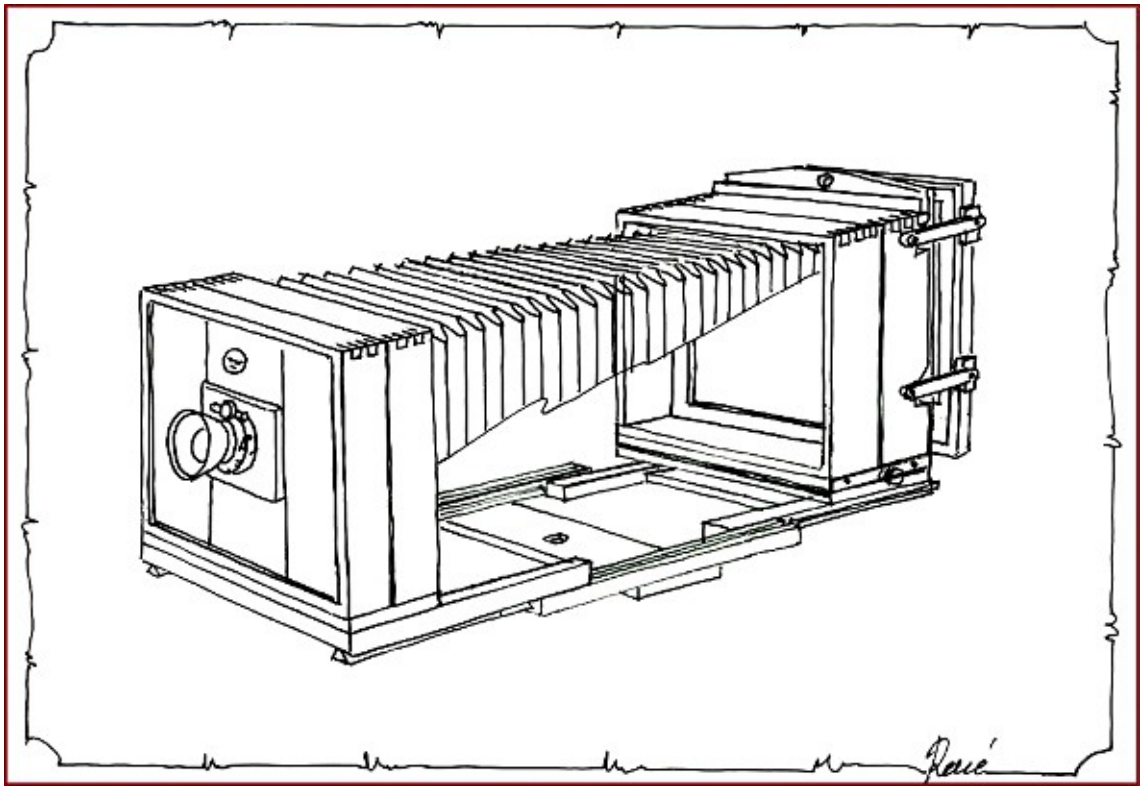
# YOUR DREAM CAMERA:



## a DIY project guide

René Smets
March-April 2015

I would like to thank all the occasional contributors, whose comments, questions, and suggestions led to significant improvements in my original designs.

René Smets

*This document was made, with the permission of René Smets, from a series of his Facebook account posts, collected, completed with followers' comments, and compiled into a structured text by Jacques Kevers.*
*French, dutch, and english versions can be downloaded from the technical pages of the*
*Picto Benelux website*

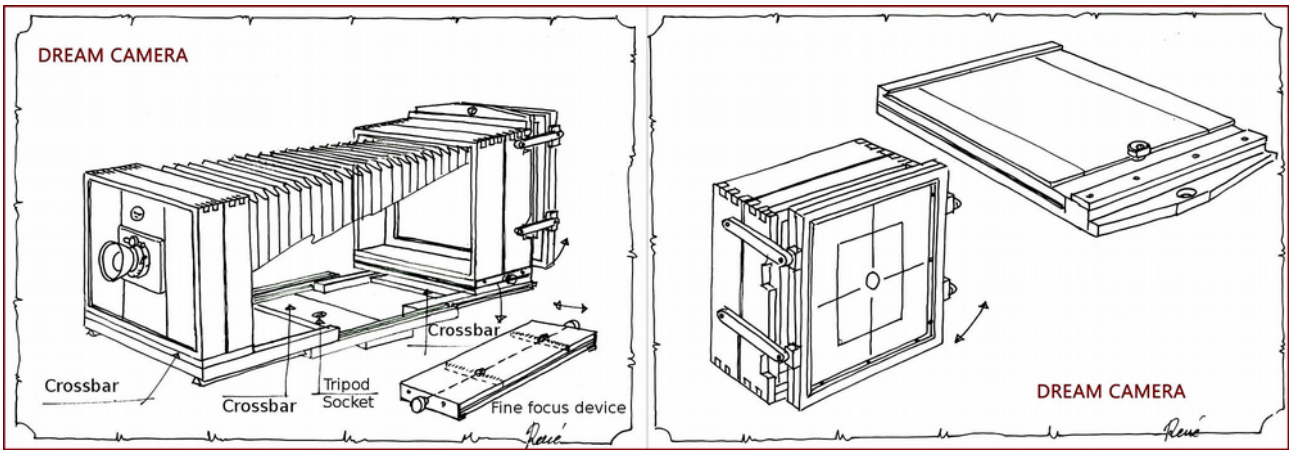
# *A GUIDE TO BUILD YOUR OWN WET PLATE CAMERA*

## *INTRODUCTION*

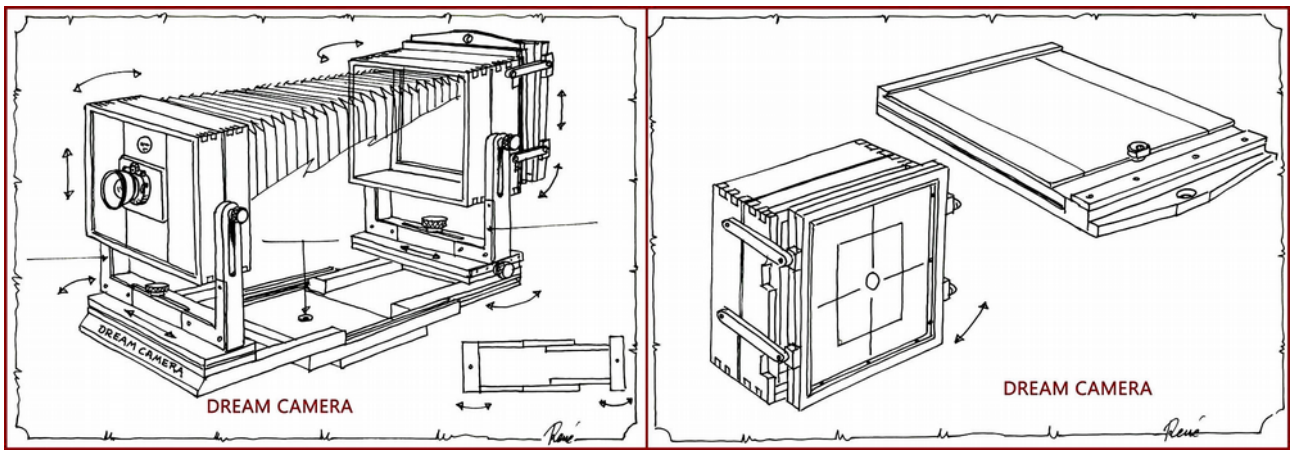
*I have been building quite a lot of cameras of all kinds: pinhole, panoramic, technical cameras, wet plate – either of them in large, medium or 35mm format – as well as related equipment such as portable darkrooms for wet plates, fuming boxes, gilding stands and mercury pots for daguerreotype photography, etc... I also am getting regularly requests for their detailed plans, for having one built to order, or even for purchasing one of my existing realizations. I build them however purely as an amateur hobbyist. I therefore have neither the time, nor the desire to sell my cameras (I only do this very occasionally) or to start building one on request .*
*But I am also keen on sharing my experience and helping those who, in their endeavors to build their own camera, are running into difficulties and get stuck. So, when a friend who wanted to build his own 24x24cm wet plate camera asked me for some advice, I thought that providing him – and all those interested – with a step-by-step guide, without any engineering graphs quoted in mm. or descriptions into the finest detail, could help without requiring too much effort or time from my side.*
*The descriptions, sketches and pictures below do not constitute in any way a DIY kit with its inclusive instructions to be followed in every detail. Their purpose is rather to familiarize you with all the aspects related to the implementation of your own project, by detailing the challenges you are going to face, and by suggesting various ways to address them. They give you a methodology, but it is you who will have to think and to design the details of the camera that will meet your specific needs. When necessary, a scale on the drawings will allow you to print it at your desired size, and to infer from the drawing the actual dimensions for each part. A word of caution however: you will need adequate tools and skills as well as enough time to go through this...*
*I wish you every success!*

## *GLOBAL CAMERA OVERVIEW*

*Considering that wet plate cameras usually are very basic, my first sketch was as follows:*

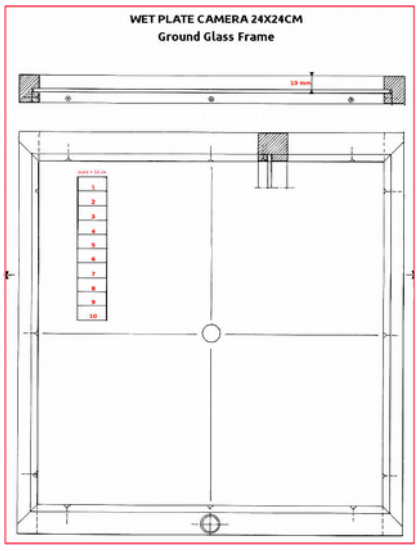



*First reactions on Facebook were about its lack of all the usual view camera movements. While some stated that such a camera needed none of them, others thought it would be nice to have them all, with some people suggesting that the front and back could provide rise, fall, shift, swing and tilt when mounted to an adequate adapter. For those who might consider this possibility, an alternative sketch was made, and is given below.*




*In this second drawing, two carriers are fixed on the base with thumbscrews. Building the movements, or only those for the back panel (the plate holder side), becomes thus an option, and you can decide for yourself whether your wet plate camera should be a simple and sturdy travel camera, or a more complex one with added tilt, swing, rise/fall, and shift possibilities.*


*To keep your woodworking projects from warping, cracking, or becoming distorted otherwise, you need of course to use only thoroughly dried wood. Above left, you see how I store my dry wood, so it stays flat. Above right, a picture of the kind of wood I use for my projects. In this case, it is pear wood. I always try to find old scraps. Most of the time I can get them quite cheap, as people are happy to get rid of them. And for my camera, I only need small pieces anyway.*

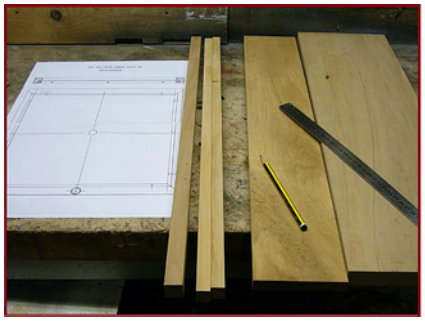
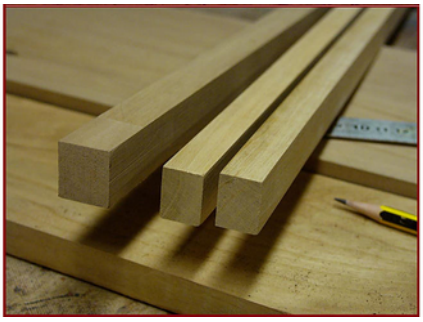
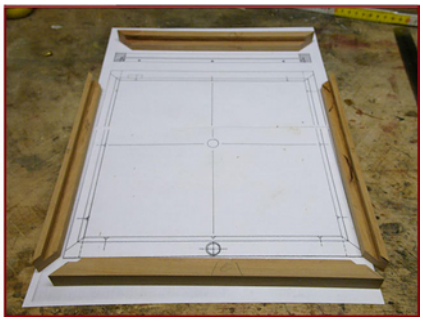


