ON THE ORIGIN OF MOVING SLIDES

Dr HAUKE LANGE-FUCHS

All early magic lanternists wanted to show 'real life'. So from the very beginnings in the 17th century, efforts to project pictures have always been connected with efforts to impart movement to the figures. Very popular in this respect was the screening of the mythical story of the pythoness of Endor who, by command of King Saul, revealed the ghost of Prophet Samuel to the king. The simple direction reads as follows: 'Behind a circular glass painted with the figures of Saul and the pythoness, a second glass representing Samuel is drawn up from beneath.'

The famous Father Athanasius Kircher (1602–80), who is often, but erroneously, regarded as the inventor of the magic lantern, tells us that already in 1671 he was successfully projecting a kind of jumping jack, as well as small insects – 'a prototype for movable lantern slides' (F. P. Liesegang).[1]

Kircher's 'prototypes' expressed the illusion of projected motion, but the motion was, in fact, accomplished by real objects in motion, not by means of a slide-mechanism. His moving 'jumping jack' was a cut-out figure, and the moving pictures of insects were produced by attracting living insects to the mirror with honey.

Martin Quigley says in his *Magic Shadows*, published in 1948, that Kircher also had the idea of substituting the oblong glass slides for a glass disc so the successive views could be changed more rapidly.[2]

Fifteen years later, this idea was realised by the German Premonstratension monk Doctor Johann Zahn (1641–1707). He describes another step which might have been an attempt to create a primitive illusion of movement in his renowned *Oculus artificialis teledioptricus sive Telescopium, Ex Abditis rerum Naturalium & Artificialium principiis protractum novâ methodo* ('The artificial teledioptric eye or telescope brought to light by a new method from the secret principles of natural and artificial things'), first published in Würzburg in 1685 and in Nuremberg in 1702.[3]

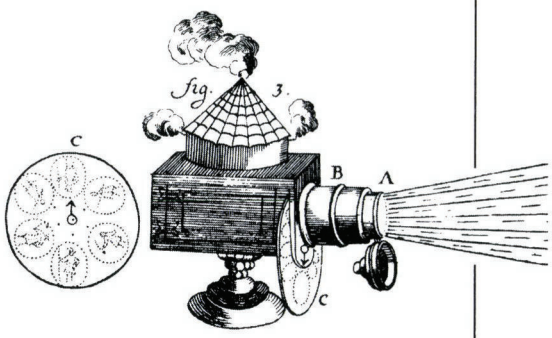
Zahn, too, projected the image of living insects, and in order to keep them in place had an even better idea than Kircher's honey: instead of fixing them onto the mirror he enclosed them between two glass slides. Zahn also developed Kircher's idea of clockwork projection.[4]

In the first volume of his book (published in 1676) Sturm presented the first printed illustration of a glass slide, showing the head of Bacchus (p.165). Zahn also described all kinds of magic lanterns including one using a revolving circular disc with six pictures to be shown one by one. A plate in his book illustrates this idea, it shows a table lantern mounted with a disc, and a disc of pictures showing a man in different positions.[5]

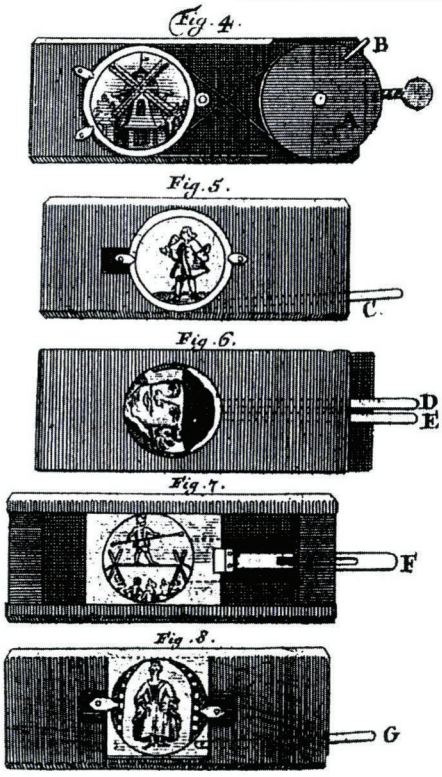
'But Zahn's modification', says Quigley, 'was the dominant pattern used by later experimenters, just before the dawn of the motion picture as we know it. The first projector to show "motion pictures" from hand-drawn slides was invented about 1851 by Franz von Uchatius and looked very similar to this model of Zahn's.'[6]

So, did Zahn already have the idea which was later worked out by Uchatius? Creating the illusion of movement by a rapid succession of pictures needs some kind of intermission, a short period of darkness between the pictures. For this purpose a shutter is necessary, moving by means of cranks in synchronisation with the changing images. There is no evidence that he had such a device.

The head of Bacchus, Sturm 1676



First illustration of lantern with revolving circular disc, Zahn 1702



Five moving slides from Essais de physique, *1739*

So, it seems to be the learned Abbé Jean-Antoine Nollet (1700–70), a scientist and scientific author from the Collége de Navarra, who described what we know as 'moving slides' for the first time. His announcement is to be found in the fifth of the six volumes of his famous *Leçons de physique expérimentale*, published by the Royal French Academy of Sciences from 1743 on in numerous editions.[7]

Nollet himself was, as Quigley points out, not himself a discoverer, but he served as a clearing house for the scientific knowledge of his day, having travelled widely, to Italy and England as well as to Holland.[8]

From one of his travels, Nollet reports: 'In 1736, when I travelled to Holland I got from Mr Musschenbroek another [type of slides] which were really worked out very nicely, the figures moving as if alive. For example, a windmill with revolving sails, a woman bowing her head while passing by, a farmer eating cheese and moving his jaws, a horseman removing his hat in courtesy and putting it on again.'[9]

1 Franz Paul Liesegang, *Dates and Sources – a contribution to the history of the art of projection and to cinematography*, translated and edited by Hermann Hecht, The Magic Lantern Society of Great Britain, London, 1986, pp.10, 14.

2 Martin Quigley jr, *Magic Shadows - The Story of the Origin of Motion Pictures*, Georgetown University Press, Washington DC, 1948, p.70.

