Procedure to Convert a Six-16 Folding Camera

for Use with 120 Film

and

Panoramic Photography

by

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August 10, 2008

(Revised, 10/1/08)

Preface

Do you have a favorite folding camera that sits on the shelf because the film it requires is no longer made? Have you looked at panoramic landscape shots longingly, then been deflated by sticker shock when you priced them at the B & H site? Consider the following proposal by Kodak camera collector, Peter Lerro, in which he converts a Kodak 616 folder to a format that is close to the popular 6 x 12 format used by companies like Horseman. No, the author is not promising the performance of a new 47mm Super Angulon XL, but you will see a 6 x 10.8 image that you can create with any 120 emulsion using a coated and well-corrected f/4.5 lens with good resolution and contrast. And the project should cost you less than $100 and a couple of evenings.

The author's first candidate for this conversion was the Kodak 616 Improved Art Deco model with a Kodak Anastigmat f/4.5 124mm lens in a Compur-Rapid shutter. Fellow collectors, rest easy--all steps required only add features that are completely reversible. You will create spool spacers to fit the 120 rolls into compartments that were originally designed for wider 616 spool and you will make and install a new film gate to keep the narrower 120 film flat during exposure.

Candidates for this project can be any 616 camera by any manufacturer. Kodak folders are the most commonly available and can be models with very simple lenses to Kodak Seniors, Special 620 and Monitors with lenses that approached the quality of Kodak's best lenses in the late 1940s. The best optical results will generally come from any of these models with an f/4.5 Kodak Anastigmat or Kodak Anastigmat Special. Typically any lens with a manufacturing serial number beginning ER, EO, ES or EI will be single-coated.

Brian Wallen, 10/1/08

Converting that 616 Folding Camera for 120 Film & "Panoramic" Photography

I'd be willing to bet that among those antique camera aficionados, who delight in actually taking pictures with some of the favorites in their collection, there is a goodly number who are frustrated by the fact that so many of their fine pieces have been rendered unusable simply because the required film isn't readily available.

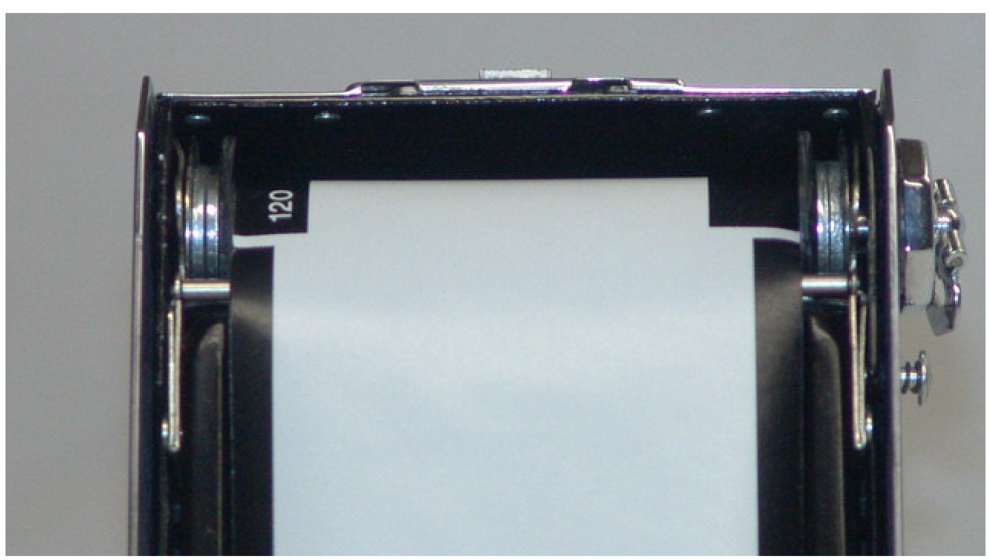
But this doesn't have to be the case for anyone who might have an operable 616 camera on their shelf. Take for example this Kodak, 616 Improved Art Deco model -- its Compur-Rapid Shutter, and its Anastigmat f:4.5, 124 mm lens make it an excellent candidate for conversion to panoramic photography, i.e., panoramic of a sort.

Pay no mind that the camera's prescribed film (616) hasn't been around since 1984, because 120 film is still with us today. However, 120 film just happens to come on a spool whose length is roughly 1/4 inch shorter than the that of a 616 film spool, and in addition, its end-flange-diameter is a 1/32 of an inch larger than what is found on the 616 film spool.

(Specifically, the Ilford 120 spool, which was shown above, has a length that is 0.274 inch shorter than the 616 spool, and a flange diameter that is .037 inch larger than that on the 616 spool.)

Fortunately, these two differences can be easily overcome with the use of two pair of home-made spool adapters, which can compensate for the length difference, along with the simple act of trimming the end flanges of both the supply and the take-up spools.

As a result of using two pair of adaptors, and trimmed down the spool flanges, that Kodak, 616 Improved Art Deco when fully loaded with 120 film, will be made to look like this:



Upon being so equipped, that once, film-starved 616 camera, can now be loaded with any one of a number of 120 print film-brands made by the likes of Kodak, Fuji, Ilford, Agfa, as well as, perhaps, lesser known brands such as Berger, Efke, Rollei, Forma and Forte. This wide variety of 120 film brands affords the photographer the opportunity for film speeds ranging from 25 to 3200, and the ability to shoot with not only black and white print film and color print film, but also, with color reversal film, such as Velvia by Fuji. However, to realize the full benefits of color films, the shooter would be wise to use a camera equipped with a Kodak Anastigmat Special (KAS) lens, and even furthermore, when using color reversal film, a clean Superamatic shutter (along with a KAS lens) should be considered, as some degree of bracketing will usually be necessary in order to obtain optimum exposures.

And for those devotees of traditional B&W print film who decry the absence of readily available film development, they can enjoy the convenience of using chromogenic black-and-white negative films such as Kodak's BW400CN, Fuji's Neopan 400CN, and Ilford's XP2, the beauty of which is that these emulsions can be developed in standard C-41 color chemicals. These films also allow the user to get their film developed at any local 1 hour lab without having to suffer the inconvenience of a 10 day to 2 week wait to have panchromatic black and white films developed and returned. These negatives also possess the dual advantage of being printable on both color and B&W paper.

