Gigantic Ideas

By Jonathan Erland

Presentation of the
The Academy Science and Technology Council

at the
Samuel Goldwyn Theater

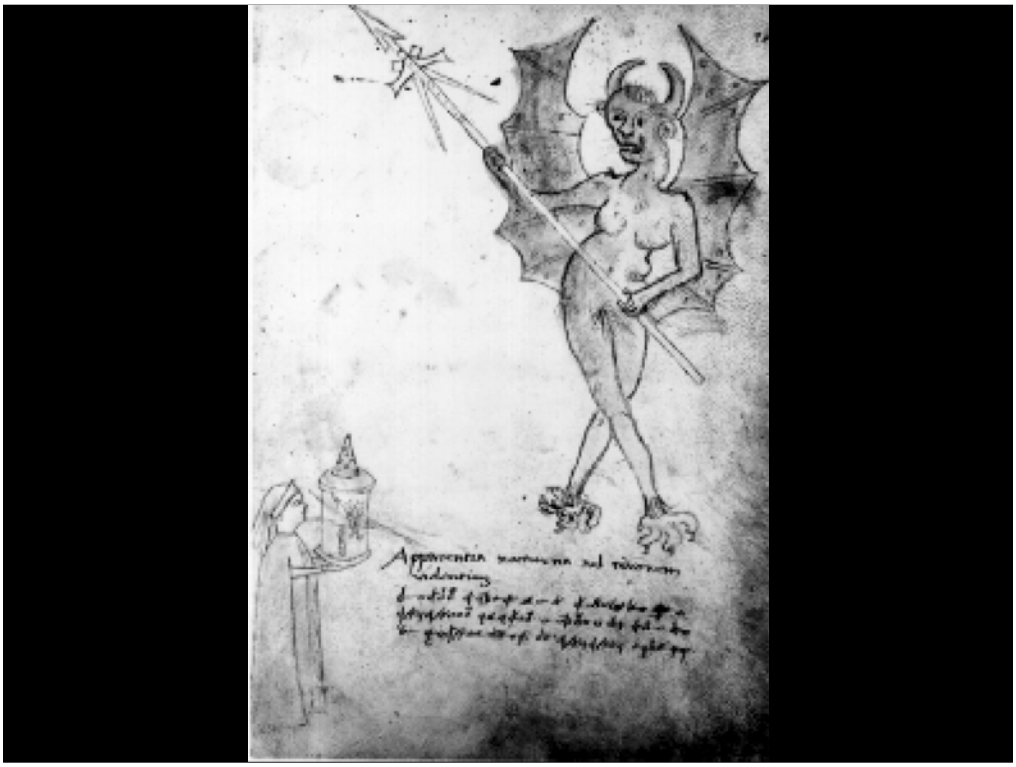
of the
Academy of Motion Picture
Arts and Sciences

October 14, 2004

Thank you, Andy! O.K. so this is a program of the Science and Technology Council of which I'm a member. The Academy also has a Scientific and Engineering Awards Committee, of which I'm also a member, and I'm on the Board of Governors, the Museum Committee, the Branch Executive Committee, the Vine Street Committee and on and on.

"We don't ask much; and that call may never come; ....." Yeah, right. You join this Academy and it's a life sentence at hard labour!

So I was tasked with presenting this segment of tonight's program, the "Pre-Cinema" segment. On the Sci-Tech. Awards Committee we've a process where we form surrogate committee's, special sub-committees, to investigate specific areas of film technology for awards consideration, and I've done a lot of those. So this assignment seemed very similar to that. Investigate and report on pre-cinema. What could be simpler? And when we've completed our investigations we produce a nice report that starts out something like, "we're pleased to submit the following findings... " And so on.



1420 Magic Lantern

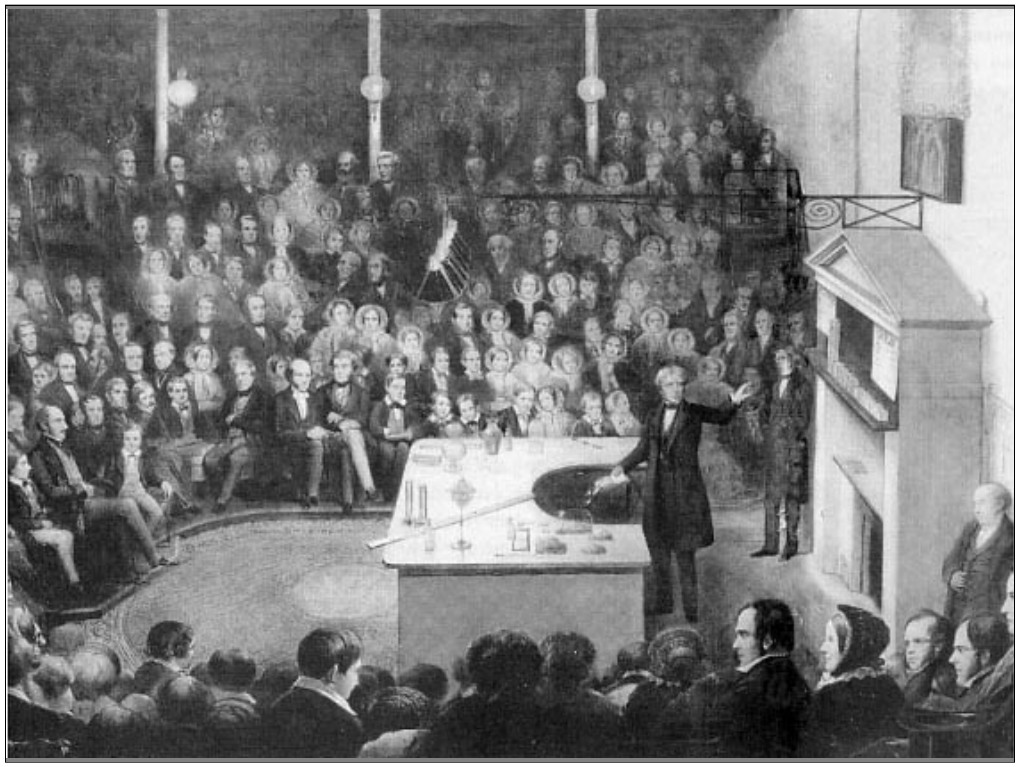
Of course, I didn't realize that my first citation would be a magic lantern projector in fourteen twenty! Leaving me with nearly five hundred years to cover! So, quite obviously, we're looking at a review of our history that'll take a number of months to accomplish. Tonight, we can only provide a summary of a report that'll eventually consume an entire evening.

Preliminary though they may be, however, the findings show that motion pictures are a manifestation of the age of enlightenment and the industrial and social revolution that accompanied it. Quite specifically it's the result of an elegant dialogue between pure science, applied science and technological ingenuity that combined to make a new art form, the cinema, not only possible - but inevitable.

There's a popular notion that cinema, radio, telephone, television, automobile, computers, flight, are all signature products of the twentieth century. But, while commercialized essentially in the twentieth century, they all began their development at least in the nineteenth century, if not earlier, and were the collective product of quite a special period which saw the very creation of the term "scientist," and of the "scientific community." Given the disinterest, bordering on disdain, with which science is held today, it's hard to comprehend how immensely popular it was with a broad spectrum of the public in the nineteenth century.

Image of RI, (watercolor by T.H. Shepherd)

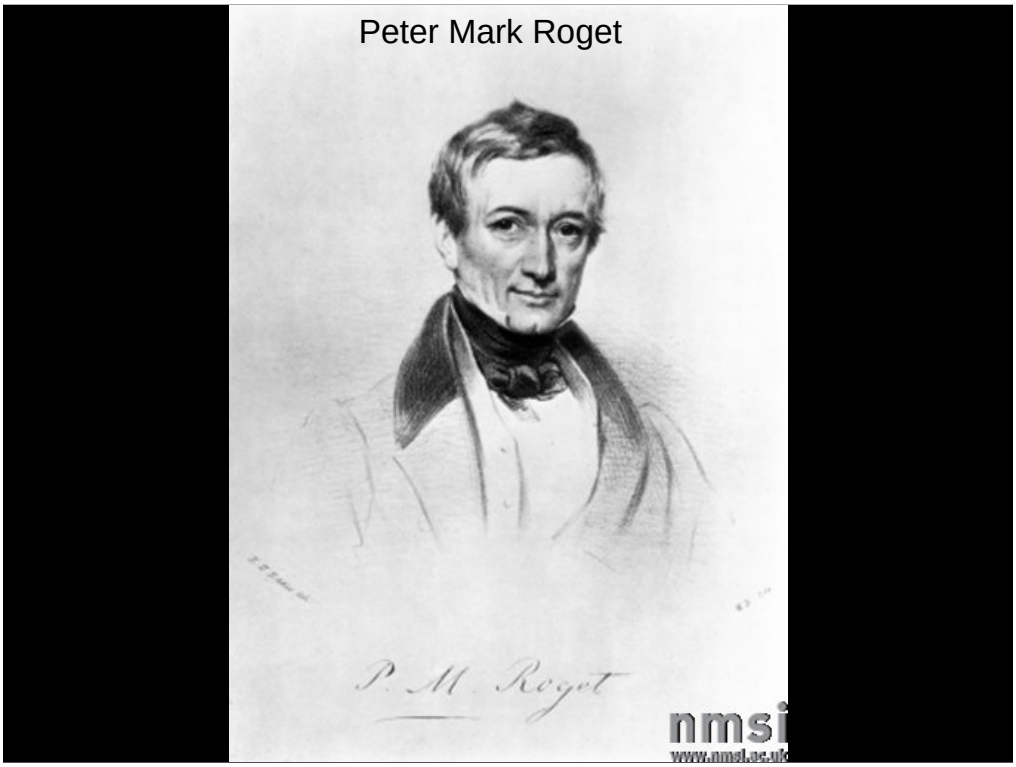
In England, in 1799, The Royal Institution was founded to “further the application of science to the common purposes of life.” For those not familiar with it, The Royal Institution was the model James Smithson had in mind when he left his fortune to the United States for the purpose of building the Smithsonian Institution.



Faraday Christmas Lecture

The Royal Institution built extensive laboratories as well as a very large hall that could accommodate hundreds, and the lectures there became so popular that in 1808, in order to unclog the tangle of carriages, Albermarle Street became the first ever “One-Way” street.

The thread of the pre-cinema story will weave back and forth through this Institution.



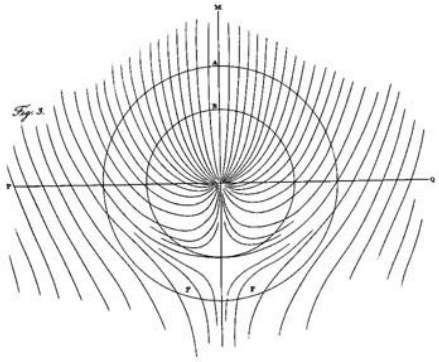
Peter Mark Roget

In 1824, a professor at the Institution, Peter Mark Roget - yes, the same gentleman who gave us the Thesaurus - presented a paper

V. *Explanation of an optical deception in the appearance of the spokes of a wheel seen through vertical apertures.* By P. M. ROGET, *M. D. F. R. S.*

Read December 9, 1824.

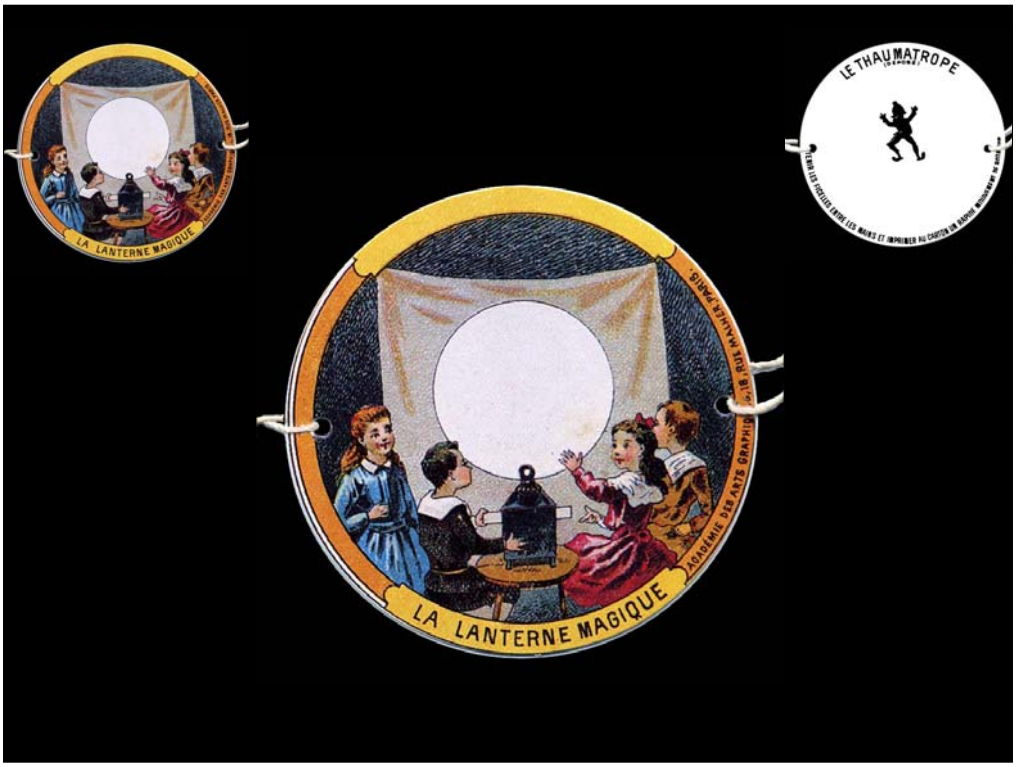
A CURIOUS optical deception takes place when a carriage wheel, rolling along the ground, is viewed through the intervals of a series of vertical bars, such as those of a palisade,



Title page of Roget paper

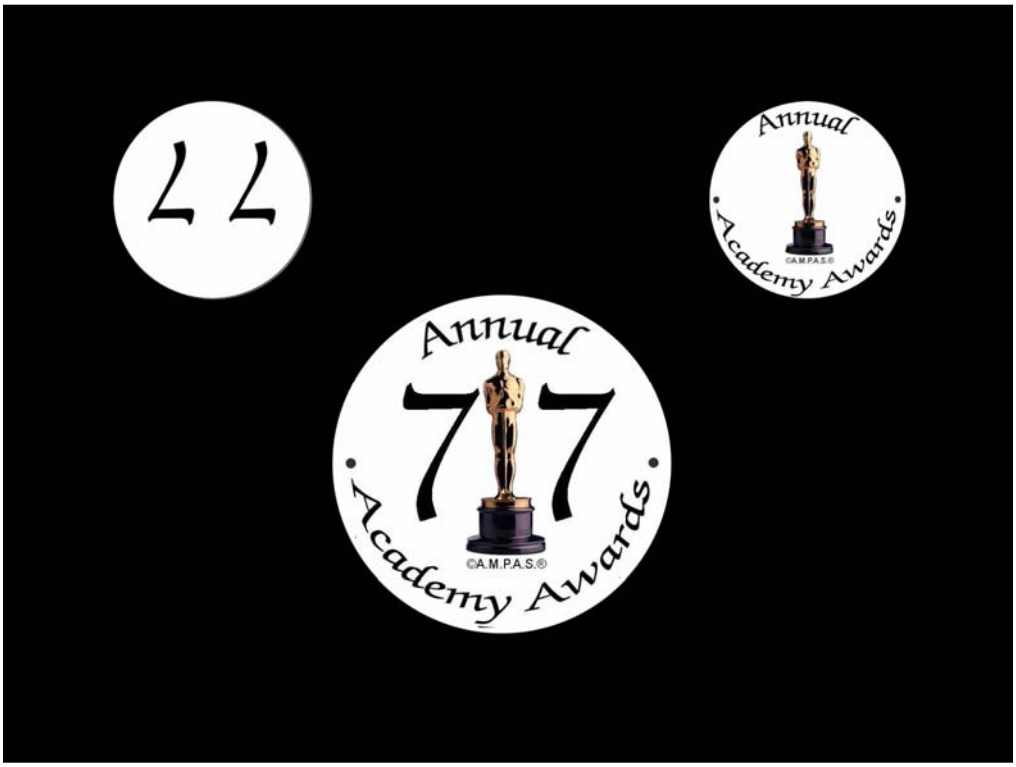
entitled "Explanation of an Optical Deception in the Appearance of the Spokes of a Wheel seen through Vertical Apertures"

With this paper, Roget began the process of explaining human visual perception. Others had certainly made rudimentary observations about such phenomena, but here began a scientific enquiry of what's involved.



