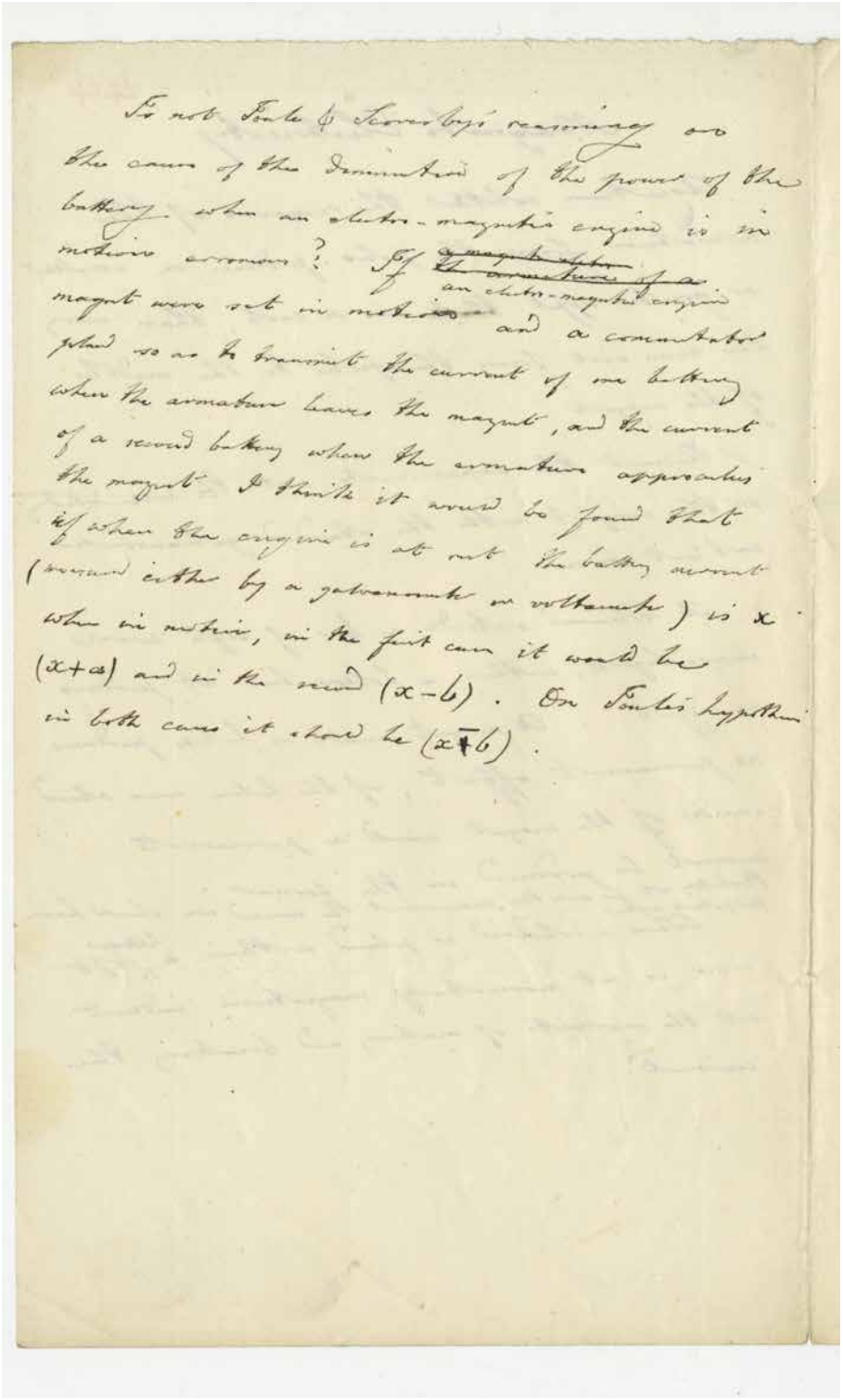

Is not Faraday & Scoresby's reasoning on the cause of the diminution of the power of the battery when an electro-magnetic engine is in motion erroneous? If ~~the armature of a magnet~~ an electro-magnetic engine were set in motion and a commutator fitted so as to transmit the current of one battery when the armature leaves the magnet, and the current of a second battery when the armature approaches the magnet. I think it would be found that if when the engine is at rest the battery current (measured either by a galvanometer or voltameter) is x when in motion, in the first case it would be (x+a) and in the second (x-b). On Faraday's hypothesis in both cases it should be (x∓b).