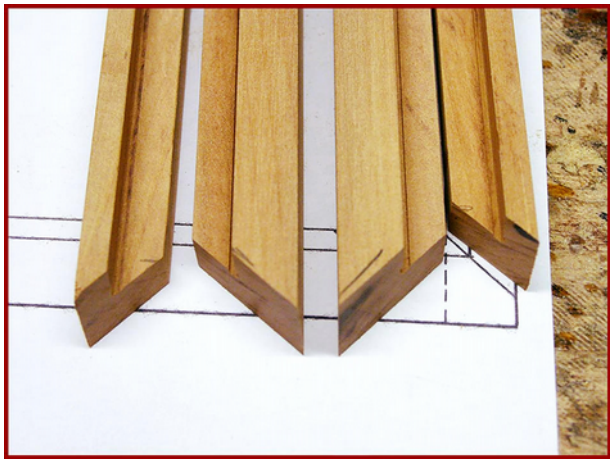

*PART 1: THE GROUND GLASS AND ITS FRAME*

*As usual, I'm starting with the drawing of a plan. In this guide, you won't find any detailed technical drawings with all the relevant dimensioning in mm.*
*Instead, I have added in the "ground glass frame" drawing (left) a 10cm scale. When measuring this scale after printing, you should be able to infer all the other sizes from there.*
*This "ground glass frame" drawing can also be downloaded from the Picto Benelux website as a 300dpi, A3 format file. This should allow you to print it easily at its real size. If you do not have an A3 printer, A4 marks are given on the drawing, which should allow you to split the original into two A4 printable parts.*

*On the following pictures, you can see how I did cut the different parts from rough pieces of wood.*
*As you can see, the lateral posts are narrower than the upright ones. This means that once all parts beveled at 45° and joined, there will be protruding parts. They have to be cut off flush with the lateral jambs.*

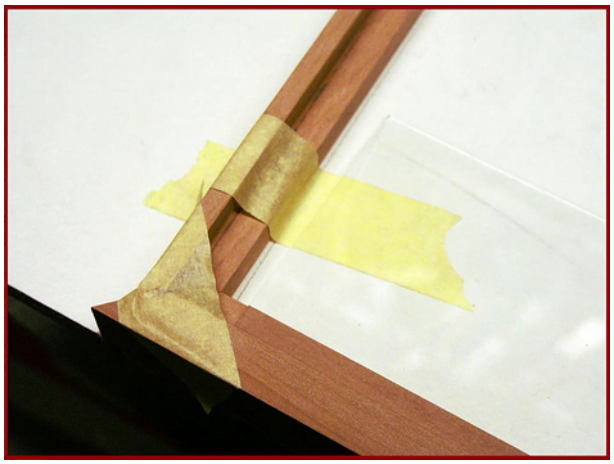
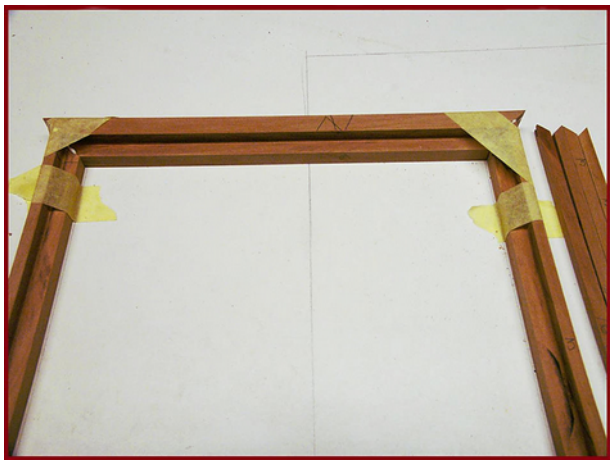
*To glue the different parts together, I use a flat panel and outline on it the position of the four sides, making sure that they are at exactly 90°.*

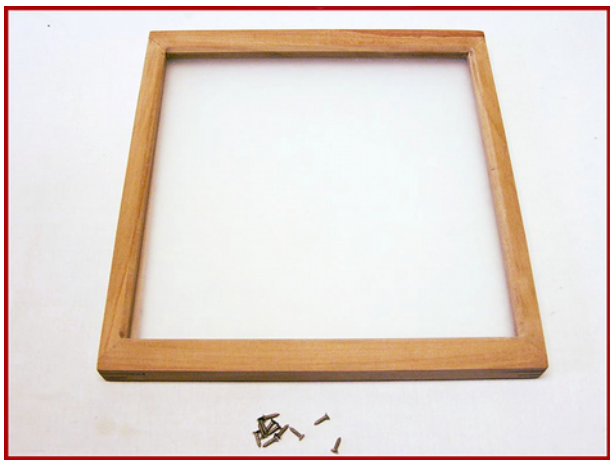


*I then clamp the bottom jamb on the plate and place the three other pieces on the lines, after having put some glue on the bevels.*

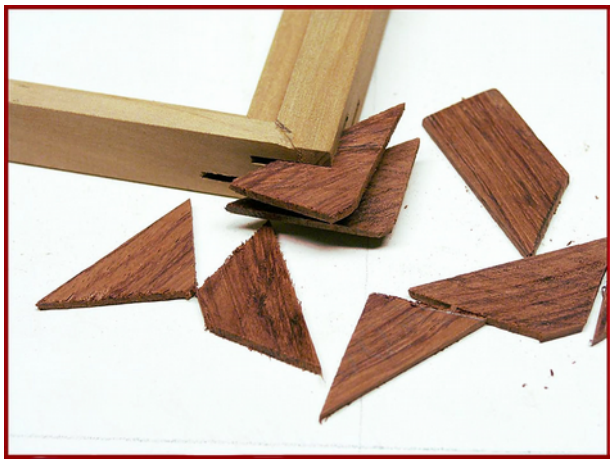
*I have a last check to make sure that everything is square. Finally, I tape it all on the plate.*

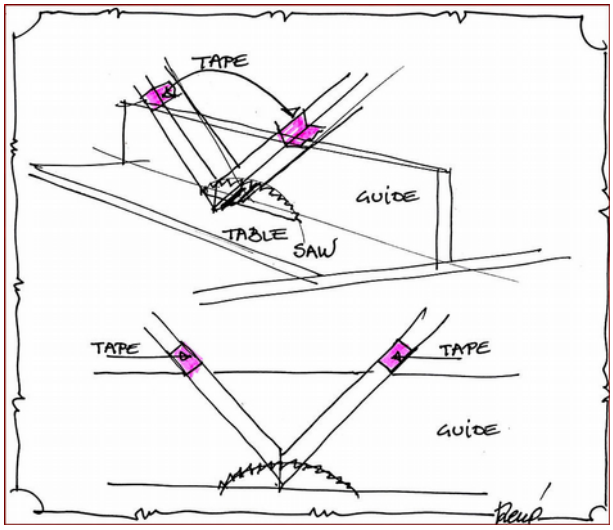



*You can see here the protruding tips that have to be cut away to get the final result.*



*Before that, the corners have to be reinforced.*

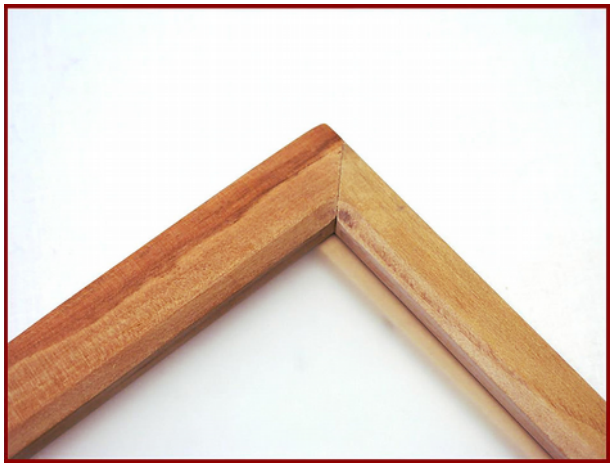




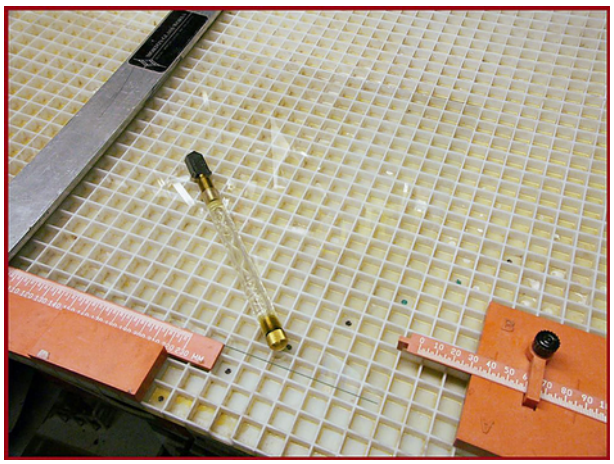

*Here's how:*

*I put tapes on both posts at same distance from the corner, in such a way that they coincide with the uper side of the 10 cm high guide on my table saw when the edge of the corner is put on the table.*

*Now I make a cut at 7mm from the side facing the saw.*
*When this is done for the four corners, I turn the frame around so that the other side of the wood is now facing the saw, and make four other saw cuts.*
*I then make tiny slats having the same thickness than the saw cuts and glue them into the grooves.*



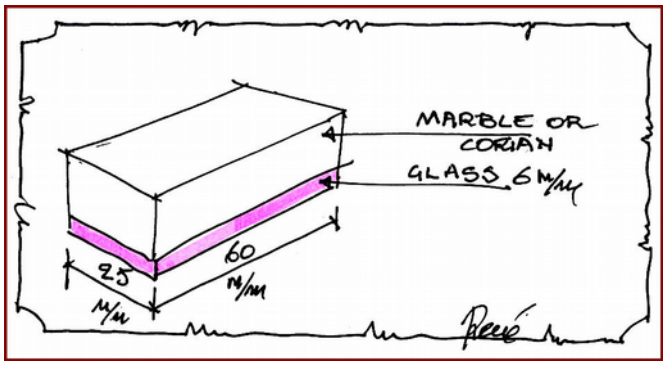
*I let dry, and finally I saw all the protruding tips and parts away. The finishing touch is given by gluing small slats on the back side of the frame (to hold the ground glass), and beveling the inner side (camera side) of the frame.*

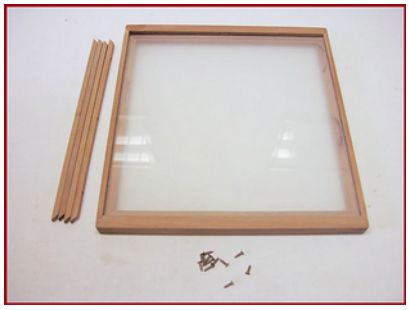


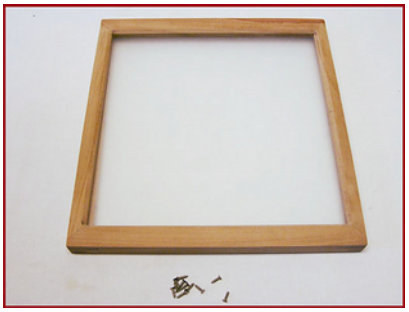
*Now it is time to make the ground glass itself. In the first picture you see how I cut the glass.*

*The glass is then put on a flat surface, protected by some plastic and a layer of kitchen towel. The matte finish is given with an abrasive compound such as 600 mesh silicon carbide (SIC) and some water.*

