ment. The method of the magnetic rise seemed in some instances to give a decrease of the order of 1% in a field of 8000 gauss, while the method of the maximum couple gave with the cylindrical pole-pieces up to 12000 gauss only a very small systematic deviation and with the conical pole-pieces (16000 gauss) the deviation was scarcely appreciable.

The solid oxygen ellipsoid with which a much lower temperature was reached seemed to give a small decrease at 16000 gauss; it is possible, however, that a greater deviation is obscured by the correction for the non-uniformity of the field. We consider, however, that, assuming that the experiments were accurate to within 1% the change of the susceptibility with the field up to 16000 gauss remains within the limits of experimental error. This is in agreement with the theory of LANGEVIN, if this, notwithstanding the deviation from CURIE's law, is still applied.

Physics. — "*The magneto-optic* KERR-*Effect in ferromagnetic compounds and alloys*". By STANISLAW LORIA. (Communication from the Bosscha-Laboratory).

It has been shewn by KAZ [1]), RIGHI [2]), KUNDT [3]), SISSINGH [4]), ZEEMAN [5]) and also by KERR [6]) himself that the phenomenon discovered by the last named in 1876 depends not only on the orientation of the reflecting surface with respect to the magnetic vectors, but also (in a somewhat complicated manner) on the angle of incidence and the position of the plane of polarization of the incident beam. In the simplest and by far the most important case of almost normal incidence of light polarized perpendicularly or parallel to the plane of incidence, the reflected light in general is elliptically polarized according to RIGHI [7]); the rotation of the major axis of the ellipse depends on the magnetisation and the wave-length.

According to the measurements made by DU BOIS [8]) it is in every case proportional to the former; as regards the variation with the

1) P. C. KAZ, Diss., Amsterdam 1884.

2) A. RIGHI, Ann. de Chim. et Phys. (6) **4** p. 433, 1885.

3) A. KUNDT, Wied. Ann. **23** p. 228, 1884; **27** p. 199, 1886.

4) R. SISSINGH, Arch. Néerl. (1) **27** p 173, 1894.

5) P. ZEEMAN, Leiden Comm. no. 15, 1895; no. 29, 1896. Arch. Néerl. **27** p. 252 1894.

6) J. KERR, Phil. Mag. (5) **3** p. 339, 1877. Phil. Mag. (5) **5** p. 161, 1878.

7) A. RIGHI, Ann. de Chim. et Phys. (1) **9** p. 120, 1886.

8) H. DU BOIS, Wied. Ann. **39** p. 25, 1890.

latter, the rotatory dispersion, according to the same author, shews certain regularities. For iron, cobalt, and nickel the rotations visually observed were always *negative*; for iron the dispersion-curve seems to indicate a numerical minimum in the ultraviolet and thence ascends from violet towards red; in the case of cobalt the minimum occurs between blue and green, and for nickel in the yellow. These numerical minima of negative rotation may be considered *algebraic* maxima, their wave-length increasing as the metal's position in the periodic system advances. For magnetite the observed rotations were in every case *positive*, though the curve appeared directed towards negative values beyond the blue; a distinct maximum occurred in the yellow, corresponding to the above algebraic maxima.

More recently INGERSOLL [1]) has contributed important papers relative to this subject; he was able to supplement DU BOIS' curves in the infra-red up to about $3\,\mu$. According to this author the complete rotatory dispersion-curves thus obtained shew a marked resemblance to a typical dispersion-curve in the region of an exceedingly broad band of resonance-absorption. The particular cases of nickel and magnetite are notable, for the rotation appears to vanish between 1 and $1{,}5\,\mu$ and then to change in sign.

Further progress in this subject was difficult in view of the fact, that as yet the only ferromagnetic substances suitable for a study of the KERR-Effect were the four above-mentioned bodies. Several attempts to study with reflected and transmitted light the magneto-optic phenomena connected with the KERR-Effect were made with partially transparent films of metals prepared electrolytically, after the manner of KUNDT, or by cathodic discharge. Although the latest investigations [2]) on the optical properties of these films of magnetic metals brought to light further interesting but confusing results, yet the conditions in the films can obviously depend on their structure and on their mode of preparation in a very complex way. As a reflecting surface such a film is certainly inferior from a physical point of view to a mirror polished on a compact and massive block of metal.