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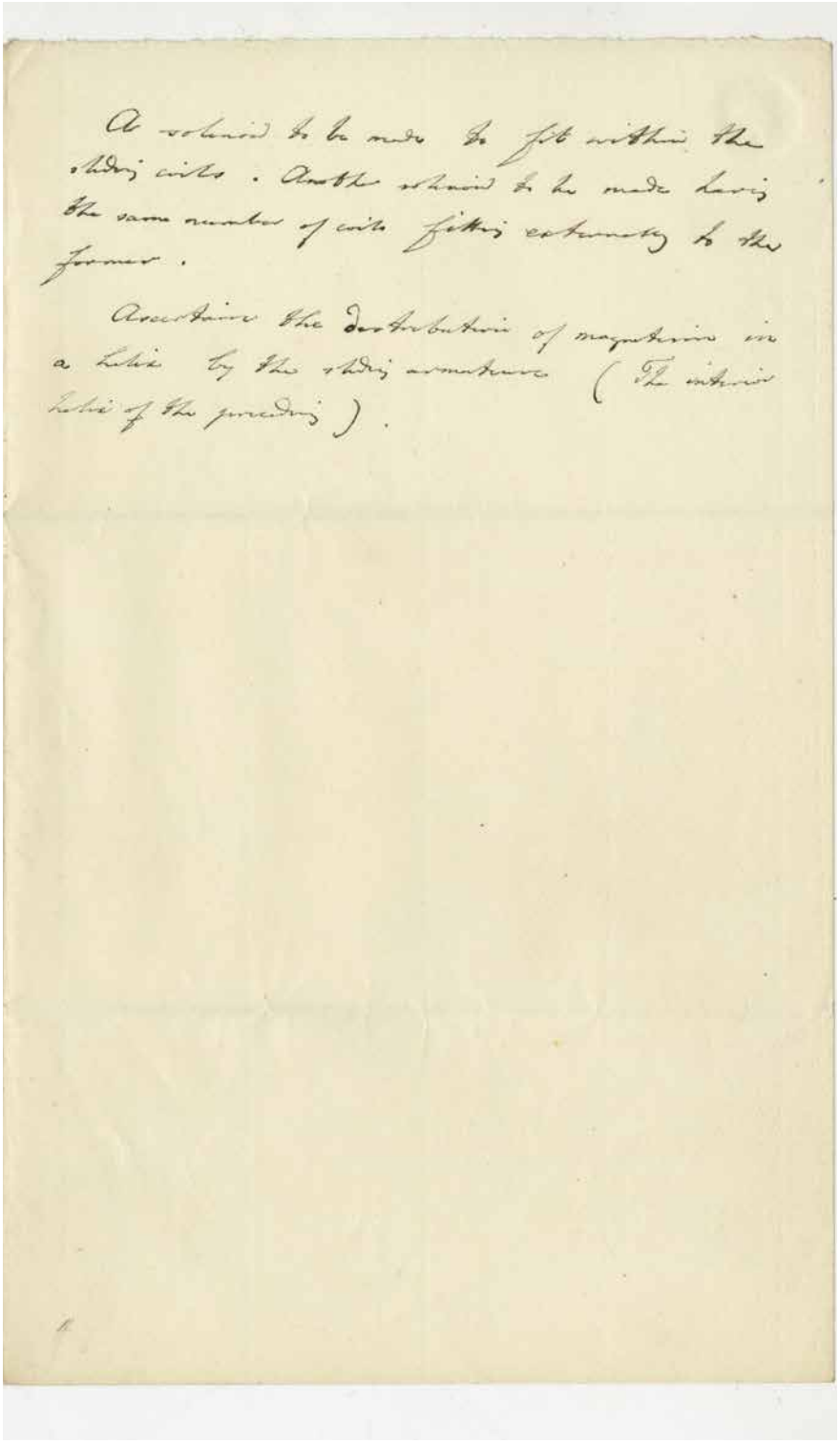


A solenoid to be made to fit within the other coils. Another solenoid to be made having the same number of coils fitting externally to the former.

Ascertain the distribution of magnetism in a helix by the steel armature (The internal helix of the preceding).

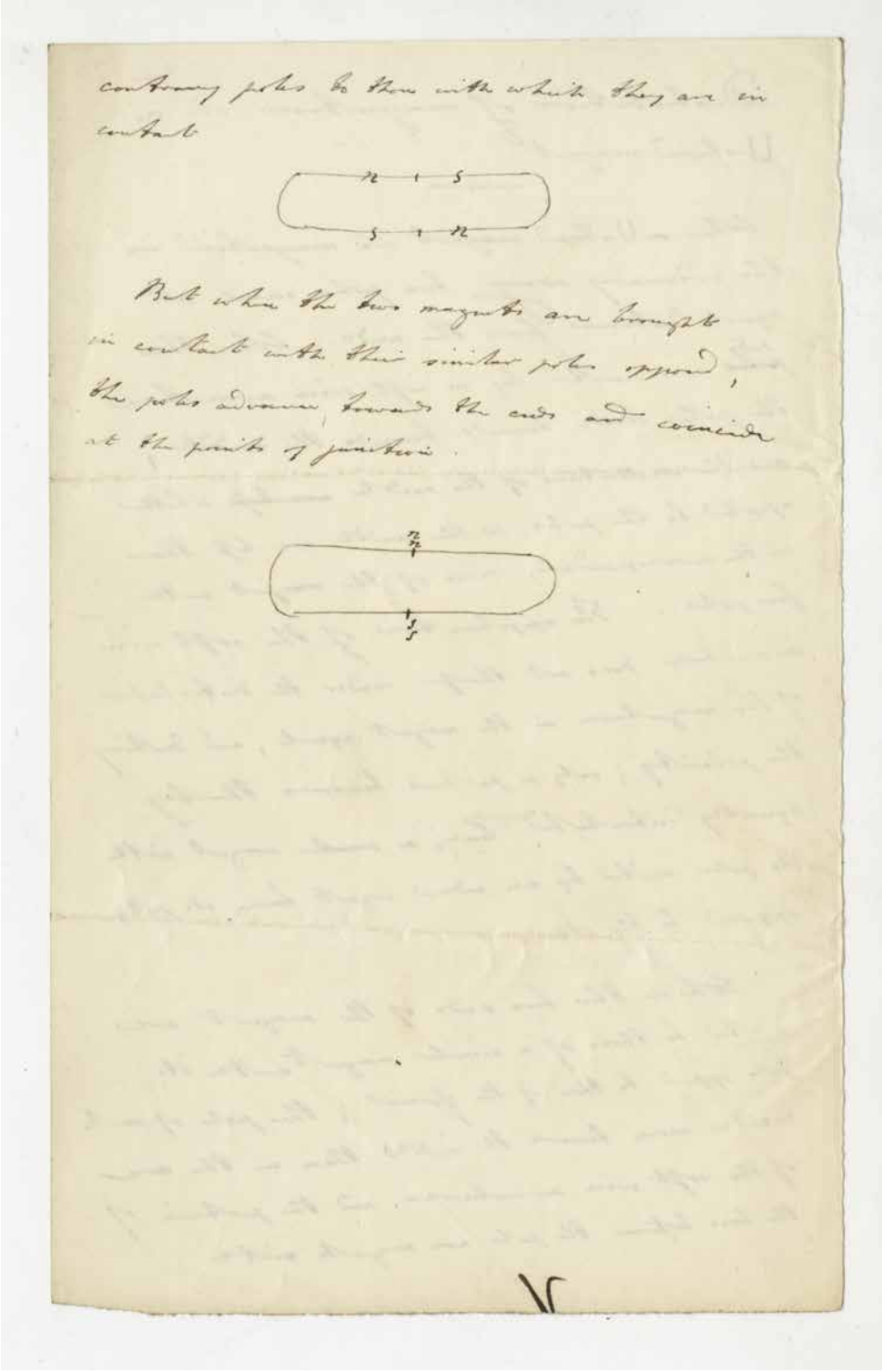
K/PP107/3/1/44
Rough notes on 'Magneto Electricity', [1839-1870], page 3.