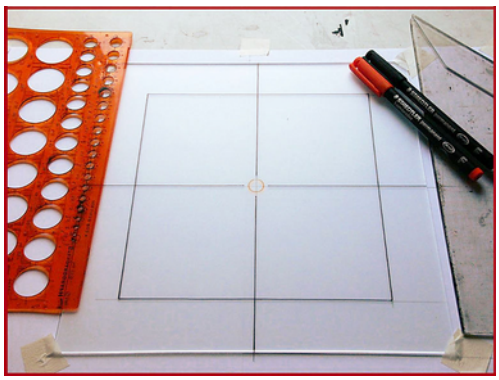
*I made a friction block with a piece of marble (Corian for instance could be OK too) on which I glued a 6mm thick glass plate. I put the SIC/water mixture on the glass to be ground and start rubbing. After a first pass of about 30 minutes, I rinse the glass surface and circle the clear spots with a marker capable of writing on glass ("permanent markers"), then start rubbing again, this time with a 800 mesh compound, until the whole surface is uniformly matte.*





*Above, you see the glass plate before and after grinding, and finally mounted in its frame. Note: I also tried using 1000 and 1200 mesh compound, but that is way too fine.*



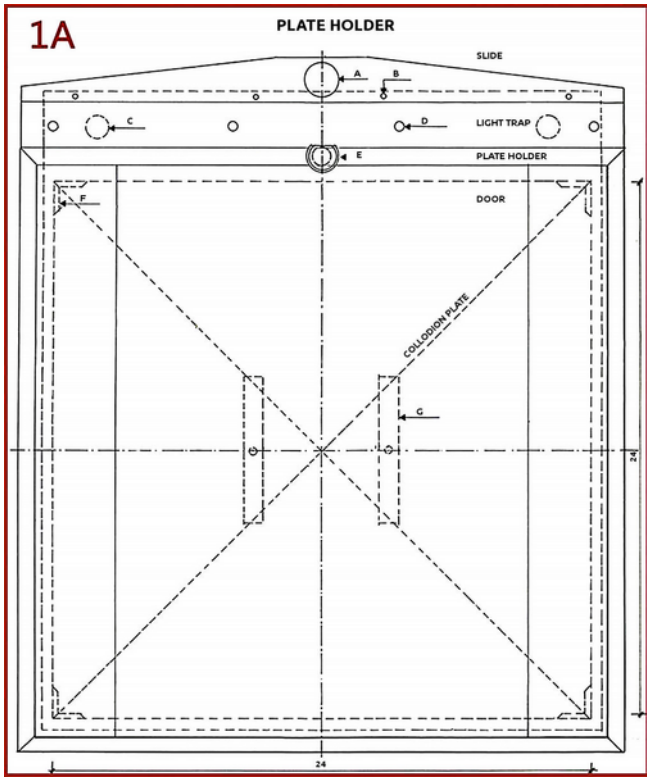

*I draw the grid lines on a sheet of paper, tape the plate on it and transfer the lines with a permanent marker to the ground side of the plate.*

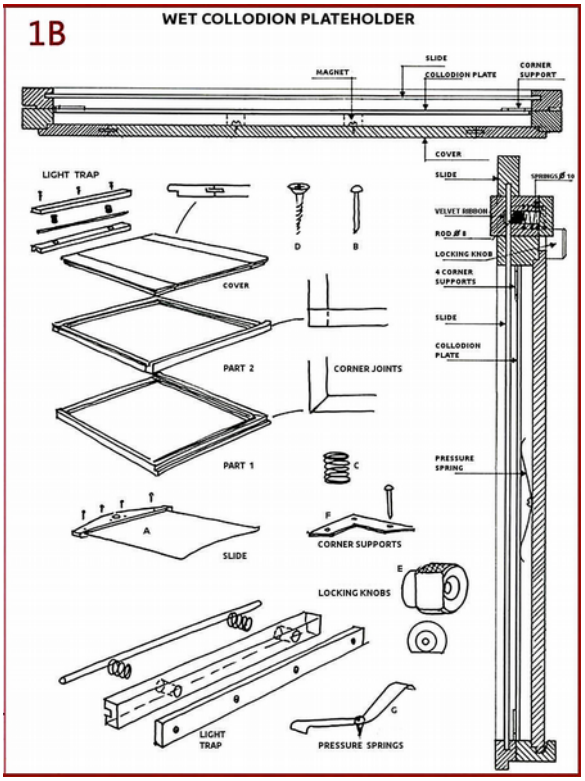
*Note: I got the suggestion to cut the corners of the ground glass in order to improve the inner air-flow in the camera when the back is moved. This might be useful especially with relatively large cameras. An additional benefit is that this allows, when looking through those corners, to check easily whether there are any obstacles (bending bellows) between the lens and the wet plate.*

*PART 2: THE PLATE HOLDER*

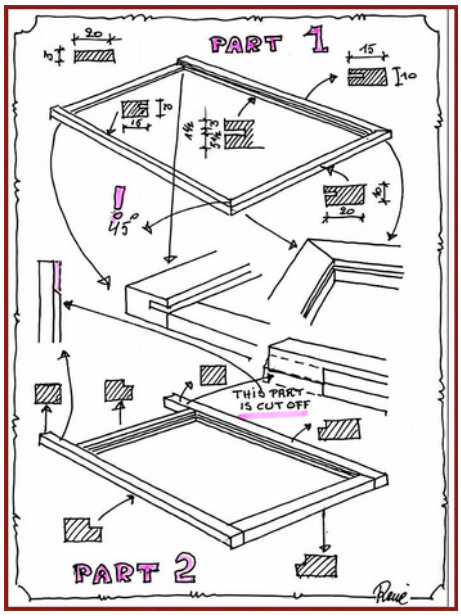
*As you can see below from drawing 1B, the frame is composed by two different parts. Part 1 is the most important: as it will be receiving the plate carriers, its thickness has to be exactly the same as that of the ground glass holder – otherwise it will be impossible to focus accurately. The 10mm thickness includes the slide. The corner joints of part 1 are beveled at 45° and glued, while the corners of part 2 join at 90°. Finally, the two parts are glued together to form one frame. On plan 1A you see some arrows with A-B-C… letters: these parts are detailed in drawing 1B. For the rod in the light trap you can use brass or steel. I used a very light and strong white fiberglass rod that I had to paint in black.*

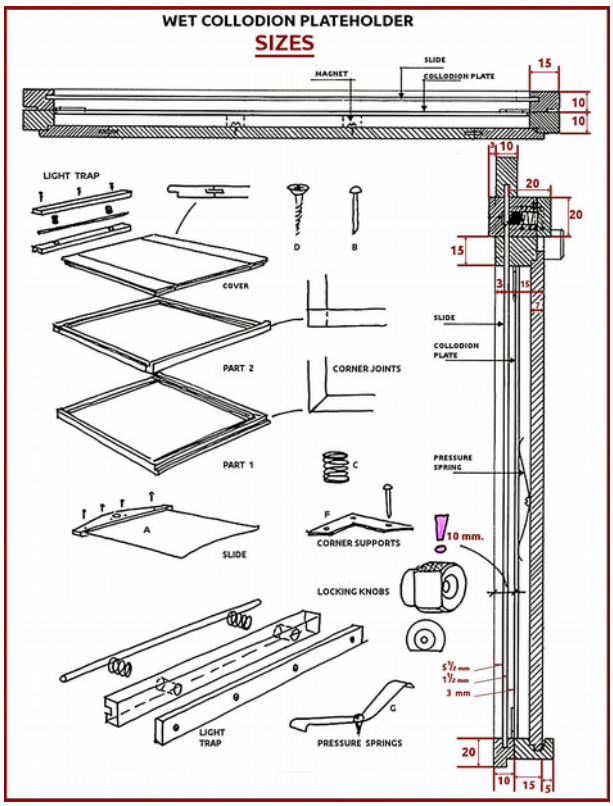
*It is best to start with part 1, making sure that it matches the thickness of the ground glass. Don't forget the slide's groove before gluing the parts together!*



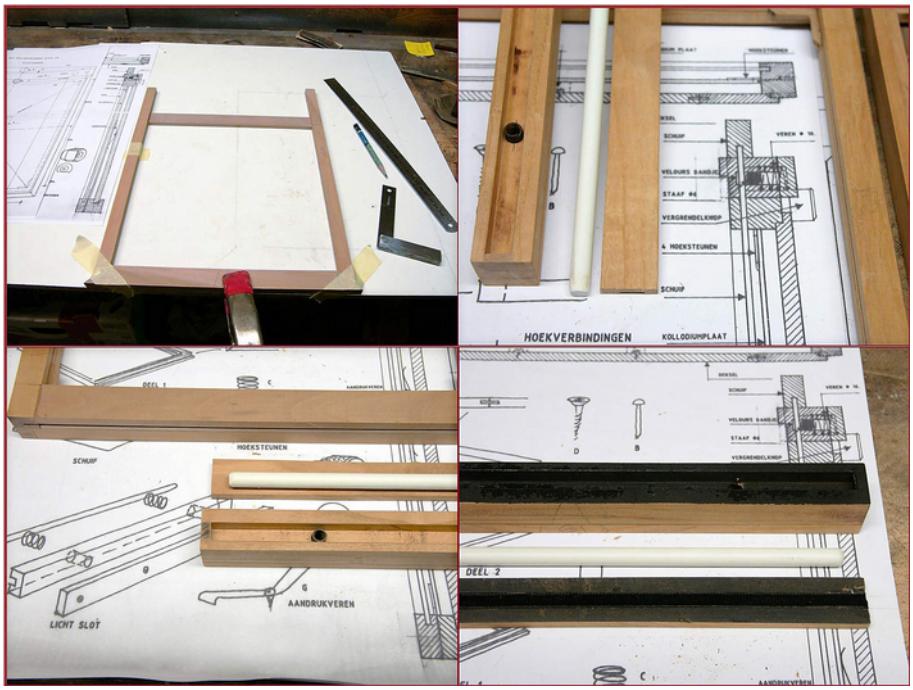



*The following drawings provide you with some more details about the way parts 1 & 2 are built, as well as about the sizes in mm. of the plate holder.*