An attempt to add to the number of substances which exhibit the KERR-Effect was thus of some interest. I entertained some hopes in this respect, since several chemists of late have synthetically prepared new ferromagnetic substances. In the first place, a number of combinations of different oxides with iron oxide, so called metaferrites,

[1]) L. R. INGERSOLL, Phil. Mag. (6) **11** p. 41, 1906 & **18** p. 74, 1909.

[2]) C. A. SKINNER & A. Q. TOOL, Phil. Mag. (6) **16** p. 833, 1908. H. BEHRENS Inaug. Diss. Münster i. W. 1908. L. R. INGERSOLL, loc. cit.

prepared by HILPERT[1]), presented an interesting field of research. In all these cases, the chemical structure resembles that of ferroferrite (ferroso-ferric oxide), in that the iron sesquioxide plays the acidic part, thus imparting ferromagnetic properties to the compound. Of this class of substances however, only cupriferrite and calciumferrite could be obtained in a state suitable for my experiments. Secondly, certain alloys of more or less ferromagnetic metals, and in particular those of nickel-iron[2]), together with the well-known ternary HEUSLER alloy, and WEDEKIND's[3]) binary manganese-antimony alloy present considerable interest. So far as I am aware, the magneto-optic properties of these alloys have been only partially investigated, the only account of similar experiments, which I have come across, being INGERSOLL's communication previously referred to and a Russian paper by TOKMATSCHEW[4]), who described experiments with HEUSLER's alloy.

I have studied the magneto-optic properties of the above mentioned bodies and also those of the well-known magnetic chromic oxide. Below an account of the preliminary results of my research is given.

Experimental Arrangement. Solar rays were exclusively used; they passed through a direct-vision monochromatic illuminator[5]), with divergence 1:4, thus furnishing light of great intensity. The rays passed (Fig. 1) through a lens (L), a total reflecting prism (P), a LIPPICH's arrangement of two halfshade Nicols (N_1, N_2) and falling nearly normal on a mirror between the two poles of an electromagnet, were reflected, finally passing through an analyser (N_3) and a telescope of fourfold magnifying power. The dimensions of the lenses, of the diaphragms, of the width and angle of the conical bores in the cores and poles were all calculated beforehand, particular care being taken to maintain maximum brightness, a uniform field of view, and also the avoidance of all unnecessary reflections[6]).

The observations were carried out with nearly normal incidence. RIGHI[7]) found, that up to an angle of incidence of 15° there was

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[1]) S. HILPERT. Ber. deutsch. Chem. Ges. **42** p. 2248, 1909. Verh. deutsch Phys. Ges. **11** p. 293, 1909.

[2]) CH. ED. GUILLAUME, Les aciers au nickel, Paris 1898.

[3]) E. WEDEKIND, Ztschr. f. phys. Chem. **66** p. 614, 1909. K. HONDA, Ann. d. Phys. **32**, 1910.

[4]) S. TOKMATSCHEW, Journ. d. russ. phys.-chem. Ges., **42** (phys. T.) p. 15, 1910.

[5]) H. DU BOIS, Verh. d. D. Phys. Ges. **11** p. 708, 1909.

[6]) A description of the analyser and polariser mentioned is given by H. DU BOIS, Wied. Ann. **46**, p. 545, 1892.

[7]) A. RIGHI, Ann. de chim. et de phys. (1) **9** pp. 120, 132, 1886.

scarcely any variation of the effect. However, in my experiments the angle between the incident and reflected beams was only 2° or 3°. The incident light was polarized horizontally in the plane of incidence. From RIGHI's observations it is known that even a normal incident beam of linearly polarized light when reflected from a magnetized mirror becomes elliptically polarized, the ellipticity however being only slight; ZEEMAN [1]) later measured this ellipticity in the case of iron and cobalt. Up to the present the evaluation of the ellipticity in my experiments has not been attempted; I considered that the slight reflecting power of some of my mirrors would not warrant such an attempt, and in addition it must be borne in mind, that the rotations themselves are small. Moreover the ellipticity, if any, must be nearly inappreciable, for by employing the best of my mirrors and by carefully avoiding diffused light, I have never been confronted with any difficulties, while the extinction of light in each half of the field of view was satisfactory. Even when the rotations are very small it is possible by means of the half-shade arrangement to observe and to measure them with sufficient accuracy. Hence it was thought unnecessary to use the method of multiple reflections, thereby avoiding new complications and further sources of error. The azimuth of the analyser was determined by means of a vertical scale seen through a combination of mirrors.