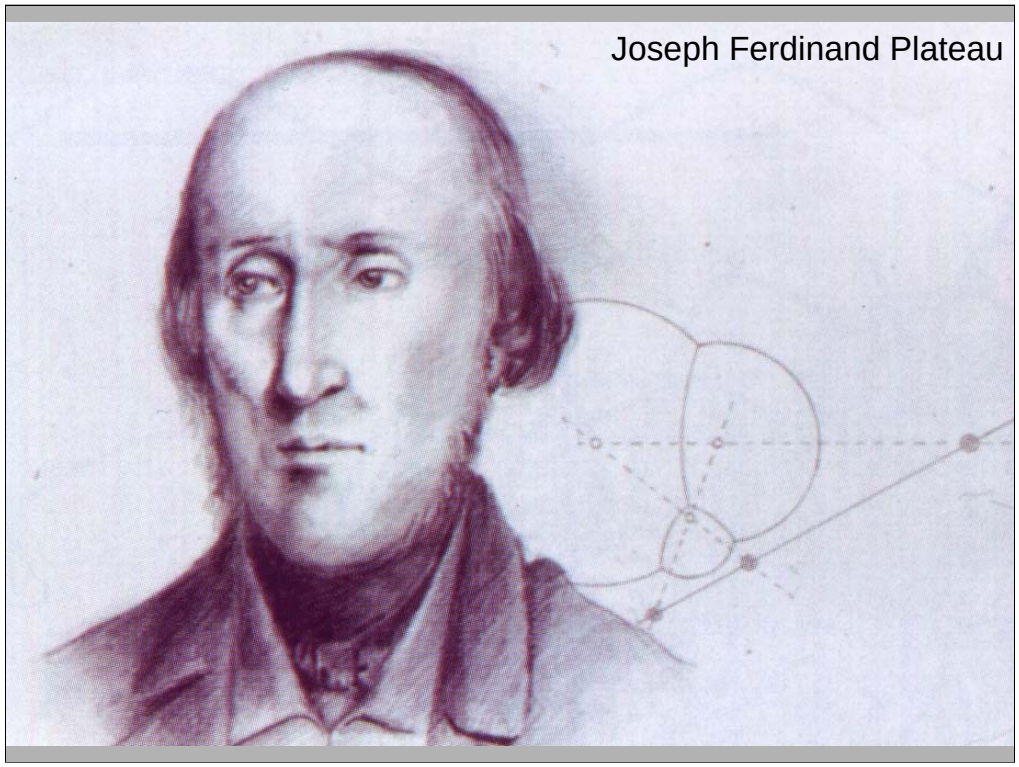
Thaumatrope

Charles Babbage then recounts to Dr. Fitton, a fellow cryptographer and colleague of Charles Darwin, a demonstration by John Herschel that you can see the two sides of a shilling when spun. Soon after, Fitton comes back bearing a small cardboard toy, the “Thaumatrope,” which was first sold at the Royal Institution. These became enormously popular for the rest of the century and came in many, many designs,



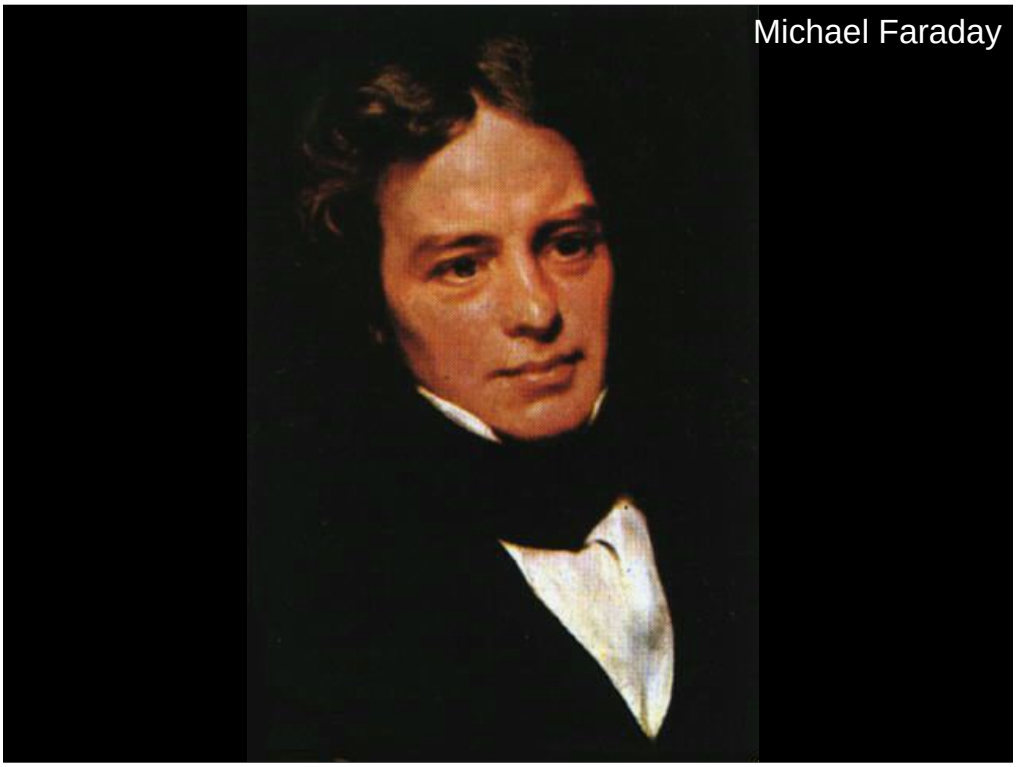
"Oscar" version of thaumatrope

Here’s one of our own design.



Joseph Ferdinand Plateau

Joseph Ferdinand Plateau, defended his doctoral thesis at the University of Liége, on “Some Properties of the Impressions Produced by Light on the Eye.”



Michael Faraday

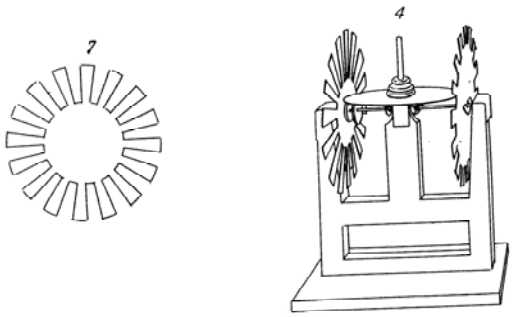
And in 1830, Michael Faraday weighed in with a talk at the Institution, “On a Peculiar Class of Optical Illusions.” With this paper Faraday provided one of his famous “wheels” which demonstrated,

Wagon wheel clip

what in the “cinema” era we call the “wagon wheel” effect, where wagon wheels appear to go forward, or backward, out of all relation to reality. Faraday’s wheel survived into the present era

Phonograph turntable with timing

in the form of the way in which we all timed our phonograph turntables, before the CD outmoded them.



Faraday wheels

Faraday wheels

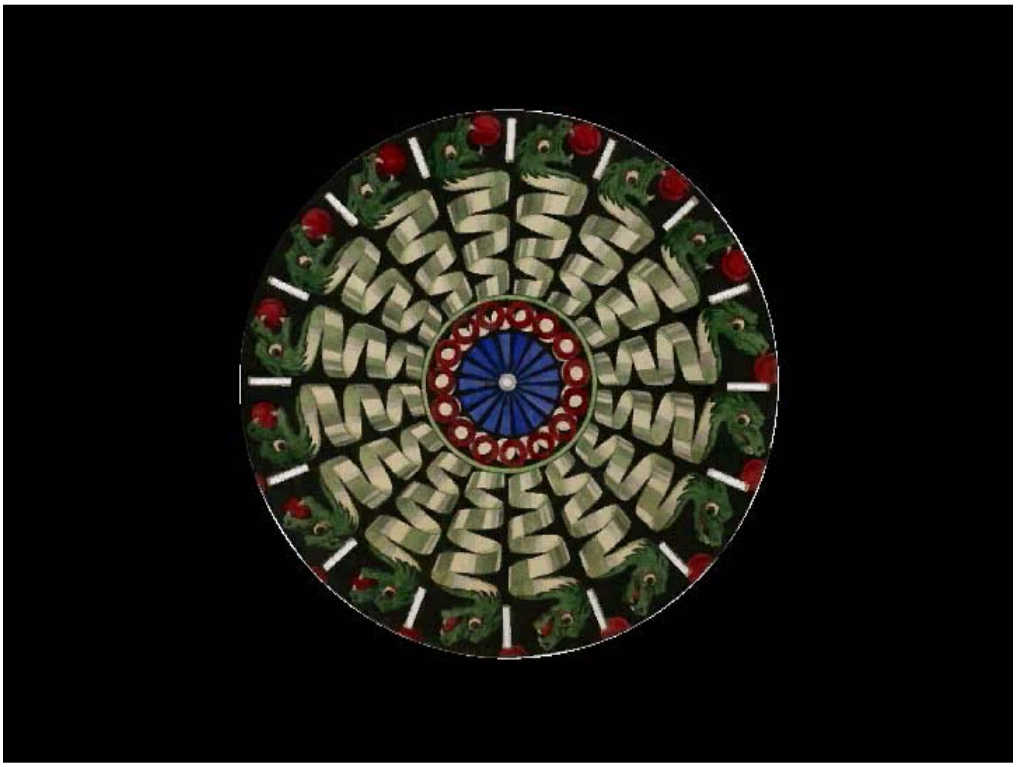
Faraday made more wheels in 1831 and published drawings of them in his paper, including this one:

Demo: Faraday Wheel

so that if you stood in front of a mirror, - this'll do nicely - and rotated it like this, - the notches appear to stand still.

Plateau's Original Phenakistiscope

Plateau examined this wheel in Brussels in December of '32 and made a major connection between the science of the physiology of human vision and the art of "Beguiling Optical Entertainment." He realized: first, that if a picture were placed in the space between the notches it'd be more interesting, and then; a real breakthrough, - as Plateau realized that the pictures could represent a series of stages of a moving object like this, which Plateau named the "Phenakistiscope".



Stampfer Stroboscopic disk

Meanwhile in Vienna, Simon Stampfer, also inspired by Faraday's wheel, had reached the same conclusion as Plateau with this: (The serpent theme, by the way was quite popular with the Victorians.) Stampfer called it: - The Stroboscopic disc.

The Zoetrope

By taking the disc and transforming it into a cylinder, George Horner dispensed with the mirror and voila!

The Zoetrope!

Magic Lantern example

From the dawn of time, humans have indulged in “Beguiling Optical Entertainment” such as the 1420 magic lantern we saw earlier.

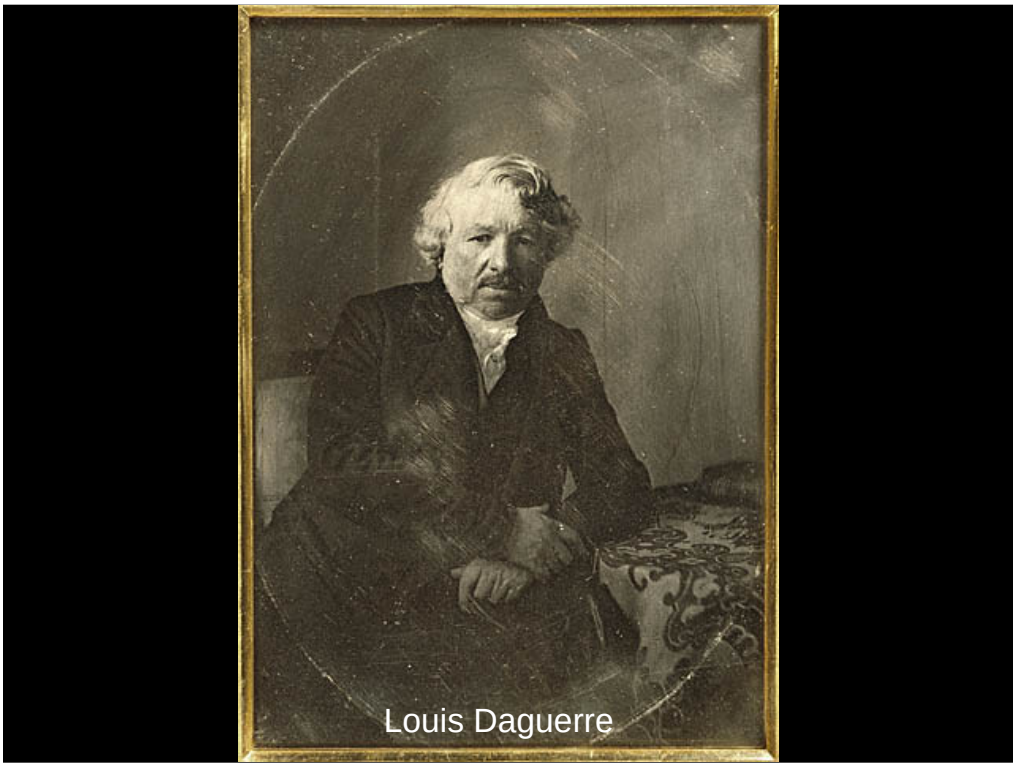
By the nineteenth century, techniques included multiple projectors with moving slides, such as this example.

“Phantasmagoria”

As well as the spectacular “Phantasmagoria” - Nothing short of a multi media extravaganza of front and rear projection; projection onto smoke; with ghosts and ghouls the featured characters.

Diorama (by Daguerre)

The Panorama and the Diorama, on the other hand, while dramatic, were much more genteel and designed for the “carriage trade.” These, often vast productions of scenes or 360° vistas, combined painting with three dimensional settings cunningly designed to transport you into their world.



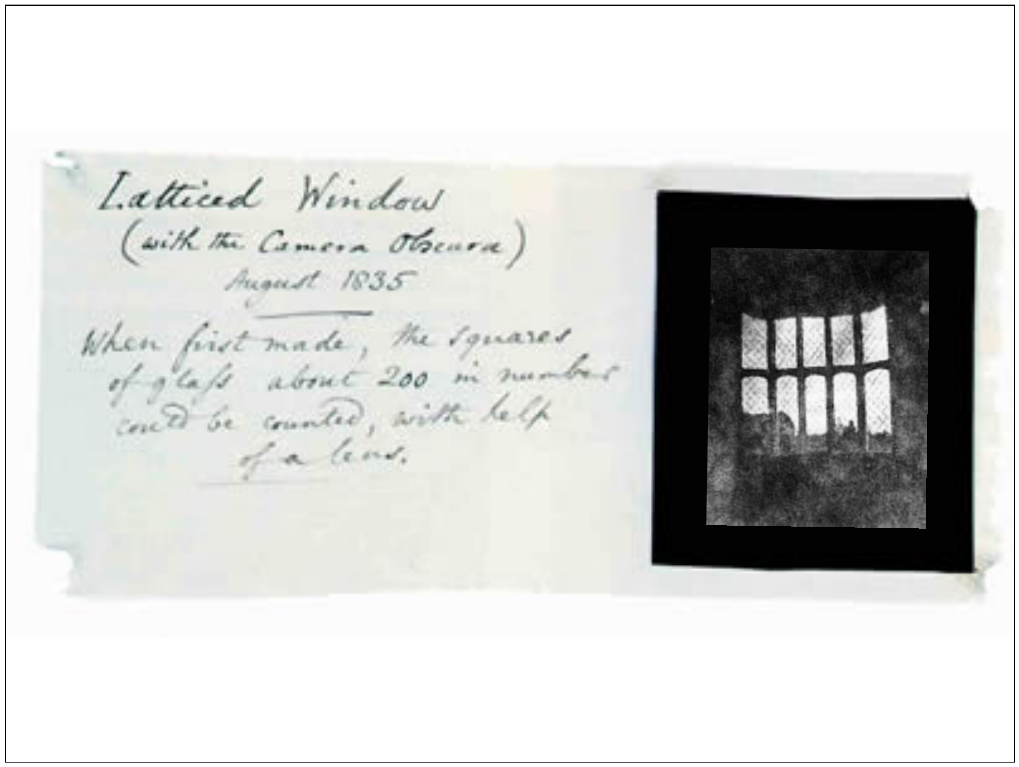
Daguerrotype. (Of Louis Daguerre!)