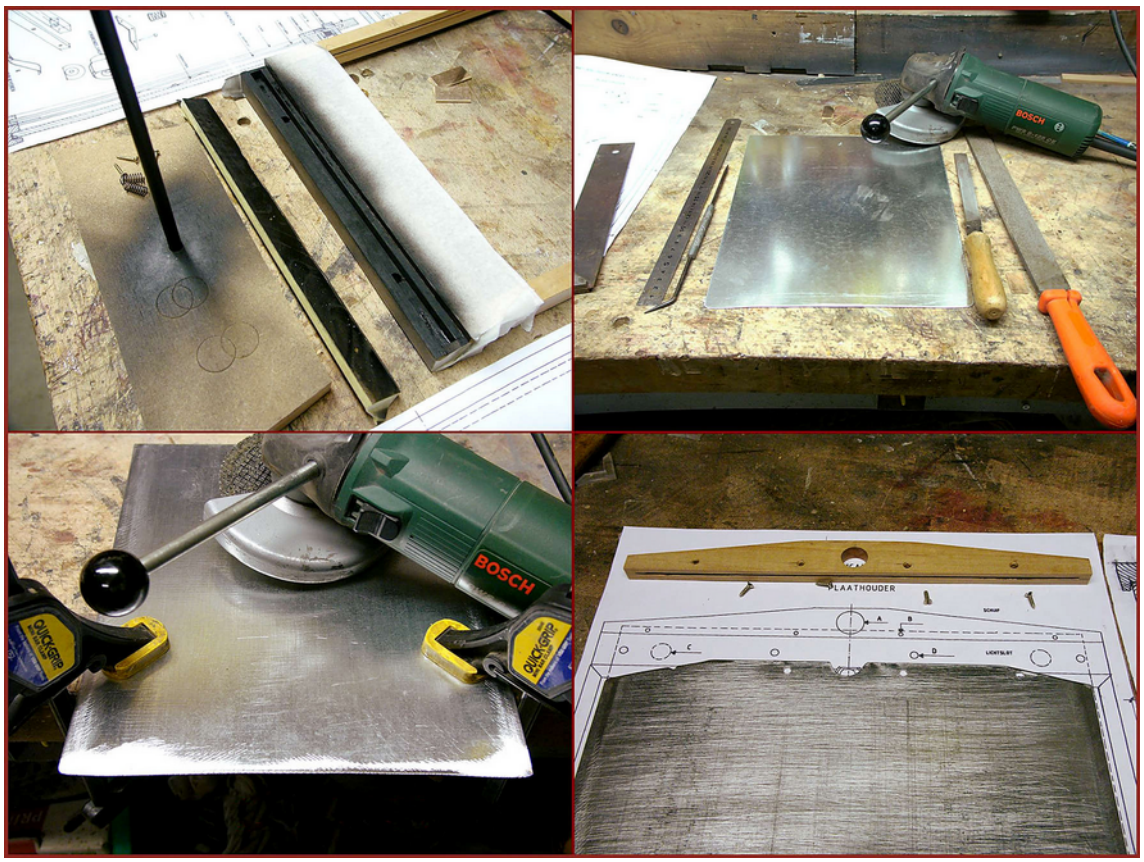




*Please note the different corner joints for parts 1 and 2 (45° and square)...*

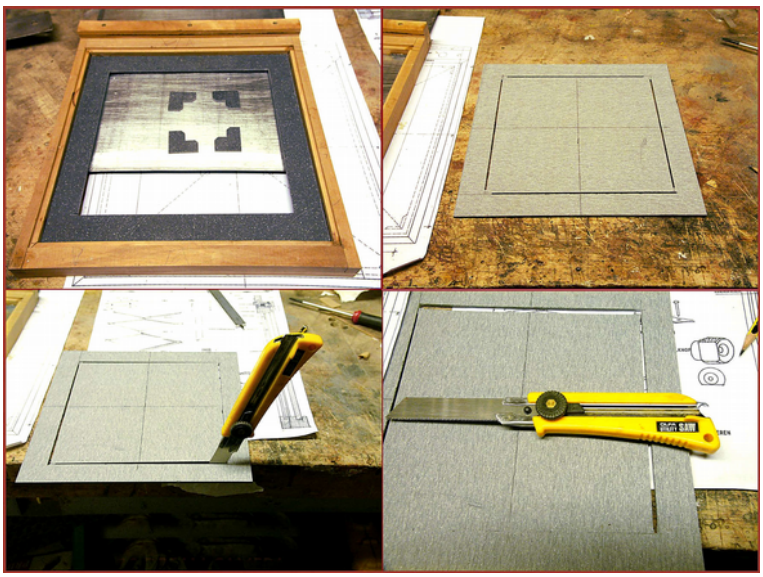



*As for the light trap, I use a rod and a pair of springs. The rod is pushed against the dark slide. When the latter is removed, the rod is pushed forward and fills the slit, preventing any light from reaching the wet plate. I used a 8mm. fiberglass rod, as it is lightweight, somewhat flexible and resistant. I had to paint it black, as all the internal parts of the light trap. You can use a steel or brass rod, of course. Make sure that the rod is long enough to block completely the slit for the dark slide.*

*As you can see on the next page, the inner parts of the light trap and the fiberglass rod were painted black. The dark slide was cut in a 1 mm steel sheet (easily found in any DIY store) with a grinding machine and finished with a file. The bottom edges have been rounded: this allows for a progressive pressure on the rod and for moving it smoothly. One could of course use stainless steel for the dark slide, which would make the painting unnecessary and avoid any silver nitrate problem. I simply did not like the idea of having such a shiny slide in my plate holder...*

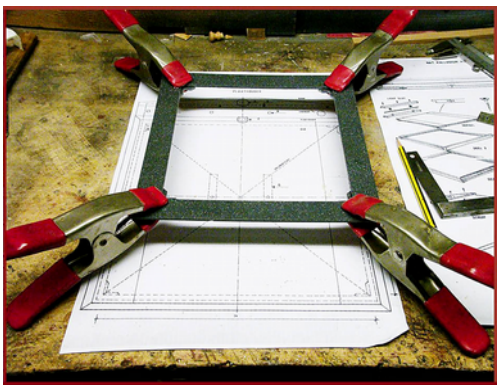



*I started this guide when a friend asked for help with the construction of a 24x24cm camera. As many people might rather use smaller plates, I designed a downsizing insert: this one is for 18x18cm plates (the maximum size compatible with my silver bath tank).*
*The insert and plate supports are made in 3 mm Corian. As this requires detailed cuts with a smooth, finished edge, I used a handy tool to complete the corners: the OLFA "saw cutter".*

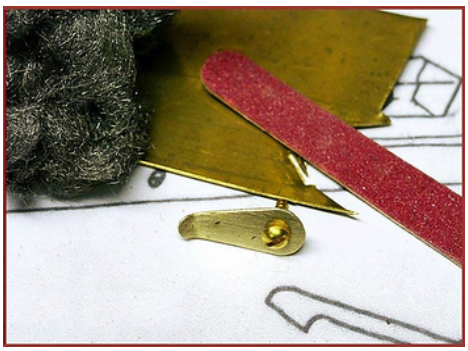


*The next images show how the insert is made. The parts are glued together with two-components glue.*

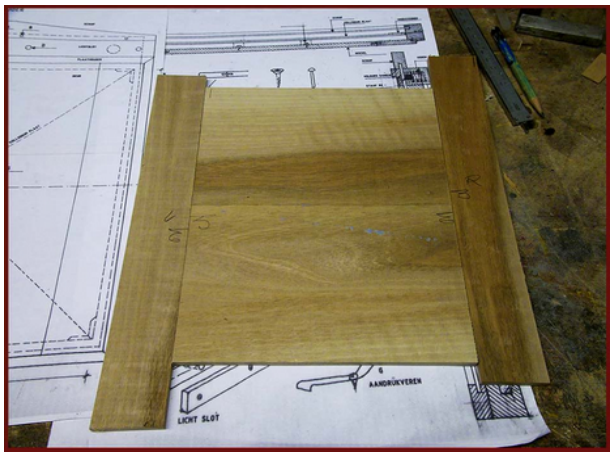
*The second image on the right shows how the corners are made.*

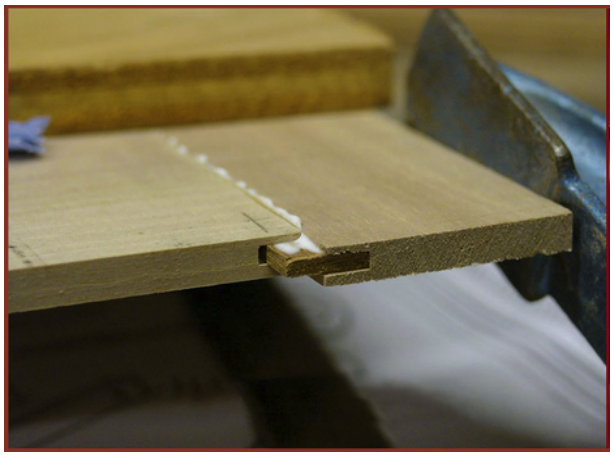


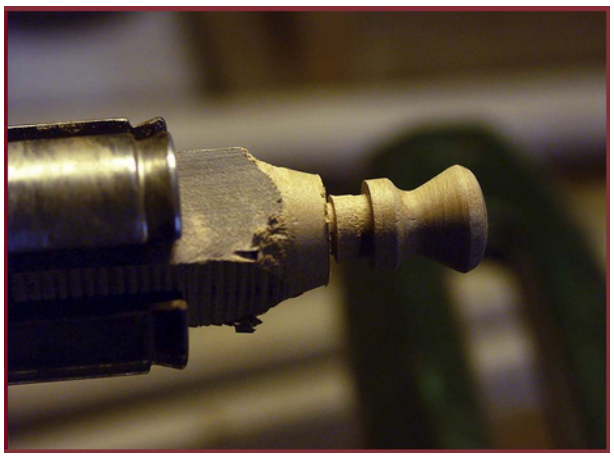
*The images on the right show the latch allowing the insert to be mounted in the plate holder.*



*To finish such a small piece, I use double sided tape to fix it, a nail file and steel wool. Inserts of different sizes can be made in the same way: make as many of them as you want, following the same instructions.*





*The body of the plate holder is finished; next task is making the door.*

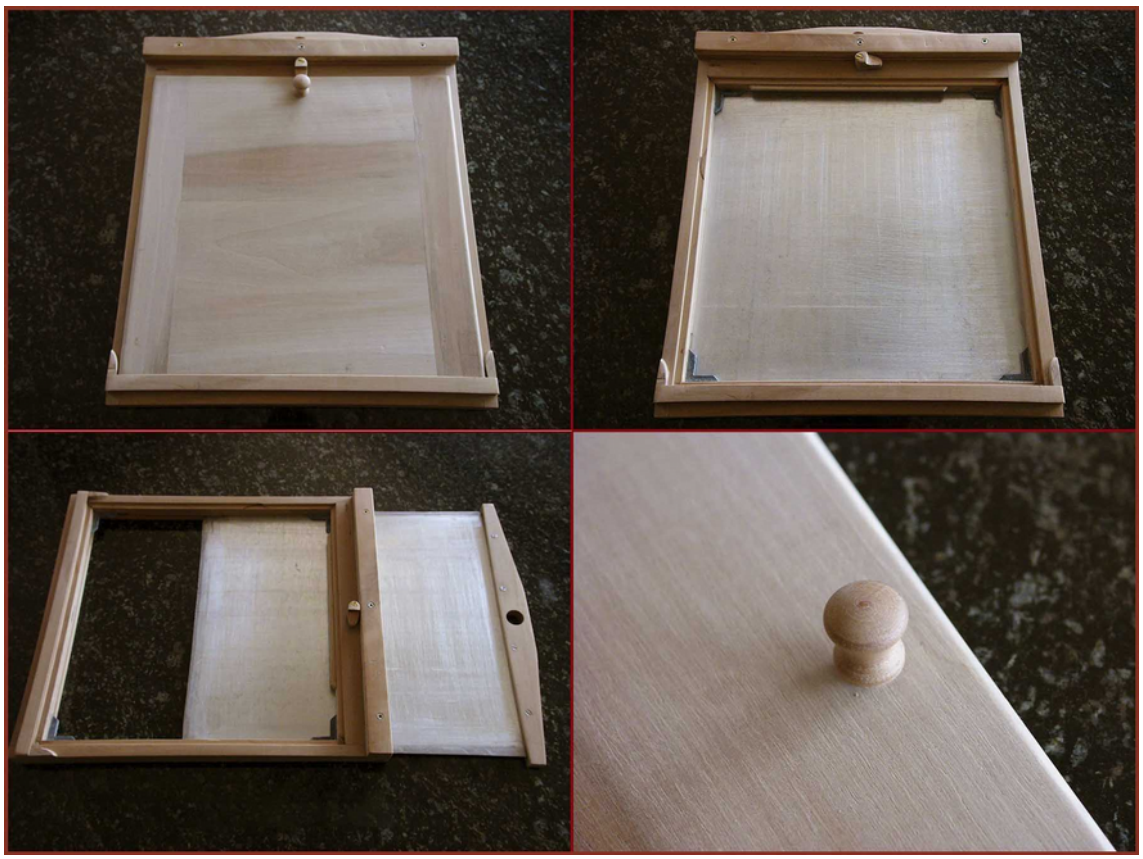
*As it is made from a thin (6 mm) board, and relatively large (25x25 cm), the wood might loose its shape after some time.*

*Even in the 1850's, when these cameras used to be made, people knew this. That's the reason why such parts were assembled from several pieces, making sure to have their wood grain cross-oriented.*

*In the 6 mm thickness of the pieces, there is a groove of $1^1/_2$ mm in which a small slat is glued.*

*Assembling such thin and large panels is not an easy task; these pictures show how it can best be done with the help of another piece of wood and some clamps.*