3 Johannes Zahn, *Oculus artificialis teledioptricus, sive Telescopium, Ex Abditis rerum Naturalium & Artificialium principiis protractum novâ methodo, eâque solidâ explicatum ac comprimis è triplici fundamento, Physico seu naturali, Mathematico dioptrico, et Mechanico, seu practico stabilitum ...* Herbipoli [Würzburg]: (Sumptibus) Quirini, Heyl 1685; 2nd. edn. (editio secunda auctior) Norimbergæ [Nuremberg]: (Sumptibus) Johannis Christophori Lochneri, Typis Johannis Ernesti Adelbulneri, 1702 (Fundam. II, pp.230–57; Fundam. III, pp.253–9, p.731).

4 During the same period, projection-clocks were made by the Italian brothers Giuseppe and Matteo Campani, in about 1668 (Liesegang, op. cit. p.11); by Christoph Treffler of Augsburg, in about 1676 (Liesegang, op. cit. p.12); and by Professor Christoph Sturm (1635-1703) of Altdorf near Nuremberg, in 1685 (Johannes Christophorus Sturmius: *Collegium experimentale, sive curiosum, In quo Primaria hujus Seculi Inventa & Experimenta Physico-Mathematica, Speciatim Campanæ Urinatoriæ, Cameræ obscuræ, Tubi Torricellani, seu Baroscopii, Antliæ Pneumaticæ, Thermometrorum, Hygroscopiorum, Telescopiorum, Microscopiorum &c. Phænomena & effecta, Partim ab aliis jam pridem exhibita, partim noviter istis superaddita.* Vol. II. Norimbergæ [Nuremberg]: (Sumptibus) Wolfgangi Mauritii Endteri & Johannis Andreæ Endteri Hæredum, 1685 (pp.236–7).

5 John Barnes ('The Projected Image: a Short History of Magic Lantern Slides', in *The New Magic Lantern Journal*, Vol. 3, No. 3 (October 1985) notes that other circular slides, now in the Victoria & Albert Museum, were painted by Abraham Helmhack (1654–1724), though these were 'more probably for use in a revolving picture drum, or peep-show device'. By this means, Zahn would have been able to project a series of pictures or tell a story, even if one has to admit that showing the pictures one by one is more like looking at a comic strip, and does not imply a kind of 'movement'.

6 Quigley, op. cit. p.67.

7 Abbé [Jean-Antoine] Nollet: *Leçons de physique expérimentale.* Tome I-VI publié par l'Académie Royale des Sciences; Paris: Frères Guérin, 1st edn. 1743;

In Mr Musschenbroek's *Essais de physique* there is a more detailed description. For the time being I would only note that the effect of movement is achieved by means of two glasses, the one wooden-framed and painted with one part of the figure, the other, opposite the first, is the movable part of the picture, moved by a string or a little rod passing through the wooden frame.[10]

Pieter van Musschenbroek (1692–1761) was a professor of natural philosophy and mathematics at the Dutch university of Utrecht. He was later known as the inventor of the first electric condenser and for his 'law of the refraction of light'. His brother Johannes van Musschenbroek (1687-1748), a scientific instrument maker in Leyden, was a skilful 'mechanicus' and constructed most of his devices. According to Quigley, Pieter van Musschenbroek developed the moving slides as a hobby (although he made them to sell) and was quite unaware of the importance of his invention until he received this visit from the French scientist.[11]

Nollet's report gives us only a short description of Musschenbroek's moving slides, and he refers for further details to the latter's book *Essais de physique*, which was published in 1739, but apparently attracted very little notice.[12]

The book contains a plate [XX] designed by J. v. d. Spyk showing five figures of moving slides, and an appendix with Johannes van Musschenbroek's pricelist (he marketed the slides himself). These slides are discussed by John Barnes in 'The Projected Image: a Short History of Magic Lantern Slides', published in *The New Magic Lantern Journal* in 1985, where Musschenbroek's advertisements are translated and quoted in full.[13]

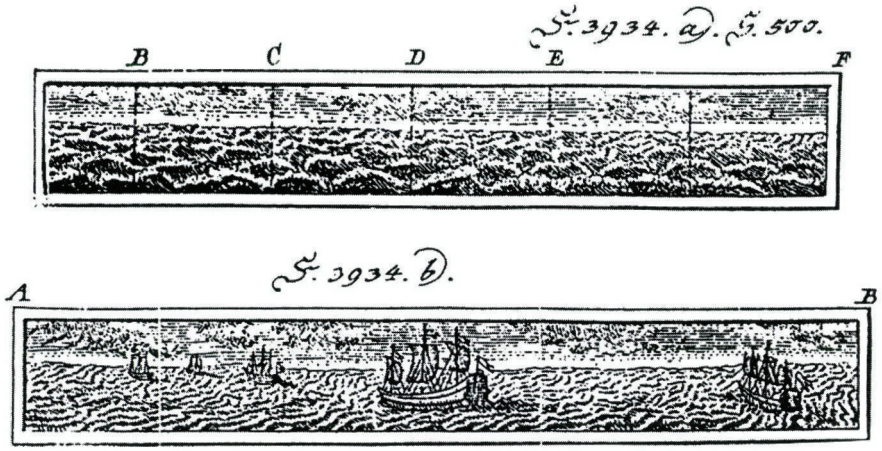
Besides Nollet another French Abbé, the Abbé Guyot, helped make Musschenbroek's moving slides known. His book *Nouvelles Récréations physiques et mathématiques*[14] was translated into English and published in 1774 by William Hooper, MD, as *Rational Recreations* in which the Principles of Numbers and Natural Philosophy are Clearly and Copiously Elucidated, by a Series of Easy, Entertaining, Interesting Experiments',[15] and into German by J. Chr. Thenn under the title 'Neue physikalische und mathematische Belustigungen, oder Sammlung von Kunststücken zum Vergnügen' (seven volumes, the first four being a translation of Guyot's book).[16]

Guyot adds to Musschenbroek's moving slides a new method of representing a tempest at sea, using two superimposed strips of glass.

This method was popularised in Germany by Johann Christian Wiegleb in his *Natürliche Magie*, published in Berlin in 1779.

Musschenbroek's moving slides were developed in about 1736, and Quigley calls him 'the first to successfully simulate motion with the aid of the projector and glass slides'.

But he was not the first.