One of the leading designers of the Diorama is Louis Daguerre.

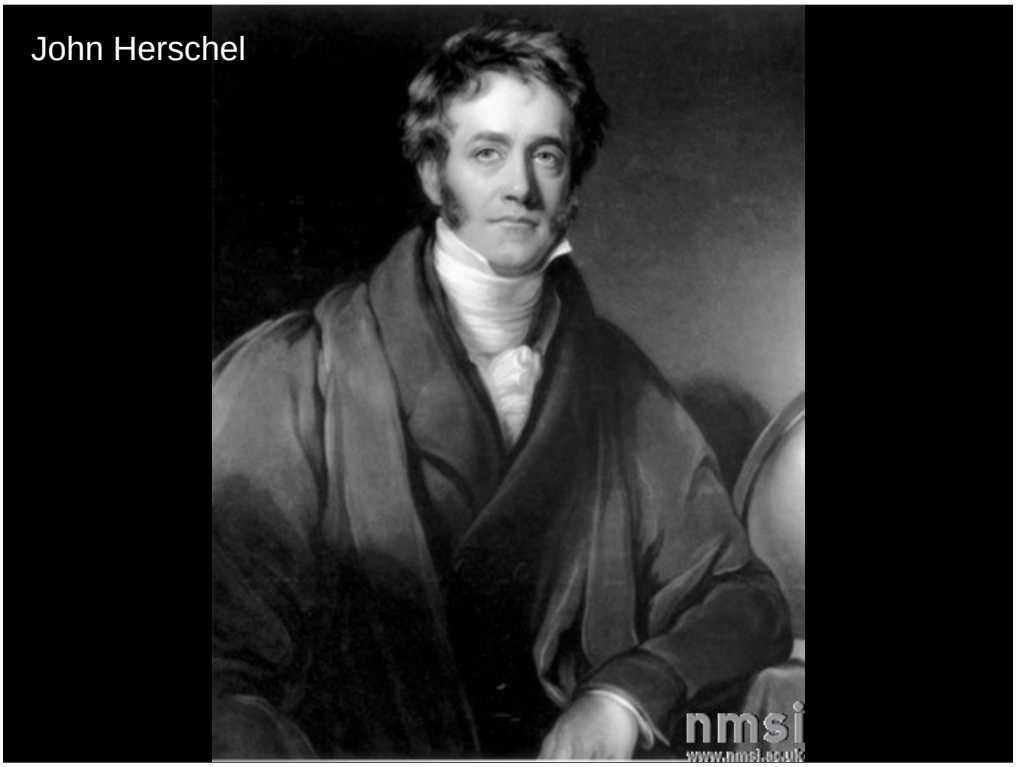
He believes that Joseph Nicéphore Niépce's efforts to "capture" images in a camera obscura could be very useful in the design of the Diorama. They form a partnership and the result is, the Daguerrotype. France buys the intellectual property rights from Daguerre and makes it a gift to the world.

Fox Talbot photograph - Talbot himself

Meanwhile Fox Talbot is beginning to have success with his “photographic” process,



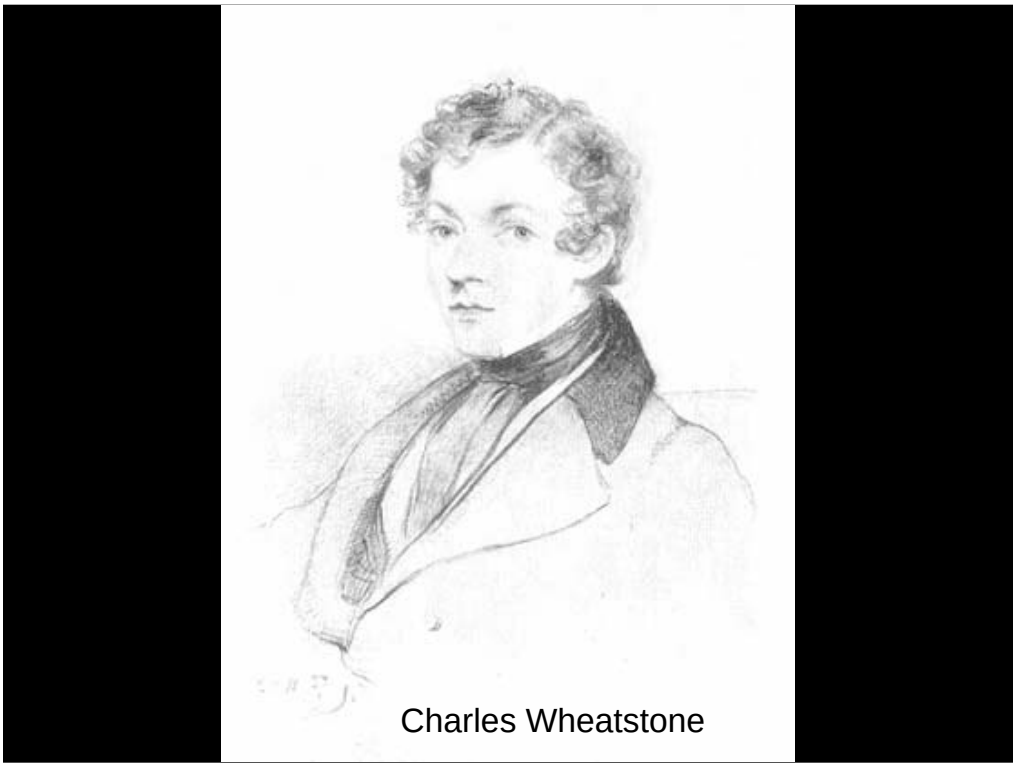
Fox Talbot photograph. "the window“



Herschel

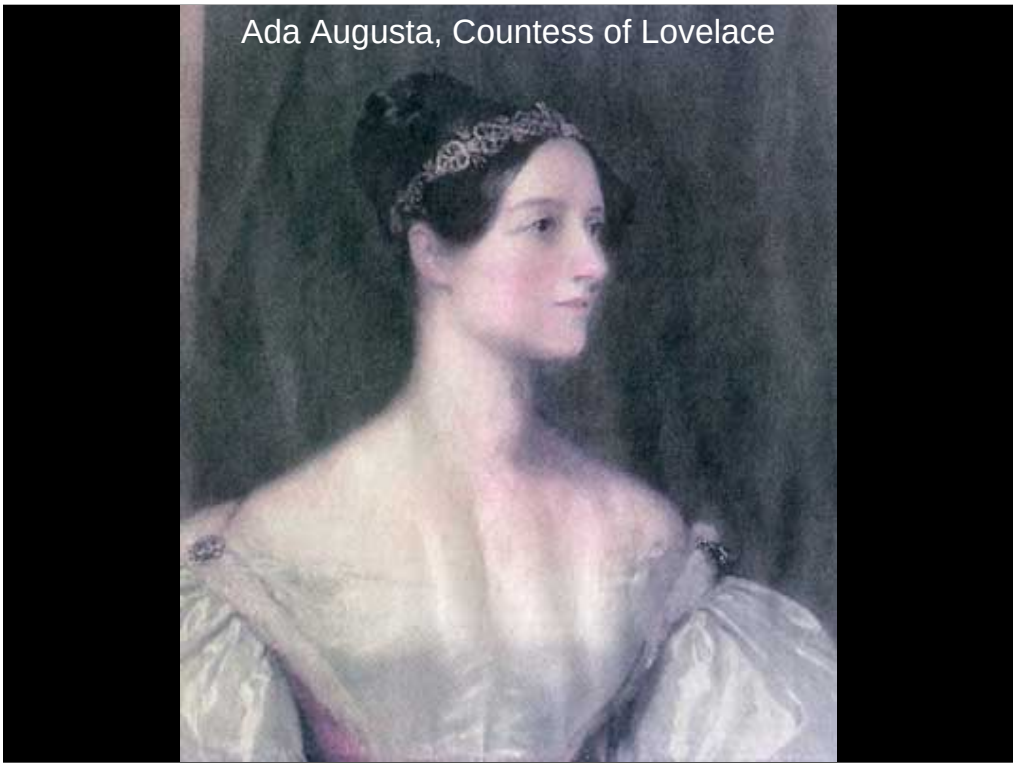
as is John Herschel who solves the problem of “fixing” photographs so they remain permanent.

Herschel also gives us the terminology we still use: “photography,” “positive,” “negative” as well as “snapshot”.



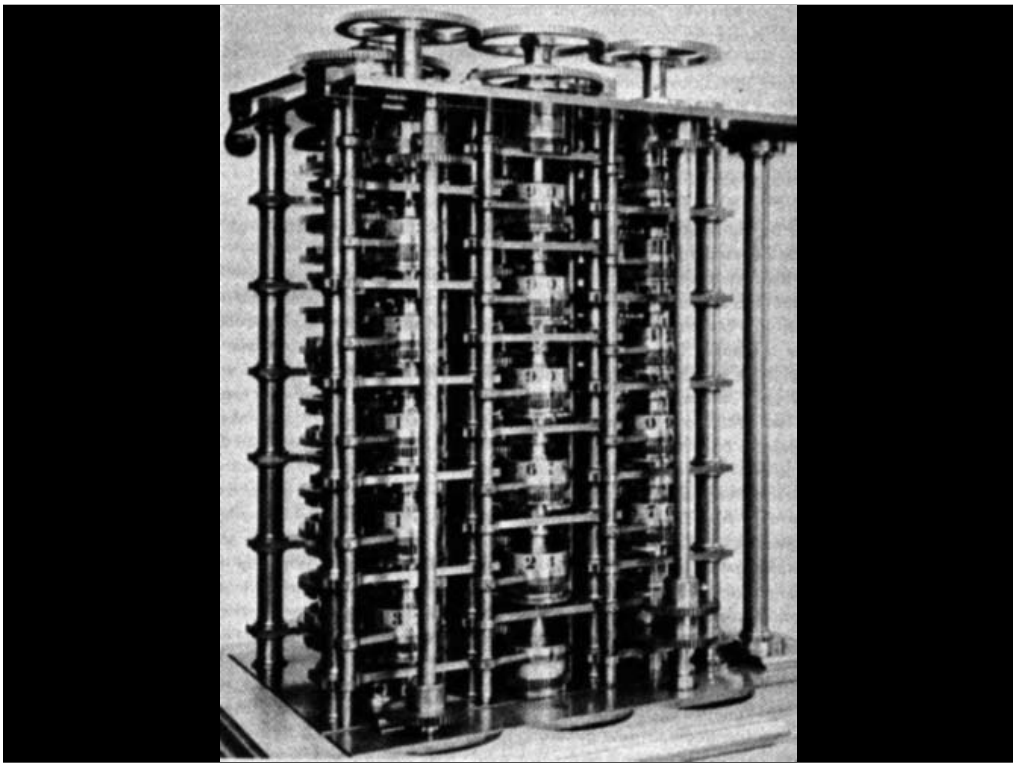
Charles Wheatstone

Meanwhile, Charles Wheatstone, who designed the first telegraph as well as the “Concertina” persuades



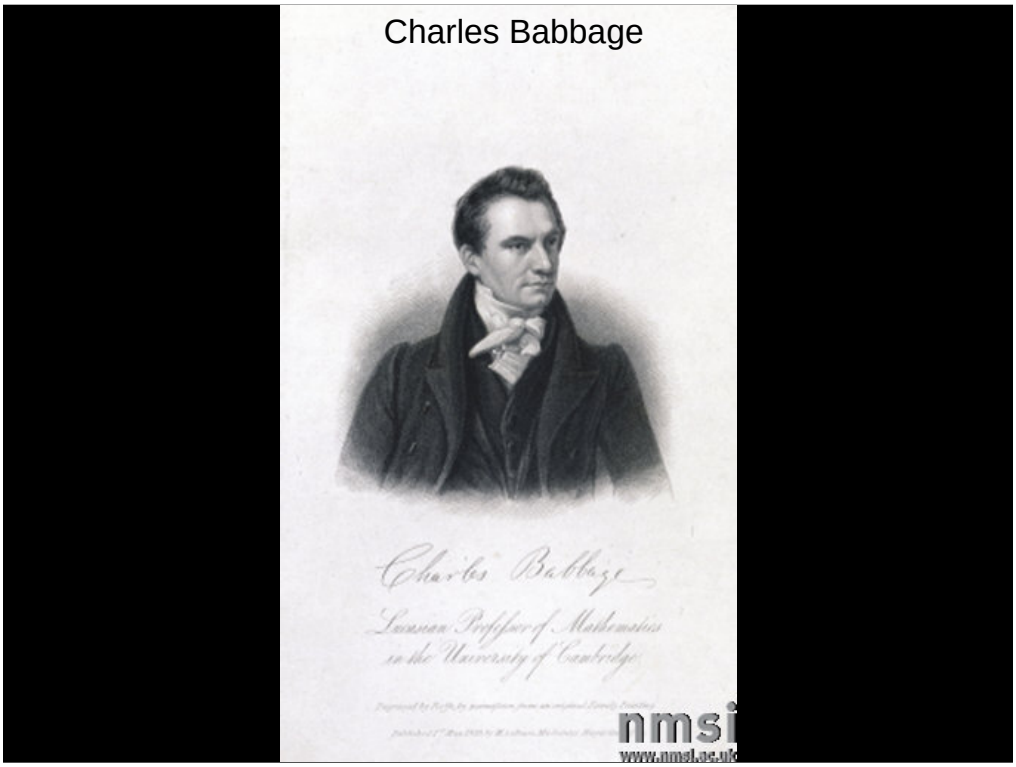
Ada Augusta, Countess of Lovelace

Ada Augusta, Countess of Lovelace and the daughter of the poet Byron, to translate a paper by the Italian Menabrea describing their mutual friend Babbage's "Analytical Engine"



The Analytical Engine

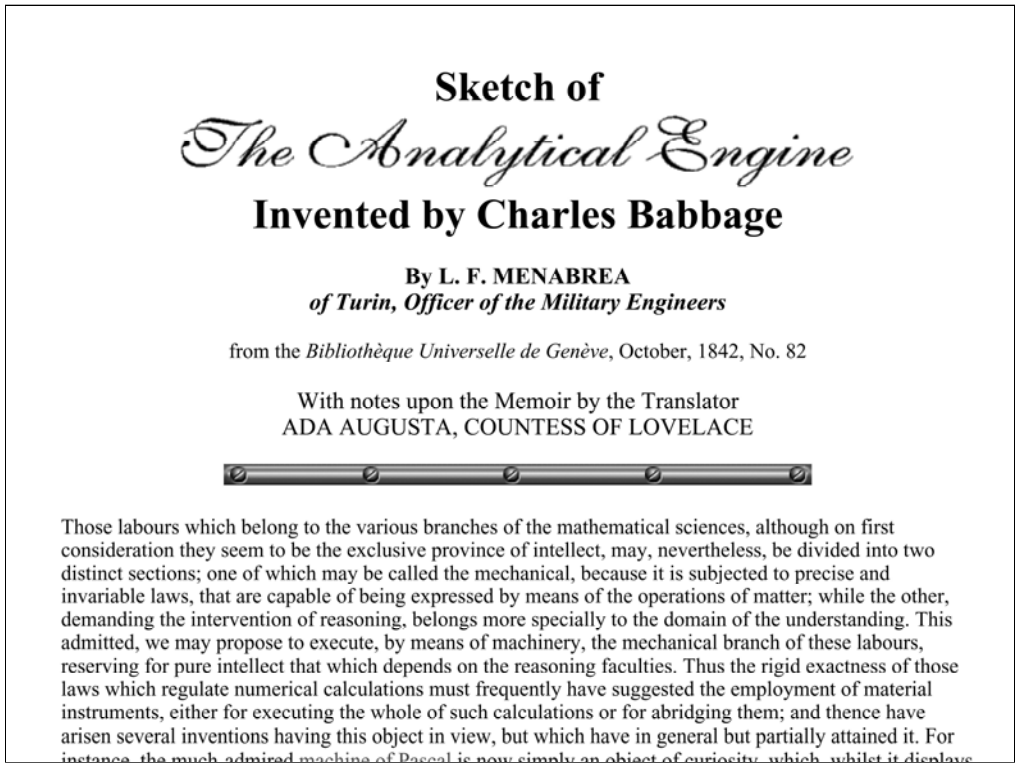
Menabrea, was reporting on Babbage designs for what today we call the computer. Menabrea described it as, “a gigantic idea” ..and said, “this is nothing less than a machine capable of analysis, the imagination is astounded.”



