coil and a hollow magnet free from the objections of the filings becoming magnetized.[1]

See page 227 & 229[2]

In all the experiments with spirals and the galvanic battery I have never obtained any change of direction. See p. 203[3]

Tried to get a tertiary current with the circuit open as in the case of page *265*[4] with galvanism but did not succed with hard needles. Tried this again with needles which had been softened in the flame of the spirit lamp but with the same result. Try this exp with the secondary

[1] There are two parallel horizontal lines in the left margin next to this paragraph, presumably placed there by Henry to emphasize the importance of this experimental technique.

[2] A reference to the experiments on the distribution of magnetism around hollow metal cylinders conducted on November 4, 1841, and recorded in the "Record of Experiments" entry of that date, printed above.

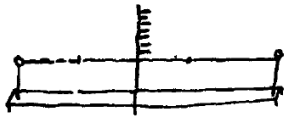
[3] Henry is referring to the "Record of Experiments" entry of October 7, 1841, above, where he had previously conducted experiments with spirals and galvanic electricity.

[4] This is a reference to the final experiments of the preceding entry.

"RECORD OF EXPERIMENTS"

Henry Papers, Smithsonian Archives

May 31st 1842
Magnetization of needles by the electrical discharge[1]



Arranged between the balls of the universal discharger a wire of platina 1/[. . .][2] of an inch in diameter and 14 inches long connected at its two ends with the plated wire ¼ of a millimetre in diameter.

1 Placed needles so as to be perpendicular to the wire and also perpendicular to the magnetic meridian. Made the discharge from 2[3] sparks. The needles were *plus* magnetized to the 5th needle the distance was ½ an inch between each needle

2 Repeated the same experiment with the same result the needles were all magnetized plus to the 5th one after this no magnetism.

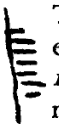
[1] In these experiments, Henry is attempting to confirm Savary's findings of reversals in polarity according to the distance of the needle from the wire.

[2] Henry neglected to record the denominator of the fraction.

[3] Given the magnitudes of the discharges in the other experiments, Henry probably meant 200 sparks.

3 Again with a larger charge 275 the platina wire was now deflagrated but the result was the same as the last

4 Next substituted for the fine wire of the last arrangement the plated wire of the same length 4½ feet. The needles were again placed transversely at the distance from each other of ½ an inch. The charge being 200 all the needles *10* in number were found magnetic. The 5th needle was magnetized minus, the others all plus. It is not improbable that the fifth needle was slightly magnetized before the experiment.



5 Repeated the same experimt charge the same arrangement of needles the same now all the needles to the 13th were magnetized and *plus*—no change. The magnetism decreased from the 2nd to the last needle

6 Repeated the same exp with larger needles no 3. The magnetism now extended only to the 8th needle.

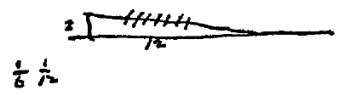
7 It is evident from the foregoing experiments that the magnetism is perceptible at a greater distance with fine needles than with coarse and that the second wire gives a greater effect than the first

8 Repeated the same exp. with fine needles found all magnetized to the 13th *plus* beyond this magnetism uncertain—the charge was now 350.

9 Increased the length of the wire to that of [. . .][4] feet procured new needles all of the same size No 10. The needles were all magnetized *plus* to the 12th needle—charge 250

10 Next charged the batteries to the amount of 250[5] sparks all the other circumstances remaining the same as in the last experiment. Needles magnetized to the 10th all *plus*—discharge not good.

11 Next charged the battery to the extent of 275 sparks now found that 15 needles were magnetized—the magnetism gradually increasing from the 2nd needle until the 15th all *plus*. It should be noted in these experiments that the needle in contact with the wire in all cases was very little magnetized and that the second needle was the one which receved the maximum of developement.

12  Next inorder to detirmin if there were any changes in the magnetism of the needles between the 1st and 2nd needles

[4] Left blank.

[5] It appears that Henry originally wrote "350," then wrote a "2" over the first digit of the number.

of the last experiment I placed the needles along the wire as shown in the figure, 11 in number. They were all magnetized *alike plus*. The first was in contact with the wire and each one 1/12 of an inch above the preceding one

The following are the relative strengths of the magnetism of the needles in exp 11[6]

no 2[7]—0 No 2—9 no 3 9 no 4 9¼ no 5—8° no 6 9½ n 7—0 No 8 4° 9 4° 10 2½° These are statical deflections see next page. The following are the relative intensities of the needles in the exp 12 last page

No 1—19° No 2 19° No 3—17½ No 4—22½ No 5 21 No 6 26 No 7 24° No 8 23 No 9 25° No 10 25 No 11 26°

Charge 275 wire 7½ feet long

no[8] of the needle	dist	deflect	no of the needle	dist	deflect
1	0	7 +	13	12	15 +
2	1	23° +	14	13	14½ Do
3	2	27 Do	15	14	13 Do
4	3	22 Do	16	15	13
5	4	27 Do	17	16	12½ Do
6	5	17 Do	18	17	15 Do
7	6	23 Do	19	18	12½ Do
8	7	18	20	19	11 Do
9	8	19 Do	21	20	10 Do
10	9	17 Do	22	21	10¼ Do
11	10	17 Do	23	22	12½ Do
12	11	16 Do	24	23	11