For the production of the magnetic field a small DU BOIS semicircular electromagnet of resistance 9 Ω was employed. To avoid the danger of sparking with reversal of current about 60 Ω were shunted across its terminals. The field was determined by means of a standardised thin glass-plate silvered at the back, which could be placed immediately in front of the mirror. The light ($\lambda = 589\,\mu\mu$), being reflected by the mirror as described above, suffers a double magnetic rotation in the glass. The ensuing very slight double rotation of the light in its passage to and fro through the magnetized air could be computed from the data of SIERTSEMA [2]), but proved quite negligible. Indeed, by using a silver-mirror, it was found that the rotation lies within the limits of experimental error. All the measurements were made with "polar" magnetization and at ordinary temperature.

Test-Specimens. The following substances were experimented upon: *Cupriferrite* ($Cu\,O\,.\,Fe_2\,O_3$), *Calciumferrite* ($Ca\,O\,.\,Fe_2\,O_3$), *Magnetite* (Ferroferrite) ($Fe\,O\,.\,Fe_2O_3$), *Ilmenite* ($Ti_2\,O_3\,.\,Fe_2O_3$), ferromagnetic *chromic oxide* ($Cr_5\,O_9$), *"Invar"* (36 Ni, 64 Fe), the HEUSLER

[1]) P. ZEEMAN, Leiden-Comm. No 15, 1895.

[2]) L. H. SIERTSEMA, Versl. Kon. Akad. Wet. Amsterdam 7 p. 289, 1899.

alloy (26 Mn, 13 Al, 61 Cu). The first two were kindly prepared by Dr. HILPERT in the metallurgical Laboratory of the "Technische Hochschule" in Charlottenburg; the natural magnetite is from the collection of the Bosscha-Laboratory, and is the same specimen, possessing a polished octahedral surface, which was formerly examined by DU BOIS [1]). A very fine-formed crystal of ilmenite was kindly lent by Prof. LIEBISCH. The HEUSLER alloy was supplied by the DE HAËN chemical factory in Seelze; its interior was full of bubbles, but its surface was capable of polish and supplied a very good mirror. The "invar" contained about 36 % Nickel and came from France (Société de Commentry-Fourchambault). For the chromic oxide I am indebted to Dr. KOPPEL. I desire to express my obligations to all the above mentioned gentlemen.

Throughout this paper I shall denote as usual by: $\mathfrak{H}$, the field intensity in kilogausses, $\mathfrak{J}$ the magnetization, $\mathfrak{J}_m$ its saturation value, ε single rotation of the plane of polarization in minutes, K, KERR's constant. In the tables, the column under N shows the number of readings in each series of measurements, which depended upon the polish of the mirror and the variable brightness, λ denotes the wave-length in $\mu\mu$, Δ the direct scale-reading in mm. of the double rotation produced by reversal of the current. The average values of the single rotations are given in the fourth column and in the fifth and sixth the average errors in minutes and in percentages.

The sense of the rotation is referred as usual to that of the magnetizing current; e.g. in the case of iron the "polar" KERR rotation is negative.

Results. The results obtained with the various substances were as follows:

1. *Cupriferrite.* Measurements were made on two mirrors of this material with similar results. The relation between the rotation and the wave-length in a field of 10,2 kgs. is shown numerically in Table 1 and graphically in Fig. 2. The dispersion-curve exhibits a type which has not been observed hitherto in the visible spectrum.