In the following pages, the writer has presented all the steps that are required in completing the conversion of a 616 folding camera for use with 120 film. These steps cover the following:

1. ***The Spool Adaptors***
    a. -the required materials and tools
    b. -assembling the spool adaptor components
    c. -preparing the 120 spools
    d. -installing the spool adaptors
2. ***Making the Film Mask***
    a. -the required mask materials
    b. -the mask installation
3. ***Masking the camera's view-finders***
4. ***Instructions for advancing the 120 film.***

Appendix:

-Rational for a Film Mask Design

1) ***The Spool Adaptors***

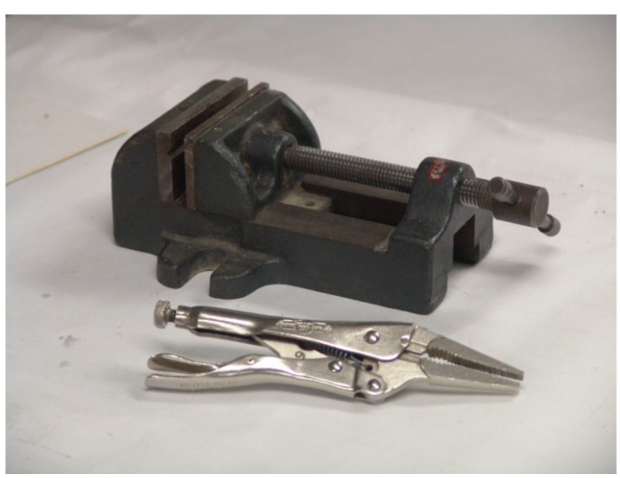
a) *Hardware and Tools*

The hardware needed for those adapters isn't very hard to come by – :

each pair of adaptors requires one old fashioned 620 spool (certainly not foreign to a real camera collector), and four, standard ¼ inch washers (the kind that's found at the local hardware supply store) with an average thickness of 0.57", i.e., about as thickness a one cent coin (i.e., U.S. one cent.)

Then, as for tools, a "Dremel" with a large cut-off wheel, and a tungsten-carbide bit are suggested.

And although, not entirely necessary, some "crazy glue" is helpful when assembling the adaptor. And finally, a small vice-grip pliers, or perhaps, more ideally, a small machinist vise is needed.



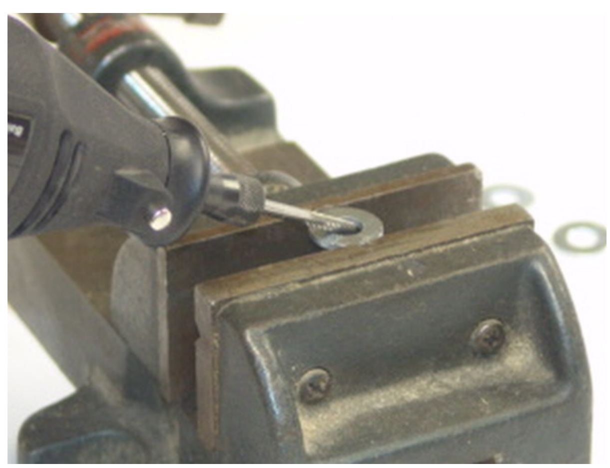
b) *Making the Adaptors*

i) Using the Dremel cut-off wheel, cut the 620 spool, in two pieces. (An approximate 50-50 cut will be sufficient.)

***CAUTION: The use of safety goggles or a face-shield, along with good, common sense, is strongly urged whenever using a high-speed Dremel tool, during any part of this project*.**

ii) As previously, stated, each pair of adaptors will require four washers. It is necessary that two of these washers be provided with a generous bevel on one side.

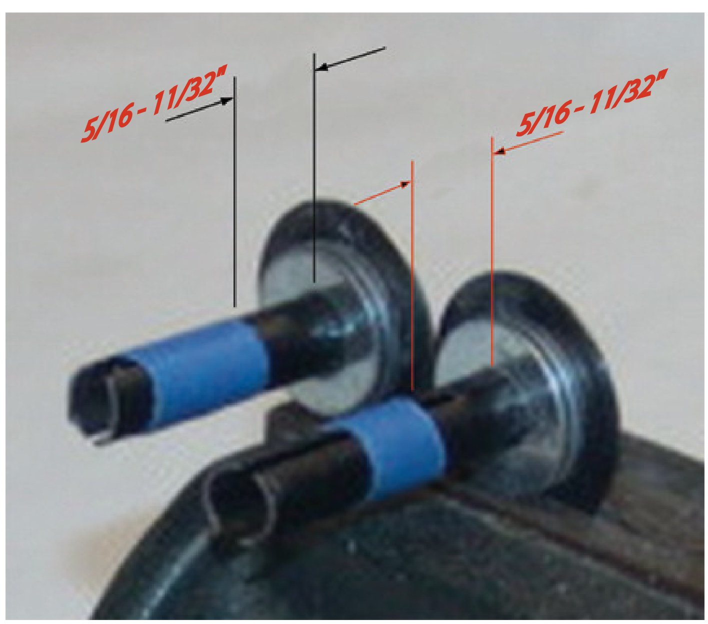
iii) This chamfer is produced with the Dremel tungsten-carbide bit while the washer is firmly secured with either with the vice-grip pliers or with the small machinist's vice,



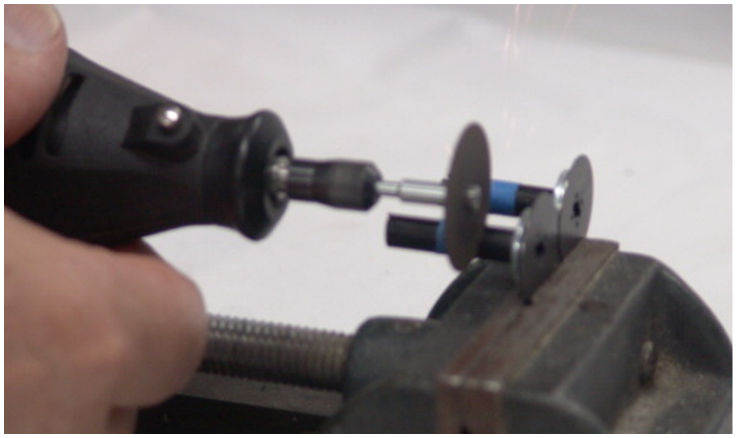
The chamfer will assure that, during the assembly (described in the next step), the washer will not hang up on the flange indentations which secure the flange and axle together, but rather will seat properly against the flange of the 620 spool..

iv) Place a tiny drop of “crazy-glue” on the inner surface of the spool flanges and then assemble one of the chamfered washers on to each spool half, with the chamfer being placed against the flange. Apply another drop of “crazy-glue” on the first washers and complete the assemblies by placing the second washer upon the first one.

v) Sizing the length of the washer/spool assembly:
With a piece of masking tape, indicate an axial distance along the spool of approximately 5/16 to 11/32 inch from the surface of the inner washer

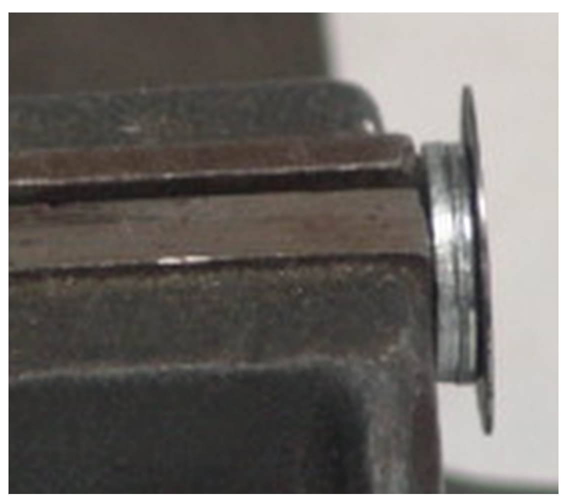


vi) Using the tape as a guide cut the axle of the spool to the length indicated by the tape.



