

## introduction

The etymology of the French name 'Sténopé' (from Greek sténos narrow and ope hole) tells us only partially the definition of the object in question. The English word "pinhole camera" appeared in 1856 is more explicit: camera with a pinhole. Thus, pinhole photography is a photograph where the optical system is not made up of a set of lenses but of a single hole.

Contrary to popular opinion, if the principle of the pinhole as Camera Obscura is known and described since antiquity and reported many times to the Renaissance, it is not the pinhole which marked the beginning of the photography but the lens. It has been used in photography that from the year 1850. The second half nineteenth century saw the development and indeed the height of the pinhole with pictorialism.

Fallen into disuse in the first half of the twentieth century, due to the rapid development of snapshot, he was brought up to date in the USA in the 1970s. But it is, from that time, beyond the technical and anecdotal, a mode of expression in itself, now to be considered as a substitute (or worse an introduction to techniques) of the photograph as "a cousin" of photography as we hear with its constraints, its specificities and limitations.

## What are the advantages and disadvantages of the pinhole?

The advantages of the pinhole are numerous, (remember Ansel Adams has made a number of landscapes with the couple room / pinhole). Focusing is not a problem because, in the ideal case, the sharpness is from 0 (or almost) to infinite. Moreover, no optical system is synonymous with the absence of optical aberrations. This is particularly interesting in the use of 'wide-angle' in pinhole

Another advantage is the simplicity of construction and implementation of this process ... cardboard, aluminium foil is often enough to start. Finally shooting is discreet and silent even ecological!

However, the principle of pinhole has its limitations: indeed difficult to do a report of a racing or even a portrait (unless you have a model capable of withstanding a perfect immobility for many seconds.) There are problems of diffraction of light at the edges of the hole (sensitive essentially on small hole diameters), limiting shooting in backlight and / or in case of bright sunshine. Handling and loading sheet film or photo paper may prove to be difficult especially outside. Finally films are not suitable for this technique (problem of lack of reciprocity). Similarly, digital sensors are not optimized for long poses.

## What is the interest of the pinhole for the processes?

The main advantage is to produce directly and at cost (relatively) small negative (film or paper) of large or very large size which can be used directly for processes. On the fringe of this major advantage, the pinhole allows to go to the approach of the "otherwise" photography (and even more, the handmade photography) by releasing the technical aspect of modern photography by simplifying procedures.

## How to make a pinhole camera?

As rarely photography, the basic material for the construction of a pinhole camera depends only on the imagination, determination or madness of the manufacturer ... The most complete freedom is allowed!

Moving quickly on the pinhole made on an ancient or modern appliances base (hijacked device or single plug housing) to keep the drive mechanism or film holder and therefore easily use film 120 or 135 Polaroid or chassis. More interesting are the subject of the environment hijackings various packages (various boxes of cake, tea, coffee, bottle ...), natural materials (shell crab, human mouth, fist ...), use object of environment (hole in a wall or floor, room, seal basket with paper) ...

In fact, only two points are really important:

- 1) You need to know a few essential formulas to calculate the various parameters of the construction and exposure;
- 2) The quality of the hole determines the image quality.

Formulary for use by the manufacturer of the pinhole camera:

Here are some formulas that I use (without their demonstration too tedious!) For more physical information, you can consult the excellent article by MATT Young.

Although this is an abuse of language, we call "focal length" or "focal distance" the distance between the film plane and the hole.

1) You should know that each focal length has an optimum hole diameter (which actually depends on the wavelength, but for simplicity, a wavelength "average" is used. Many formulas exist in diameter calculation but the following formula suits me well!

$$A = 0.03679 \times \text{square root of } (F)$$

With A: hole diameter (in millimetres)

F: focal length (in millimetres)

- 2) The image circle produced by optimal hole is equal to 3.5 times the focal length.

I checked it by constructing a pinhole from a box plan Film 4 X5 inches that is to say a focal length of 16mn which produces a circular image around a diameter of 55 mm on

the film ... The minimum focal length to cover 4x5 inches should be of 35mm and of 8x10 inches should be of 7mm regardless vignetting. Given the price of large format optics and especially wide angle low optical aberrations, it is the dream!