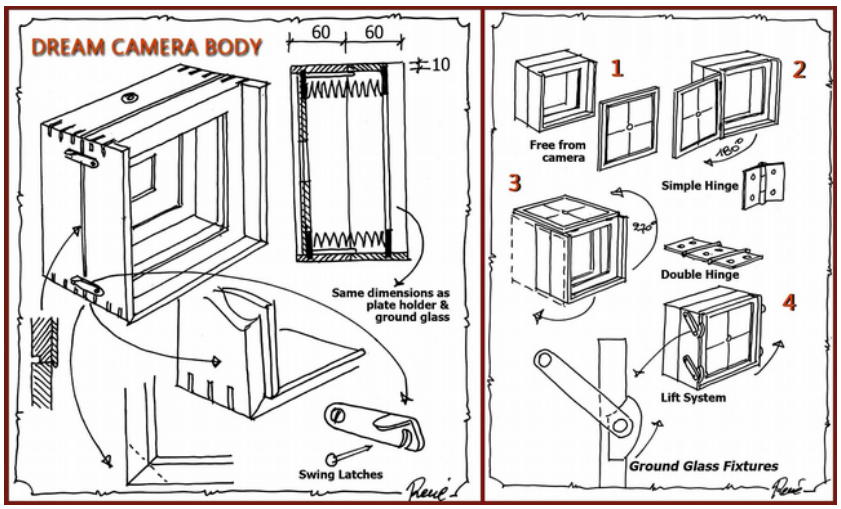
*Finally, I made the door knob. A wood turning lathe is of course quite handy...*
*The picture on next page shows the finished plate holder with its light trap.*
*Our next step will be to make the body of the camera.*



*PART 3: THE BODY*

*3.1: THE STANDARDS*

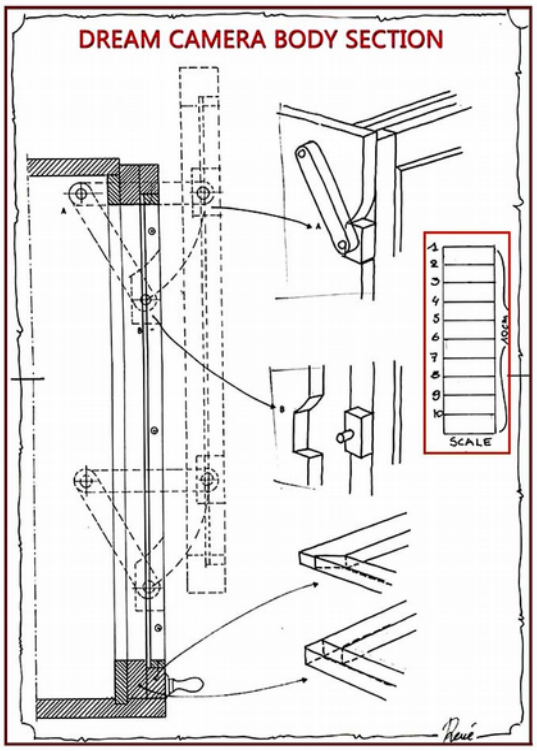
*The camera body basically has two parts: the front standard with the lens mount, and the back standard on which either the ground glass or the plate holder will be fixed. The bellows will connect those parts, which can be either fixed or mobile on the flatbed. From now on, the precision of the overall dimensions is not that important, as long as the plate holder and the ground glass are fitting correctly.*




*When the camera is folded, the standards are hold together by four swing latches. The front standard has an internal rabbet so that both parts will easily lock into place.*

*The four sides of each standard are glued and connected by an MDF board glued into a grove cut in those sides.*
*It is on those boards that the bellows will be fixed.*

*Before moving on, you have to decide how you want to have the ground glass frame fitting to the back standard. Above are illustrated four possibilities. I adopted the fourth, with the lift – maybe because this is the most difficult one...*




*The section plan on the left shows how the lift system is made.*

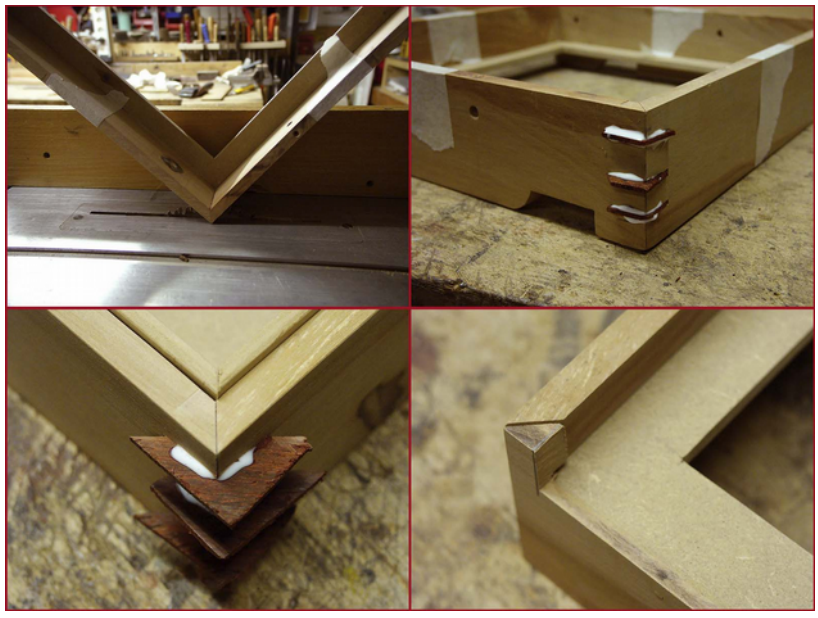
*Note:*
*A high resolution file with an A3 version of this image can be downloaded from the Picto Benelux website.*

*The camera body is the most visible part of the camera; if the looks of your camera are important to you, you have to choose carefully the type of wood and to arrange the wood veins of the available pieces to make a nice decor.*

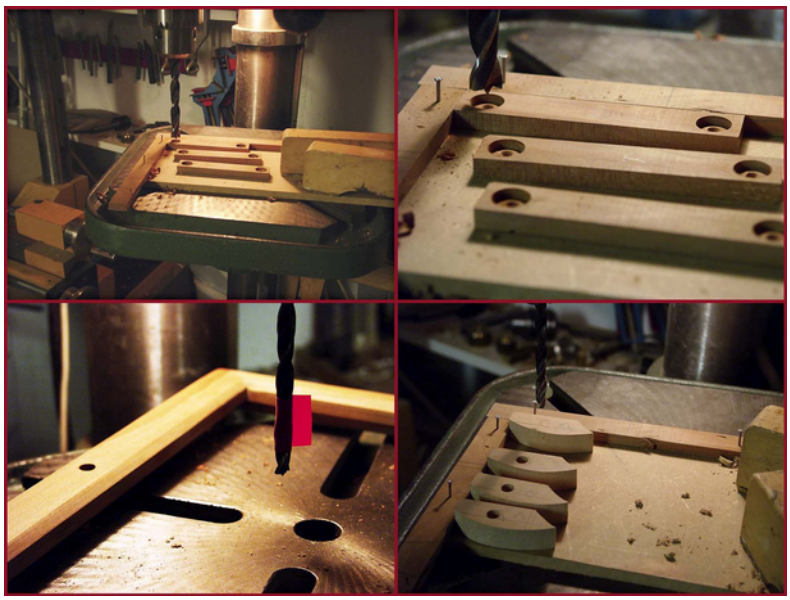
*The picture on the right shows how I tried to do this.*

*You can also see the 6 mm groove for the MDF board, which will help to hold the four parts together during gluing, and make sure that all corners are square.*

*The corners are beveled at 45° and glued together; later on, they are reinforced with small corner slats, as explained before.*
*Once this is done, the corners won't deform any more.*



*The small slats glued in the corner grooves are pieces of padouk (or padauk) mounted in a way that their wood fibers are crossing those of the corner jambs.*
*On the bottom right photo you see the opening for the ground glass / plate holder frame.*



*If you have to make a number of identical small wooden pieces, work in series and drill all the holes at once, after having positioned and fixed a guide with the help of two pieces of wood. All the holes will be exactly positioned, and all the pieces identical.*

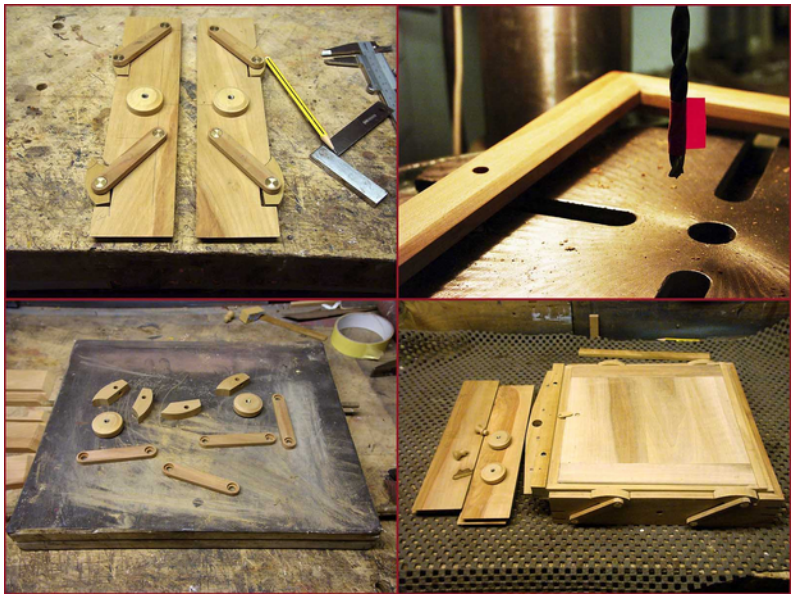
*A tip:*

*- When you have to drill a small hole inside a bigger one, start with a wood drill on which you will have marked the drilling depth with a piece of tape, and continue drilling the smaller hole with a metal drill in the center of the first hole.*

*The above applies when making the lift system of the ground glass frame as it is composed by a lot of small pieces, which must be exactly the same.*

*Some other tips:*

*- When you have to make several curved pieces, make card board templates with different diameters; this will allow you to easily draw the curved edges of those pieces. To cut these edges, I use sanding discs.*



*- When you have to buff small pieces, glue a sheet of sand paper on a marble plate and move the pieces over the paper, you will get a surface that is really flat.*

*We have completed now the back standard of the body, as well as the lift for the ground glass.*

*Next part will be the front standard with the lens board.*

*Top left and bottom right: the pear wood for the front panel with the lens board. The other pictures show some of the equipment to bevel these parts.*

*Next, you see how these parts are glued on a 6mm thick MDF panel, the same as used in the other standard. This panel fits in a groove in the front body.*

*Finally, you see how things fit together, with the lens board and its two different slots: to remove the lens you simply lift up the board.*

### *3.2: THE BELLOWS*

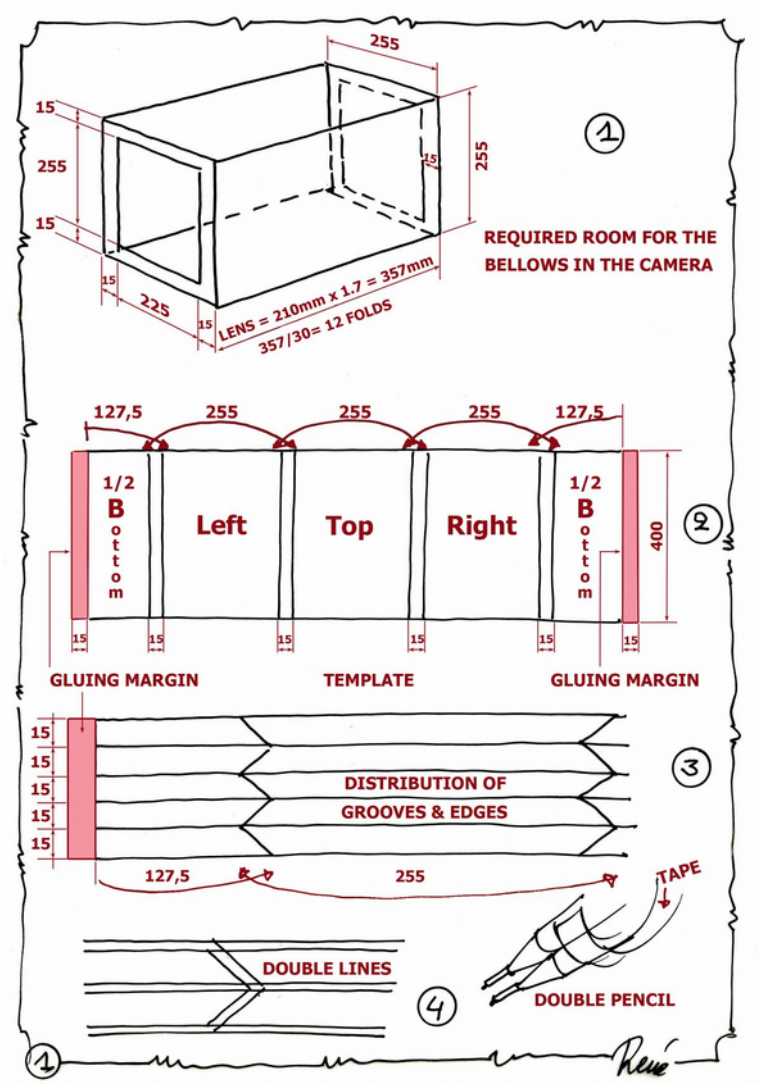
*I don't know exactly how people proceeded in the early times; I developed my own way. Bottom line is that my method works well and can be used with good results, provided you work carefully.*