Double slide 'Sea storm' from Natürliche Magie, *Wiegleb 1779*

In 1990, the American *Magic Lantern Gazette* published an article by Theodore Barber on 'phantasmagorical wonders', which summarised the story of moving slides.[17]

Like Quigley, Barber regards the magic lantern as the forerunner of the motion picture projector since it could screen moving images by means of special slides or adaptations of the lantern itself, and he adds that 'mechanical slides, which were in existence by 1713, were the most common way to convey a scene in motion. The mechanics usually consisted of two pieces of glass, one placed over the other. Thus, for example, a windmill without its sails might be painted on the bottom, stationary piece of glass, and the sails themselves might appear on a movable glass disc placed on top of it. A hand-operated pulley wheel caused the disc, and hence the sails, to revolve. Amusing and quaint images such as the windmill scene were commonly projected by the first part of the 18th century, when popular itinerant showmen began touring with the lantern throughout Europe, giving public exhibitions in homes, halls and taverns. The original developers of the lantern had apparently already exploited its "magical" potential, however.'

Barber's statement that 'mechanical slides were in existence by 1713' is made without any reference, though a short note in Liesegang's *Dates and Sources* states: '1713: Ehrenberger of Hildburghausen makes and describes mechanically moved lantern slides.'[18]

Liesegang himself referred, without crediting his source, to the renowned 18th-century encyclopedia *Oekonomisch-technologische Enzyklopädie* (242 volumes!), published from 1773 to 1843 in Berlin by Dr Johann Georg Krünitz. In volume 65, which appeared in 1794, Krünitz says:

Die wichtigste Verbesserung rührt vom Prof. Ehrenberger, in Jena, her, welcher die Bilder beweglich gemacht hat, so daß man Bilder mit Bewegungen dadurch an die Wand werfen kann:

The most important improvement was made by Professor Ehrenberger of Jena, who made the pictures movable so that pictures with movement could be projected onto a wall.[19]

Already half a century earlier than Krünitz, Christian v. Wolf noted in his encyclopedia:

Ehrenberger, als er noch in Jena Adjunctus Facultatis Philosophicæ war, hat in einer Disputation, die er hiervon gehalten, zuerst entdecket, wie man Bilder mit Bewegung dadurch an die Wand werffen könne:

Ehrenberger, when still at Jena as Adjunctus Facultatis Philosophiæ, in a disputation on this subject, was the first to make it known how to project pictures with movement onto a wall.[20]

Bonifacius Heinrich Ehrenberger (1681–1759) graduated as master of philosophy at Jena in 1705 (a degree then regarded higher than a doctorate by certain universities), and in 1712 he was Adjunctus Facultatis Philosophiæ (assistant professor) at the Jena University, in 1713 professor of mathematics and logic at the Hildburghausen High School in Thuringia, and later (1720 until his death), professor of mathematics and metaphysics at the Academic High School at Coburg. Among the numerous publications on various subjects which are ascribed to him, one dealing with the magic lantern was published in 1713 under the title *Novum et curiosum Laternæ Magicæ Augmentum* ('New and Curious Augmentation of the Magic Lantern').

Laura Minici Zotti refers to the same publication in her *Laterna Magica* when saying that at the beginning of the 18th century, the religious-fantastic themes of the magic lantern persisted, together with new, different subjects, 'as it is reported by

4th edn. 1759, and later, [Tome I-IV] Amsterdam: aux dépens de la compagnie, 1745–56; [Tome V] Amsterdam & Leipzig: Arkstee & Markus, 1756; nouv. edit. Paris: Durand, 1775; 1784 [Vol. 5, p.466]. German edn. [transl. Anton Rudolph]: *Vorlesungen über die Experimental-Naturlehre.* Aus dem Französischen ins Deutsche übersetzt. Theil 1-9, part 5-9 titled Herrn Abts I. A. Nollets Physikalische Lehrstunden, nach der vom Herrn Verfasser selbst durchgesehenen Pariser Ausgabe übersezt. Erfurt: Joh. Friedrich Weber, 1749–75.

8 Quigley, op. cit. p.73.

9 This would seem to prove that Musschenbroek, the staid scientist, in his idle moments had attempted to create the first 'boy-meets-girl' motion picture (Quigley, op. cit. p.71).

10 Nollet, op. cit. (German edition), Vol 5, 1770, p.446.

11 Quigley, op. cit. p.71.

12 Pieter van Musschenbroek: *Essai de Physique par Mr. Pierre van Musschenbroek, Professeur de Philosophie & de Mathématiques à Utrecht; Avec une Description de nouvelles sortes de Machines Pneumatiques, et un Recueil d'Expériences par Mr. J[oannes] V[an] M[usschenbroek].* Traduit du Hollandais par Mr Pierre Massuet, Docteur en Médecine. 2 vols. Leyden: Samuel Luchtmans, 1739 [1320 passim, p.622]. German edition: Hrn. Peters von Muschenbroek, MD, *Grundlehren der Naturwissenschaft. Nach der zweyten lateinischen Ausgabe nebst einigen neuen Zusätzen des Verfassers, ins Deutsche übersetzt. Mit einer Vorrede ans Licht gestellt von Johann Christoph Gottscheden.* Leipzig: Kiesewetter, 1747 [1063, p. 617–18 & tab. XX].

13 John Barnes, op. cit. p.3.

14 [Gilles E.] Guyot: *Nouvelles Récréations physiques et mathématiques, contenant ce qui a été imaginé de plus curieux dans ce genre et qui se découvre journellement* ... Tome 1-4, Paris, 1st edn. 1769, 2nd edn. 1770, 3rd edn. 1786, and 4th edn. [3 vols.] 1800.

15 W[illiam] Hooper: *Rational Recreations in which the Principles of Numbers and Natural Philosophy are Clearly and Copiously Elucidated, by a Series of Easy, Entertaining, Interesting Experiments.* 4 vols. London, 1st edn. 1774; 2nd edn. by L. Davis, 1783; 3rd edn. 1787; corrected [4th] edn. 1794 and 1802.

16 J. Chr. Thenn: *Neue physikalische und mathematische Belustigungen, oder Sammlung von Kunststücken zum Vergnügen, mit den Zahlen, aus der Optik sowohl, als aus der Chemie, nebst den Ursachen derselben, ihren Wirkungen und den dazu erforderlichen Instrumenten.* 7 vols. Augsburg: Klett, 1772–7.

17 *Magic Lantern Gazette,* Vol. 2, No. 1, Spring 1990, Reprint X. Originally published in *Film History,* Vol. 3, pp.73–86, 1989.