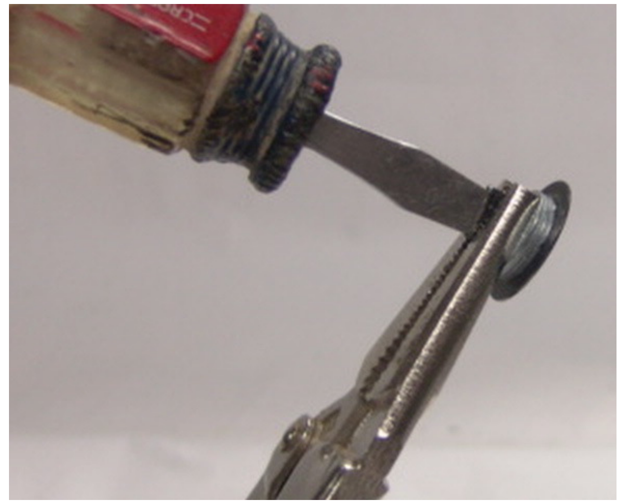
vii) In the following steps, the axle of the washer/spool assembly, which was just cut to length in step 3b, will be compressed into the rectangular-like shape shown below.

(1) Place the surface of the inner washer flush against the end face of either the pliers or the vise, and carefully begin to compress the axle of the spool.



+

(2) After the initial stage of the compression process (i.e., when the axle's shape has gone from a circle to an oval), the tip of a screwdriver should be placed into the axis opening in order to insure the rectangular shape is not distorted during the remainder of the compression process. The tip of this tool should be kept in place until the compression is completed.



This final step in the compression process will also insure the dimensional uniformity of the final shape, which should fall within a length of 0.373" – 0.385" and a width of 0.110" – 0.115"
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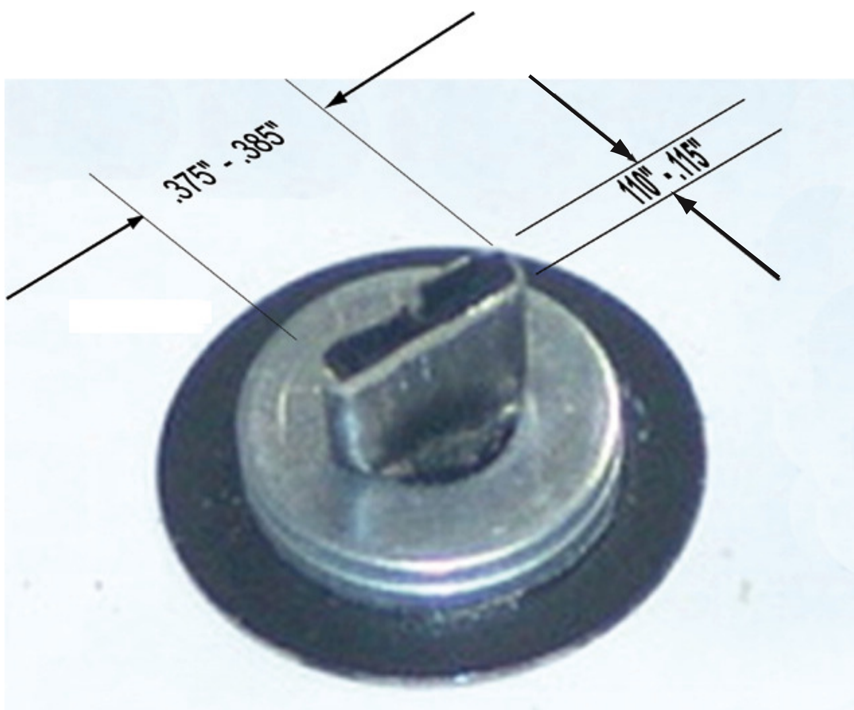


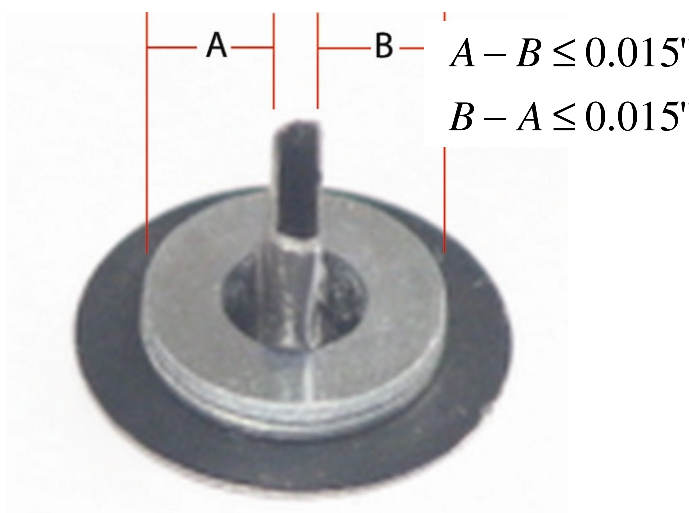
viii) Tips to help insure the success of the finished adaptor:

(1) Although it is not readily noticeable, there is actually a split along the entire length of the spool's axle. This split is always in line with the longer of the two slots in a 620 spool.

However, this split is decidedly noticeable once the compression step is completed.

In order to maintain the dimensional stability of the adaptor's final shape during the compression process, the spool's axle should be positioned in either the pliers or the vise, so that when the compression (step 4a) occurs, the split will eventually reside in the longer of the two dimensions as shown above on the right.

(2) One final caution regarding the lateral placement of the smaller of the two dimensions within the washer's opening: care should be taken during the compression step that the final shape is positioned evenly within the washer. The two dimensions shown below should differ no more than .015 inch.



c) *Preparation of 120 Film Spools*

Prior to assembling the finished adaptors into the 120 film spool, the end flanges of both the supply and the take-up spools must be trimmed, because a 120 spool-flange has a larger diameter than that of a 616 spool, The eventual diameter of the trimmed 120 flange should be approximately equal to that of an adaptor's flange diameter. For this operation, it is recommended that a toe nail clipper with a ½ inch wide, concave cutting edge be used, as this size and shape compliments the spool's circular flange, and results in a cut edge that requires little, if any, additional finishing.