45

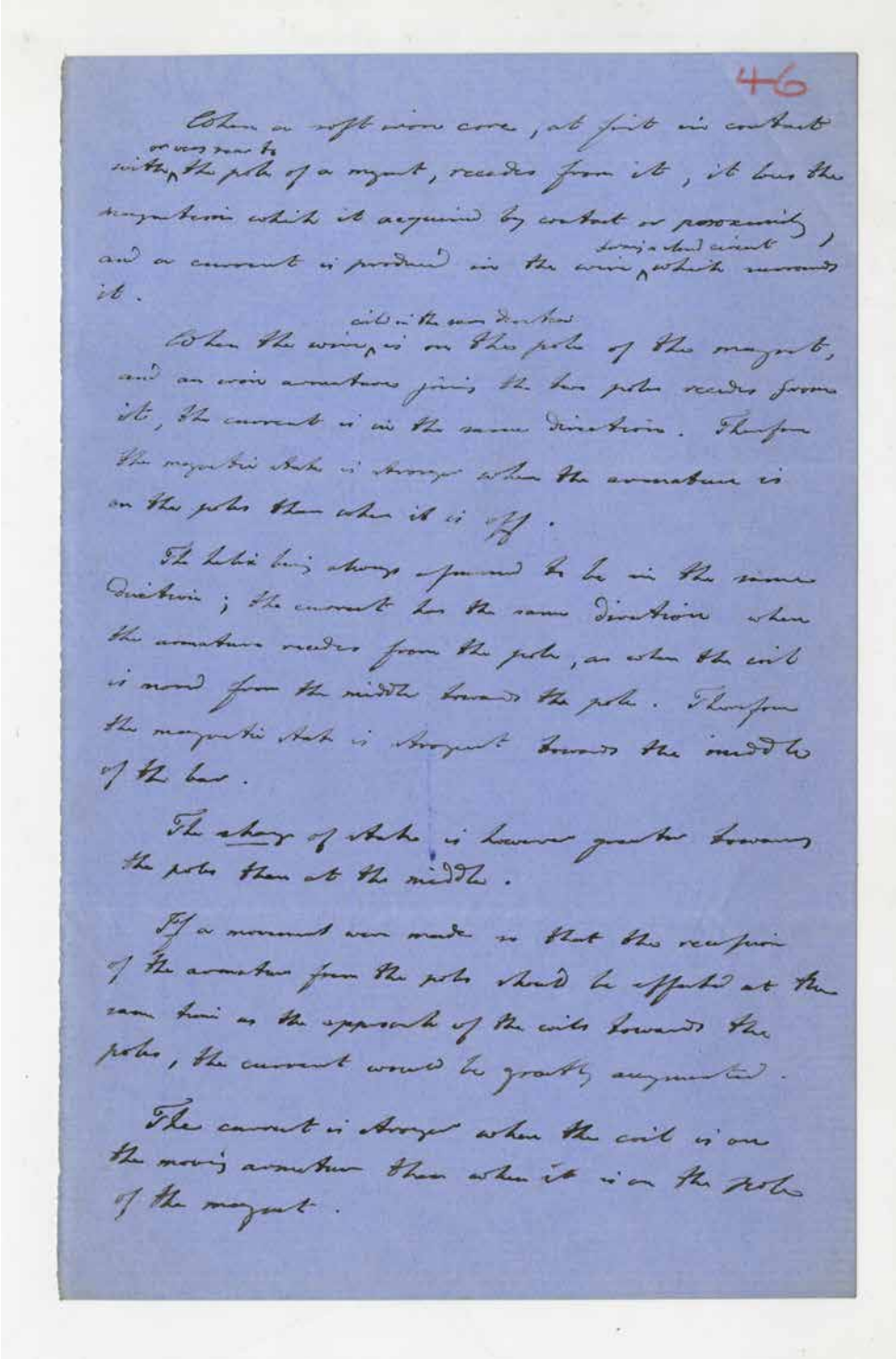
Distribution of magnetism in a U-shaped magnet.

When a U shaped magnet is magnetised in the ordinary way two poles occur at equal distances from the ends. When the ~~poles~~ ends are united by a soft iron armature the poles recede towards towards the middle, and the oscillations of the needle ~~are less~~ whether applied to the poles or the middle are less than in the corresponding cases of the magnet with free poles. The application of the soft iron armature does not therefore render the distribution of the magnetism in the magnet equal, and destroy the polarity; only a portion becomes thereby equally distributed leaving a weaker magnet with its poles united by an induced magnet having its poles opposed to the other.

When the two ends of the magnet are united to those of a similar magnet with its poles opposed to those of the former; the poles of each recede more towards the middle than in the case of the soft iron armature and the portion of the bars between the poles are magnets with



K/PP107/3/1/45b
Notes with sketch diagrams describing the distribution of magnetism in a u-shaped magnet, [1839-1870], page 2.



46

When a soft iron core, at first in contact or very near to with the pole of a magnet, recedes from it, it loses the magnetism which it acquired by contact or proximity, and a current is produced in the coil which surrounds it.

When the coil is on the pole of the magnet, and an iron armature joins the two poles recedes from it, the current is in the same direction. Therefore the magnetic state is stronger when the armature is on the poles than when it is off.

The helix being always supposed to be in the same direction; the current has the same direction when the armature recedes from the pole, as when the coil is moved from the middle towards the pole. Therefore the magnetic state is strongest towards the middle of the bar.

The change of state is however greater towards the poles than at the middle.

If a movement were made so that the recession of the armature from the pole should be effected at the same time as the approach of the coils towards the poles, the current would be greatly augmented.

The current is stronger when the coil is on the moving armature than when it is on the pole of the magnet.