18 Liesegang, op. cit. p.14.

19 Johann Georg Krünitz: *Oekonomisch-technologische Encyklopädie, oder allgemeines System der Stats-Stadt-Haus- und Land-Wirthschaft und der Kunst-Geschichte in alphabetischer Ordnung.* Vol. 65. Berlin: Joachim Pauli, 1794 (p.470).

20 [Christian Reichsfreiherr von Wolff]: *Vollständiges Mathematisches Lexikon, Darinnen alle Kunst-Wörter und Sachen, welche der erwegenden und ausübenden Mathesi vorzukommen pflegen, deutlich erkläret; überall aber zur Historie der Mathematischen Wissenschaften dienliche Nachrichten eingestreuet,* 2 volumes. Leipzig: Gleditsch, 1st edn. 1716, 2nd edn. 1732, 3rd edn. 1734 [p.755 passim], 4th edn. 1742 [p.790 passim]. There is also a short note on Ehrenberger in the 19th volume of Zedler's encyclopedia published in 1739: 'welcher zeiget wie man durch sie Bilder und Bewegung an die Wand werffen könne' ('he who demonstrates how to project pictures and movements onto a wall'). *Großes, Vollständiges Universal-Lexicon aller Künste und Wissenschaften, welche bißher durch menschlichen Verstand und Witz erfunden worden*; 64 volumes; Leipzig/Halle: Johann Heinrich Zedler, 1732–54 (Vol. 19, p.315).

D. A. G.

NOVVM ET CVRIOSVM

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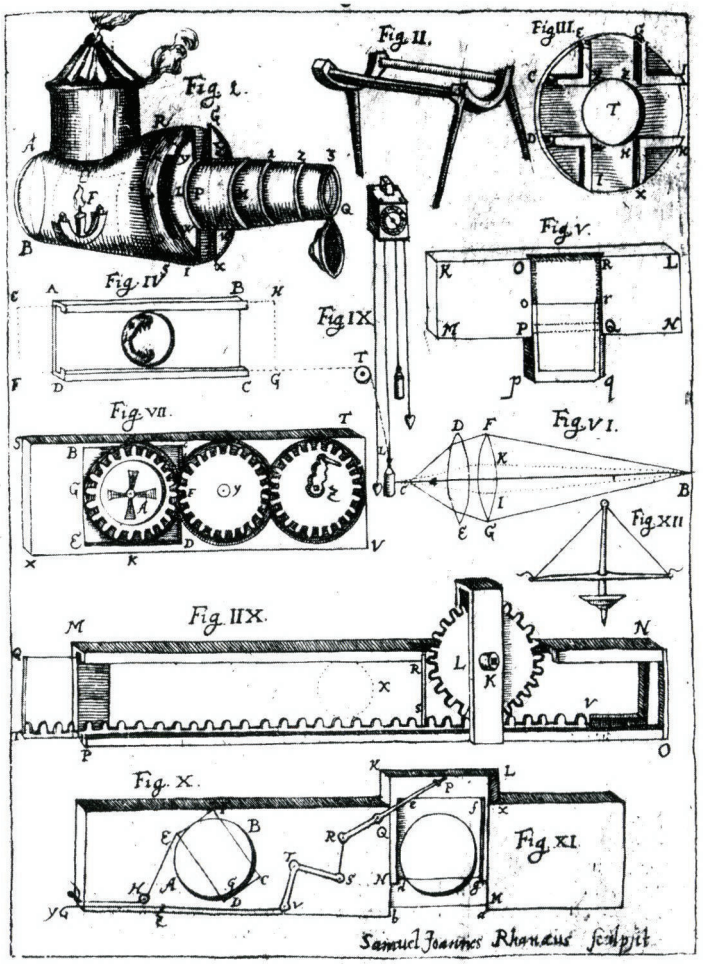


Title page and details of moving slides by Rhanæus, 1713

Rhanæus in his *Novum et Curiosum Laternæ Magicæ Augmentum* of 1713'.[21]

Zotti gives even more details on Rhanæus' invention: 'He describes various movable glass slides among which there are, besides the usual hellish and apocalyptic images, windmills, cooks, animals, gentlemen taking off their hats, ladies curtseying. The most common animation mechanisms used for these images are quite simple, mostly pull-type, mask or lever systems ... The rotary frames, made of a fixed glass slide and a movable one, both round-shaped, are more complicated and are used for many different subjects to obtain highly spectacular effects. The continuous rotary motion is transmitted to the movable slide by a continuous cord that starts a pulley with handle. Alternatively, the motion is given by a rack-type gear or toothed wheel.'[22]

Rhanæus or Ehrenberger, who was the author? All these writers refer apparently to the same source, a small booklet of only 24 pages which was published at Jena in 1713 under a Latin title which reads in full as follows:

Novum et curiosum Laternæ Magicæ Augmentum quod dissertatione mathematica... sub præsidio M. Bonifacii Henrici Ehrenbergeri Fac. Phil. Adjuncti... A. D. Junii A. MDCCXIII publico doctorum examini exponit Samuel Joannes Rhanæus, Grentzhofia Semigallus: Jenæ Prelo Nisiano.

New and Curious Augmentation of the Magic Lantern, as mathematical dissertation under the presidency of Magister Bonifacius Heinrich Ehrenberger, assistant professor at the philosophical faculty, exposed in June 1713 to the judgement of the learned public by Samuel Johann Rhanæus of Grentzhofen in Semgallen: Nisian-press Jena.

As the title says, it was a dissertation in mathematics, 'exposed' (submitted) by S.J. Rhanæus 'under the presidency' (sub præsidio) of B.H. Ehrenberger. In the 17th and 18th century, dissertations or 'disputations' were usually registered under the name of the responsible professor (the praeses). So it could happen that more than a hundred dissertations were credited to one professor – for the simple reason that most of those dissertations were not 'dissertationes inaugurales' (doctoral theses) worked out by a candidate for a doctorate, but merely transcripts of the professor's university lectures written down on command by a student. In some cases the professor himself wrote the thesis and submitted it to a student who then had to discuss and defend the arguments publicly 'in collegio', assisted by his professor. Thus, the student held the position of 'respondent' (defender), and the professor that of 'praeses', which meant not only chairman but also protector.[23]

When printed, the title page in any case bears the name of the praeses first, followed by the name of the respondent. There would be no reference to – in modern terms – the true and real 'author'. The decision as to whom we should regard as author depends on circumstantial evidence, which is to be found in the dissertation itself, or its preface, or its post-scriptum.