d) *Assembly of Adaptors & Spool*

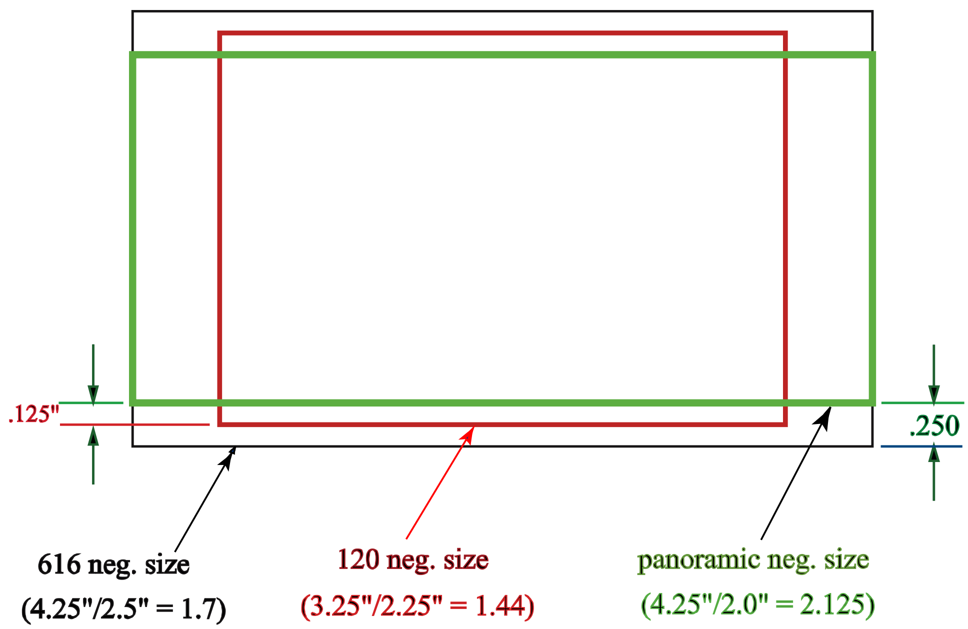
The finished adaptors can now be inserted into the end flanges of the trimmed 120 film-spools. Care should be taken to insure that the inner most washer of each adaptor is flush against outer surface of its corresponding end flange.

Careful attention to the preceding instructions for the construction and installation of the adaptors will assure that once the finished pieces are in place, the axial length of the final assembly will be nearly identical to that of an actual 616 film spool. In the example shown to the right, the final assembly's axial length was within .010" of that of the 616 film spool.

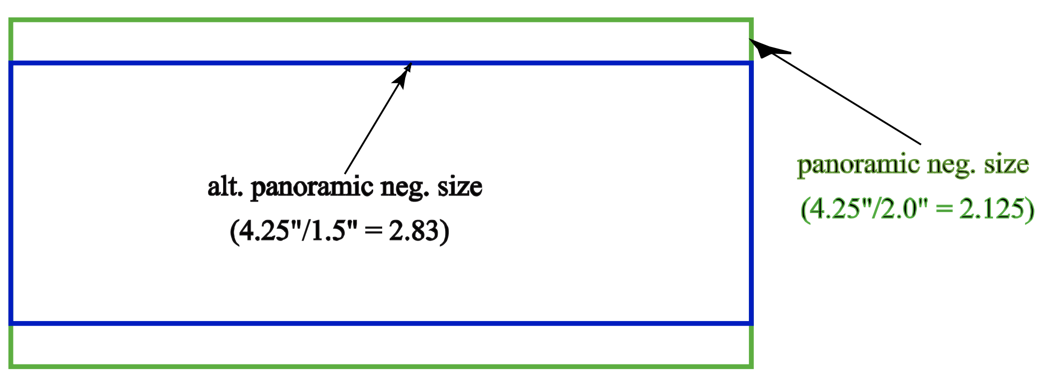
The Film Mask:
The next step in the 616 conversion is the installation of a film mask.

1) The three most obvious factors to consider in the design of the film mask are the relative sizes of:
   a) the 616 negative
   b) the 120 negative and
   c) the desired size of the panoramic negative

   In the following figure, all three sizes are superimposed in the same view. While the aspect ratios of both the 616 and 620 (i.e., 120) negative sizes are given values, the final ratio of the panoramic negative was based on the writer's personal goal of achieving the largest possible exposure on 120 film, while still maintaining the correct negative flatness. To this end, negative size of 4.25" x 2.0", with an aspect ratio of 2.125, was selected. The choice of a 4.25" length was a "no-brainer" in that it was the same as that of a 616 negative, while the 2.0 inch width was based on a purely subjective judgment that to have sized the width any larger would have compromised both negative flatness and masking strip stability.

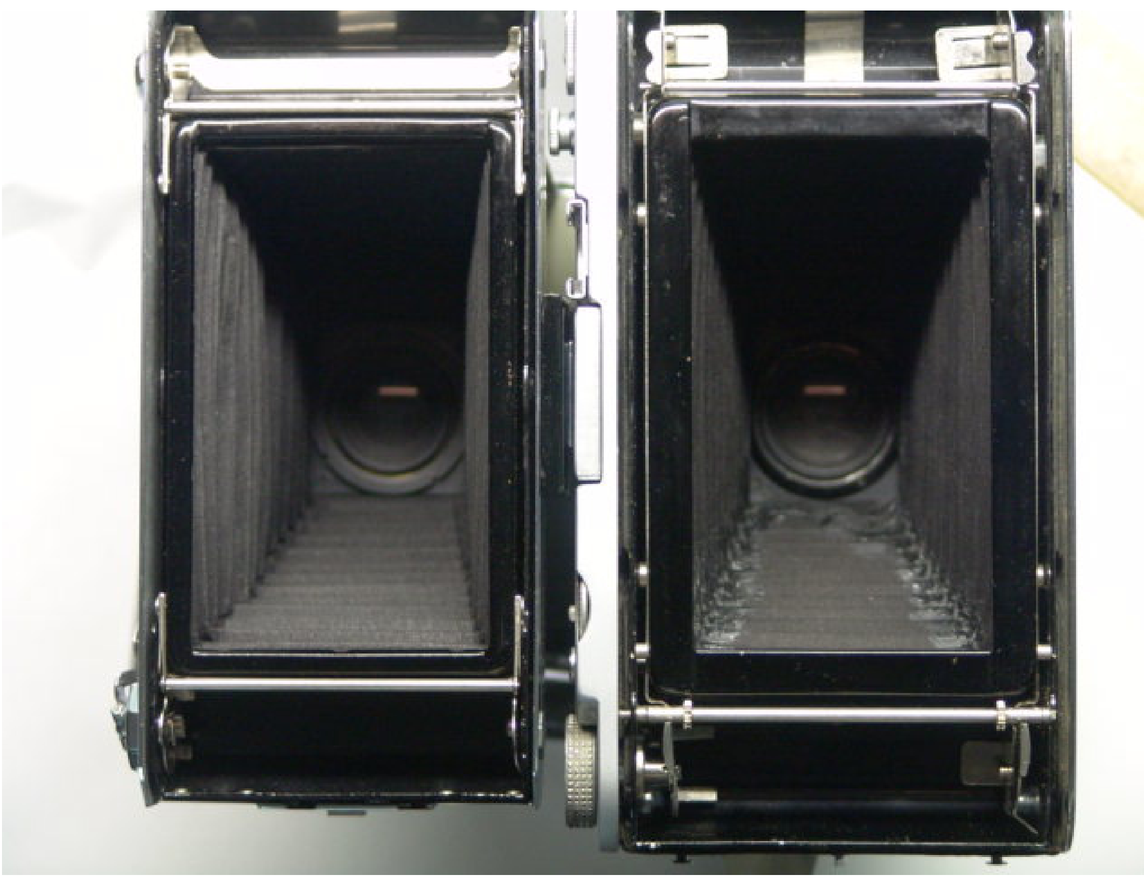


*(For the sake of discussion, it should be pointed out that the panoramic negative width would have been somewhat smaller if the writer had initially opted for a larger aspect ratio, rather than" achieving the largest possible exposure on 120 film." Had his initial leaning been toward that of a larger aspect ratio, Then he would most likely have used as references two, very fine panoramic 120/220 film cameras on the market today: the **Horseman 6x17** and the **Linhof 6x17**. Both units have an aspect ratio of 2.83. which, when applied to the panoramic negative length of 4.25", would have yielded a negative width of 1.5". Below is a comparison of negative sizes obtained with aspect ratios of 2.83 and 2.125.)*