Charles Babbage

Wheatstone was aware that Ada was more fluent in explaining it than was Babbage himself.

Babbage went further, saying Ada, a gifted mathematician, was abundantly capable of writing a scientific paper in her own right – never mind translating one.



Sketch of

The Analytical Engine

Invented by Charles Babbage

By L. F. MENABREA
of Turin, Officer of the Military Engineers

from the *Bibliothèque Universelle de Genève*, October, 1842, No. 82

With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE

Those labours which belong to the various branches of the mathematical sciences, although on first consideration they seem to be the exclusive province of intellect, may, nevertheless, be divided into two distinct sections; one of which may be called the mechanical, because it is subjected to precise and invariable laws, that are capable of being expressed by means of the operations of matter; while the other, demanding the intervention of reasoning, belongs more specially to the domain of the understanding. This admitted, we may propose to execute, by means of machinery, the mechanical branch of these labours, reserving for pure intellect that which depends on the reasoning faculties. Thus the rigid exactness of those laws which regulate numerical calculations must frequently have suggested the employment of material instruments, either for executing the whole of such calculations or for abridging them; and thence have arisen several inventions having this object in view, but which have in general but partially attained it. For instance, the much admired machine of Pascal is now simply an object of curiosity, which, whilst it displays

Title page, “Sketch of The Analytical Engine”

So the upshot was that Ada translated the paper and then appended some “Notes by the translator”.

Today, it’s the theme of her “notes,” – much more comprehensive than Menabrea’s original paper – that echo down through the years

Ada Augusta, Countess of Lovelace was born 10 December, 1815.

On 10 December, 1980, The U.S. Department of Defense created Military Standard 1815, a computer programming language they named “Ada.”

Ada is a powerful object-oriented general purpose programming language designed to support the construction of long-lived, highly reliable software systems.

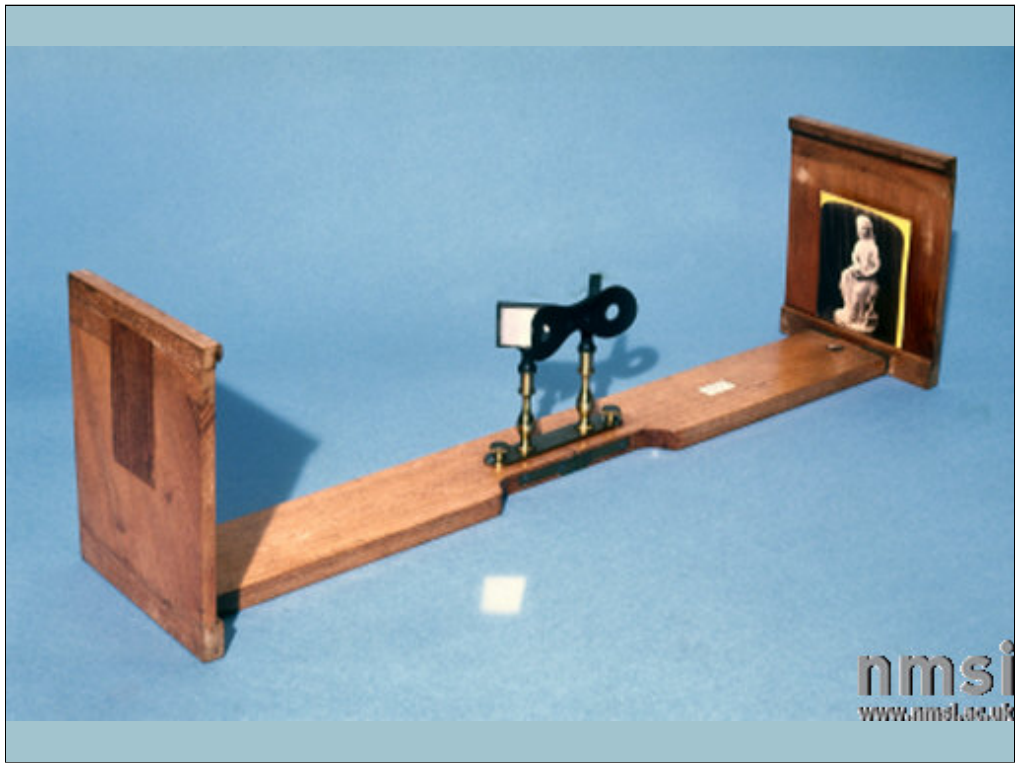
For Ada’s contribution to the “Analytical Engine” concept was nothing less than computer programming – “software” – and implicit in her concept was the fact that such a process would be capable of creating art, such as music and graphics.

Notable Members of the Royal Institution

So this is an intriguing bunch, the Royal Institution gang, quite at home with "gigantic ideas." Most remember them as figures in history, unrelated to each other. In fact they were a community, they corresponded, attended each others lectures, dined together. This disparate group included: Charles Darwin, author Charles Dickens, David Brewster, who gave us the kaleidoscope!, Michael Faraday of electric induction which meant motors and generators, and his electromagnetism brought us telecommunications such as the telegraph of Wheatstone, Fox Talbot, photography, along with John Herschel who was full of ideas, he even invented the 'blueprint," the speedometer, the cowcatcher, besides spinning the famous shilling that became the "thaumatrope"!

Charles Dickens

Oh, and if you want to know what the dickens Charles Dickens contribution to the cinema was, just try adding up the number of hours of cinema text he’s provided to us.



Stereoscope

To this point, however, all of the investigations have attributed visual phenomena as a function of the retina of the eye, such as the so called “persistence of vision.” Charles Wheatstone now proceeds to deal with binocular vision and he introduces the “stereoscope” to illustrate it.

He develops this investigation, – amazingly, the first coherent discussion and explanation of binocular vision that we’re aware of – and makes a critical distinction. Wheatstone leads us into the mind as the place where visual processing takes place, rather than the retina.

Since this is so basic to the motion picture process, I’m going to spend a minute with it here. The so called “persistence of vision” mechanism is actually not the one that’s pertinent to comprehending motion pictures. Roget, by the way, never actually used the term in his paper.

Demo: “Bendy” stick

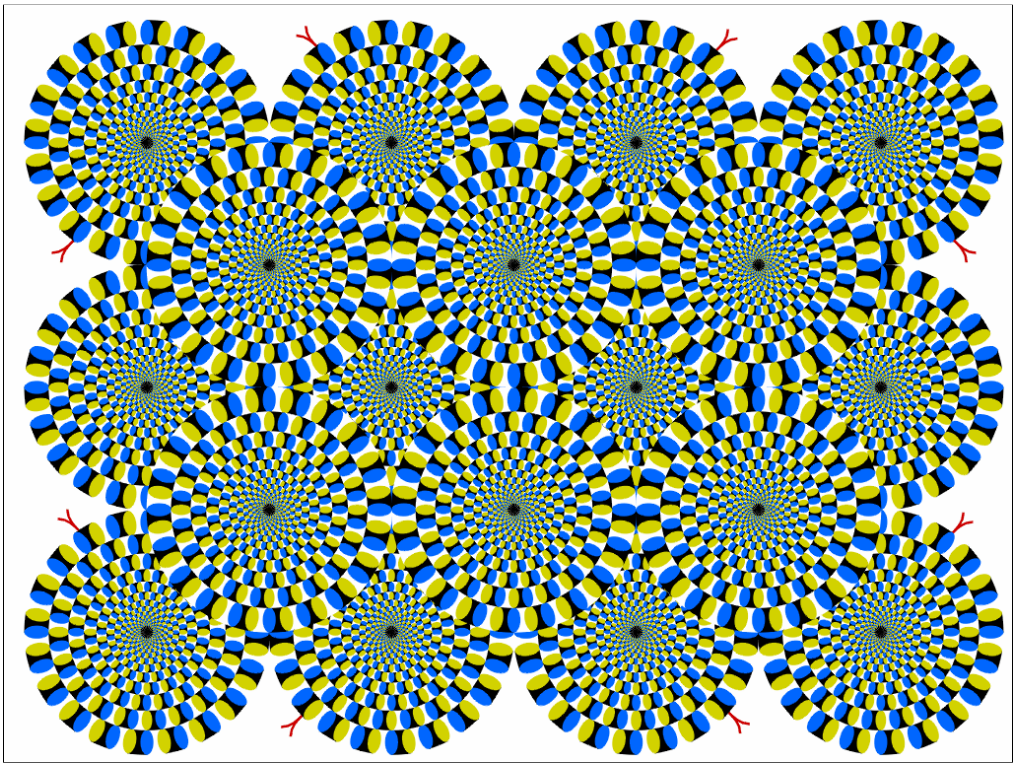
The best way we can get close to a persistence of vision process is by this demonstration.

DEMO: Flashlight infinity sign

You should be seeing an infinity symbol as I do this. This is because the light source is relatively very much brighter than anything else. So that’s one “motion” process. Here’s another:....

DEMO: Bendy stick

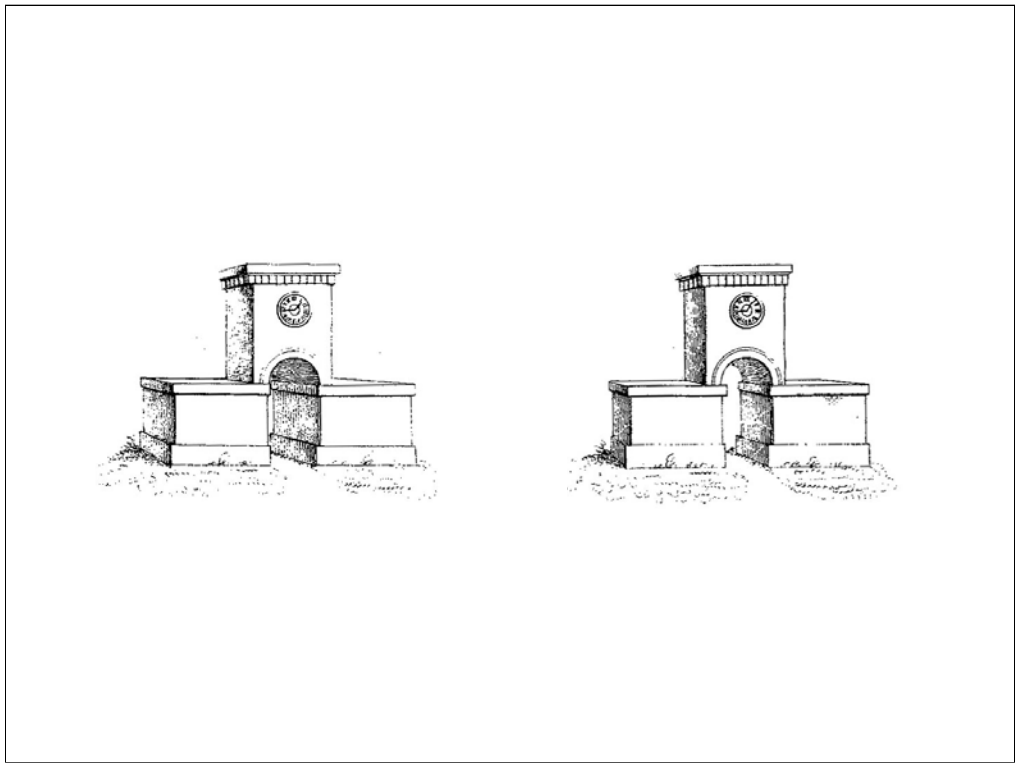
Now this, as you can see, is a perfectly rigid stick. Yet you saw it apparently become a rubber stick. However, it’s not a bright light. So it’s not the same mechanism as the flashlight.



Kitaoka design

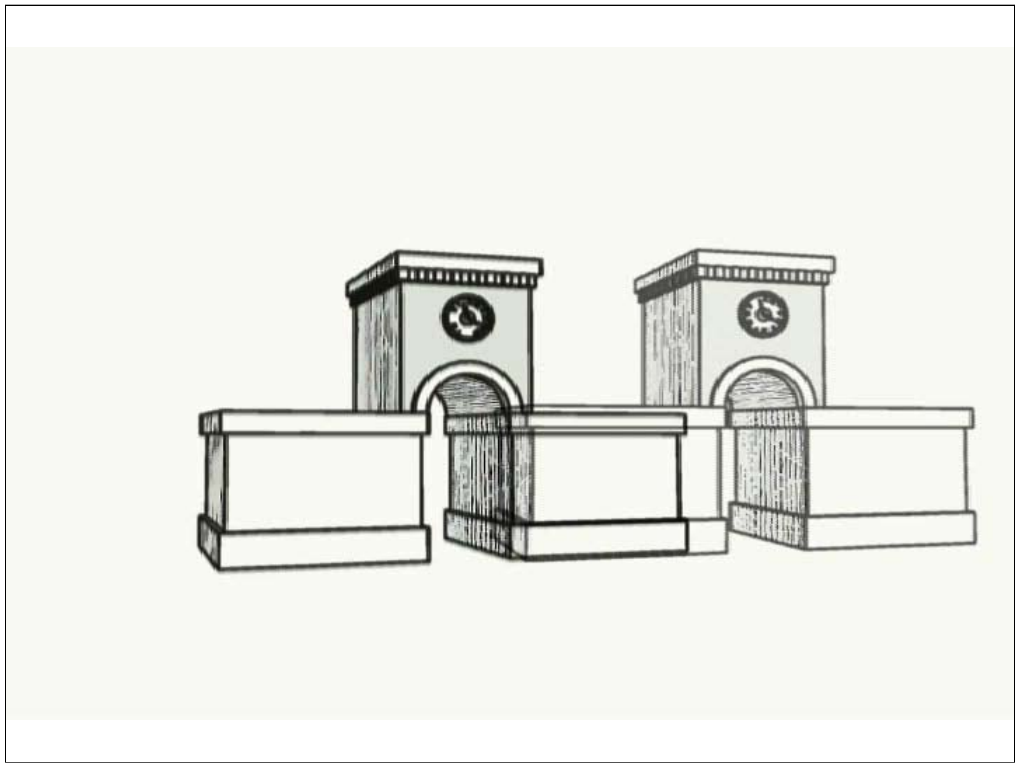
And here's yet another mechanism of our human visual system.