The above results were obtained by placing a series of needles on the same piece of lath at the distance of ½ an inch from each other inclined to the

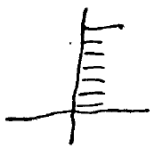
[6] This data does not match Henry's written account of the eleventh experiment, which reported "the magnetism gradually increasing from the 2nd needle until the 15th." We are uncertain whether Henry meant to write that the magnetism in experiment 11 was gradually decreasing, or that this data belongs to another experiment. In the latter case, it is possible that these are the statical deflection readings for experiment 12, to be compared to the initial deflection readings which follow on the next page of the manuscript.

[7] An obvious slip of the pen. Henry meant needle 1.

[8] In this table, and in similar tables that follow, we have eliminated the vertical rules that appear in Henry's manuscript. In a few cases we have added a horizontal rule to set off a table from the text.

axis of the same wire used in the last experiment. The first needle was in contact with the wire <*the second one 1/12 of an inch above the wire*>. The last end of the stick was 2 inches from the wire and consequently the several needles were each 1/12 of an inch above the other

In the above experiment the deflection is the initial deflection. This I find to be about as accurate as the statical deflection and is incomparably more expiditious to be used.[9] The small degree of magnetism of the first needle is shown in the above experiment very conspiciously. Needle placed against a piece of glass



Charge the batteries with 275 sparks placed the needles on the lath perpendicular to the meridian and in the same vertical plane. Then introduced into the circuit a tube with about ¼ of an inch of water between the balls. The tube was broken into powder and the peces scattered about. The following is the result of the magnetism

Small needles no 10

no of the needle	Dist from wire	deflec	no	dist	deflec
1	0	0	9	4	0
2	½ inch	0	10	4½	0
3	1	15°+	11	5	0
4	1½	0	12	5½	0
5	2	0	13	6	15+
6	2½	0	14	6½	17½+
7	3	5+	15	7	18+
8	3½	10+	16	7½	23+
			17	8	28+

In the above expermt the tube of water was placed on the negative side of the fine wire. This result is so curious that I will repeat the experiment again.

[9] Judging by a survey of natural philosophy texts, the terms "initial deflection" and "statical deflection" were not in common use in Henry's day. We believe that Henry used the former to indicate the initial displacement of the magnetometer needle from the zero point. The latter probably refers to the final resting point of the needle. Using initial deflections would be much faster.

May 31, 1842

Needles the same

no of needles	dist from wire	Deflection	no of needles	dist	deflect
1	0	0+	13	6	0
2	½	17+	14	6½	0
3	1	16+	15	7	0
4	1½	12+	16	7½	0
5	2	10+	17	8	0
6	2½	7+	18	8½	0
7	3	3+	19	9	0
8	3½	2+	20	9½	0
9	4	very slight +	21	10	0
10	4½	" +	22	10½	0
11	5	" +	23	11	0
12	5½	" +	24	11½	0

The place of the tube in this exp. was supplied by a cup of water the crack was louder than before but the magnetic effects quite different from those of the last experiment

Wire 7½ feet long small needles No 10 charge 275

no of n	dist	defl	No of n	dist	defl
1	0	4+	13	6	12+[10]
2	½ inch	20+	14	6½	feeble +
3	1	16+	15	7	0
4	1½	16+	16	7½	0
5	2	9+	17	8	0
6	2½	8+	18	8½	0
7	3	6+	19	9	0
8	3½	5+	20	9½	0
9	4<½>	4+	21	10	0
10	4½	3+	22	10½	0
11	5	very feeble +	23	11	0
12	5½	" +	24	11½	0

[10] This figure is clearly a slip of the pen.

Here the magnetism diminishes gradually after the second needle. The effect ends with the 12th needle.

I have been careful in all the experiments of to day to place the needles perpendicular to the magnetic meridian so as to nutralize or rather prevent any action of the earth.

Next changed the wire, substituted a thicker one of copper 1/[. . .][11] of an inch in diameter same length 7½ feet. Charge 275

No	Dis	def	no	dis	def
1	0	0	11	5	1°+
2	½ inch	20+	12	5½	very feeble +
3	1	15+	13	6	0
4	1½	12+	14	6½	0
5	2	11+	15	7	0
6	2½	10½+	16	7½	0
7	3	8½+	17		
8	3½	7½+	18		
9	4	4+	19		
10	4½	2+	20		

[11] Left blank.

"RECORD OF EXPERIMENTS"

Henry Papers, Smithsonian Archives

June 1st 1842
Magnetization of needles by elect discharge

From the last experiment it appears that the thike wire does not give as great a developement of magnetism as the thinner. In this experiment [just][1] as in those with the thin wire the needle in contact is not magnetized.

[1] A hole in the paper.