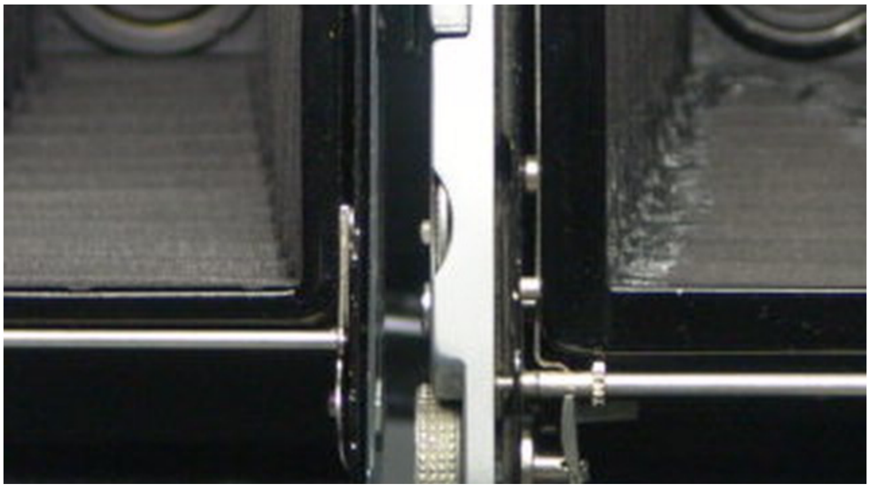


2) Preparing the Film Mask
   a) To accommodate the desired panoramic aspect ratio 2.125, a mask was fashioned from two plastic strips that were 6” in length by 0.233” in width. The strips were cut from 0.040” thick, black styrene plastic sheet - Item No. 9515 by Evergreen Scale Models, Inc.; purchased from Hobbylinc.com. This material is quite easily cut to size by scoring and cutting with either a no.11 fine point blade or a no. 16 scoring blade, both made by X-acto.

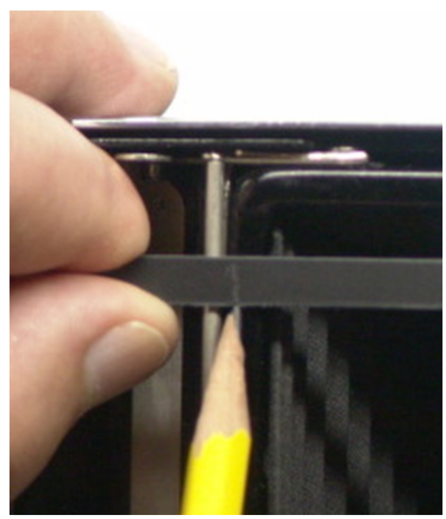
Although the 0.233” width was the exact dimension required to produce the desired aspect ratio, the 6” length is deliberately made longer than what is actually required, because the final dimension is dependent on the design of the specific Six-16 camera being converted. The reason for this dependency can be explained in the following photo in which the open backs of a Kodak Art Deco Special (on the left) and a 616 Kodak Monitor (on the right) are shown side by side



Although the film gates of both cameras are the same (i.e., those rectangular openings which define the outline of the exposed area on the film), the external dimensions of the metal boundary that surrounds the film gates are not the same. In the following close-up photo', it can readily be seen that, for the Monitor on the right, the long side of the film gate (aka, the "rail"), as well as the depressed shorter side of the film gate (aka, the "valley") are wider than their counterparts on the Art Deco Special shown on the left.

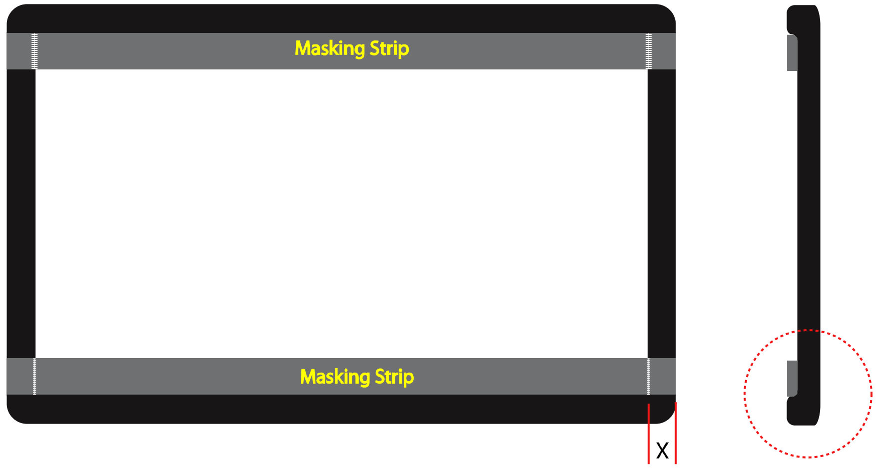


b) The actual, final length of a masking strip is obtained by simply placing the strip across length of the film gate, as shown below and marking the length to suit the camera.

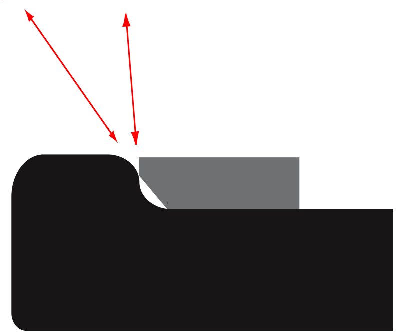


As a result of the physical differences between these two cameras, the final length of the masking strip for the Art Deco Special was 4.625", while the length of the Monitor's masking strip was 0.320" longer, at 4.950".

c) After the strips are marked and cut, their final lengths are checked by placing them across the film gate, flush against the length of the “rail”. The ends of the strip should not extend beyond the outer edges of the short side of the gate, as shown in the following graphic.