*I make my bellows in four materials:*

1. *inside, a matte black liner*
2. *in the middle, a thick (300 g/m$^2$) black paper*
3. *the outside layer is made of faux-leather skai, available from fashion materials shops.*
4. *Everything is glued together with glue sheet.*

*Note: The glue sheets I use are those sold in artist shops, for picture mounting. Contact glue is problematic (the skai doesn't adhere well), as is bookbinders glue which is water based and therefore drenching the paper.*

*Here is how I proceed.*
*It is most important to measure exactly the body of the camera, as this is the base allowing to calculate accurately the sizes for the bellows.*

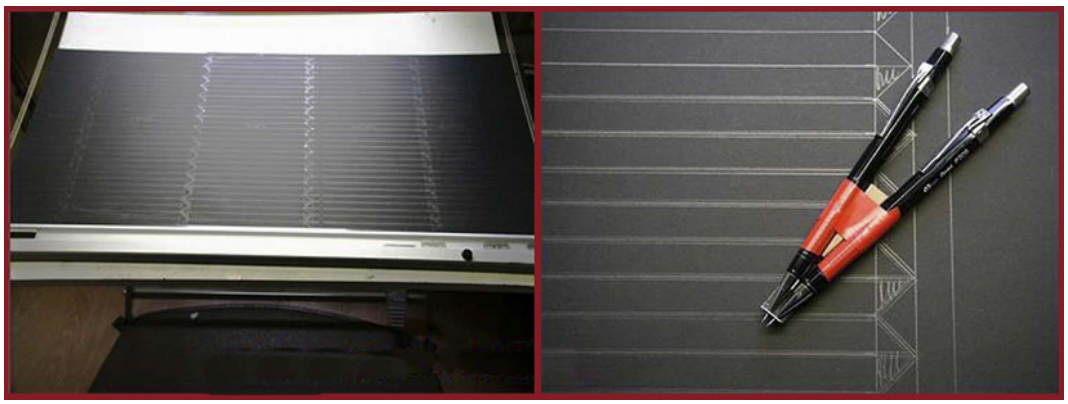



*<u>Sketch 1</u> shows what should be the bellows dimensions for my camera: outside 255x255mm, and inside 225x225 mm. The bellows length has also to be defined. Basically, this is a function of the lens you use, and of the desired close-focus ability. Roughly, a lens of a given focal length needs a bellow extension equal to this focal length when focused at infinity. For a reproduction ratio of 1:1 (subject size on the film plane to the actual subject size ratio), this extension is doubled. As the type of camera built here is not likely to be used for macro photography, but should allow to focus close enough for head & shoulder portraiture, a ratio of 1:1.7 should be fine. For a lens of 210mm, the bellows extension should then be around 210 x 1.7 = 357mm.*
*For 30mm folds, this means that 350 : 30=12 folds will be needed.*

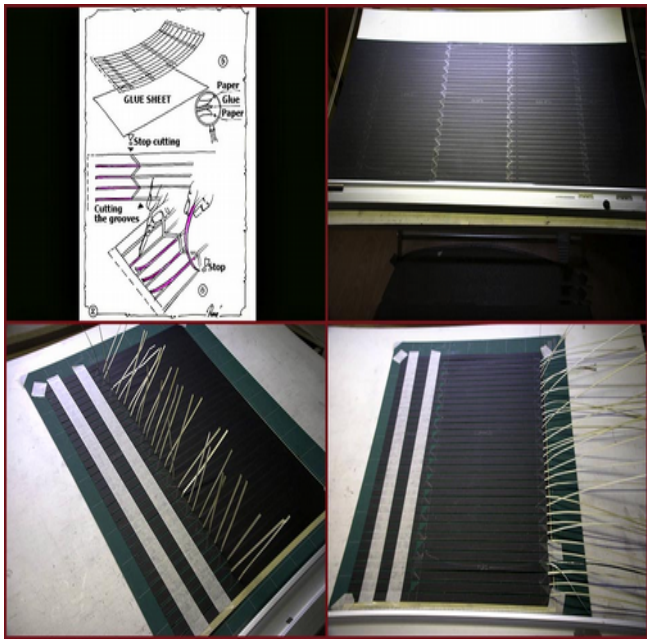
*<u>Sketch 2</u> A template is made on a sheet of 300 gr/m$^2$ black paper. The fourth face of the bellows is not drawn as a whole, but in two halves located at the left and right extremities of the whole set; don't forget to end with a gluing margin of 15 mm.*

*<u>Sketch 3</u> Now we draw the zig-zag lines between the different faces.*

*<u>Sketch 4</u> When this is done, you have to draw double lines at 3 mm distance. To do this easily, I made a 3 mm-distance "double pencil" with tape; going over the first lines, one gets automatically double lines with a gap of 3 mm.*



*The double line pattern is made on the black paper which will be inside the bellows. Next we fix a glue sheet on the back of the paper.*




*On the right, you see how the strips are cut out, the cut-out 45°corners just before taping, the back side with the glue sheet ready to be peeled off.*

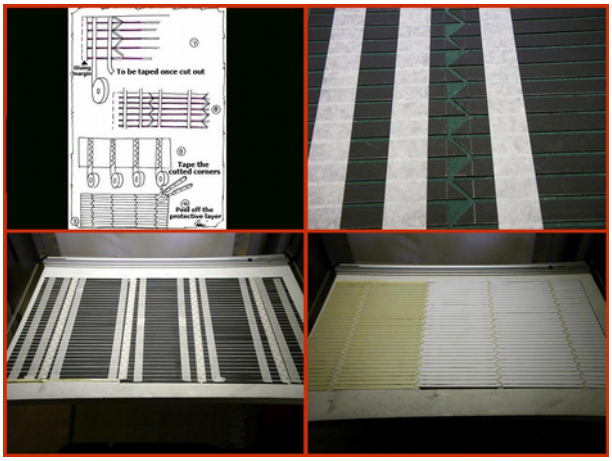
*The black paper strips are glued on the black cloth. To form easily the tube, I use a case made from some scrap wood in such a way that its outer sizes match the inner sizes of the bellows.*
*The bellows is wrapped around it (paper side against the wood), and the extremities taped together.*

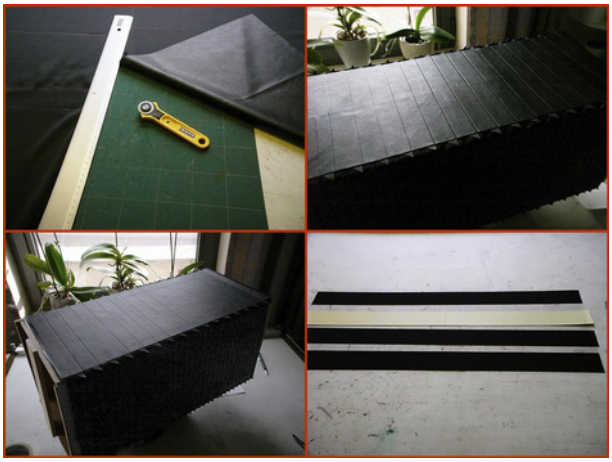
*Now we cut our four faces of faux-leather, and fix them on the paper with glue sheet.*
*With the help of a piece of wood (avoid too sharp edges) we stamp the grooves and press the folds together.*
*The zig-zag corners are made from black textile with paper inside.*

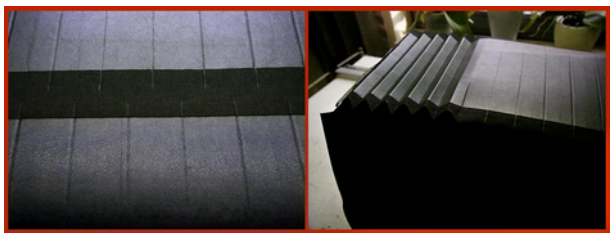
*On next page, you can see somewhat better how the four corners are made: the big surfaces are faux-leather skai, the corners are black textile.*
*The stamped inner folds allow the bellows to fold easily.*

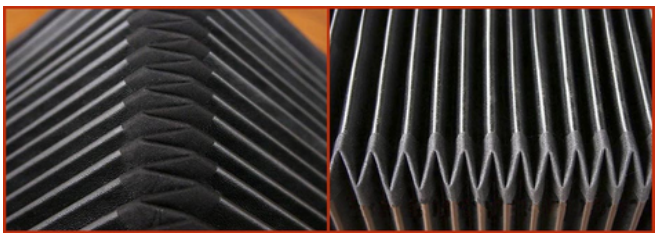
*All the folds are made; because of the inner lining made of the black 300 gr/m$^2$ paper acting as a backbone, the bellows takes its form easily and perfectly.*

*Now we can cut small strips following exactly the lines, through the paper and the glue sheet. This has to be done one face at a time, taping the strips together when all lines of the face are cut, so that they cannot move. Repeat this for the five faces.*
*When all the strips are cut and taped together, the zig-zag lines ( the 45° corners) can be cut in the same way, taking care not to move the cut parts before they are taped.*