The pattern, I can promise you, is absolutely still. Your mind, – brain if you prefer, – is creating the impression of movement. There are now known to be several different areas of the brain that process visual data from the eyes about motion and in several different ways.



Wheatstone illustration of building

In illustrating binocular vision, Wheatstone also effectively created the science of photogrammetry, by which we use images of objects as a means to measure them. He had to do this because photography didn’t quite exist when he began his work



Animation: Wheatstone building

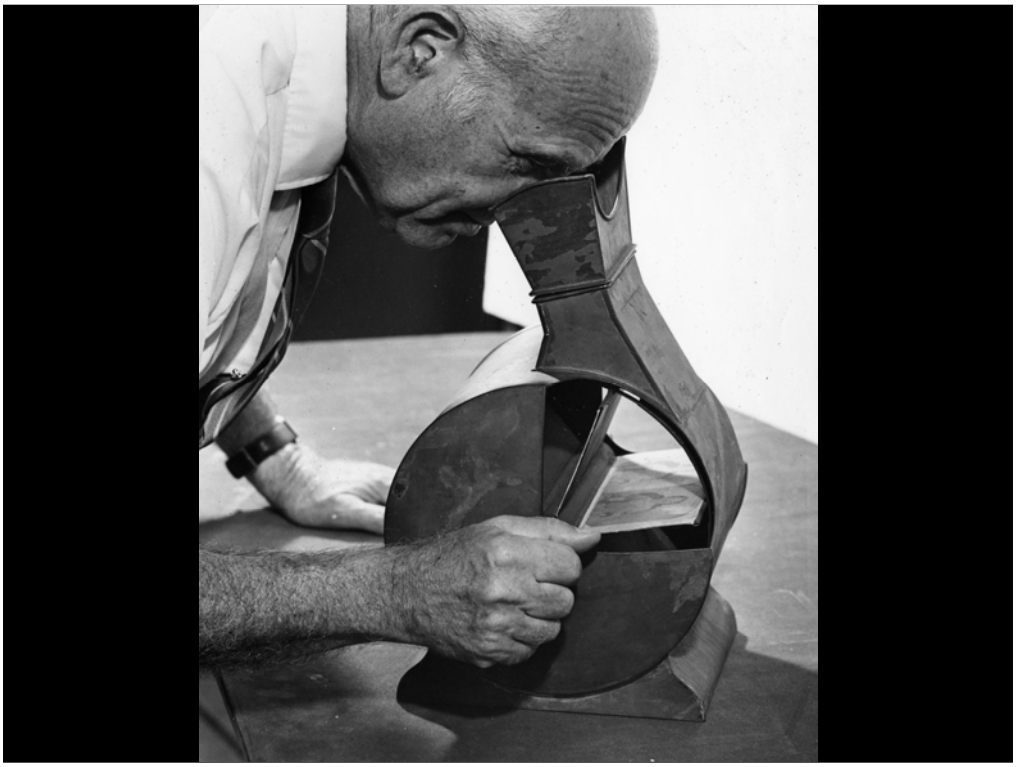
and so he had to draw his stereo views by hand. . . . So we've been able to reconstruct the building he depicted. Wheatstone is all over anybody who will make him the stereo views he needs to demonstrate his binocular vision theories, and both Daguerre and Talbot are known to have done so.

Crystal Palace Expo.

Stereoscopes became an immediate rage and by 1851, the year of the Crystal Palace Exposition, 250,000 were sold in a three month period. As the story of the pursuit of moving pictures unfolds from the ‘50's through the ‘80's, much of the effort is directed at a stereo version.

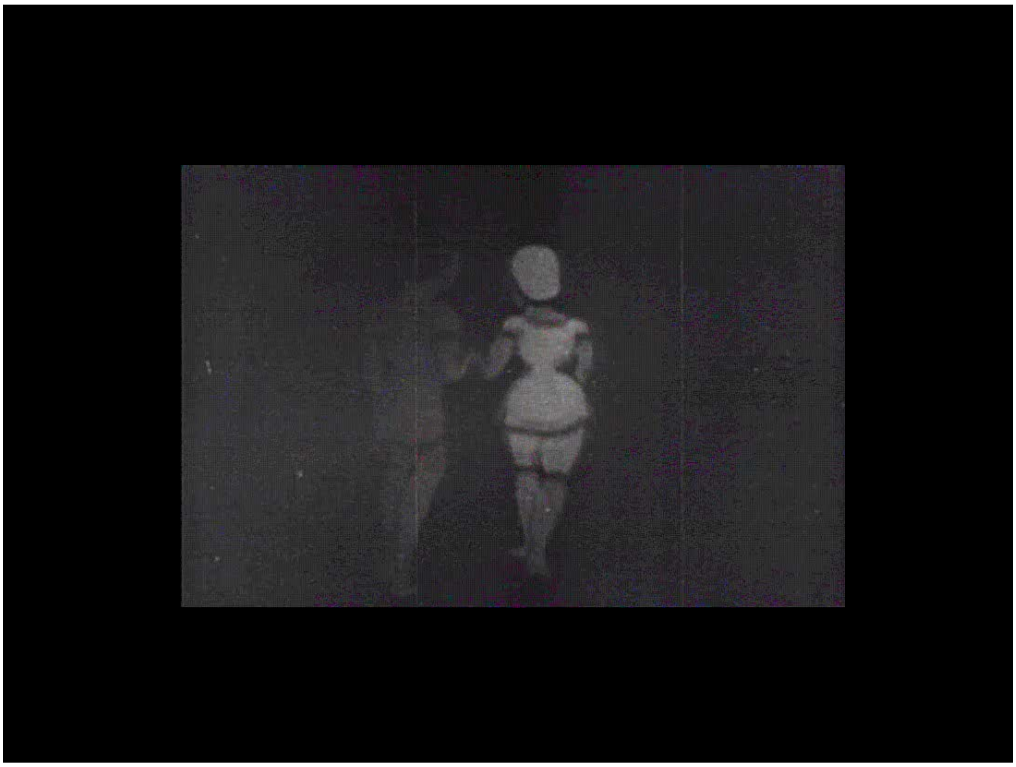
Wheatstone Kine stereo view and pictures

This approach by Wheatstone only provided for 13 pairs of moving images and wasn’t very effective.



Coleman Sellers’ stereo viewer

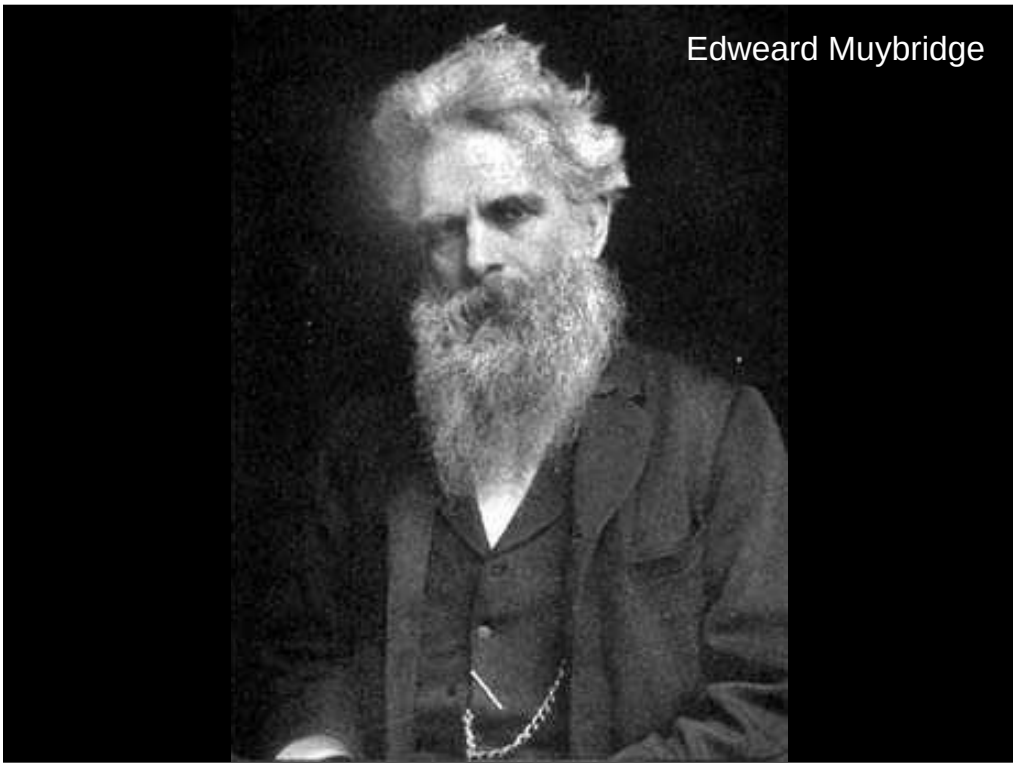
Coleman Sellers version of 1861 is getting better and anticipates the Mutoscope by some thirty years.



Sample of Reynaud's moving pictures

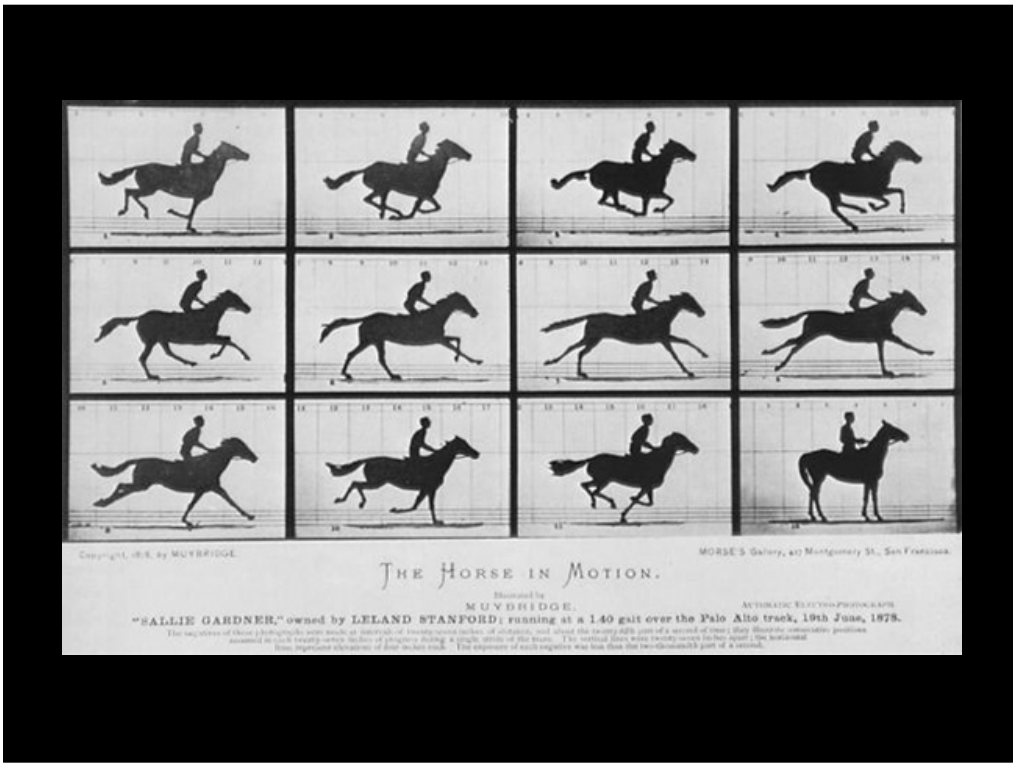
But the stereo approach to moving pictures was thwarted by the inability to project the images.

Projectionists, a vital part of our art form today, of course, preceded the cinema. In earlier days they were often known as "lanternists" and, as we've seen, have been with us since at least 1420. (So, Carl, your profession is actually 584 years old!)



Edweard Muybridge

The photographer Edweard Muybridge, famous for his work with the Stanford horse project in 1872,

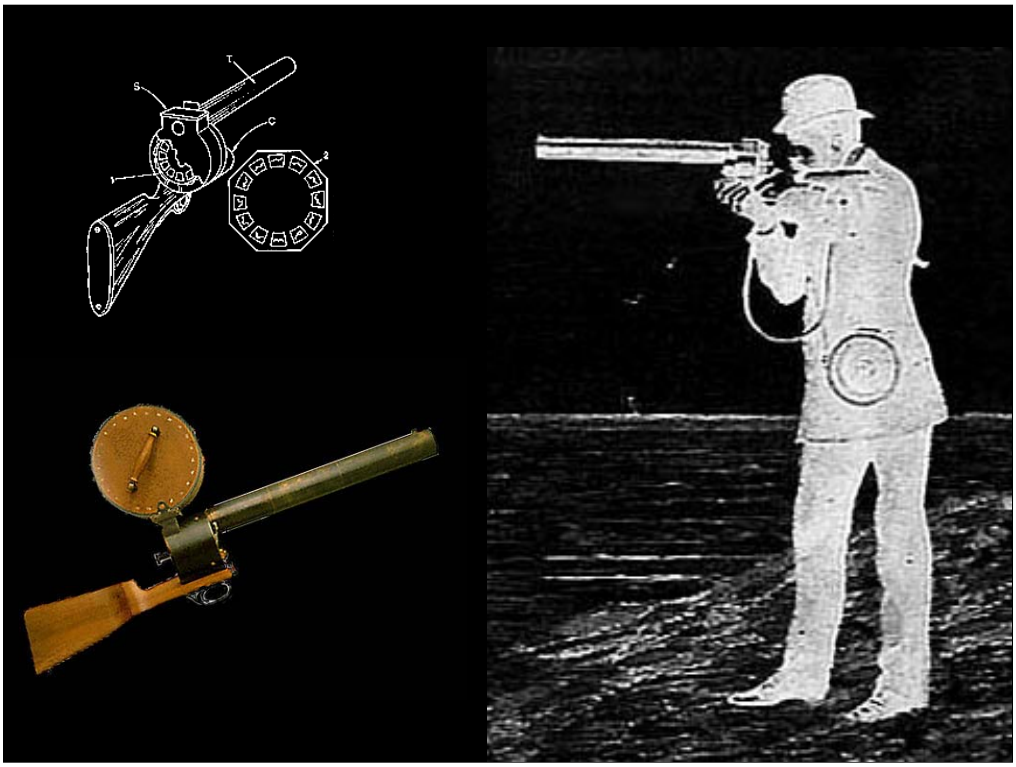


Animation: Stanford / Muybridge Horse

while an excellent pictorial photographer, was also a photogrammetrist. He used photography to study and measure, and for a time was employed by the U.S. Government Coastal Survey. Closely allied in this science was Etienne Jules Marey who used images to study physiology,

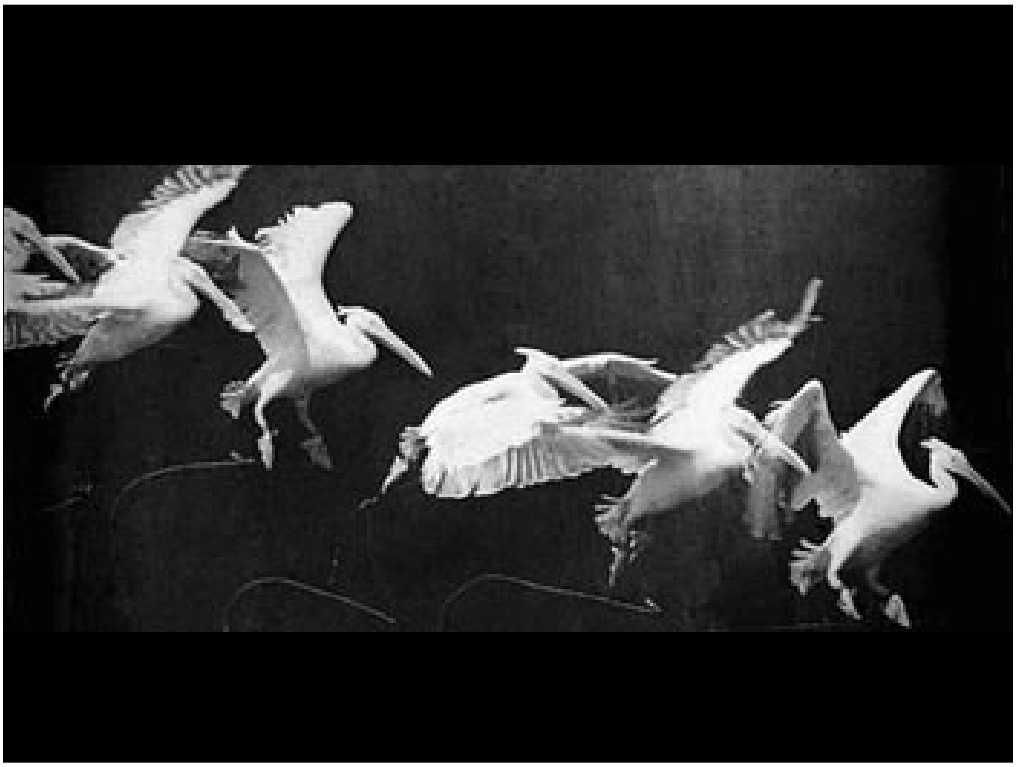
Animation: Marey falling cat

Closely allied in this science was Etienne Jules Marey who used images to study physiology,



Marey photo gun

and created a sort of “photo-tommy gun” capable of “shooting” images at a rate of 100 a second.