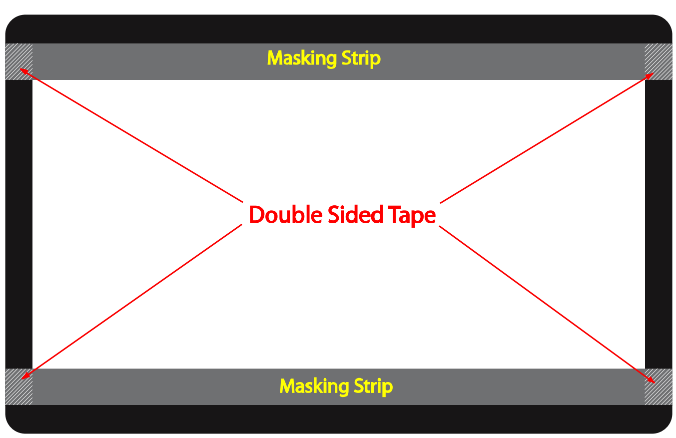
d) The two remaining steps in the preparation of the masking strips are trimming and finishing: “Trimming” involves providing a generous chamfer at both ends of each strip where they rest atop the short end (or valley) of the film mask. In the exploded graphic on the right, it can be seen that the chamfer is necessary in order to prevent contact between the corner of strip and the filet radius that connects inner surface of the “rail” and surface of the “valley”. The required length of the chamfer should be at least 1/16” longer that which is indicated by the dimension, “x”, i.e., the width of the short end of the film mask.



Finally, the “finishing” operation requires that any corner or edge of the masking strips that have the potential of contacting the surface of the film be carefully smoothed and free of any sharp edges in order to insure that the film emulsion is not scratched.

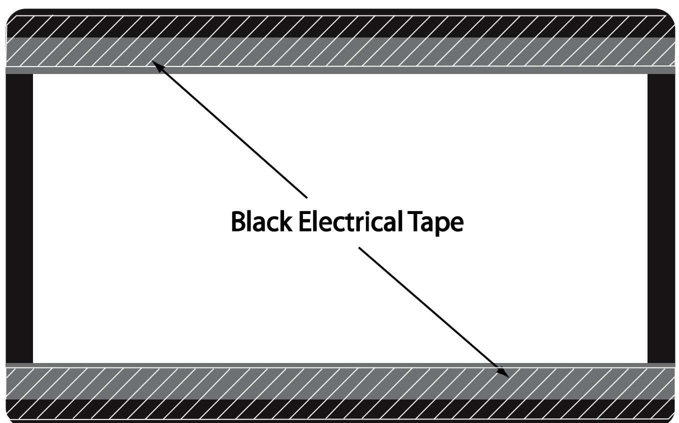
e) Film Mask Installation
Installation of the film masks is a simple procedure requiring only:
   i) Double sided tape
   ii) Black electrical tape

A short segment of double sided tape, applied to the ends of each masking strip, as shown below, is used to secure the strips to the film gate. Care must be taken to insure that, when the strips are installed, their chamfered ends are in their correct locations as shown in the preceding “exploded” graphic..



In the photo below, the masking strips are seen secured in place with the use of the double-sided tape.

f) Finally, black electrical tape is then placed along the length of both the masking strip and the “rail” of the film gate. The actual width of the tape that is to be applied is a function of the combined width of the masking strip and the width of the “rail” of the film gate. When applying the tape, care should be taken to insure that the masking strip is positioned tightly up against the inner surface of the “rail”

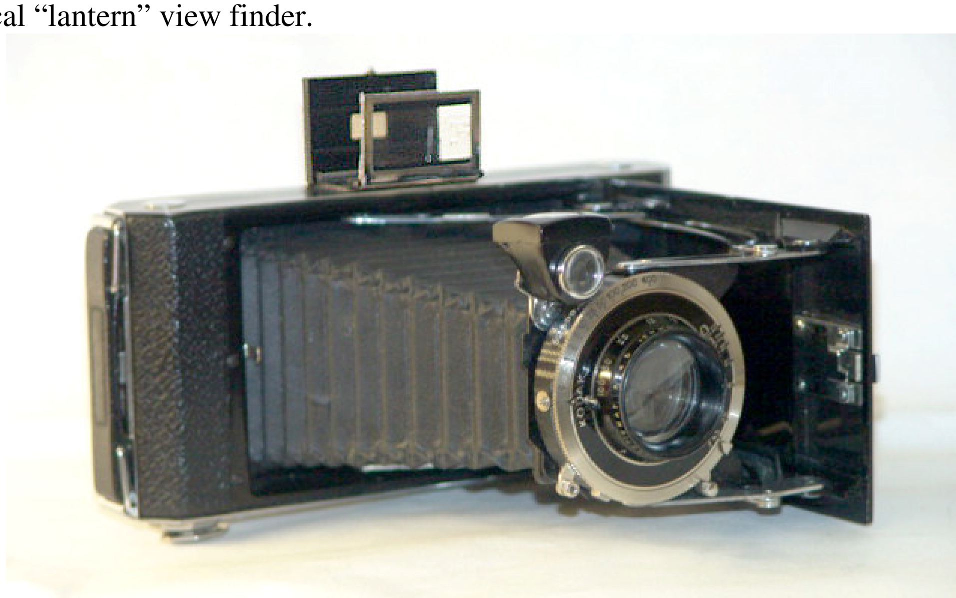


Shown below is the Kodak Art Deco Special which has been outfitted with film masks as described in this section.

This arrangement of masking strips applied to a camera's film gate will yield the desired panoramic aspect ratio of 2.125, and will result in the following landscape effect:

(For a more detailed explanation of the rational behind the design of the film mask, please refer to Appendix A, "Design of a Film Mask".)

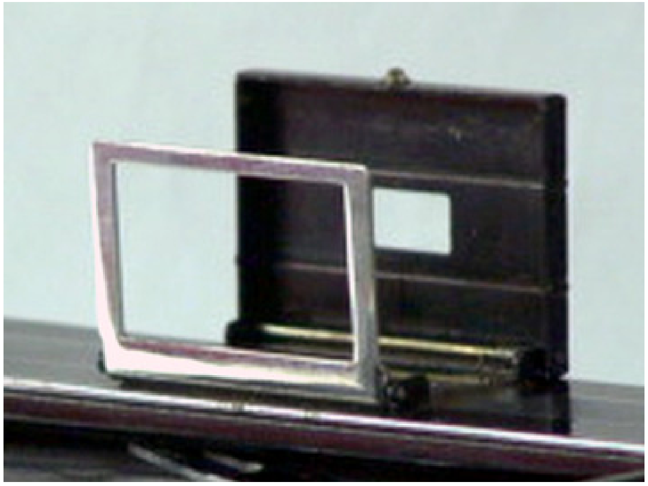
3) ***<u>The View-Finder Mask:</u>***
Like most of the 616 "folders" of its vintage, this Improved Art-Deco, has both a metal-frame view-finder and an optical "lantern" view finder.