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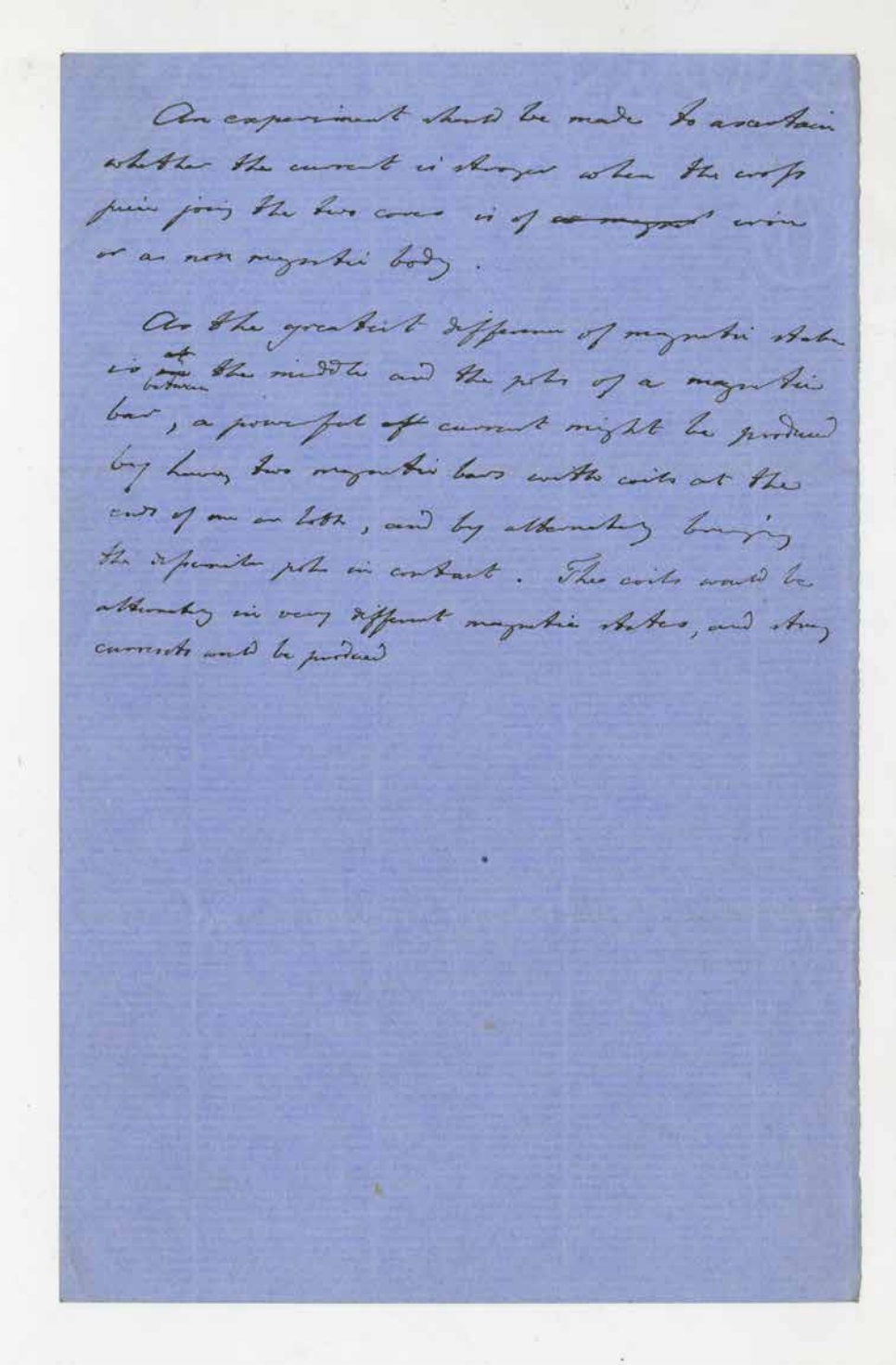
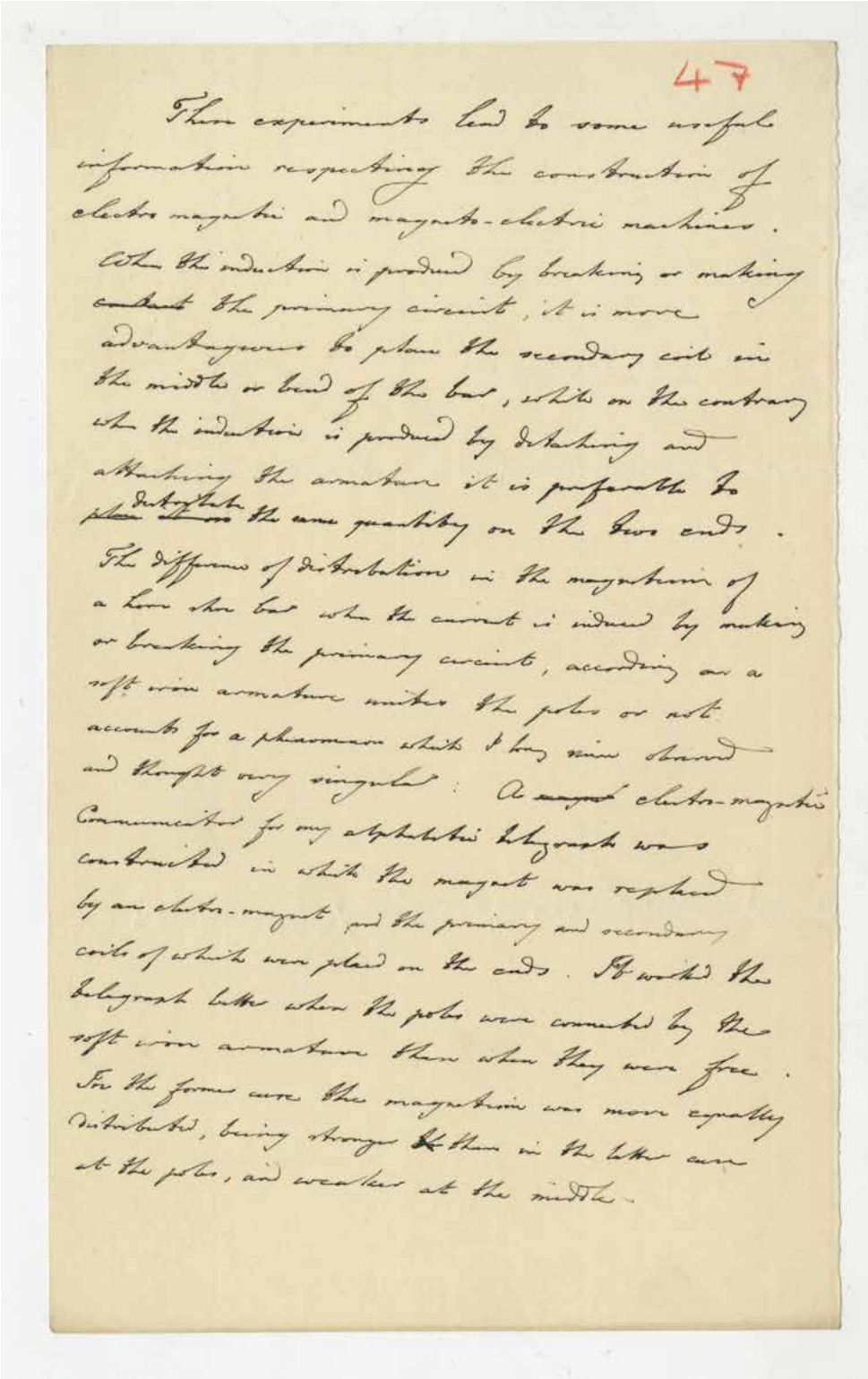