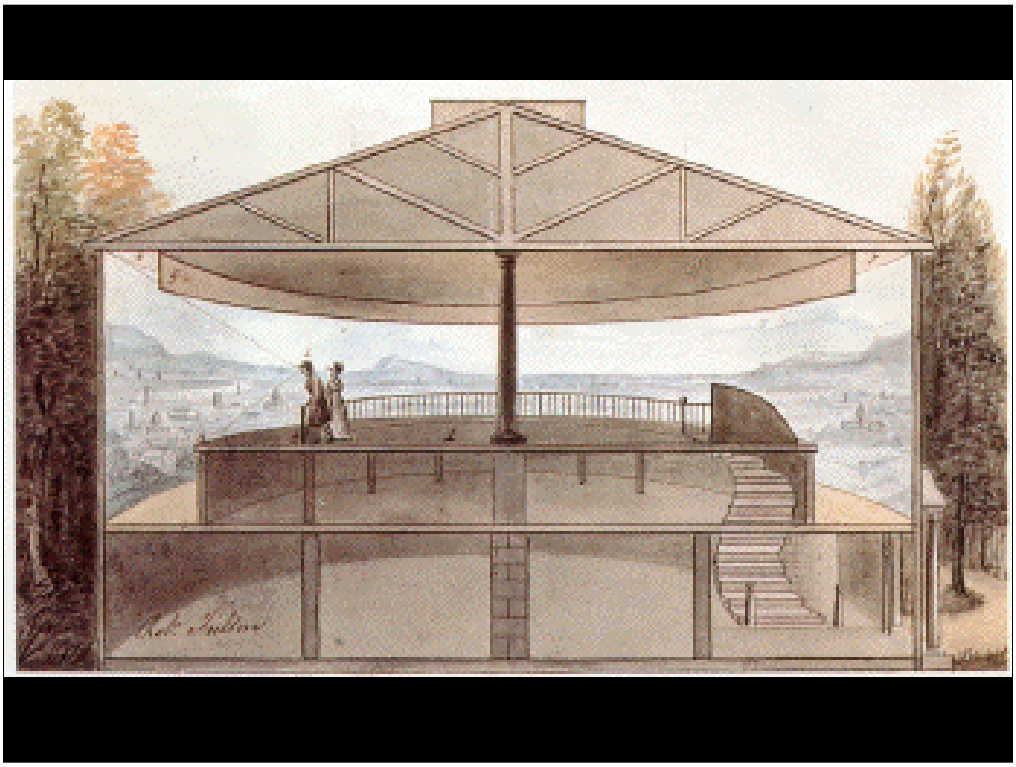


Animation: Marey Pelican in Flight

But while they had the potential for being rendered as “movies” the actual goal was to view them like this.

Edison phonograph

They're both aware of each others work – and aware of both of them, was a certain Thomas Edison. In '87, Edison instructed William Dickson to create a visual counterpart to his phonograph. As with his by now familiar cylindrical sound recording device, the visual version would record minute images in a spiral around a cylinder so that both sound and image could be replayed together.

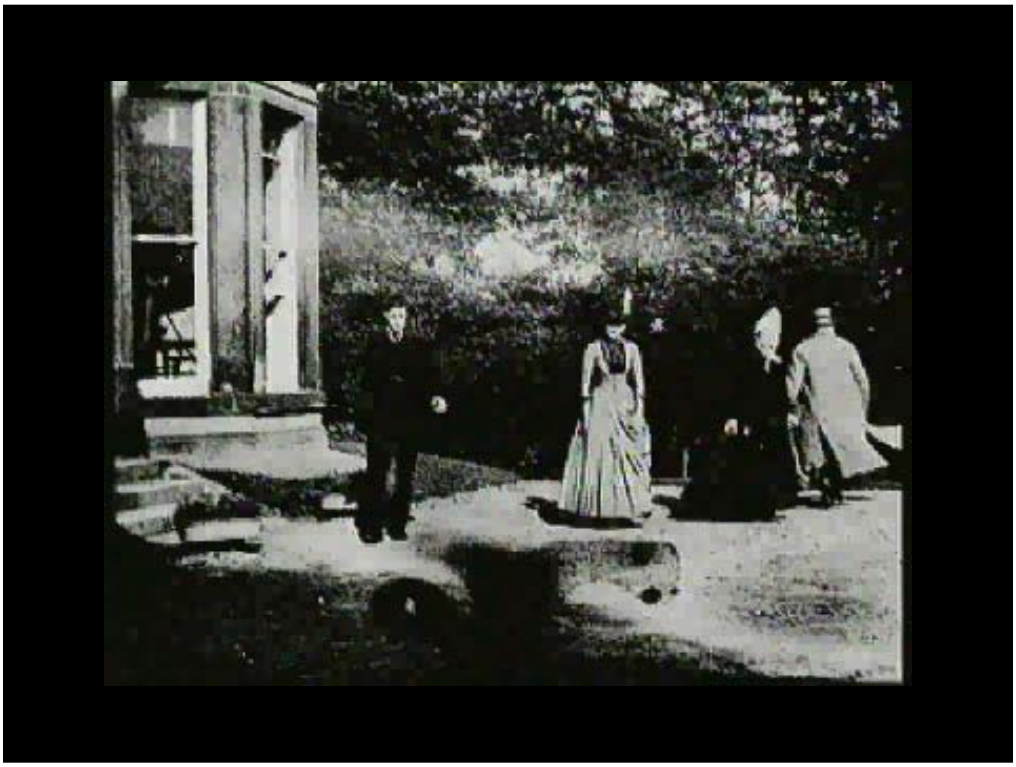


Panorama image

Meanwhile Louis Aimé Augustin LePrince, who’s the manager of Poilpot’s Panorama Company, in New York, conceives the notion that the panorama effect would be greatly enhanced if it were possible to project numerous real life, three dimensional moving scenes within the grand scale of the panorama.

LePrince cameras – Single & 16 Lens Versions

LePrince experiments with both single and multiple lens cameras

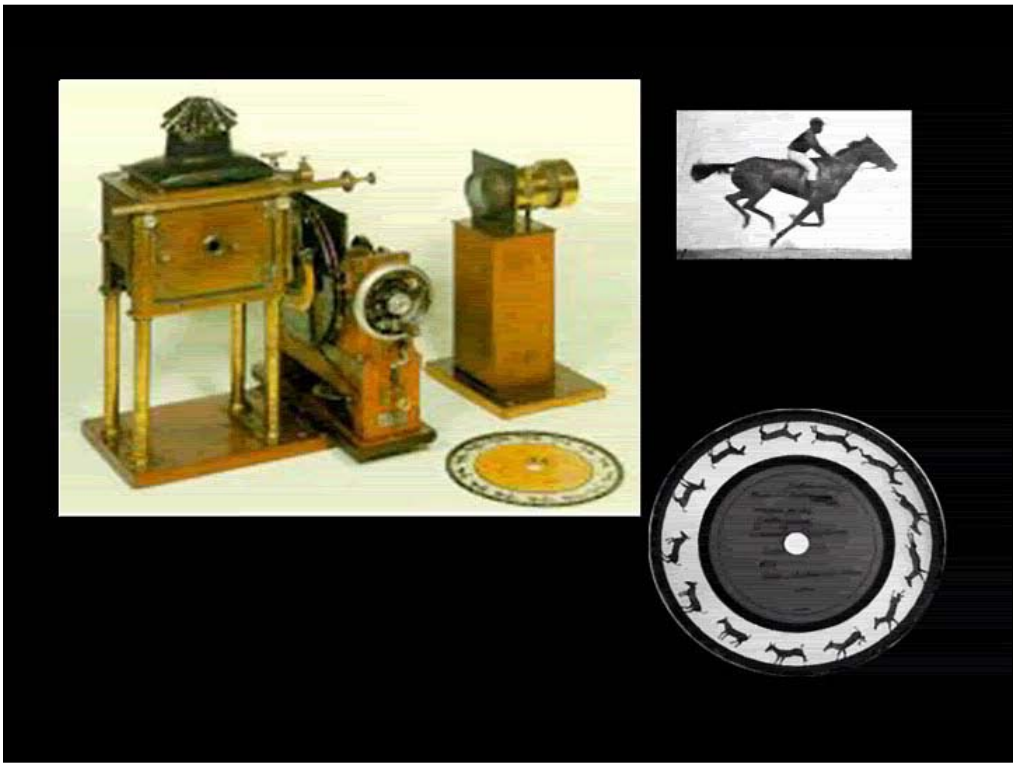


Film:

and on October 14th, 1888, with his single lens camera, films this scene in his father-in-law's garden. These are all the frames that survive from that test.

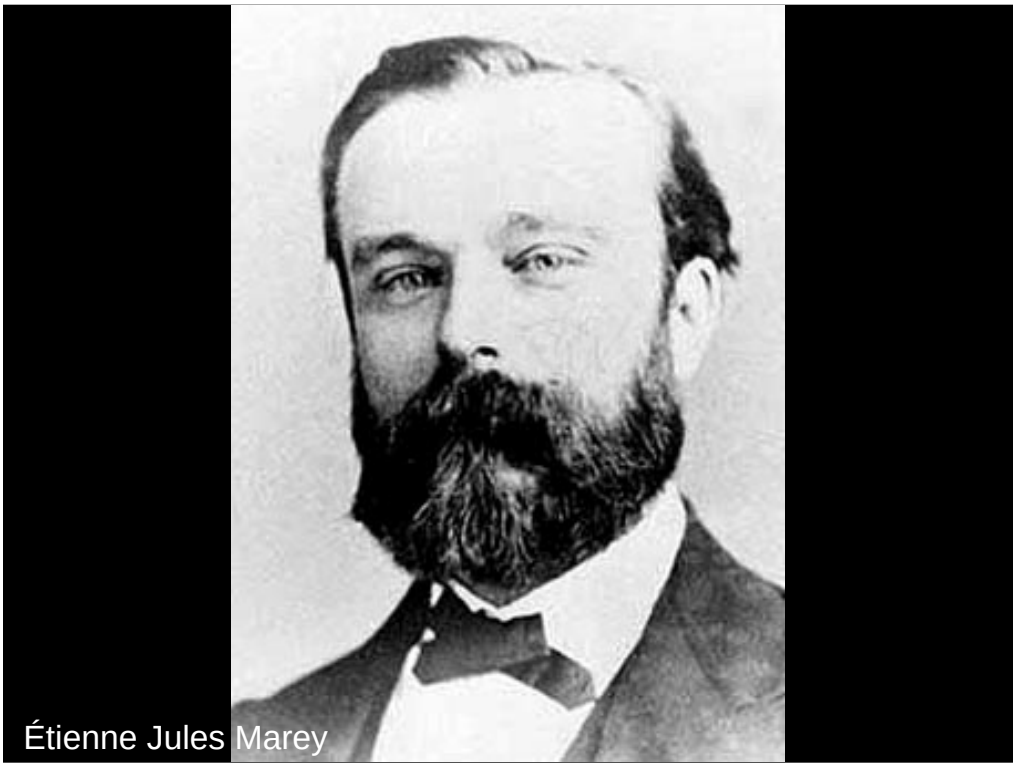
Film: LePrince. Leeds Bridge scene

From the following year, we have another few frames shot from a building overlooking Leeds bridge.



Zoopraxiscope with animated horse

That same year Edison met with Muybridge who demonstrated the “Zoopraxiscope.”

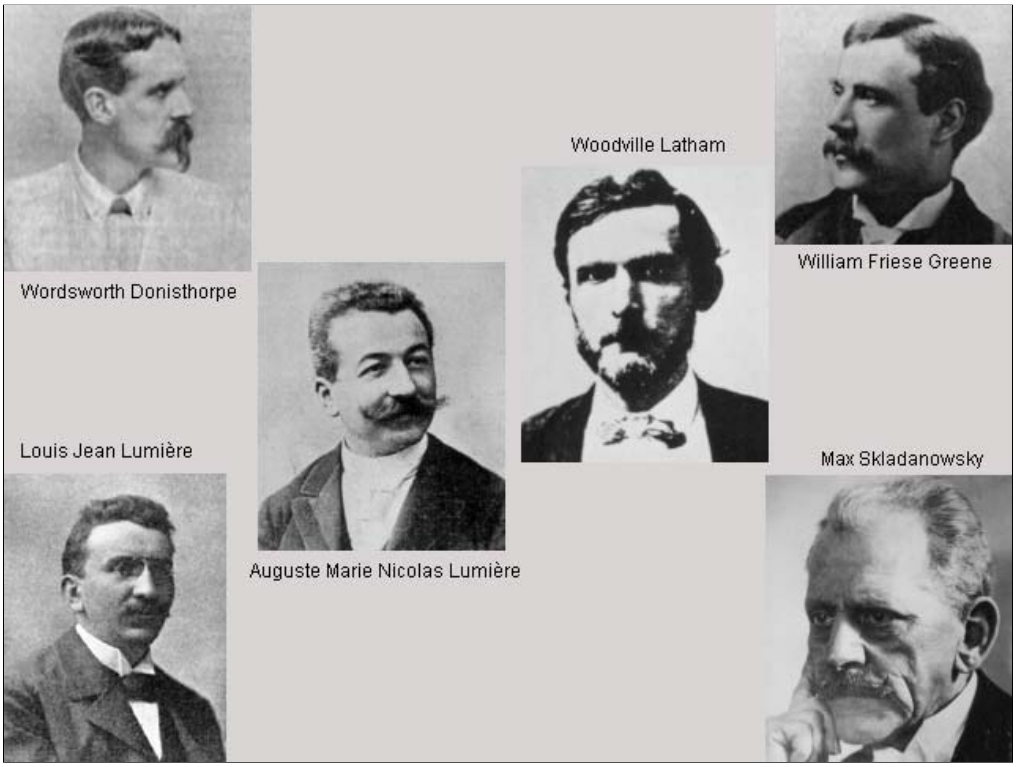


Étienne Jules Marey c. 1850

The following year, 1889, Edison traveled to France for the Exposition Internationale, saw Reynaud's work and met Marey.