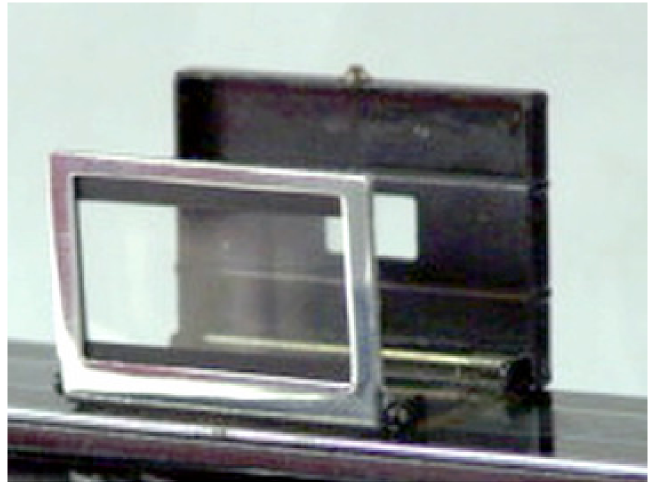
Admittedly, the necessity for masking both, or even just one of these view-finders is certainly a point that is open to discussion. However, for the purpose of presenting a total procedure in this conversion process, the following steps outline how these view-finders can be masked in order that they reflect an accurate view of the scene which is being recorded in a panoramic format.

a) Metal Frame View-finder

If the user feels the need to mask this item, the following relatively simple procedure can be used to provide that component with an appropriately sized mask as seen in the "before and after" views below.



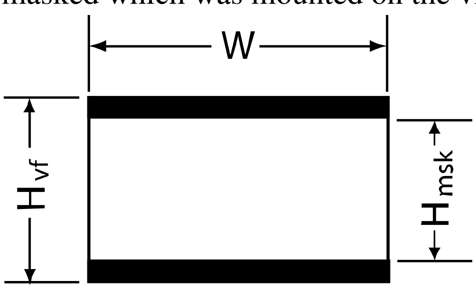
View 1, Unmasked View-finder



View 2, Masked View-finder

i) The first step requires measuring the width of the inner opening in the forward element of the two piece, view-finder, i.e., the right to left dimension of that opening. Since the panoramic format yields the same negative length as of a 616 negative length, this dimension is actually the width of the mask for this viewfinder.

ii) Divide the measured width-opening by 2.125, i.e., the aspect ratio of the panoramic mask discussed on page 12). The result is the required height of the view finder. Below is a scaled graphic of the masked which was mounted on the view finder as shown in the preceding View 2.



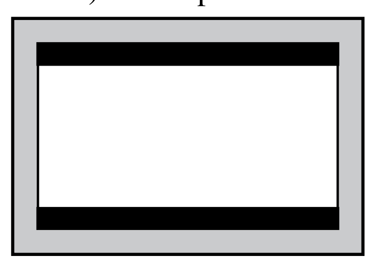
W = Width of View Finder-Opening & Width of Panoramic Mask

H_{vf} = Height of View-finder Opening

H_{msk} = Height of Panoramic Mask = W/2.125

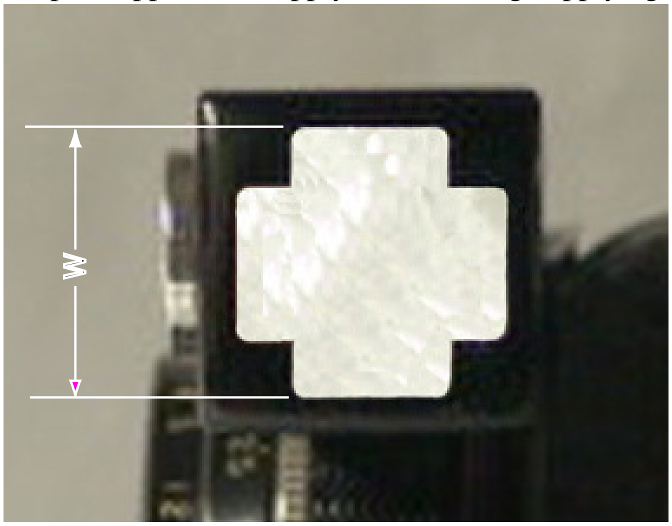
iii) As for mounting this mask, there are several options available. Two of which are as follows:

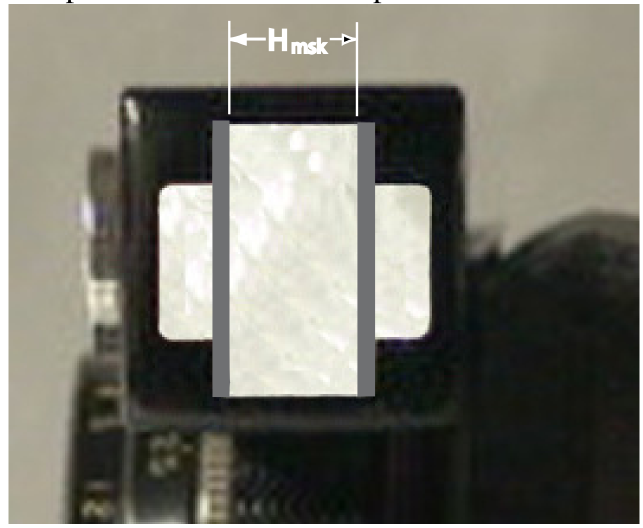
(1) The option which this writer chose for this project (shown in View 2 above) was to print the above mask on transparency film with a laser jet printer. Using vector-based drawing software (in my case, Adobe Illustrator), I was able to create a precise layout of the mask to the dimensions determined in steps 7)a)i) & ii). When drawing the mask, I added a border around the mask that was equivalent to the width of the forward element of the view finder. With the use of double-sided tape, placed on the border, the mask was easily mounted onto the view finder's frame.



(2) A second, and certainly less elaborate option, would be to simply mount two strips of black construction paper onto the top and to the bottom surface of the view-finder frame, while carefully maintaining a distance between the two pieces is equal to the height of the mask, previously determined in step 7) a) i) ii).

b) Optical - Lantern View-finder
If one chooses to mask this element, Step 7)a)i) & ii) apply in determining the height of the mask. However, because of the relatively small size of the finder's viewing area, one should consider the simplest approach to apply the mask, e.g., applying two strips of a a dark colored tape





4) ***Advancing the film***

*(**Note:** When a 616 camera is loaded with 120 film, the camera's little red observation window will actually display the 120 film's number-sequence which is intended for 16 exposures, i.e., the 4½ cm x 6 cm format.)*

a) Load the 120 film into to camera as shown in the two photo's on the lower half of page 3
b) Close the camera back and advance the film to reveal the No. 3 in the red observation window.
   You are now ready for the ***first*** exposure.
c) Advance the film to a point midway between 5 & 6, i.e., the 5½ position, for the ***second*** exposure.
d) Advance the film to the 8 position for the ***third*** exposure
e) Advance the film to the 10½ position for the ***fourth*** exposure.
f) Advance the film to the 13 position for the ***fifth*** exposure.
g) Advance the film to the 15½ position for the ***sixth*** and final exposure.