In the violet the rotation is *positive*, a maximum occurring in the blue; with increasing wave-length the rotation gradually decreases and in the neighbourhood of 587 $\mu\mu$ goes through zero, becoming *negative* for longer wave-lengths. Between 640 and 670 $\mu\mu$ a rather flat minimum is exhibited, the curve then gradually proceeding upwards. The rotations are small throughout, the maximum value not being

[1]) H. DU BOIS, Wied. Ann. 39, p. 25, 1890.

TABLE 1.

ε = funct (λ)		Cupriferrite		$\mathfrak{H}$ = 10.25 Kgs.
N	$\lambda(\mu\mu)$	Δ (mm)	ε (Minutes)	$\delta\varepsilon$
19	436	+ 8.3	+ 1.31′	± 0 04′ = 3.5%
48	477	+ 11.1	+ 1.75′	± 0.05′ = 3 „
43	539	+ 8.1	+ 1 28′	± 0.04′ = 3 „
40	574	+ 2.6	+ 0.41′	± 0.02′ = 6 „
52	599	— 2.3	— 0.36′	± 0.03′ = 8 „
45	637	— 6.0	— 0 95′	± 0.01′ = 1 „
51	688	— 4.9	— 0.78′	± 0.03′ = 4 „

greater than + 1,75′, but they still admitted of exact measurement. The above-mentioned change of sign is analogous to that found by INGERSOLL in the infra-red and presents a characteristic and theoretically important phenomenon.

The relation between the rotation and the field was also investigated, and the results are shewn in Table 2 and Fig. 3. For low values of the field the two are proportional to each other, the rotation

TABLE 2.

ε = funct ($\mathfrak{H}$)		Cupriferrite		λ = 477 $\mu\mu$
N	$\mathfrak{H}$ (kgs)	Δ (mm)	ε (Minutes)	$\delta\varepsilon$
40	0.93	+ 5 3	+ 0 85′	± 0.02′ = 2%
22	2.25	+ 8.4	+ 1.34′	± 0 04′ = 3 „
59	4.47	+ 9.7	+ 1.56′	± 0 03′ = 2 „
31	7 19	+ 10 2	+ 1.63′	± 0.03′ = 2 „
20	9 32	+ 10 4	+ 1 66′	± 0.03′ = 2 „
48	10.15	+ 11.1	+ 1.75′	± 0.05′ = 3 „

afterwards assuming a maximum value, which remained nearly constant for further increase of the field. Considering the form of the curve ε = funct ($\mathfrak{H}$) and accepting the results previously found

by DU BOIS in the case of iron, nickel, and cobalt, we may assert the proportionality between ε and $\mathfrak{J}$ with great probability. Bearing in mind this fact we are able to determine from purely magneto-optic measurements the order of magnitude or at least an inferior limit of maximum magnetization. As DU BOIS [1]) has shewn in the case of an unlimited homogeneous plane disc, the magnetization of which is uniform and normal, the abscissa of the point of intersection of the straight line $\varepsilon = K\mathfrak{J} = K\mathfrak{H}/4\pi$ and of the asymptote $\varepsilon = const.$ has the value $4\pi\mathfrak{J}_m$.

Accordingly $\mathfrak{J}_m \geqq 140$ c.g.s. in the case of cupriferrite. The small inclination of the upper part of the curve in Fig. 3 may be explained by the fact that for irregularly formed specimens the real conditions do not correspond to those in the ideal case mentioned above. However this inevitable difference can only produce a decrease in the apparent value of $\mathfrak{J}_m$ so that an inferior limiting value is really determined; small fissures, cavities, and impurities in the reflecting surface are particularly capable of exerting such an influence.

2. *Magnetite.* The dispersion of the KERR-Effect is shown in Table 3 and Fig. 4 (continuous line). If we compare this curve with the

TABLE 3.