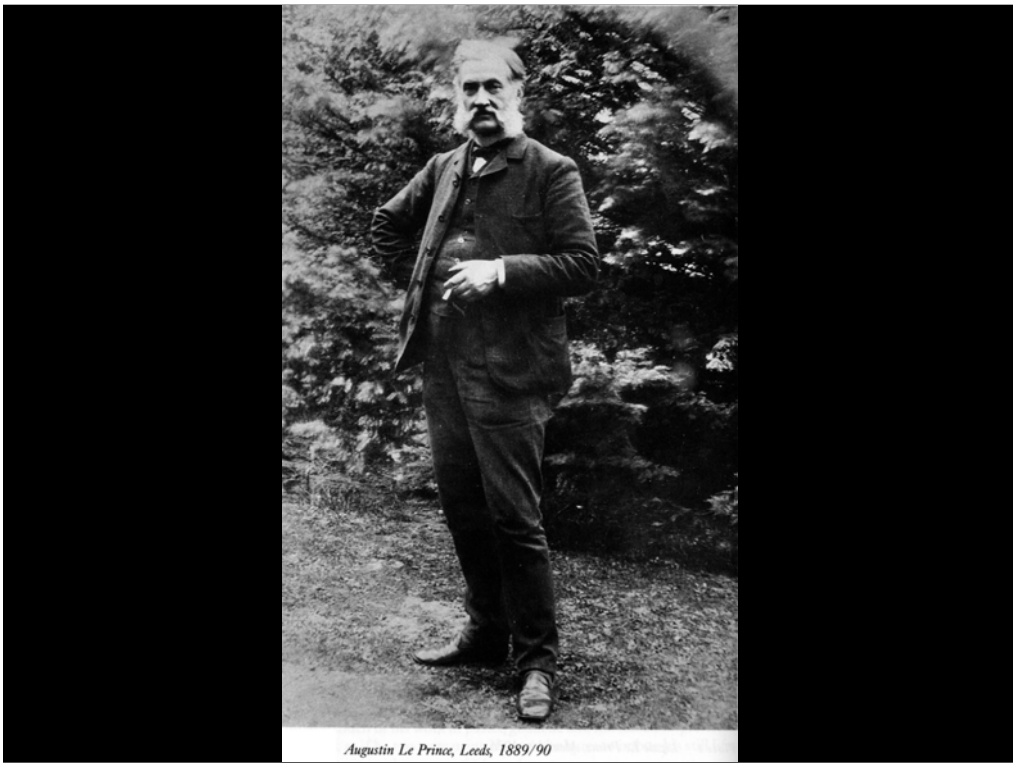
George Eastman

There he recognized the validity of Reynaud’s and Marey’s use of long continuous rolls of film, which fortunately, now became generally available from Eastman Kodak, though Eastman had not originated the concept.



Montage of Inventors

So, by the close of the decade, our now galvanized and growing community of inventors and scientists are right at the point of bringing motion pictures into being. The field has grown to include: Leon Bouly, Donisthorpe and Crofts, Friese-Greene, Skladanowsky, the Lathams, the Lumière's –



Augustin Le Prince, Leeds, 1889/90

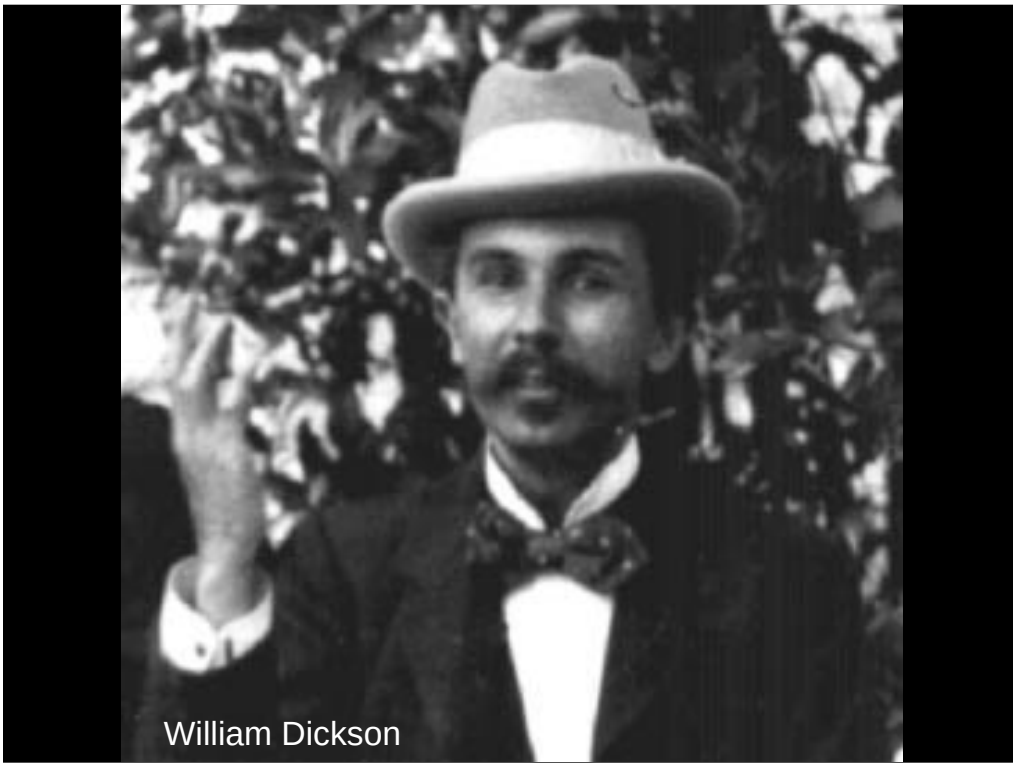
Le Prince

with LePrince' efforts showing every sign of imminent success.

At which point – he simply disappears. He boards a train in Dijon and he's never seen again. His disappearance, rather than death, crippled the efforts of his family to continue the work, as his legal affairs were frozen for the requisite seven years. Conceivably a very convenient grace period for some.

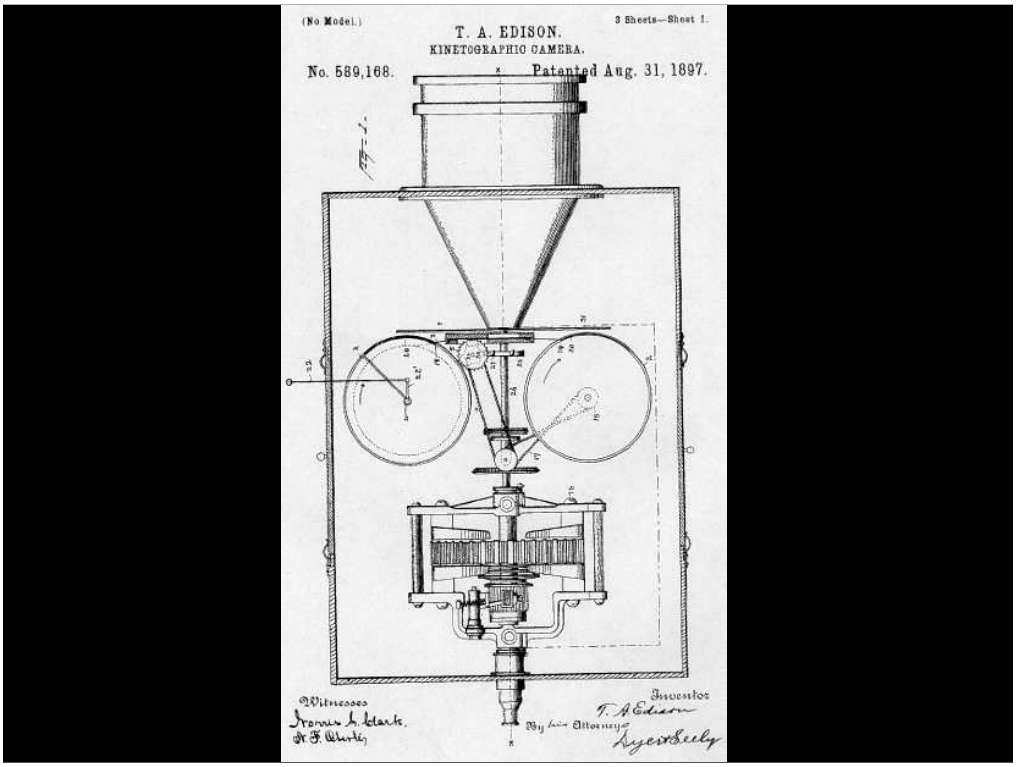
William Friese-Green

Hard behind LePrince was Friese-Greene, but he was unable to sustain the costs of a very promising technological effort, went bankrupt and even served time in debtors prison. He wrote Edison in hopes of selling out to him, though all he may have accomplished was to spur Edison on. He died, broken and penniless.



William Dickson

However, devising a motion picture camera was now demonstrably achievable, and William Dickson did just that for Edison in 1891


(No Model.) 3 Sheets—Sheet 1.

T. A. EDISON.

KINETOGRAPHIC CAMERA.

No. 589,168. Patented Aug. 31, 1897.

Witnesses
Frank L. Dyer.
H. F. Church.

Inventor
T. A. Edison
By his Attorneys
Dyer & Seely

Kinetograph

with the “Kinetograph.”

Kinetoscope

Projecting motion pictures, however, was proving somewhat more difficult. So for the “Kinetograph” display system, Dickson built the “Kinetoscope,” a personal viewer.

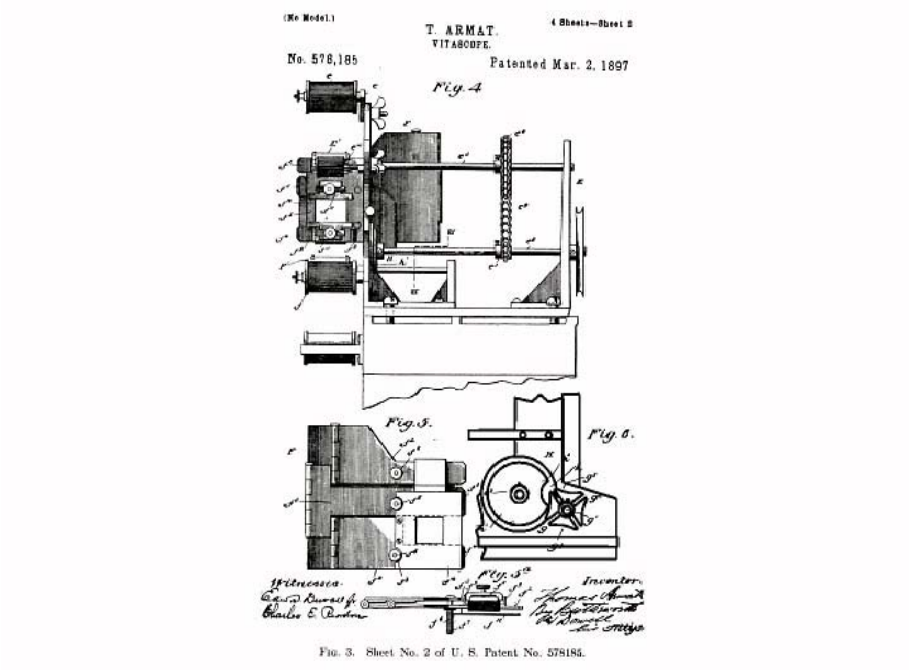
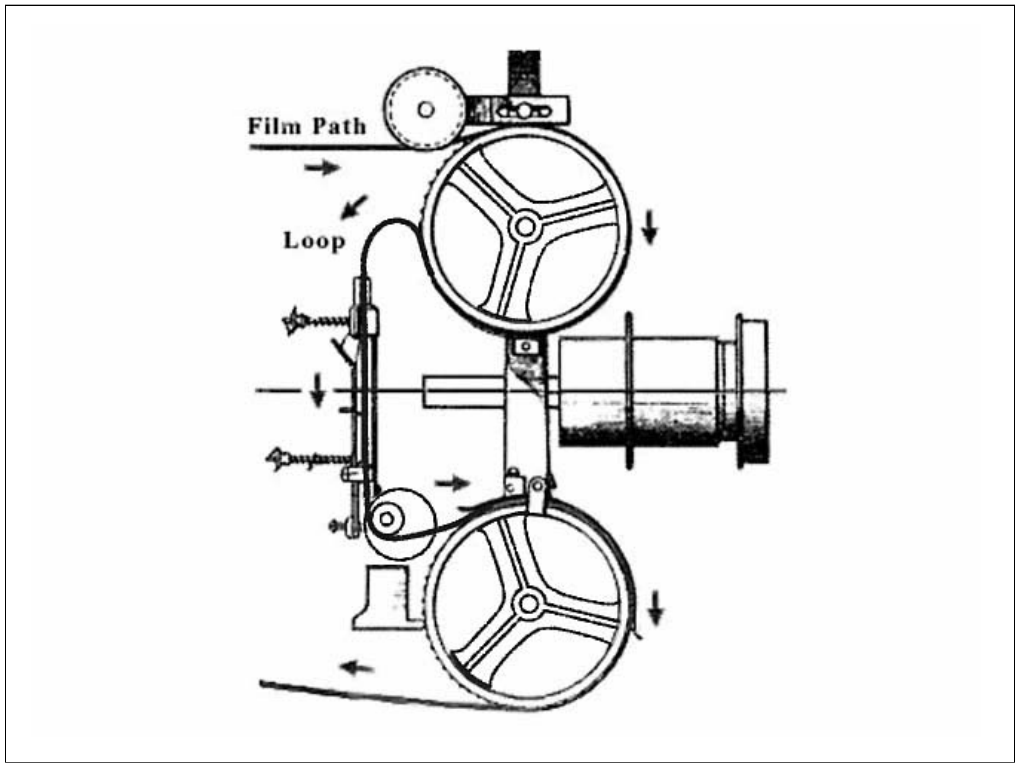


Fig. 3. Sheet No. 2 of U. S. Patent No. 578185.

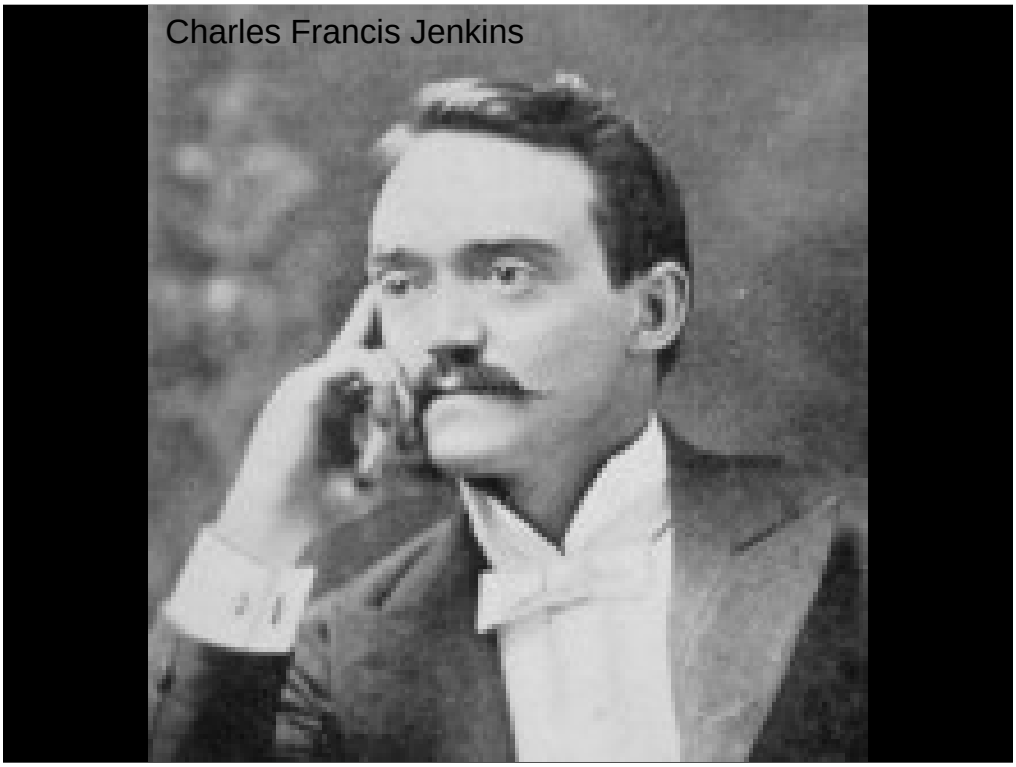
Animation: Maltese Cross

Two vital developments were needed to make projection really practical: The Maltese cross provides a way to obtain a rapid intermittent action from a constantly rotating drive, so that an image could be displayed long enough to be comprehended



Animation: Latham loop

And this very important stratagem: a loop of slack film formed before and after the “gate” so that each frame could be swiftly advanced, without having to pull the weight of the entire roll of film behind it. This was claimed by the Latham’s and is known as the “Latham Loop” but may well have preceded them.