- 3) The chamber diaphragm, once known the hole diameter and focal length is determined as follows:

$$F = F / A$$

with

*F*: diaphragm

A: hole diameter

*F*: focal length

This calculation of the actual diaphragm is important to calculate the exposure time after measurement of the light.

## Hole and its difficulty

It can never be repeated enough, it is the quality of the hole which makes the image quality. It must be circular and regular diameter (but nothing prevents to experiment with oval holes, square, star, slots, several holes ...)

The easy solution is to buy a 'ready hole' ... For this refer to the internet references and order many 'holes' which will arrive in a few days by mail. But making the hole is not that hard provided you follow certain principles.

- a) Making hole

Although the ideal material described in the literature is brass, it is easier to find high quality aluminium sheets, for an equivalent result. The technique generally used to drill a small diameter hole is as follows: a pin can drill the hole (1), then we use very fine sandpaper to trim the output cone of the tip of the needle (2). A second passage of the needle tip allows to regulate the circumference of the hole

- b) Check diameter and regularity of the hole

Once the hole is made, remains to know its diameter (we do not drill a hole of 0.238 mm. we drills a hole and we note if it is of 0.238 mm !). The simplest method is to project a hole (slide projector or overhead projector) along with a standard measure (e.g. a millimeter graph layer or a double decimeter ruler) and do the ratio of the two measures. On the same principle if you have a scanner with a high-definition, you can use a computer to measure the hole, or with a drawing program, or with an image analysis software (with Mac I use for this a quite extraordinary freeware called "NIH Image" which allows, among other to measure distances and surfaces). Obviously, all these steps can be avoided through many experiences and a risk of discouragement

We must ultimately always remember that the goal is not to build the item, which can be exhilarating and become a goal in itself, but to get pictures!

## I have my pinhole what do I do now?

Pictures!

Again several schools:

- Those charging with photo paper that they use as a paper negative;
- Those using plane negatives or film negatives
- Those measuring the light that converts it in time and measure it with a stopwatch
- Those making everything at random ...

As always, no dogma, the important thing is to have images 'in fine'! My technique, I use negative film or negative plane, I measure the light exposure and I convert in time pause and play with Schwarzschild, but I count aloud. Regarding movies: everything fits in black and white (you must think to the Schwarzschild effect exposure and also to the developing) but in return the colour negative and colour Polaroid are very disappointing (drift of the dominants) . A special mention for the reversal film that seems to have been designed for 'pinhole men': the provia100F gives extraordinary images, shining by its perfect reciprocity up to 120 seconds; there is some latitude!

## bibliographic references

Pinhole photography,rediscovery of historical technique 2<sup>nd</sup> edition d'Eric Renner(ISBN:0-240-803507).

E.Rener is one of the most ardent defender and promoter of the pinhole in USA (it has a foundation, teaches, publishes a pinhole newspaper 'pinhole Journal' etc.). His website (<http://www.pinholeresource.com> ) sells online pinholes camera, holes ready (very good) and many books dedicated to pinhole.

Internet reference

Le sténopé de la photographie sans objectif, Jean-Michel Galley, éd photopoche.

La saga des sténopés : (et autres appareils photo à bricoler soi-même) John Evans, éd Eyrolles 2004

Le sténopé de la photographie sans objectif, Jean-Michel Galley, éd photopoche.

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Les pratiques pauvres : du sténopé au téléphone mobile éd isthmes éditions

La photographie au sténopé [Broché], Éric Marais

Je construis mon appareil photo ,Annick Maroussy et Lucienne Deschamp, éd ETSF Dunod, 2006

La photographie au sténopé - des techniques traditionnelles aux applications numériques Illustrator (version 4) deux décennies d'écriture, cinq amendements, appelé sténopé photographie Bible , Ailike Lunna, Broché 2012

La Camera obscura : Philosophie d'un appareil, Martine Bubb, éd Lharmattan 2010

**The internet references are numerous;** just take the word as pinhole keyword.

The easiest way is to log into the site Pinhole Vision (<http://www.pinholevision.org>) excellent introduction on the subject: he is kept by the organizers of the World Pinhole Day (every last Sunday of April month).

For exemple

<http://www.pinholeday.org> ).

<http://foto-grafik.blogspot.fr/>

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