As there is no preface to the 'dissertatio de novo laternæ magicæ augmento', we have to take a look at the dissertation itself. But there we find only a few personal remarks; for example, on p.22 when the author refers to 'nostrum Laternæ Magicæ augmentum' ('our contribution to the magic lantern'), or on p.4 when he refers to the 'Celeberrimus Dn. Hambergerus, Præceptor noster nunquam satis a nobis laudandus' ('The most famous Herr Hamberger, our preceptor whom we never can praise satisfactorily.'). But, who does the 'we' refer to? Georg Albrecht Hamberger (1662–1716/17), at this time 'professor mathematum' at the Jena university, had been teacher to both Ehrenberger and Rhanæus.[24]

On p.20 the author notes 'Præsidis dissertationem de Polemoscopio' ('praeses' dissertation on the polemoscope', another dissertation published by Ehrenberger in 1709), which could be evidence that the person writing was not Ehrenberger himself. There is more evidence in a post-scriptum attached to the dissertation, dated 31 May 1713, and dedicated 'respondenti nobilissimo, doctissimoque præses' ('to the most noble and most learned respondent by the praeses'). Following the usual academic custom in the 17th century, Ehrenberger speaks in high terms of the scholarship of his student and praises especially:

...ut dissertationis hujus argumentum Tibi a me subministratum... conscriberes ac prelo mandares, sed etiam schematismos, quibus præsens opella haut carere poterat, æri ipse incideres:

...that You wrote down the arguments of this dissertation which I submitted to You, and let it print, and made also the copper-plates of the figures which were necessary for this booklet.

The illustrations attached to the dissertation are signed 'Samuel Joannes Rhanæus sculpsit' (SJR was the designer). Ehrenberger praises Rhanæus also for his 'manum promtitudine' (skilful hands), thus referring to his illustrations as well as to his models of movable slides. Though the authorship to the booklet itself may still remain uncertain (did Rhanæus write the dissertation himself, or did he merely 'write down' what Ehrenberger said?), there is evidence enough to conclude that it was Rhanæus who designed and made the moving slides.

Who was Samuel Johannes Rhanæus? The front label names him as 'Samuel Joannes Rhanæus Grentzhofia Semigallus', ie, born at Grentzhofen (Gräntzhof) in Semgallen. Ehrenberger says in the post-scriptum that Rhanæus had studied at Wittenberg and Jena, and that the 'nobles of his country' will be proud of him. Semgallen was at that time a province of the duchy of Kurland in southern Latvia, and the Rhanæus family was very prominent there.[25]

We may assume that Samuel Johannes was a son of mag. philos. Samuel Rhanæus who, in about 1680, had also been a student at Wittenberg and later became a priest at Grentzhofen, where Samuel Johannes was born. His father was a well-known writer and amateur historian who ended his days in bankruptcy. In 1717, he lost at the same

time a daughter and a son. Was this Samuel Johannes? We do not know.

Of his invention, Rhanæus says in the first chapter of his dissertation that he constructed ten kinds of movable slides showing the following figures:

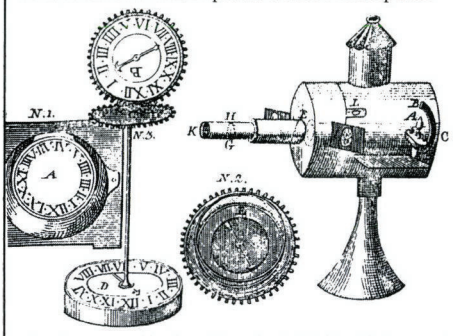
In pariete albo exhibemus

1. Infernum, ex quo tria hominum vitia Cardinalia tanquam ex orco excedunt, &, si libet directori, domicilium etiam suum repetunt, inferno manente immoto, quamdiu placet.

2. Christum ex sepulchro adscendentem & cælum petentem, relicto sepulchro & vigilibus illi adsedentibus.

3. Molam alatam, cujus alæ ventis quasi agitatæ circumeunt, stante mola immota. Quod spectaculum una cum præcedentibus spectatorum admirationem haud exiguam excitavit.

4. Manum de cælo ex nubibus sese exporrigentem, cui Serenissimi Patris patriæ nomen inscriptum.



Clockwork projection. The clock (left) is hidden in the foot of the lantern (right), Sturm 1685

5. Animal Apocalypticum e mari exsurgens & litori insistens, quod una cum proxime præcedenti & subsequentibus fere omnibus adhuc sub manu artificis sudat.

6. Horologium nocturnum adscriptas in circulo horas cum indice versatili monstrans, vulgaribus horologiis majoribus, ligneis pariter & ferreis facillime adplicandum.

7. Aliud adhuc horologium, non indice, sed duodecim Apostolorum effigiebus cum adscripto numero prætereuntibus præditum, itidem horologius vulgaribus accomodatum.

8. Animal quadrupedum, e. g. ursum pedibus posterioribus innixum anteriora erigentem, ad iram quasi incitatus & hosti insultanti se oppositurus esset.

9. Hominem plebejum, pileum manu tenentem eumque ventilantem, vel, si mavis, Chori Musici Præfectum officio suo directorio fungentem.

10. Mulierem gestum reverentialem, sexui sequiori usitatum exprimentem.

Qubis, cum structuræ ratio detecta fuerit, quilibet pro suo ingenio plura haud difficulter poterit superaddere, & historiam sacram æque ac profanam imaginibus vividioribus illustrare. Nos ne nimis prolixi simuss, ad ipsam potius structuram pergimus.

On the white wall, we project

1. The three main vices of mankind rising out of hell as out of the underworld and, when the projectionist decides, returning to their home while hell remains unmoved, as long as it pleases him.

2. Christ rising out of his sepulchre and ascending toheaven, leaving behind the sepulchre and the guards beside it.

3. A windmill with arms rotating in the wind while the mill stays still. Like the foregoing, this spectacle stimulates the admiration of the spectators.

4. A hand coming from heaven out of the skies, with the name of His Highness the Sovereign written on it.

5. An apocalyptic animal rises out of the sea and stands on the beach. Like the preceding and nearly all the following, it is presented by the hand of the artist.[26]

6. A night clock showing the hours written in a circle, by a movable hand. This can easily be done with normal wooden or iron clocks.

7. Another clock without a hand, the numbers written on the figures of the twelve apostles who are passing by; will also fit normal clocks.

8. A quadruped animal, eg, a bear, standing on his hind legs and raising his front paws furiously as if to attack an aggressor.