An experiment should be made to ascertain whether the current is stronger when the copper wire joining the two coils is of ~~a magnet~~ wire or a non magnetic body.

As the greatest difference of magnetic state is ~~at~~ between the middle and the poles of a magnetic bar, a powerful ~~of~~ current might be produced by having two magnetic bars with coils at the ends of one or both, and by alternately bringing the opposite poles in contact. The coils would be alternately in very different magnetic states, and strong currents would be produced

K/PP107/3/1/46
Notes describing the properties a soft iron core magnet and related experiments, [1839-1870], page 2.



47

These experiments lead to some useful information respecting the construction of electro magnetic and magneto-electric machines. When the induction is produced by breaking or making contact the primary circuit, it is more advantageous to place the secondary coil in the middle or bend of the bar, while on the contrary when the induction is produced by detaching and attaching the armature it is preferable to place ~~distribute~~ the same quantity on the two ends. The difference of distribution in the magnetism of a bar when bent when the current is induced by making or breaking the primary circuit, according as a soft iron armature unites the poles or not accounts for a phaenomenon which I long since observed and thought very singular: A magneto electro-magnetic Communicator for my alphabetic telegraph was constructed in which the magnet was replaced by an electro-magnet and the primary and secondary coils of which were placed on the ends. It worked the telegraph better when the poles were connected by the soft iron armature than when they were free. For the former case the magnetism was more equally distributed, being stronger ~~at~~ than in the latter case at the poles, and weaker at the middle.

K/PP107/3/1/47
Notes describing the use of electromagnets in experiments and in the communicator for Wheatstone's 'alphabetic telegraph', [1859-1861].

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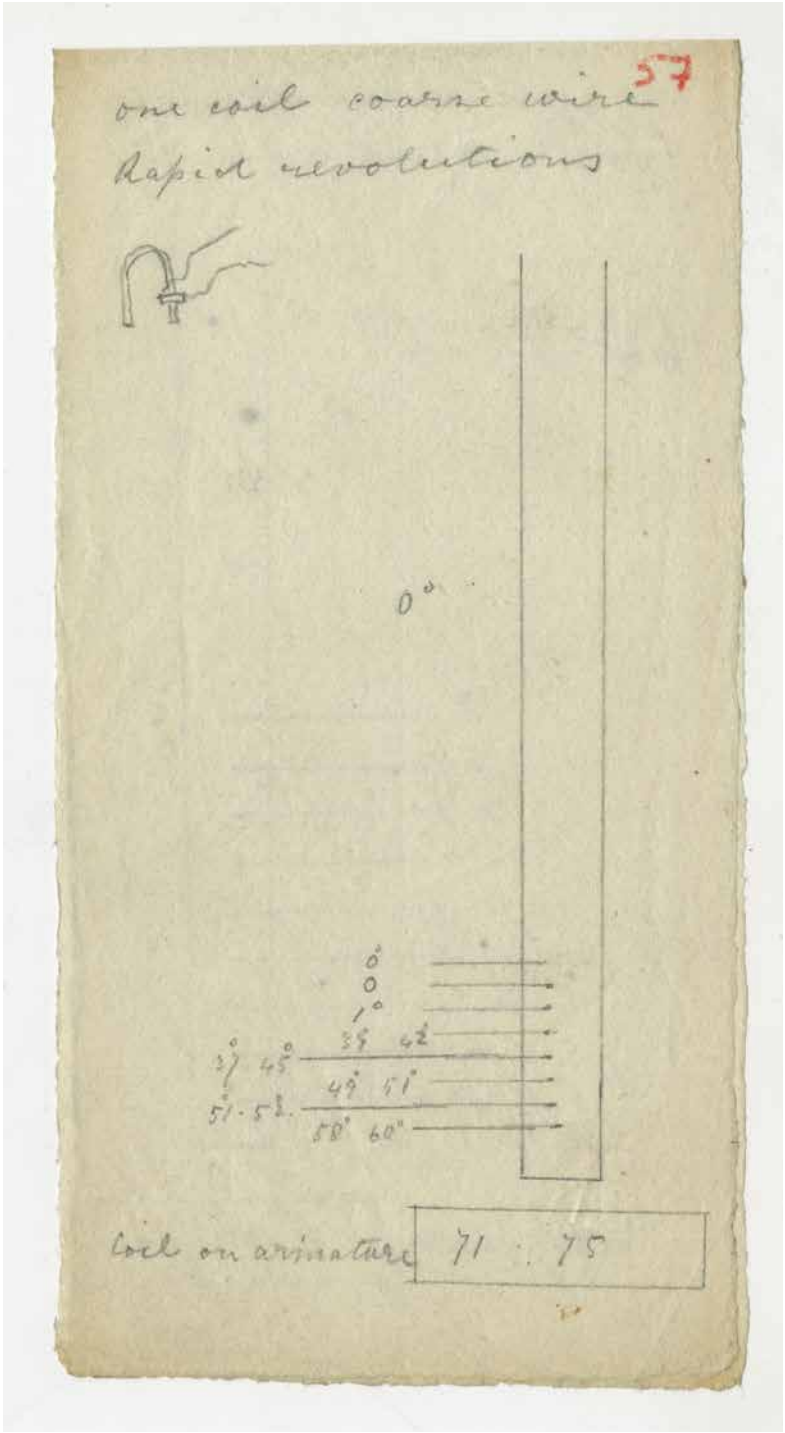
K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



K/PP107/3/1/57
Rough sketches showing details possibly of Wheatstone's weight-driven magneto [example held at the Science Museum], [not in Wheatstone's hand], [1865-1870].