ε = funct (λ)		Magnetite		$\mathfrak{H} = 11.56$ Kgs
N	λ ($\mu\mu$)	L (mm)	ε (Minutes)	$\delta\varepsilon$
30	436	— 24.0	— 3.81′	± 0.03′ = 0.9%
25	442	— 19 9	— 3.15′	± 0 05′ = 1.5 „
15	453	— 9.6	— 1.52′	± 0.03′ = 2 „
30	464	0	0	—
40	477	+ 6.7	+ 1.06′	± 0 03′ = 2 „
26	510	+ 19.4	+ 3.07′	± 0.02′ = 0.6 „
25	539	+ 24.3	+ 3 84′	± 0.02′ = 0.5 „
30	574	+ 28 2	+ 4.45′	± 0.02′ = 0.4 „
30	599	+ 24.9	+ 3.94′	± 0.02′ = 0.5 „
31	637	+ 21.0	+ 3.32′	± 0.04′ = 1 „
30	688	+ 16 0	+ 2.50′	± 0.07′ = 3 „

[1]) H. DU BOIS, Wied. Ann. 31 p. 965, 1887; Phil. Mag. (5) 29 p. 301, 1890.

previous one given by DU BOIS (dotted line), which he obtained with the same specimen (a holoëdric regular crystal; possessing a natural octahedral surface) we see, that with the exception of a displacement throughout the whole range of wave-lengths amounting to about 10 to 30 $\mu\mu$ — which is explained by the fact that 20 years ago only an imperfect method of spectral decomposition was available — the curves are in agreement in the region between 486 and 671 $\mu\mu$. The rotation attains a maximum value of 4.45′ in the yellow and decreases rapidly with decreasing wave-length. DU BOIS [1]), who was unable to proceed further than the blue on account of insufficient intensity of light, observed that the rotation probably vanished in the blue; he also considered that a change of sign possibly might occur in the ultraviolet. I have located this zero-point in the visible part of the violet at 464 $\mu\mu$. For smaller wave-lengths the rotation has rather a large *negative* value, which seems to approach a minimum. Unfortunately it was impossible to carry the investigation beyond 436 $\mu\mu$ since the light at that point becomes too feeble.

At all events, the existing observations establish satisfactorily the fact that the dispersion-curve obtained with natural crystalline magnetite ($FeO \cdot F_2O_3$) is of the same type as that obtained above with cupriferrite. Without entering into theoretical considerations it may be seen at once that in both cases the curve passes through a maximum, goes through zero and probably also through a minimum. Experiments are being carried out to see whether the course of these curves depends on the optical constants of the substances investigated, viz. their ordinary absorption- and dispersion-curves.

In the same way as in the case of cupriferrite the relation between the rotation and the field was also investigated. The results are shown in Table 4 and Fig. 5. They give $\mathfrak{J}_m \geqq 358$ C. G. S., which agrees with that obtained by DU BOIS [2]) (350).

The magnetic properties of magnetite crystals have been recently investigated by QUITTNER [3]), adopting WEISS' methods. From his measurements it follows that the component magnetization parallel to the field, which in this case is alone of interest, reaches a saturation value of about 475 C. G. S.; this subject and the cause of the discrepancy ought to be investigated in greater detail. One remark, however, may be made at once. In many cases the natural magnetite slightly departs from the simple structural formula ($Fe\,0, Fe_2\,0_3$);

[1]) H. DU BOIS l. c. p. 38.

[2]) H. DU BOIS, Phil. Mag. (5) **29**, p. 301, 1890.

[3]) P. WEISS, Journ. de Phys. (3) **5** p. 435, 1896 and (4) **9**, p. 373, 1910, V. QUITTNER, Dissertation, Zürich, 1908.

TABLE 4.

ε = funct ($\mathfrak{H}$)	Magnetite		$\lambda = 574\ \mu\mu$	
N	$\mathfrak{H}$ (Kgs)	Δ (mm)	ε (Minutes)	$\delta\varepsilon$
15	2 10	+ 12.9	+ 2.07′	$\pm$ 0.04′ = 2 %
15	3.40	+ 21.3	+ 3.37′	$\pm$ 0.05′ = 1.5 „
15	5.87	+ 28.7	+ 4 54′	$\pm$ 0.07′ = 1.5 „
15	8.87	+ 28.0	+ 4.43′	$\pm$ 0.05′ = 1 „
15	10.82	+ 28.9	+ 4.57′	$\pm$ 0.06′ = 1 „
30	11.56	+ 28.2	+ 4.45′	$\pm$ 0.02′ = 0.4 „

also QUITTNER has established the great diversity of samples by measuring their variable densities. It is difficult to foretell the influence of all this on the magneto-optic properties.