9. A plebeian man holding his hat in his hand and waving it; or a conductor of a musical chorus while performing his duty.

10. A woman curtseying in a way typical of the weaker sex.

To these may everyone at will, as the principle is revealed, easily add more according to one's capacity, and illustrate holy or profane stories by moving pictures. There is nothing we would like more than to continue in this way.[27]

In chapter II (pp.14–20), Rhanæus gives a precise description of how to work out the ten models of moving slides presented in chapter I. But it might tire the patience of the reader, to reproduce here the six pages of this description in full.

Half a decade before Rhanæus, another experimenter had the same idea. He too developed a system of moving slides. Liesegang tells us that 'Uffenbach in 1709, when visiting the glass-grinder Temme in Kassel, saw a magic lantern with (it must be admitted, inferior) movable figures.'[28]

Zacharias Conrad von Uffenbach was a nobleman who undertook an educational journey through parts of Europe in the first years of the 18th century. He wrote a diary on his 'Curious Travels to Lower Saxony, the Netherlands, and England', which was published much later. The first volume wherein he made his interesting notes on Themme, appeared as late as 1753.[29]

In November 1709, Uffenbach came to Kassel in order to see the curiosities of the city. The resident Landgraf von Hessen-Kassel was a friend of all kinds of sciences and known for his 'Naturalien-Cabinett', a collection of odd items which included magic lanterns. It was for this reason he had induced the glass-grinder and optician Themme to move from Wolfenbüttel (then known for its university) to his court. Arriving in Kassel, Uffenbach notes:

Den 19. November Morgens gingen wir erstlich zu einem Glas-Bläser Zahn... Von diesem gingen wir zu dem Glas-Schleiffer Themme am Zwirner-Thor, welchen Ihro Durchlaucht von Wolfenbüttel anhero kommen lassen. Dieser ist ein alter, sehr wunderlicher Heiliger, welcher gewaltig Prahlens von sich selbsten macht. Er zeigte uns allerhand Arten von Seheröhren, Vergrösserungs-Gläser, Zauber- Laternen, Brenn- und Fern-Gläser, welche er unerträglich lobte, obschon sie gar mittelmäßig waren... Von seinen Zauberlaternen schwatzte er sehr groß, daß er uns zeigen wollte, was wir noch nie gesehen, nemlich, daß seine Figuren sich bewegten, und Geschütze, die losgezündet würden, präsentiren solten, welches zu sehen er uns Abends zu sich bate.

On the morning of the 19th of November, we went first to the glass-blower Zahn… From him we went to the glass-grinder Themme at the Zwirn gate, who had been ordered hither from Wolfenbüttel by His Highness. He is a curious old fellow, boasting very much. He showed us all kinds of microscopes, magnifying-glasses, magic lanterns, burning-glasses and telescopes, which he praised unsufferably, though they were mediocre... Especially, he boasted about his magic lanterns, promising to show us something we had never seen before, that is, moving figures and shooting guns, which we were invited to see that evening.[30]

In the evening, Uffenbach and his party got to see various kinds of magic lanterns and movable slides:

Abends sahen wir bey dem Glas-Schleiffer und Optico Themme, dessen oben erwehnt, seine Art von Zauber-Laternen, von welcher er so viel Rühmens gemacht. Seine beweglichen Figuren lassen in der That artig, sind aber, wann er das große Geheimnis davon entdecket, von schlechter Erfindung. Die Carossen, so fortgehen, sind nichts anders, als daß die Räder in dem Glas mit einem Diamant ausgeschnitten, und kleine messinge Räder daran vest gemacht werden, die man vermöge eines Fadens, so man darum gewickelt, herum ziehet; und so beweget sich auch das Spinn-Rad, an welchem der Cupido spinnet. Das Schießen und Bomben-Werffen ist noch einfältiger, scheinet aber auch viel artiger. Es wird zwischen das Glas und die Einfassung eine Öffnung gelassen, dadurch strecket man einen Pappendeckel, welcher eben so ausgeschnitten, daß dasjenige, so die Kugel und das Feuer vorstellet, eben bedecket wird. Wann es nun eingezogen, und Feuer geben soll, so ziehet man in Geschwindigkeit itzt gedachten Pappendeckel hinweg, und hält sogleich mit der andern Hand die Röhre, darinnen die Gläser zu; so präsentirt die rothe Farbe das Feuer, als wann es plötzlich losgezündet worden. Ich kaufte von seinen Figuren, so ziemlich gemalet sind, zwölf Bretter, auf deren jeglichem vier Figuren; und dann noch sieben, auf deren jeden eine beweglich, für zehn Reichs-Thaler.[31]

Uffenbach describes three of Themme's movable slides, the first showing a moving carriage with rotating wheels (made of brass and moved by a thread), the second showing a spinning Cupido at a

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21 Laura Minici Zotti presenta … *La Laterna Magica*, edited by Alessandra de Nitto, 3rd ed, Padova 1990 (p.2).

22 Zotti, op. cit. p.4.

23 Cf. Gertrud Schubart-Fikentscher: *Untersuchungen zur Autorschaft von Dissertationen im Zeitalter der Aufklärung*, Akademie-Verlag Berlin 1970 [p.42 passim]; see also R. Stintzing, *Geschichte der Deutschen Rechtswissenschaft*, München & Leipzig: R. Oldenbourg 1884, p.27: 'Wir sind heute gewohnt, bei [Dissertationen] an die Abhandlung eines Candidaten zum Zwecke der Erwerbung eines akademischen Grades zu denken... Allein die Dissertationes "inaugurales" bilden einen verschwindenden Bruchttheil der enormen Masse von Dissertationen, welche uns aus dieser Zeit von den namhaften Autoren erhalten sind ... Diese Erscheinung erklärt sich nur aus der engen Beziehung, in welcher die Dissertationen zu den collegia privata und den öffentlichen Disputirübungen stehen... Die "Dissertationen" werden den Mitgliedern des Collegiums dictirt oder zum Abschreiben überlassen, dann auch, zunächst für sie, in Druck gegeben. Aus den Schülern wird einer zum Respondens ernannt, dessen Name bei der Drucklegung auf dem Titel ersscheint. Seine Aufgabe besteht darin, bei den Exercitationes den Inhalt der Dissertation zu vertreten, also die einzelnen Sätze zu beweisen, zu erläutern und gegen die Einwürfe und Fragen zu verteidigen, welche von den übrigen Mitgliedern des Collegiums erhoben werden'.