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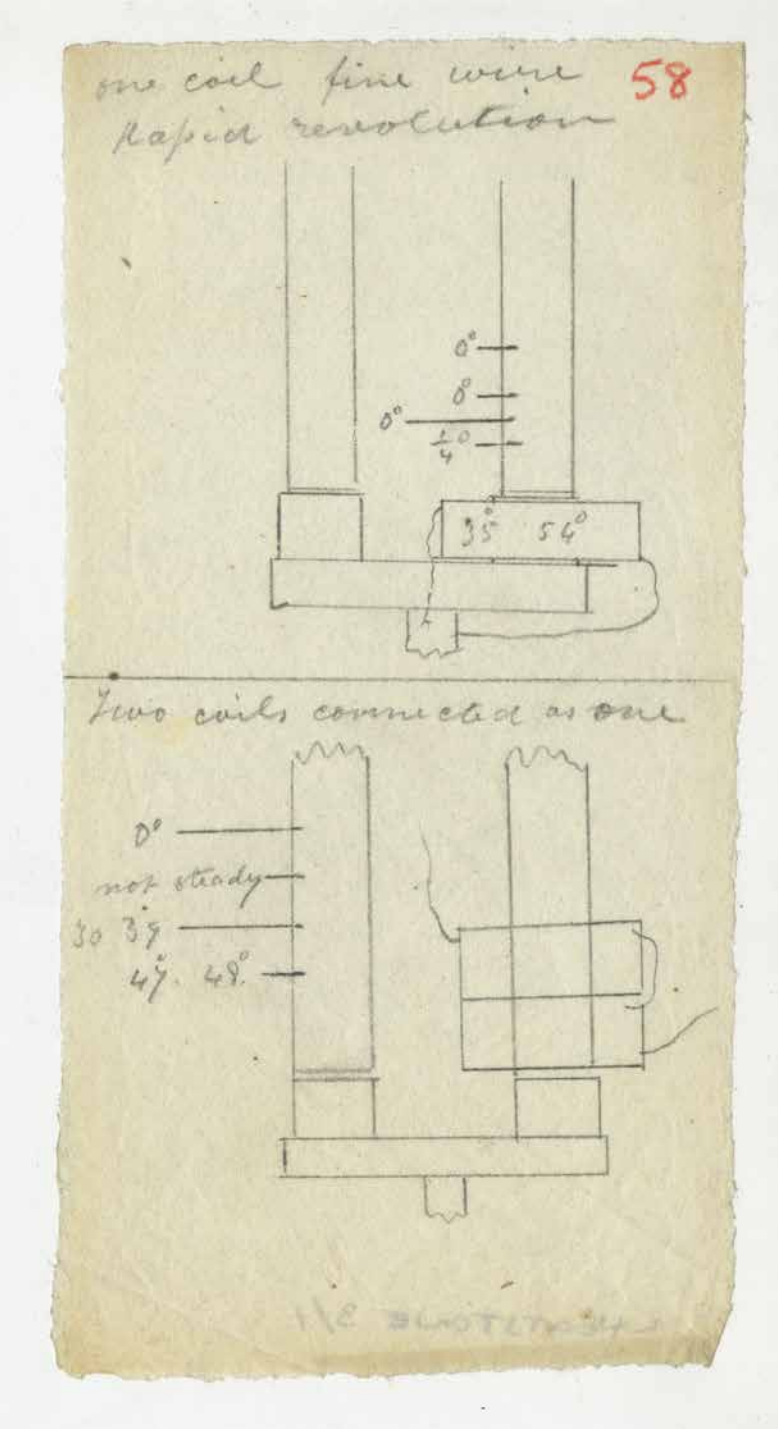

K/PP107/3/1/58
Rough sketches showing details possibly of Wheatstone's weight-driven magneto [example held at the Science Museum], [not in Wheatstone's hand], [1865-1870].