Charles Francis Jenkins

A practical projector incorporating all these elements was built by Thomas Armat and Charles Francis Jenkins, who would later go on to found the Society of Motion Picture Engineers.

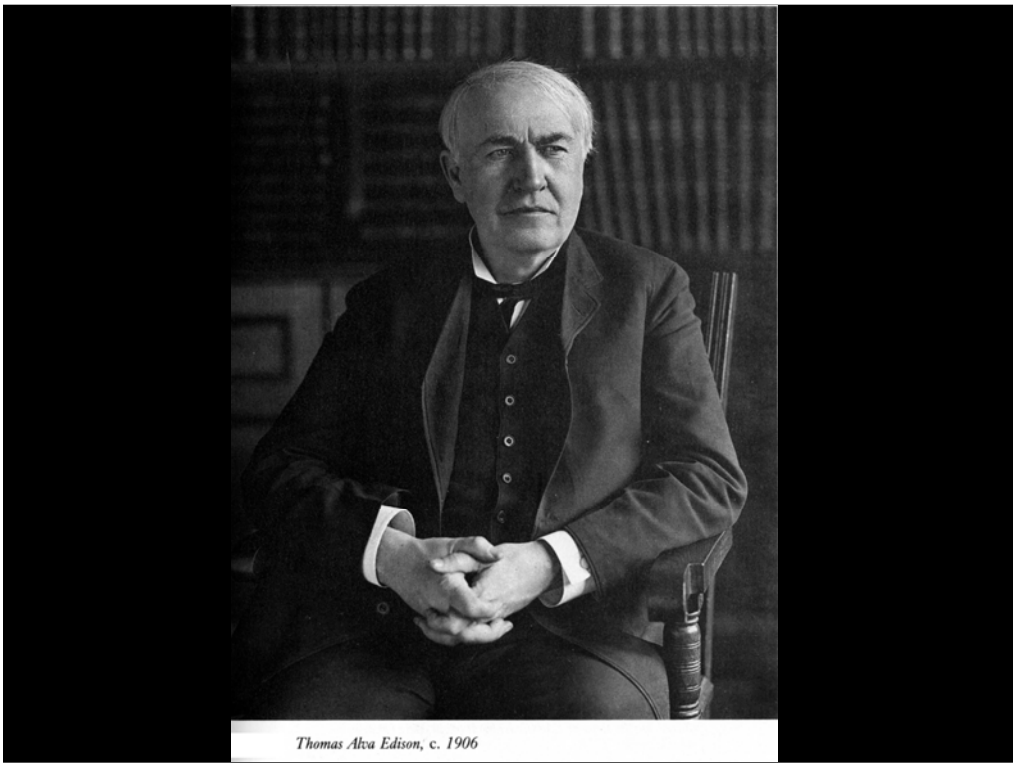
Film: Edison “The Blacksmith”

The projector was called the “Vitascope” and was subsequently bought by Edison who promptly claimed it as his own invention, making possible the production of such films as this.

(By the way, this scene is the subject of what may be the first cinematic “homage,” which occurs in Méliès “Trip to the Moon.” See if you can spot it in the clip at the end of the program.)

Film: Lumière factory workers clip

Meanwhile, the Lumière brothers in France were building functional cameras and projectors, and in 1895 effected the first commercial presentation with this film. The Lumière's were already a thriving photographic supplies company when they embarked on their project, and thus, like Edison, had the financial wherewithal to sustain the development program.



Thomas Alva Edison

But Edison had more than mere financial wherewithal, Edison had the business acumen to secure, by whatever means, a business monopoly which he, in concert with George Eastman was able to maintain until the Supreme Court ended it in 1918. But that's a whole other story.

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Fisher, David	Terra Media	http://www.terramedia.co.uk/Chronomedia/index.htm	UK
Greenberg, Dan	Dr. Dan's Movie Page	http://www.occ.cc.mi.us/moviepage/	Detroit, MI, USA
Hall, George C	Professor Hall's silentmovies.com	http://www.silentmovies.com/	Prescott, AZ, USA

In summary, then, our findings, derived from an exhaustive study of the literature, show that motion pictures are not the conception of any individual “inventor” but the product of quite a large community effort.

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Kench, Larry aka Henry Clark	Professor Clark's Virtual Magic Lantern Show	http://hometown.aol.com/larrykench/	Long Island, NY
Lucassen, Charl	Anima	http://web.inter.nl.net/users/anima/	The Netherlands
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Museum for the History of Sciences	Joseph Plateau	http://allserv.rug.ac.be/~ivhaeghe/mhsgent/eng-plat1.html	Belgium
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Walker, John	The Analytical Engine	http://fourmilab.ch/babbage/contents.html	Switzerland
Weynants, Thomas	A History of Visual Media	http://www.visual-media.be/history.html	Belgium
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Eames, Charles & Ray	A Computer Perspective
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Mast, Gerald	The Movies - A Short History
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Schwartzman, Arnold	Flicks - How the Movies Began
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Some Properties of the Impressions Produced by Light on the Eye	Plateau, Joseph	1829
On a Peculiar Class of Optical Illusions	Faraday, Michael	1830
Contributions to the Physiology of Vision – on some remarkable, and hitherto unobserved, phenomena of binocular vision	Wheatstone, Charles	1838
Experimental Researches in Chemistry and Physics	Faraday, Michael	1859
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Selected Attempts at Stereoscopic Moving Pictures and their Relationship to the Development of Motion Picture Technology 1852 - 1903	Gosser, H. Mark	1975

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Inventor	Subject or Title	Date	Country	Patent No.
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Wheatstone, Charles	Five Needle Telegraph	1837	British	7,390
Wheatstone, Charles	Stereoscope	1838	British	
Duboscq, Jules	Stereo moving picture apparatus (called the "Stereofantascope" or "Bioscope")	November 12, 1852	French	113,069
Seguin, Pierre		September 16, 1852	French	14,510
Duboscq, Jules	Stereo moving picture apparatus (first patented devices in which photography was used for the achievement of a moving picture)	February 16, 1852	French	113,069
Claudet, Antoine	Stereo Moving Picture Devices: modified Brewster stereoscope with a central shaft on which several stereo pairs were turned.	March 23, 1853	British	711
Seguin, Pierre		June 21, 1854	French	14,977
Benoist, Philippe	Stereo moving picture device	August 23, 1856	British	1,965
Fisher, Robert & Aspray, Charles	sStereo moving picture device	October 5, 1859	British	2,258
DuMont, Henry	Series of devices providing the illusion of motion and relief	March 26, 1859	Belgian	7,321
DuMont, Henry	Series of devices providing the illusion of motion and relief	November 17, 1859	French	42,843

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Liesegang, f. Paul	Stereo Moving picture Device	January 9 1860	British	58
Desvignes, Peter Hubert	Variations on zoetrope designs showing an endless band with eye slots revolving on two spools	February 27, 1860	British	537
Shaw, Thomas	Stereotrope - a stereo peep-show with octagonal drum	May 22, 1860	British	1,260
Furne & Tournier	Stereo phenakistiscope	August 14, 1860	French	26,340
Seguin, Pierre	A device called the "poly-stereoscope"	April 13, 1860	French	44,723
DuMont, Henry	Intermittently moved band of stereoscopic photographs	June 8, 1861	British	1,457
DuMont, Henry	Intermittently moved band of stereoscopic photographs	July 5, 1861	Belgian	11,130
Sellers, Coleman	Stereoscopic moving picture peep-show called the "kinematoscope" (notes pictures should be entirely at rest during the moment of vision)	February 5, 1861	US	31,357
DuMont, Henry	Intermittently moved band of stereoscopic photographs	May 2, 1861	French	49,520
Cook, Henry		August 19, 1863	British	2,063
Du Hauron, Louis Ducos	Series of pictures, fixed on an opaque or transparent flexible band moved between two spools	December 3, 1864	French	61,976
Du Hauron, Louis Ducos	Magnified images shown at very short intervals so as to give the illusion of movement	March 1, 1864	French	61,976
Bonelli, Gaetano	Stereo moving picture device	June 12, 1865	British	1,588
Lincoln, William E.	Zoetrope toy	April 28, 1867	US	64,117
Linnett, John Barnes	Improvement in the Means of Producing Optical Illusions - Flipbook	March 18, 1868	British	925

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Janssen, Pierre Jules Cesar	Chronophotography camera for tracking planetary movement at 12 frames per second	1873	French	
Ray, A.	Stereo Zoetrope	1874	British	100
Donisthorpe, Wordsworth	Improvements in Apparatus for Taking a Succession of Photographic Pictures and For Exhibiting Such Pictures	November 9, 1876	British	4,344
Reynaud, Emile	Stereo praxinoscope	August 30, 1877	French	120,484
Muybridge, Eadweard James	Method and Apparatus for Photographing Objects in Motion	March 4, 1879	US	212,864
Muybridge, Eadweard James	Method and Apparatus for Photographing Objects in Motion	March 4, 1879	US	212,865
Muybridge, Eadweard James	Method and Apparatus for Photographing Changing or Moving Objects	June 19, 1883	US	279,878
Hughes, William Charles	Magic lantern slider	October 9, 1884	British	13,372
Rudge, John Arthur Roebuck	Lantern carried slides around its outside wall intermittently by means of a modified Maltese Cross	November 12, 1884	British	14,886
Le Prince, Louis Aime Augustin	Complex camera and projector added a light source, loop, and satisfactory frame rate	January 10, 1888	British	423
Le Prince, Louis Aime Augustin	Complex camera and projector	January 11, 1888	French	188,089
Reynaud, Emile	Le Théatre-Optique	December 1, 1888	French	194,482
Le Prince, Louis Aime Augustin	Method of and apparatus for producing animated pictures of natural scenery and life (16-lens camera)	January 10, 1888	US	376,247
Marey, Étienne-Jules	Chronophotograph	1888	French	

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Friese-Greene, William & Evans, Mortimer	Camera	June 21, 1889	British	10,131
Donisthorpe, Wordsworth & Crofts, William Carr	Camera/projector	August 15, 1889	British	12,921
Donisthorpe, Wordsworth & Crofts, William Carr	Camera/projector	1889	French	206,174
Anschutz, Ottomar	Viewing device called the "electrical tachyscope"	November 16, 1889	US	*Scientific American*
Friese-Greene, William & Varley, Frederick Henry	Photometer	March 25, 1890	British	4,622
Varley, Frederick Henry	Improvements in cameras for photographing objects in motion	March 26, 1890	British	4,704
Jundzill, Adam Dunin	stereo animated picture device called the "Kinimoscope"	May 24, 1856	British	1,245
Donisthorpe, Wordsworth & Crofts, William Carr	Method of producing instantaneous photographs	May 26, 1891	US	452,966
Demeny, Georges	Machine that combined a cylinder phonograph and a phenakistiscopic disc	September 1, 1892	British	15,709
Demeny, Georges	Modified phonoscope	June 30, 1893	British	12,794
Friese-Greene, William	Improvements in Apparatus for Exhibiting Panoramic, Dissolving, or Changing Views, and in the Manufacture of Slides for Use Therewith	November 29, 1893	British	22,954
Edison, Thomas Alva	Apparatus for exhibiting photographs of moving objects	March 14, 1893	US	493,426

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Demeny, Georges	Series photographic camera	August 13, 1895	US	544,480
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Lumierè, Auguste & Louis	Kinetographic camera	March 30, 1897	US	579,882
Edison, Thomas Alva	Kinetographic camera	August 31, 1897	US	589,168
Prestwich, John Alfred	Mechanism for Propelling and Exposing Films in Kinetoscopic Apparatus	February 28, 1899	US	620,357
Latham, Woodville	Projecting Kinetoscope	August 26, 1902	US	707,964
Paulson, Charles J.	Moving Picture Machine	May 10, 1910	US	957,246
Ryan, William A.	Moving Picture Apparatus	September 14, 1915	US	1,153,341

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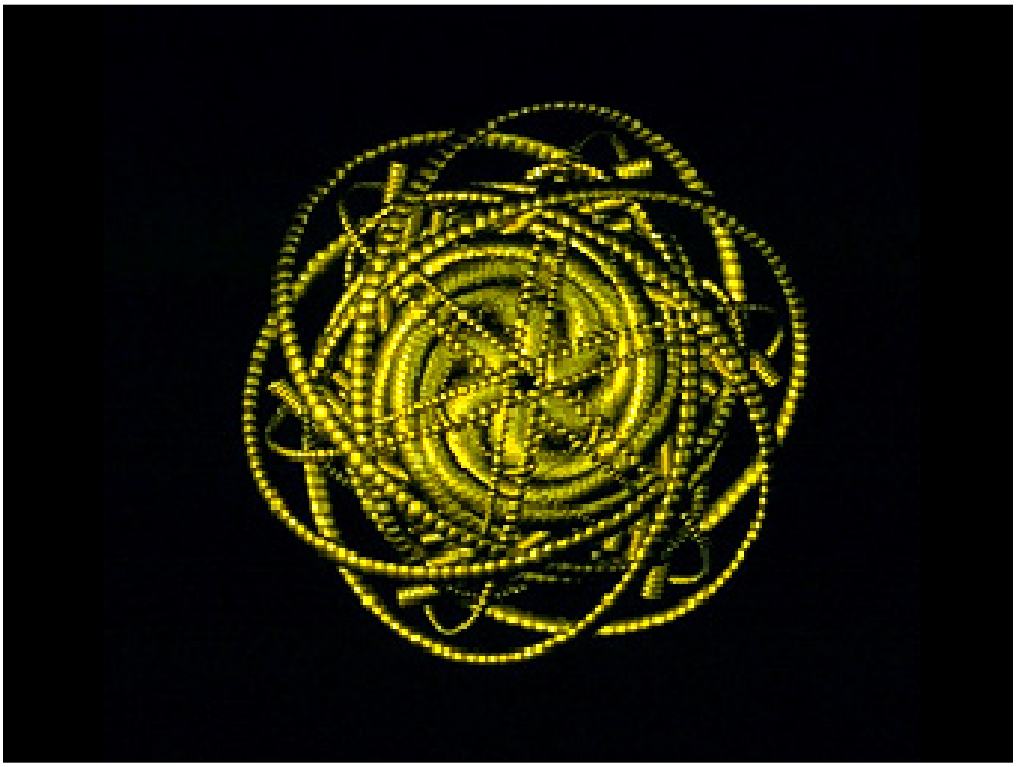

Film: "Evolution of Form.“

So, I’d like to conjure up the spirits of all of the community we presented here tonight, to gather with us to view just one small manifestation of their catalogue of “gigantic ideas;” William Latham’s “Evolution of Form” a “beguiling optical entertainment” in the tradition of the nineteenth century, but created by a computer program of William Latham and Stephen Todd, in which Latham acts in the capacity of an editor, rather than a creator, and incorporates the contributions of almost everyone we’ve discussed this evening, with a special apology to Wheatstone and Brewster; in that, of course, a three dimensional version of this film exists, but sadly, even after a hundred and seventy five years, we’re unable to present it in that form.

If our lanternist could, – roll film.