3. *Other ferromagnetic compounds.* The distinct analogy in the dispersion for substances of similar chemical structure as e.g. cupri- and ferroferrite in contradistinction to iron, nickel, and cobalt suggests whether the properties of other ferromagnetic ferrites and oxides are not similar. The investigation of *calciumferrite* was in this respect of importance. This substance is very feebly magnetic and brittle. A small piece was surrounded by the easily fusible WOOD alloy and then thoroughly polished. No KERR-Effect however was observed although the mirror was sufficiently good. The effect, if it exists, must be smaller than 0,35′. A similar result was obtained with *ilmenite* [1]). The light was reflected from the base of the crystal as well as from a plane parallel to the principal axis, but in no case could a rotation be detected. ($< 0{,}3'$). It was also impossible to detect any rotation with *chromic oxide* $Cr_5\,O_9$, which without doubt is ferromagnetic. The following alloys were tested:

4. *Nickel-iron* with 36% nickel, so called "Invar", known to possess a very small coefficient of expansion; is strongly magnetic and distinctly shows the KERR-Effect. The rotation is exclusively *negative* in the region of the spectrum investigated, and there is only a slight variation with wave-length. (Table 5, Fig. 6). The dispersion-curve lies considerably below the zero-line; with increasing wave-length

[1]) See B. BAVINK, Magn. Influenz in Krystallen, Göttinger Dissertation 1904.

TABLE 5.

ε = funct (λ)		"Invar"		$\mathfrak{H}$ = 13.30 Kgs.
N	λ ($\mu\mu$)	Δ (mm)	ε (Minutes)	$\partial\varepsilon$
15	436	— 74.4	— 11.78′	$\pm$ 0.05′ = 0 4%
15	477	— 78.8	— 12 48′	$\pm$ 0.06′ = 0 5 „
15	539	— 83.5	— 13.22′	$\pm$ 0.06′ = 0.4 „
20	574	— 86 3	— 13 66′	$\pm$ 0.03′ = 0.2 „
15	599	— 86 8	— 13.74′	$\pm$ 0.05′ = 0 3 „
15	637	— 86.7	— 13.72′	$\pm$ 0.07′ = 0.5 „
15	688	— 86.2	— 13.54′	$\pm$ 0.06′ = 0.4 „

it proceeds slowly downwards, passes through a flat numerical maximum in the orange, after which the rotation decreases very slowly. The relation between rotation and magnetization, as in the cases above, exhibits distinct proportionality and we have $\mathfrak{J}_m \geqq 530$ (Table 6, Fig. 7).

TABLE 6.

ε = funct ($\mathfrak{H}$)		"Invar"		λ = 574 $\mu\mu$
N	$\mathfrak{H}$(kgs)	Δ (mm)	ε (Minutes)	$\partial\varepsilon$
31	0.54	— 6.5	— 1.02′	$\pm$ 0.02′ = 2 %
15	1.80	—23.2	— 3.67′	$\pm$ 0.02′ = 0.5 „
15	3.20	—39.0	— 6.17′	$\pm$ 0.03′ = 0.5 „
15	6.32	—69 7	—11.03′	$\pm$ 0.05′ = 0.4 „
15	10.37	—84.5	—13.36′	$\pm$ 0.03′ = 0.2 „
15	12.60	—86.6	—13.71′	$\pm$ 0.02′ = 0.1 „
20	13.30	—86.3	—13.66′	$\pm$ 0.03′ = 0.2 „
15	14.51	—86.2	—13.65′	$\pm$ 0.03′ = 0.2 „

It would be interesting to study the magneto-optic behaviour of the nearly non-magnetic nickel-iron alloy, which contains 25 percent nickel.