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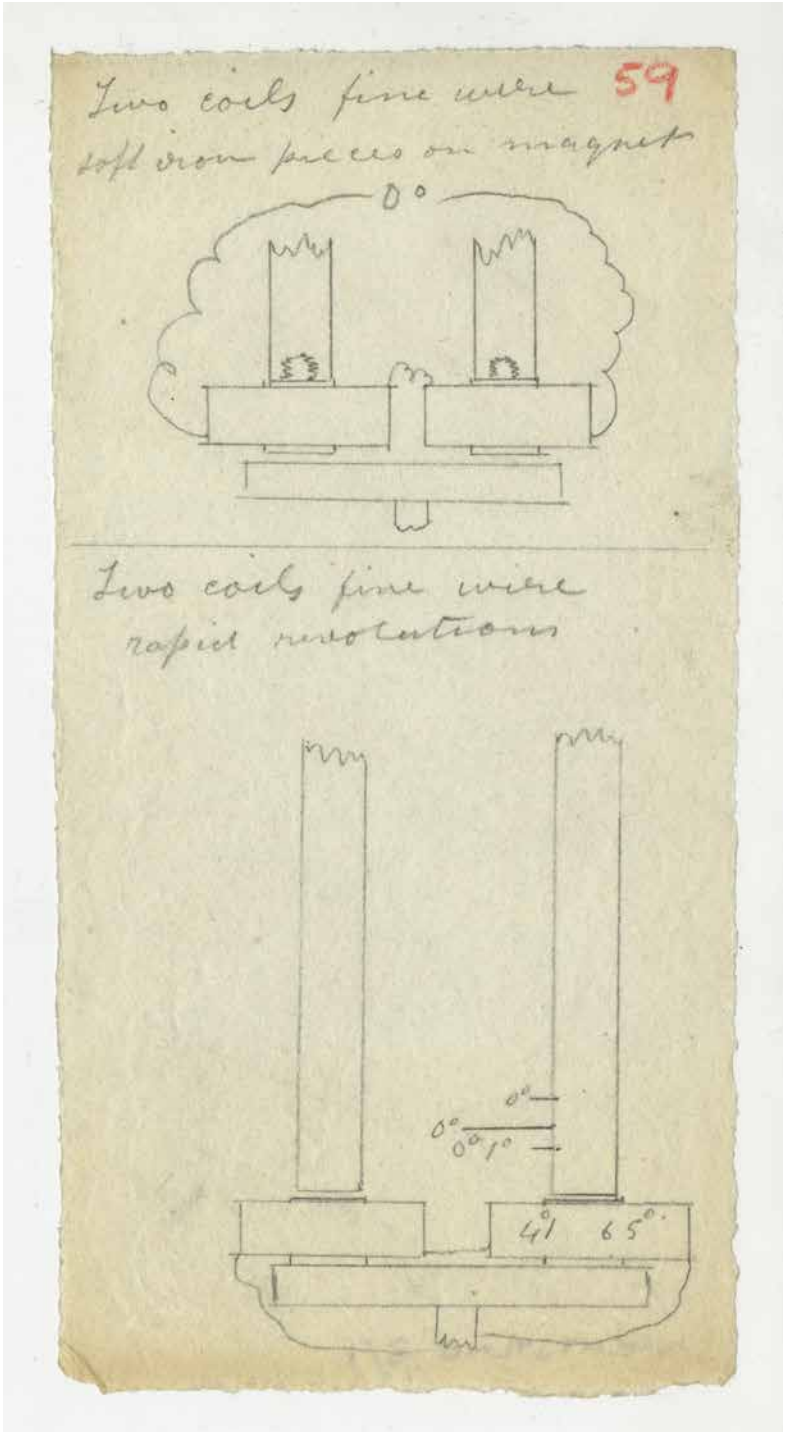

K/PP107/3/1/59
Rough sketches showing details possibly of Wheatstone's weight-driven magneto [example held at the Science Museum], [not in Wheatstone's hand], [1865-1870].

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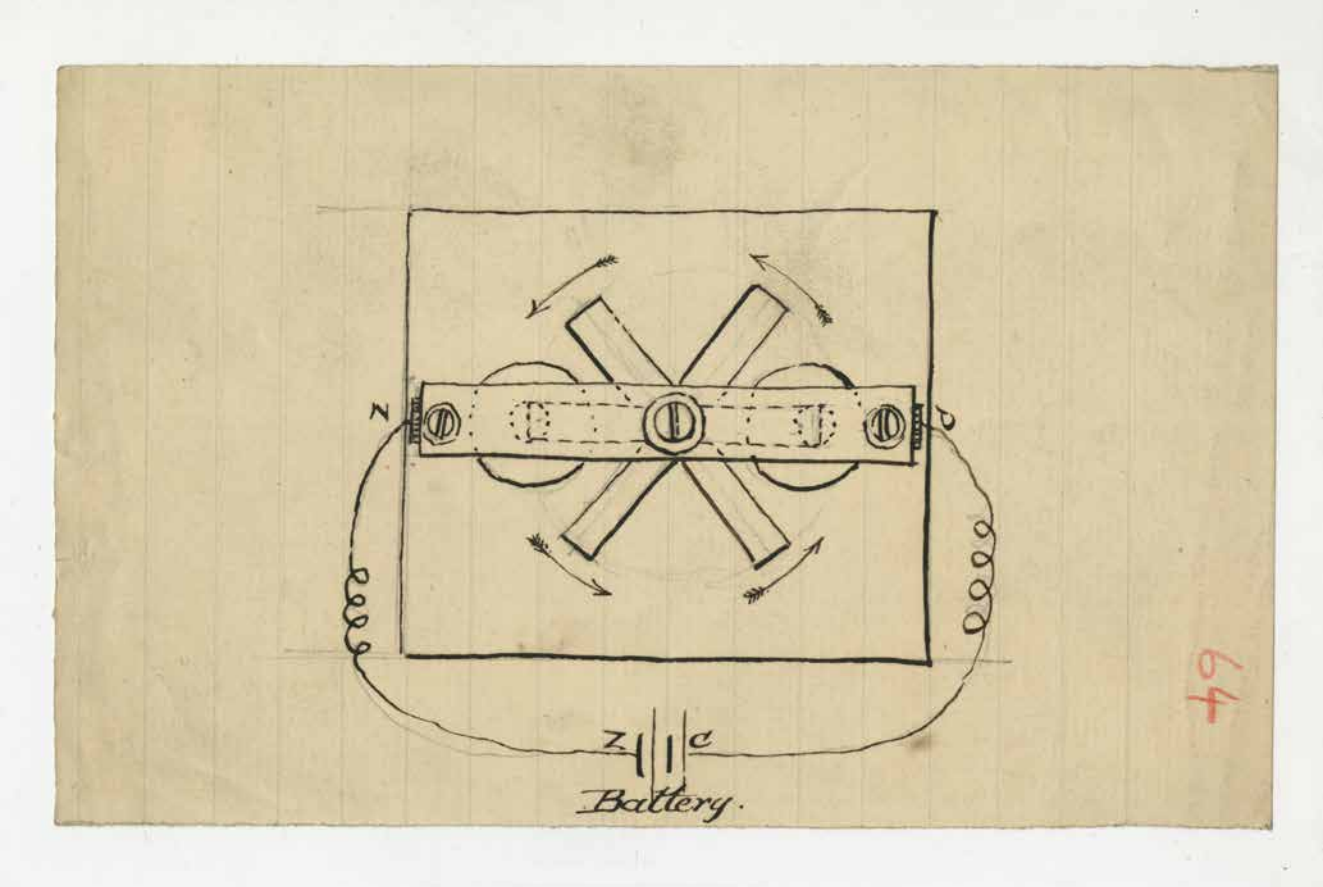
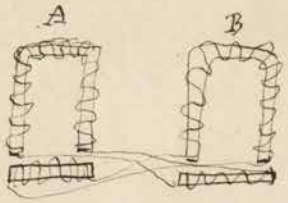
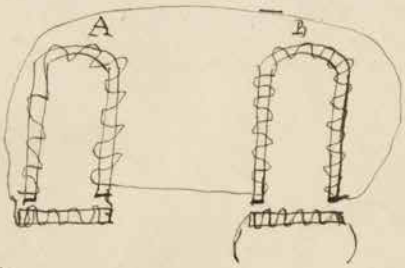


K/PP107/3/1/64
rough sketches showing details possibly of Wheatstone's weight-driven magneto [example held at the Science Museum], [not in Wheatstone's hand], [1865-1870].