24 He did in fact have a closer relationship with Ehrenberger, whom he recommended for the vacant position of a professor at Coburg in 1713; cf. Johann Christoph Adelung: *Fortsetzung und Ergänzungen zu Christian Gottlieb Jöchers allgemeinen Gelehrten-Lexico*, Vol. 2, p.842, Leipzig: Johann Friedrich Gleditschens Handlung, 1787. Adelung says expressis verbis: 'Im folgenden Jahr [1713] schrieb er eine andere Disputation de novo laternæ magicæ' ('In the following year, he wrote another disputation.').

25 The first Samuel Rhan (in Latin, Rhanæus), who died in 1660, was senior of the ministery at Pilten. His son Samuel Rhanæus II was a priest, as was his grandson magister Samuel Rhanæus III, who lived from 1695 at Grentzhofen; cf. Theodor Kallmeyer: *Geschichte der Kirchen und Prediger Kurland's*, Riga: W. F. Häcker, 1849.

26 Cf. *Revelation of St John*, Chapter, 13, I.

27 Rhanæus, op. cit. pp.8–9; partial Italian translation of Rhanæus' description: C. Alberto Zotti Minici (1988), op. cit. pp.18–20.

28 Liesegang, op. cit. p.14, according to von Klinckowstroem, *Geschichtsblätter für Technik und Industrie 1920*, Vol. 7, p.122.

29 Zacharias Conrad von Uffenbach: *Merkwürdige Reisen durch Niedersachsen, Holland und England, herausgegeben von Johann Georg Schellhorn.* 3 vols, Frankfurt/Leipzig: Gaum; Ulm: Stettinische Buchhandlung, 1753–4.

30 Uffenbach, op. cit. pp.50–1.

31 Uffenbach, op. cit. pp.62–3.

spinning-wheel, also moved by a thread, and the third, which was 'more simple, but working better', a shooting gun. To achieve this effect, Themme had a simple idea. He hid the gun-fire with a paper-strip, which he then withdrew rapidly so the bullet and the red colour of fire appeared, at the same time hiding the gun.

Uffenbach also found similar movable slides in the *Philosophical Collection* of Johann Andreas Schmid in Helmstedt.[32]

According to Liesegang the pictures in a book by Schmid were 'apparently painted on a piece of flexible cloth', which seems to be improbable. I have not had the opportunity to look into Schmid's book, but Uffenbach's report from Kassel gives clear evidence that the figures were painted on glass. Maybe the concealing 'paper-strip' was made of cloth. Furthermore it is not justified to call Themme's invention 'mediocre'. Uffenbach did not like his boasting, but Themme was right in promising to show something that had never been seen before. Uffenbach was disappointed when the simple idea behind the 'great secret' was revealed: 'His movable figures work very well, but as soon as he reveals their great secret, are a mediocre invention.' Nevertheless, Uffenbach was apparently impressed by the show. He bought from Themme twelve 'nicely painted' wooden-framed glass-slides with four figures each, and seven movable slides, for ten florins.

Although Themme may have worked out movable slides before Rhanæus, he too was not the first. Rhanæus himself testifies to the existence of experiments with animation applied to glass slides before his own. He notes two of them: the first is described by the 'laudable man' Johann Conrad Creiling in his dissertation of 1705. The full title of this book reads as follows:

Phænomena Laternæ Magicæ ad Stateram expensæ dissertatione academica per Principium isodynamicum explicata, Favente Supremo Numine Præside Viro nobilissimio, amplissimo, excellentissimo, Domino Johanne Cunrado Creilingio, Philosophiæ Naturalis & Mathematicæ Professore Publ. Ord. p.t. Decano Spectatissimo. Domino Patrono, Præceptore & Promotore piè devenerando. Publicæ Ventilationi exposita à Samuele Urlspergero, Kircho-Teccense, Georgio Erico Remmelino, Schorndorffense, Philosophiæ & Magisterii Candidatis. In Aula Philosophorum Nova d. Julij MDCCV. Tubingæ, [Typis] Johannis Græzii, 1705:

Phenomena of magic lantern... explained by the isodynamic principle in an academic dissertation presided over by... the most noble man... Herr Johann Conrad Creiling, professor in ordinary of natural history and mathematics, at present His Spectability the Dean ... and exposed to public deliberation by Samuel Urlsperger from Kirchheim-Teck and Georg Erich Remmelin from Schorndorf, candidates of philosophy and mastership.

Once again we have the same problem of authorship as with Rhanæus' own dissertation.[33]

Johann Conrad Creiling was professor of natural history and mathematics at the university of Tübingen in about 1700. From his own account we know that he published his first dissertation in 1701, that he was dean of the faculty in 1705, and died after 1744. In 1705, he was presiding over the dissertation citated above, the respondents being two probationers (candidates of philosophy and mastership), Samuel Urlsperger from Kirchheim-Teck and Georg Erich Remmelin from Schorndorf in Bavaria. In the first chapter of their book, they describe how to prepare and how to begin a magic lantern show.[34]

Having discussed the necessary preparations, they say: Extinctis candelis insimulque remoto cautè operculo derepentè parieti insultans Prologi persona miris gesticulationibus habitusque ridiculo scenam quasi aperiens comparuit, Dominisque Spectatoribus genu flexo pileoque ventilato ita salvere jussis evanuit, loco ipsius ab alio momento citius occupato, aliis aliisque ordine sibi succedentibis.

When the lights are put out, and the cover is removed carefully, suddenly the person of the prologue appears on the wall, moving strangely and in a ridiculous habit, and opens, so to say, the scene, greeting the spectators by bowing, and removing the hat in courtesy, and then he disappears again, and the same place is quickly occupied by other movements which follow in order one by one.

Rhanæus presumed that 'this little man had limbs which were worked out and really moving, so that what we are going to invent ourselves, had already been invented by others'. If this had been true, his own work would have been 'superfluous'. But he could find no proof other than that one remark in the Creiling/Urlsperger/Remmelin-book, and so he continued working on his own ideas.

But when Rhanæus was ready to publish his book it happened that he learned of another experiment preceding his own. He himself reports:

Id tamen, cum opella hæc nostra prelo esset demandanda, ex ore Celeberrimi Domini Hambergeri percepimus.