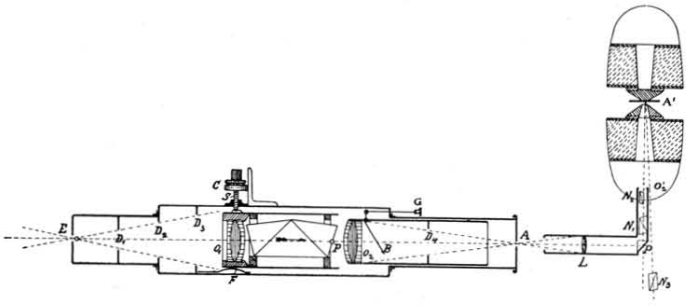

Fig. 1.

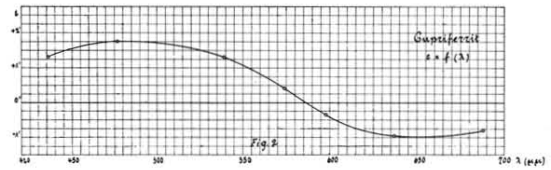

Fig. 2

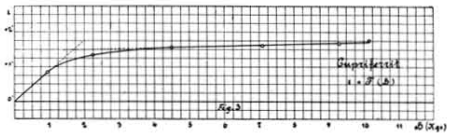

Fig. 3.

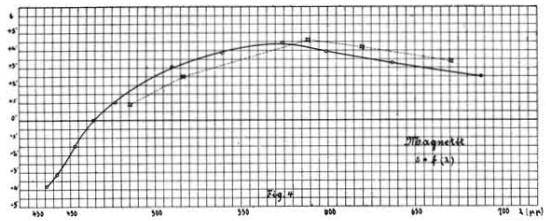

Fig. 4.

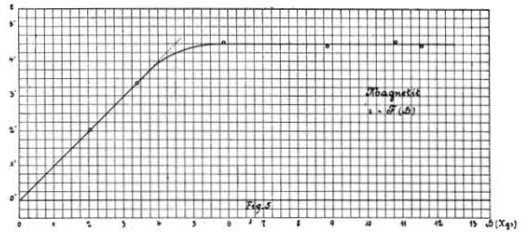

Fig. 5.

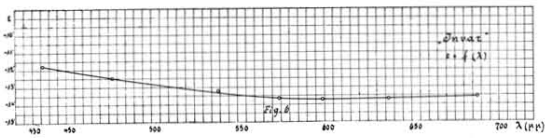

Fig. 6.

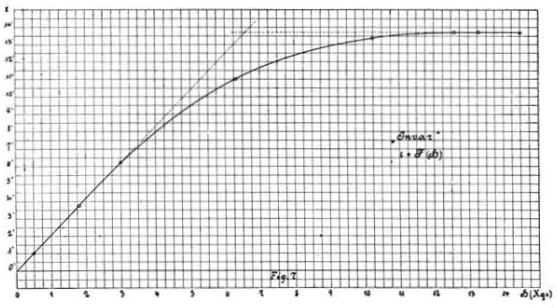

Fig. 7.

5. *The* HEUSLER *alloy*, supposed to contain 61% Cu, 26% Mn and 13% Al is rather strongly magnetisable. Different portions of two well-polished mirrors were carefuly examined in various parts of the spectrum but proved to be magneto-optically ineffective. It is of course possible that the KERR-Effect might be less than 0,3′ in this case. Quite recently there appeared a communication by TOKMATSCHEW recording similar experiments on the HEUSLER alloy No. 32 (58,9 Cu, 26,5 Mn, 14,6 Al). From theoretical considerations the author arrives at the conclusion of the probability of an effect capable of measurement occurring in the neighbourhood of 450 $\mu\mu$. I have carried out a series of readings at this wave-length but no rotation could be observed. INGERSOLL also failed to notice any measurable effect either in the visible spectrum or in the infra-red.

The discussion of the theoretical signification of the above partially positive and partially negative results I reserve for a future occasion; further experiments are in preparation, and the determination of the purely optical properties of the investigated substances is already in progress.

ERRATA.

In the Proceedings of the Meetings of Jan. and Febr. 1910:

p. 672 Table III for 5050 read 8050.
p. 675 Table VII for 102.58 read 102.85.
p. 676 Table VIII for 71.75 read 71.95.

(May 26, 1910).