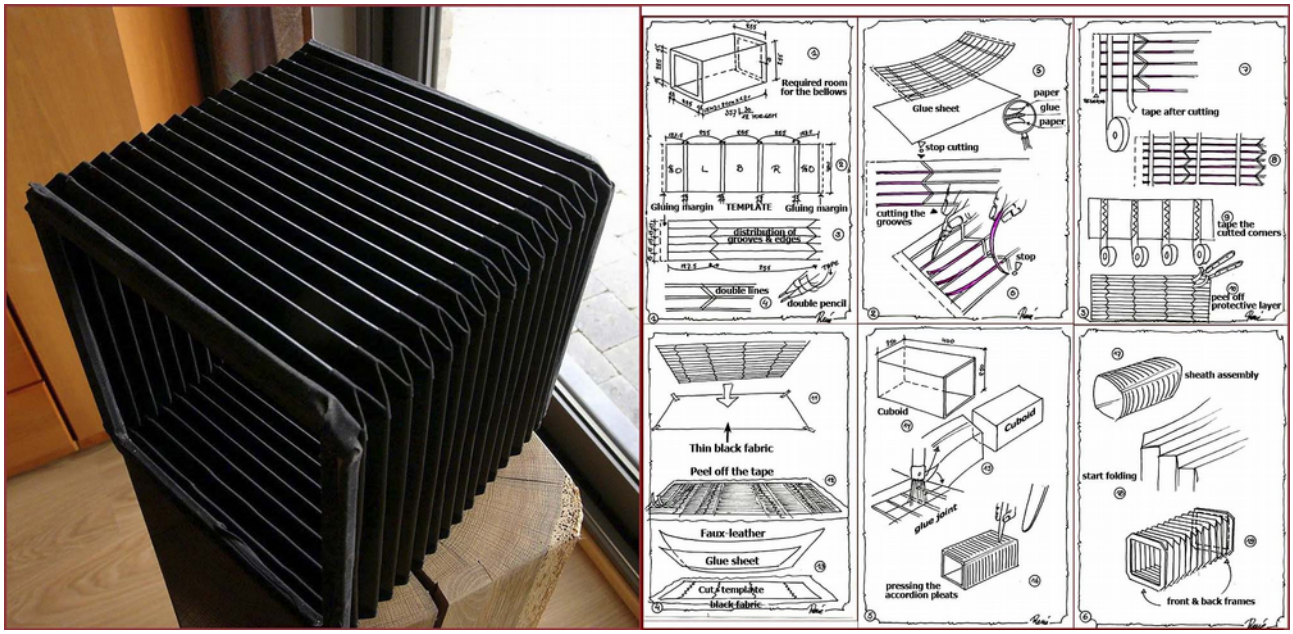


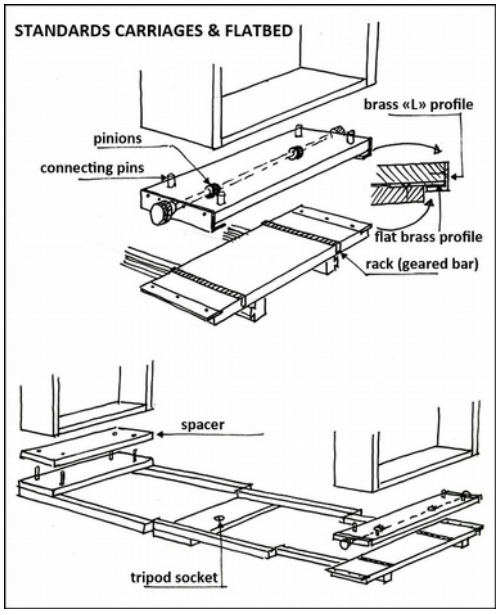




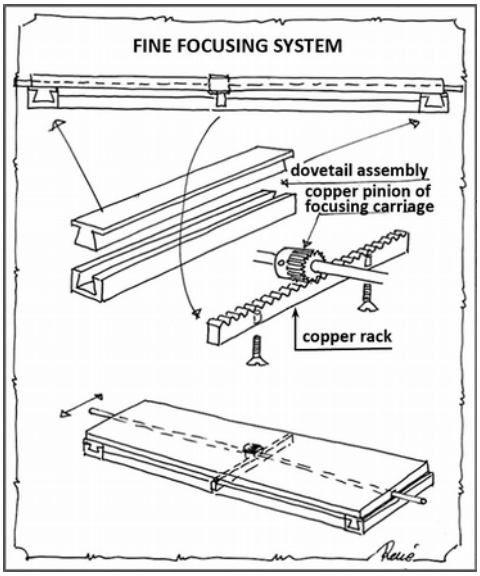
*Below, a summary of the various stages I went through, as well as the picture of the final result...*




*3.3: THE FLATBED*



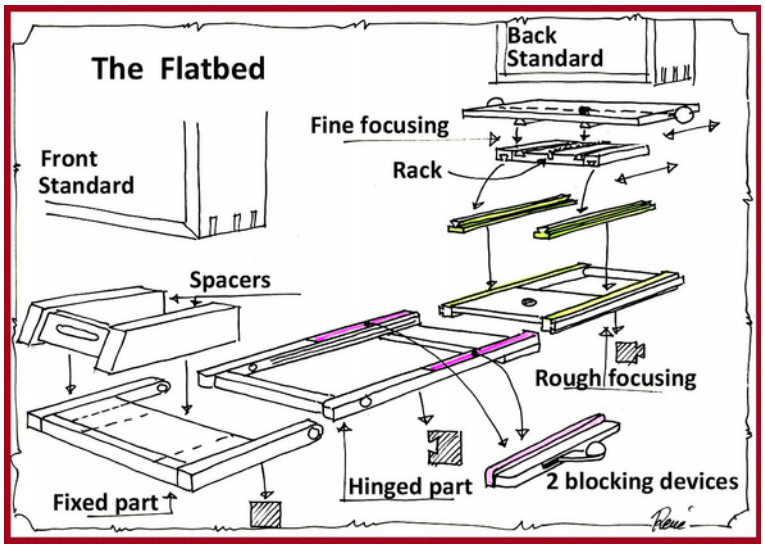

*It is time now to make the flatbed as well as the standard carriages with their fine-focusing system. A "flatbed" basically is a rectangular framework on which both standards are mounted, with at least one of them being able to travel. It usually is composed by a telescoping assembly allowing for a rough lens-to-film distance adjustment, and an additional fine-focus system. Flatbed cameras fold usually up into a compact, self contained box for carrying.*

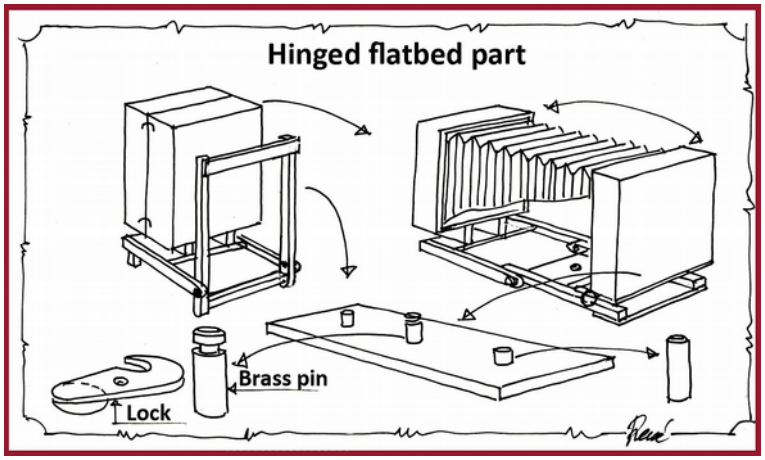



*I first imagined a fine-focus system using two rack & pinion assemblies. Considering their cost, I designed a carriage with only one central rack & pinion, and two lateral guides (two dovetail-assembled bars). They are sliding smoothly, and the system works as it should.*

*The pictures below show how the focusing system is built.*

*The actual flatbed ended up to be somewhat different from the first sketches. Changes were made along the way, when they seemed to be the most adequate options at that moment. The following sketches show the flatbed as it turned out to be after those changes. The flatbed consists of three parts:*



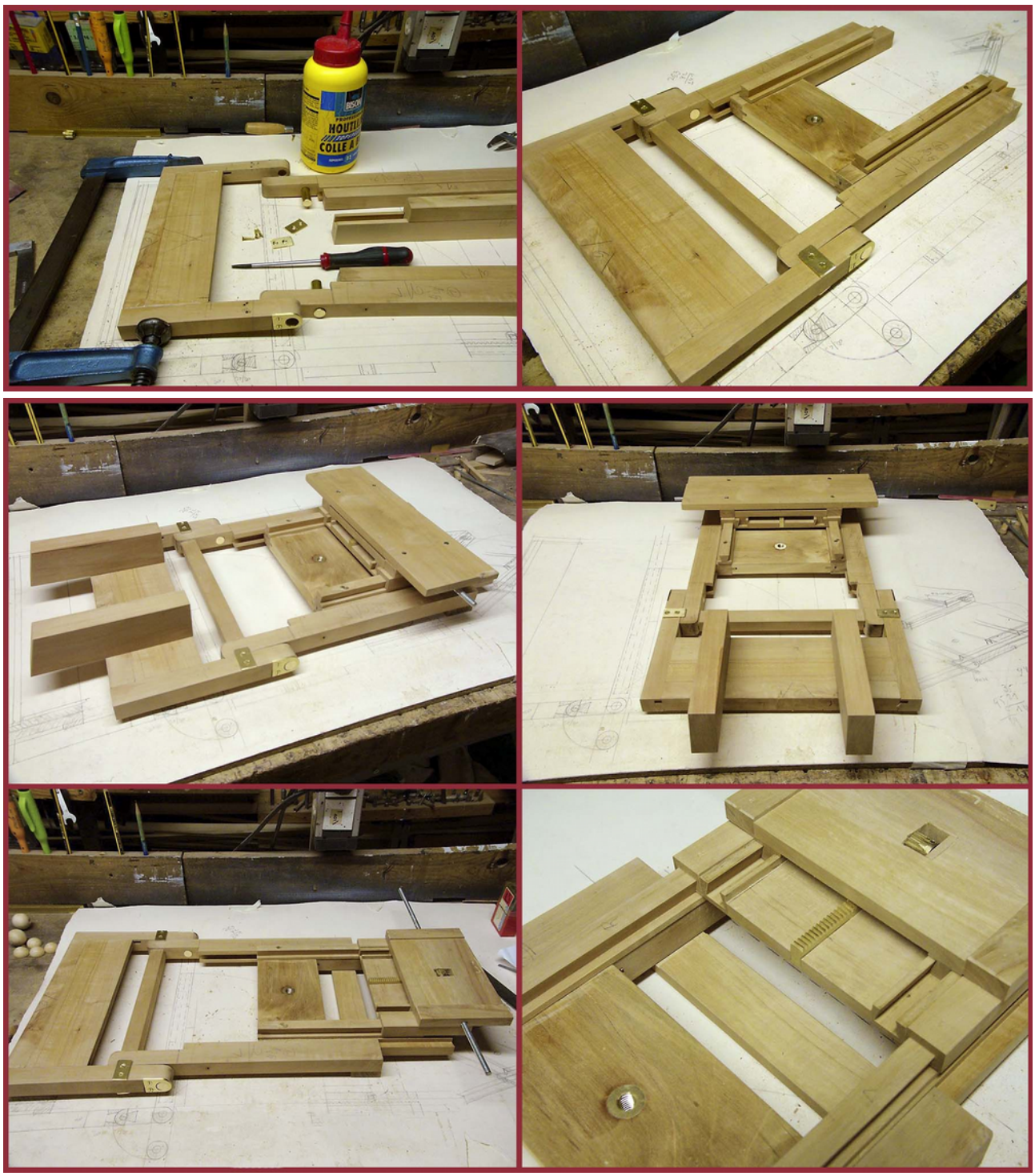

*— The central part, whose side-members have grooves allowing the back part to slide into them, and are fitted with the fine-focus blocking devices as well as with hinges connected to the frontal part.*

*— The frontal part, with the front standard mounted on its crossbar via some spacers. This standard is fixed; only the back part and its carriage is used for focusing.*