When this our booklet was just going to be printed, we learned the same out of the mouth of the famous Herr Hamberger.[35]

According to Hamberger (who has already been mentioned), slides of that kind had already been made sixteen years earlier, ie, in 1697.

Hermann Hecht cites Liesegang (op. cit. p.14) saying 'Georg Albrecht Hamberger's reference may be contained in a volume of his dissertations published in Jena in 1708. This would date the first movable slides as 1692.' But Rhanæus had his knowledge 'ex ore... Hambergeri' ('out of the mouth... of Hamberger'), and he dates it 'ante annos abhinc sedecim' ('sixteen years before now'), ie, 1697. In 1708, Hamberger published a dissertation on eye-diseases *Dissertatio de opticis oculorum vitiis* (cf. Friedrich-Carl Gottlieb Hirsching: Historisch-litterarisches Handbuch berühmter und denkwürdiger Personen, welche im 18. Jahrhundert verstorben, Vol. 2, Leipzig: Schwickertscher Verlag, 1795, p.305).

Hamberger was one of Rhanæus' teachers at the Jena university. He told him that the invention was made by the Jena physicist Erhard Weigel.[36]

Hamberger should have known – he was a son-in-law of this then famous scientist, and in 1698 his successor as professor of mathematics at the university, and in 1705 professor of natural history. According to Rhanæus, he reported on Weigel's experiments:

Quod jam ante annos abhinc sedecim laternæ suæ auxilio exhibuerit hircos arietantes & ursum exsurgentem unguibusque suis virum quendam, Helvetiorum habitu indutum, petendem.

...that he had already sixteen years before, projected by means of his lantern, goats butting, and a bear rising and attacking with his paws a man dressed in a Swiss outfit.

There is only Hamberger's oral report, as Weigel himself was dead and had not written down this invention ('a morte autem præventus inventum illud litteris mandare non potuerit'). But as Rhanæus remarks, 'asseruit autem nobis laudatus vir structuræ rationem a nostra plane fuisse diversam' ('this laudable man left behind the idea of a model which was quite different from our own').

Erhard Weigel (1625–99) was appointed as professor mathematum at Jena in 1653, but worked in various fields: architecture, astronomy and physics as well as ethics and history. He was a skilful experimenter and mechanic, known for more than a hundred pieces of apparatus that he had invented or developed himself. He listed his inventions in a booklet, which also contained some optical devices, (*Mathematische Kunstübungen sampt ihrem Anhang*, Jena: J.J. Bauhofer, 1670). Rhanæus calls Weigel 'præcedentis sæculi Archimedem ad mundi interitum usque merito laudibus veneratur posteritas' ('the last century's Archimedes, whose merits will be praised by posterity unto the end of the world').[37]

Weigel kept up a correspondence with Christian Huygens, whom we have to regard as the inventor of the magic lantern. In 1691/2, he travelled to Holland where he met Huygens in The Hague and at his country-house. Did they discuss magic lantern problems? We do not know. Weigel's actual destination had been London, in order to present his inventions to the Royal Society. But he returned before crossing the Channel, worried by rumours of 'frequent piracy and storms'.

Weigel's idea of a movable slide is illustrated by Krünitz in his encyclopedia. There is a figure and a description of how to work it out.[38]

Krünitz explains:

Man mahlt auf eine runde dünne Glas-Scheibe AB ein Stück Feld oder Erdreich, worauf des Bären Hinterfüsse, bis an die Knie ruhen, schneidet ein rundes Loch in den hölzernen Schieber KL, und passet dieselbe da hinein, daß ihre Fläche mit dem Holze gleich sey; das übrige von dem Bären mahlt man auf das viereckige Glas CDEF, welches dem ersten, wo die Knie aufhören, bey G also angehänget wird, daß es um eine kleine Axe beweglich ist und, durch die bewegende Kraft in E, auf und nieder gelassen werden kann. Dieses letztere geschieht vermittelst eines seidenen Fadens oder Pferde-Haares, welches, bey E in ein durchbohrtes Loch geknüpfet, und bey H um eine kleine Rolle, bis über den Schieber hinaus, geht, wo man es mit den Fingern fasset, und den Bär, beym Anziehen des Fadens I, gegen E in die Höhe hebt, beym Nachlassen aber denselben nach B niederfallen lässet. Fast auf eben die Weise kann auch die Bewegung der sich stoßenden Böcke bewergstelligt werden.

On a circular thin glass-slide (AB), a piece of field or earth is painted, with the hind legs of the bear up to its knees. From the wooden frame (KL), a circular hole is cut out, fitting the glass-slide on the same level. The rest of the bear is painted on the rectangular glass (CDEF), which is fixed to the other one at the end of the knees, that is to say, at G, so that it is movable around a little axis, and by the moving force in E may be moved up and down. The latter is achieved by means of a silk-thread or horse-hair tied through a hole at E, going round a little bobbin at H and beyond the frame. By drawing the thread towards E, the bear moves up, and when drawn towards B it moves down. In a similar way, the movement of the butting goats is achieved.

32 Johann Andreas Schmid: *Collegii experimentalis physico-mathematico Demonstrationes*. Helmstedt, 4th edn. Helmstdt, 1721 (plate X, fig. 156).

33 Johan Christoph Adelung's encyclopedia of scholars *Fortsetzung und Ergänzung zu Christian Gottlieb Jöchers Gelehrten-Lexicon*, 2. Band C-J, pp.522–3, Leipzig: John Friedrich Gleditschen 1787, and most later authors ascribe it to Creiling; Krünitz, op. cit., refers to it as 'Creiling Diss de Laternae magicae phaenomenis ad stateram ad-plicatis'.

34 op. cit. Chapter I, p.4.

35 Rhanæus, op. cit. p.7.

36 Zotti, op. cit. p.18, says that Rhanæus is referring to 'B. Wegel', but in fact he writes 'de B. Weigelio', and that is 'Beatus Weigel', the blessed (or late) Weigel.

37 On Weigel's life and inventions, see Edmund Spieß: *Erhard Weigel, weiland Professor der Mathematik und Astronomie zu Jena, der Lehrer von Leibnitz und Pufendorf - Ein Lebensbild aus der Universitäts – und Gelehrtengeschichte des 17 Jahrhunderts, gleichzeitig ein Beitrag zur Geschichte der Erfindungen sowie zur Geschichte der Pädagogik*. Leipzig: Julius Klinkhardt, 1881.

38 Krünitz, op. cit. p.509, and fig. 3939.