Reacting Magnet 69



Two electro-magnets each with its distinct armature. The coil of the armature of A in circuit with the coil of the electro-magnet B and vice versa.



The coils of the Electro-magnets A and B in circuit with the coil of the armature of A. The coil of the armature of B independant for the purpose of producing magneto-electric effects

K/PP107/3/1/69
Notes and diagrams relating to a 'reacting magnet', [1839-1870].

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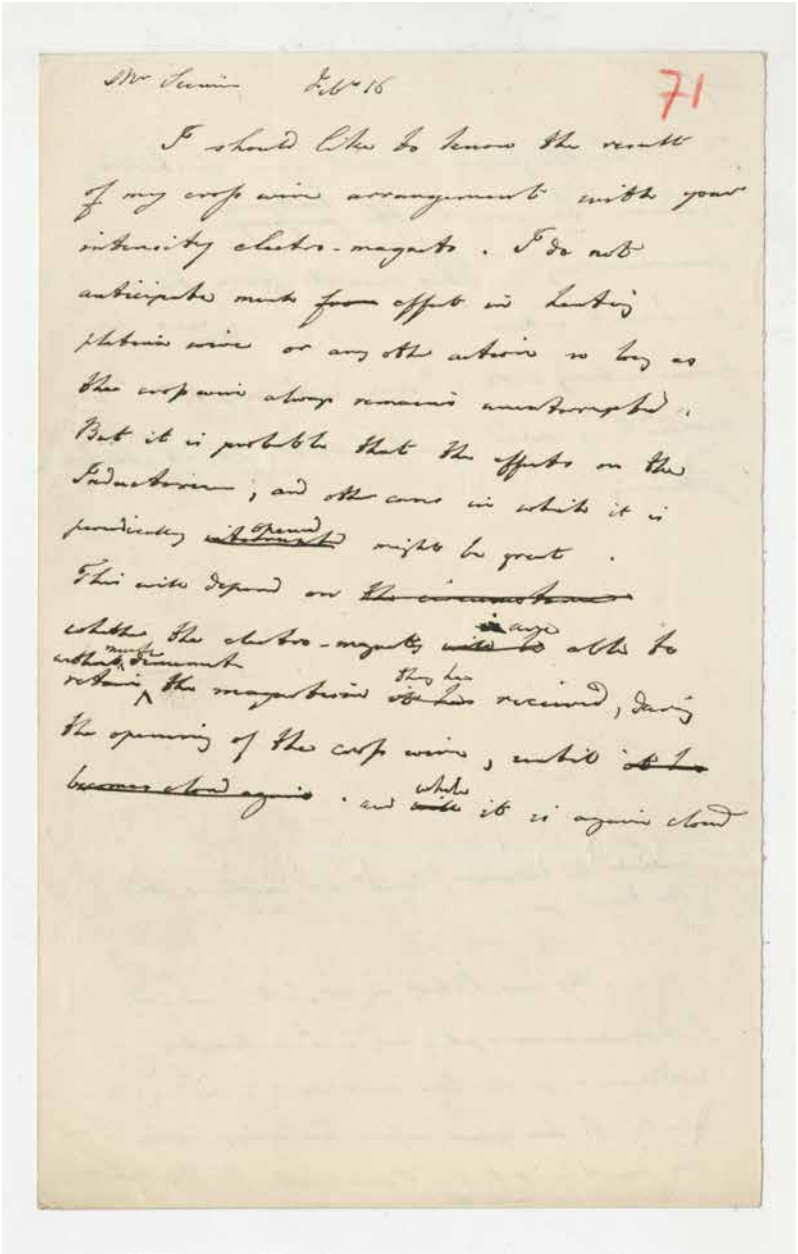
K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics



Mr Siemens Feb 16 71

I should like to know the result
of my cross wire arrangement with your
intensity electro-magnets. I do not
anticipate much from effect in heating
platinum wire or any other which as
the cross wire always remains unbroken.
But it is probable that the effects on the
Inductorium; and other cases in which it is
powerfully ~~[illegible]~~ might be great.
This will depend on ~~the circumstance~~
whether the electro-magnets will be able to
retain the magnetism they have received, during
the opening of the cross wire, which ~~it will~~
~~become steel again~~. and while it is again closed

K/PP107/3/1/71
Rough draft of a letter to Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, asking for the results of experiments using a cross wire arrangement on Siemens' 'intensity electro-magnets', [1867] Feb 16, page 1.

The Papers of Charles Wheatstone

K/PP107/3/1 - Papers relating to electricity, magnetism and thermodynamics

In the paper I sent you yesterday
please to omit the sentence ~~passage~~
commencing "This results from the
persistent action" . . . . and
terminating with "an interrupted
circuit", and substitute for it the
following.

whether the Submarine Compn are made with
the French Govt

My new Patent is at last secured
I shall ~~[illegible]~~ place my ~~new~~ automatic
instrument on the line next week; and I hope
shortly to ~~[illegible]~~ inform you when you
may expect me at Paris. I am waiting for the result
of the arrangement ~~[illegible]~~

K/PP107/3/1/71

Rough draft of a letter to Charles William [Karl Wilhelm] Siemens (1823-1883), electrical engineer and metallurgist, asking for the results of experiments using a cross wire arrangement on Siemens' 'intensity electro-magnets', [1867] Feb 16, page 2.