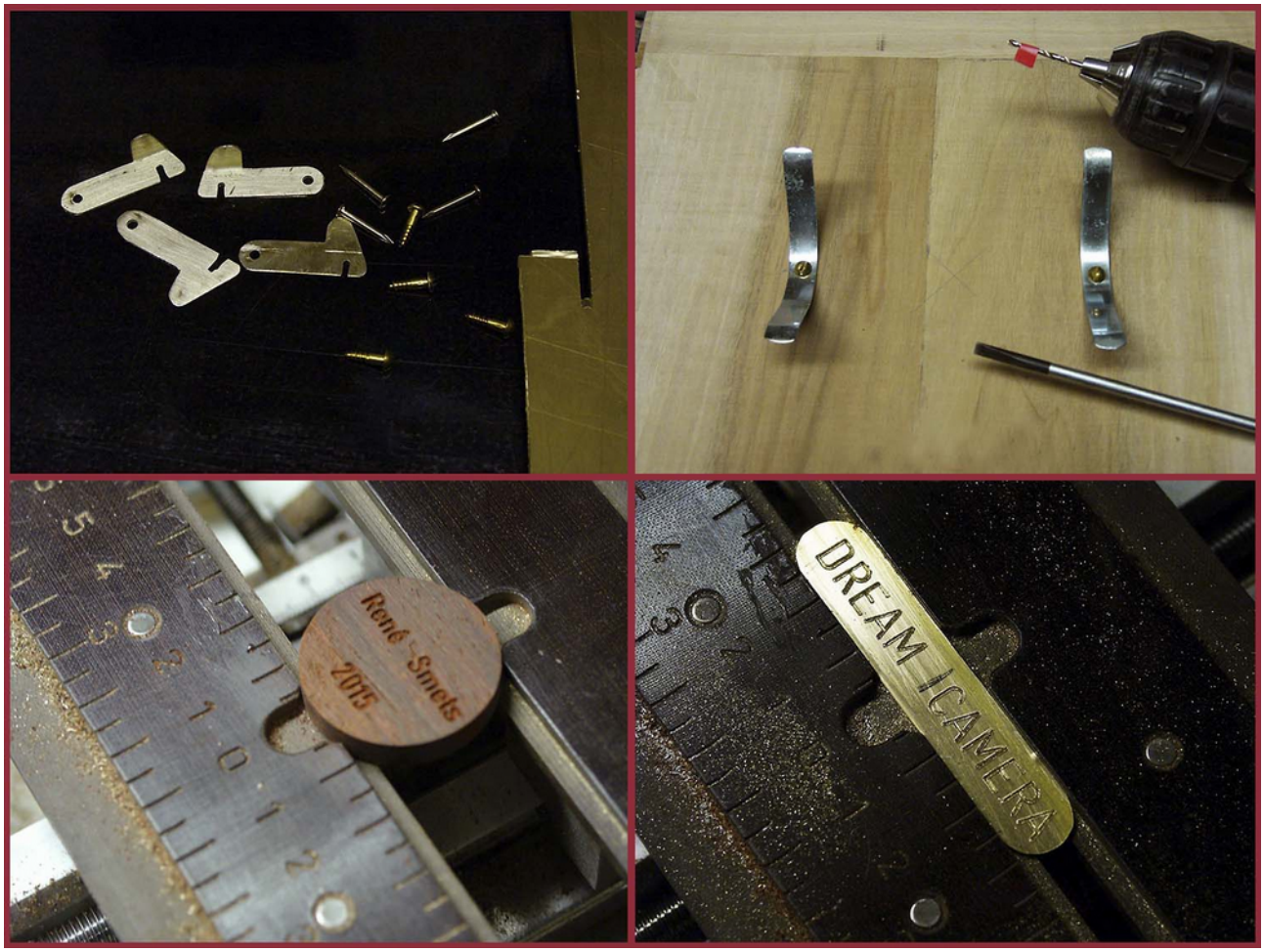
*— The back part slides in the grooves of the central part for rough focusing purposes. This sliding is stiff enough to exempt the assembly from any blocking system. A tripod mounting socket is fitted on the crossbar. As said before, this part has two lateral dovetail guides for the fine-focus carriage. The back standard is mounted on the fine-focus system with the help of two guiding pins and locked with a third brass pin and a swing latch.*

*The base of the fine-focus carriage can be blocked by two devices and their rubber "braking linings".*

*The back standard is removable. When folding up the camera, it is detached, fitted onto the rabbet of the front standard, and locked with the help of four latches. Note: as the lens board can be fitted inside out on the front standard, the lens is protected and can be kept on the camera when folded up for transportation...*



*The tripod socket is machined from a 16 mm brass rod. On the bottom picture of previous page, you see the various stages: drilling the center point and the hole, screw threading it, countersinking the hole, finishing the thread, drilling a 16 mm hole in the crossbar, pressing and gluing the finished socket into it.*





*All engravings, bits and pieces on this camera, including the metallic ones, were self-made, excepted the rack & pinion, the flat springs maintaining the wet plates (taken from old photo frames and having a hole drilled into them), and various screws.*
*For small brass pieces, I use sheets of 1, 1½ or 2 mm, a disc cutter, files and sandpaper. To fix pins on them, I use silver solder. Protective coating is done with Renaissance wax.*
*Apart from the screws, there are about 25 brass parts. More than 30 pieces were made from wood.*

*In order to varnish small wooden parts, I fix them on a panel with double-sided tape and give them three layers of boat varnish.*

*FINAL DETAILS*

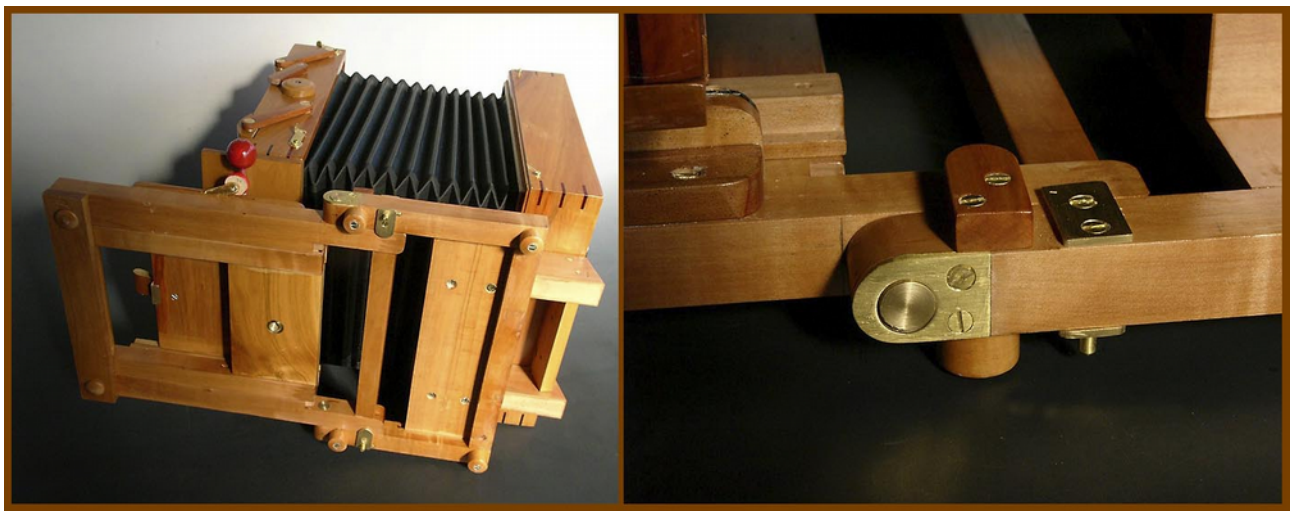
*In this section, you will find some additional pictures and comments, detailing various aspects of the construction.*

*Below, you can see how the ground glass lifting system works: once the ground glass raised, it can be blocked in this position with two levers (one in the middle of both sides of the standard); the plate holder can then be introduced. When the above mentioned levers are lowered, the frame comes down and is hold against the camera back with mini magnets.*

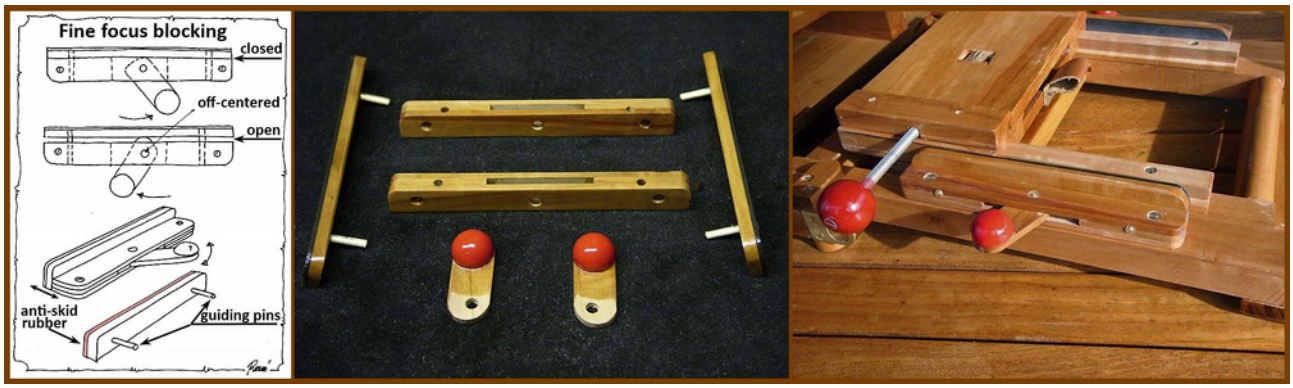
*Next, a closer view on the plate holder: the wooden knob I did initially imagine had to be replaced by a leather strip, as the distance between the frame and the camera was too narrow.*

*The dark slide is a 1mm galvanized steel sheet. I painted it black but this didn't resist to the friction when moving the slide in or out. I finally sanded it blank. I know that there are both cold and hot blacking processes (chemical blacking / black oxidizing), but I know too little about them to undertake this.*

*The lens board has two slots; the upper one is made deep enough to disengage the bottom slot when lifting the board, after having removed the brass blocking device. The board can be taken out, or turned inside out and locked into place with the lens being safely inside the camera during transportation.*

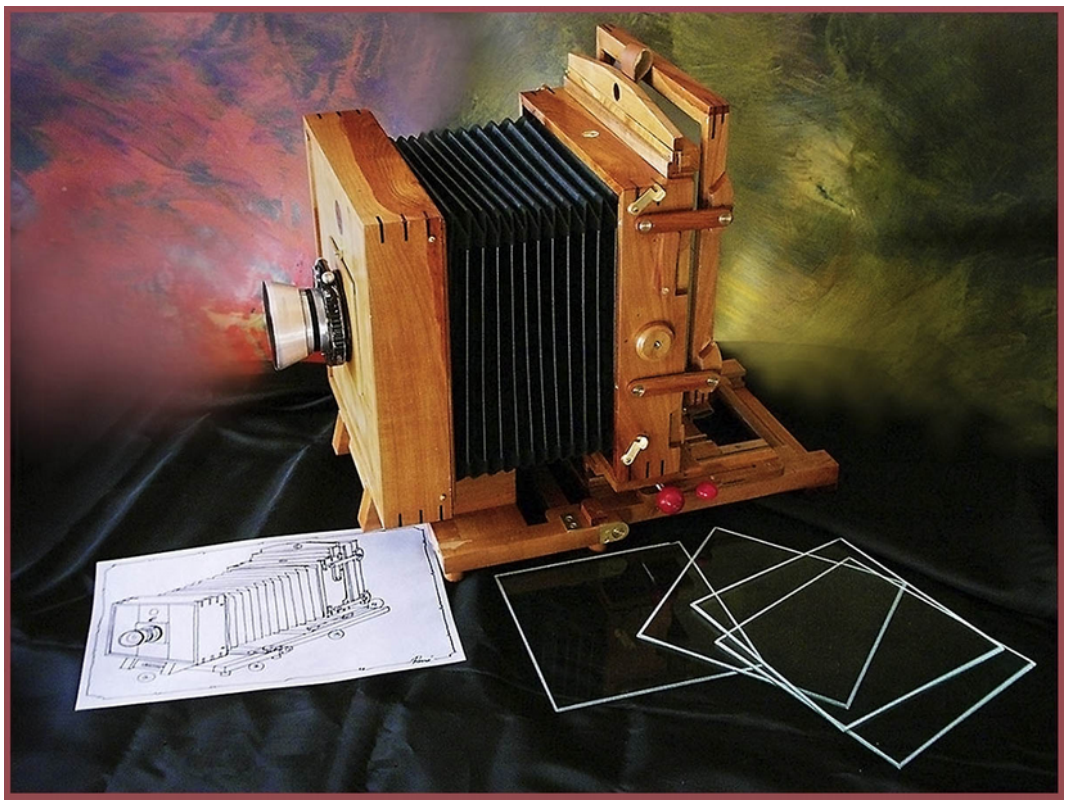


*A closer view on the flatbed hinges; once the flatbed unfolded, it is kept into position by two upper stops and two lower latches, all of them made from brass sheet.*




*This is the blocking system of the fine-focusing carriage. The handle is off-centered and has an anti-skid rubber layer inside. The flatbed is fitted with two of them.*

*And finally, a quick release plate was made. It quickly screws onto the tripod to properly and securely position the camera. This is simply done by fitting the dovetail parts fixed on the flatbed in the plate on the tripod, and blocking the assembly with the brass bolt.*



*We would like to thank René Smets, who kindly accepted to have his original texts and pictures edited, translated and distributed by Picto Benelux, an informal group open to everybody in the Benelux countries having an active interest in photographic processes developed from the very beginning of Photography. The aim is to revisit them, while respecting anyone's creative approach.*

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*Contact: Jacques Kevers - jacques@kevers.org*