Film-Advance Chart

Exp. No.	Film Number
1	**3**
2	**5½**
3	**8**
4	**10½**
5	**13**
6	**15½**

*(**Note:***
In step 4b, when advancing the film to reveal the No. 3, be sure to count the number of indicators that occur between no.'s 1 and 2. As an added precaution, recheck the count as you advance the film from No,'s 2 to 3. Knowing the number of indicators that are present between the exposure numbers will enable you to identify the half-way position required in steps 8c, 8 e and 8g.)

. PETER A. LERRO, Sr., August 10, 2008

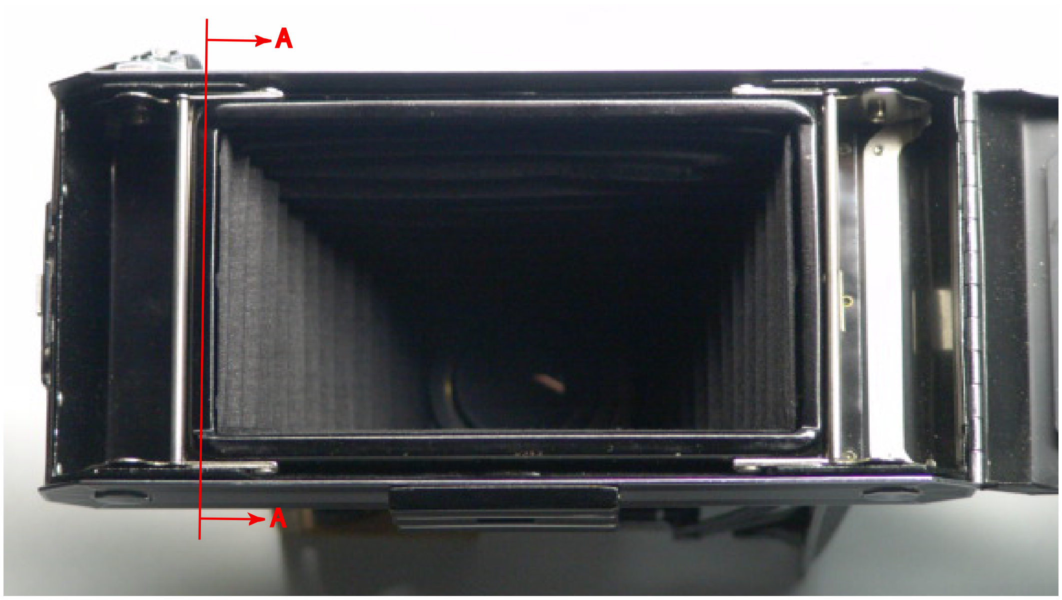
(revisied October 1, 2008)

Appendix

A. Design of a Film Mask

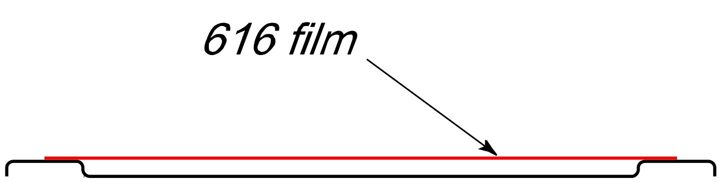
In designing the film mask for this “panoramic” conversion project, the object was to modify the film gate of the Six-16 camera so that the exposed area of the 120 film would equal that of the “panoramic neg. size” (shown in Step 6-a, i.e., 4.25” x 2.0”), while simultaneously assuring that the position of the 120 film relative to the camera’s body was identical (or as close as possible) to that of the original 616 film (to the camera’s body.)

To examine the original position of the 616 film relative to the camera body it is necessary to view the film and camera body at the position identified below as “Section A-A”.



Launch Internet Explorer Browser.lnk

“Section A-A” is a cross section through that part of the camera body that forms a short side of the film gate. Shown below, to scale, is a view of the relative position of the original 616 film to that “short side” of the film gate

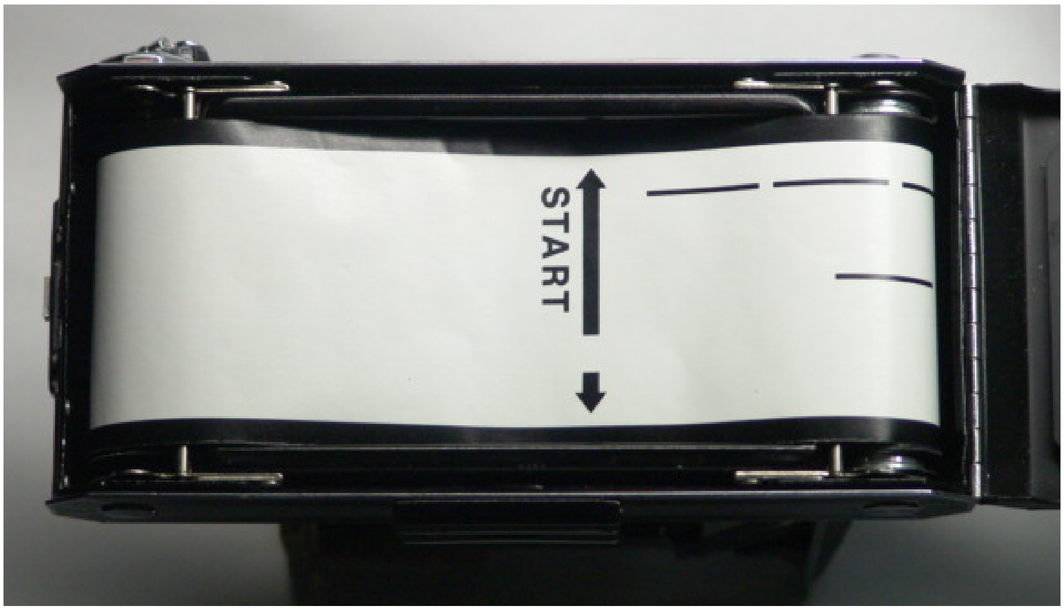


Section A-A

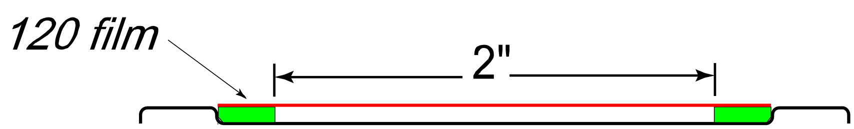
It is plainly apparent that while the film rests directly on the long sides (or “rails”) of the film gate, it does not make direct contact with the “valley” of the film gate, i.e., the “short side” of the film gate. A survey of the American made, Kodak Six-16 and Six-20 “folders” in my collection showed that “valley” of the film gate to be

0.30” to 0.40” lower than the “rails”. For the specific camera body shown in this article, i.e., the Kodak, 616 Improved Art Deco, that depth was 0.40”.

The following, rather exaggerated, view shows 120 film in the Six-16 camera body without benefit of a film mask. Here, it can be seen that the “rails” of the film gate for this Six-16 camera offer no support to the 120 film. A measurement of the film gate’s opening , i.e., its width, and that of the 120 film-backing’s width, were, for all intents and purposes, the same.

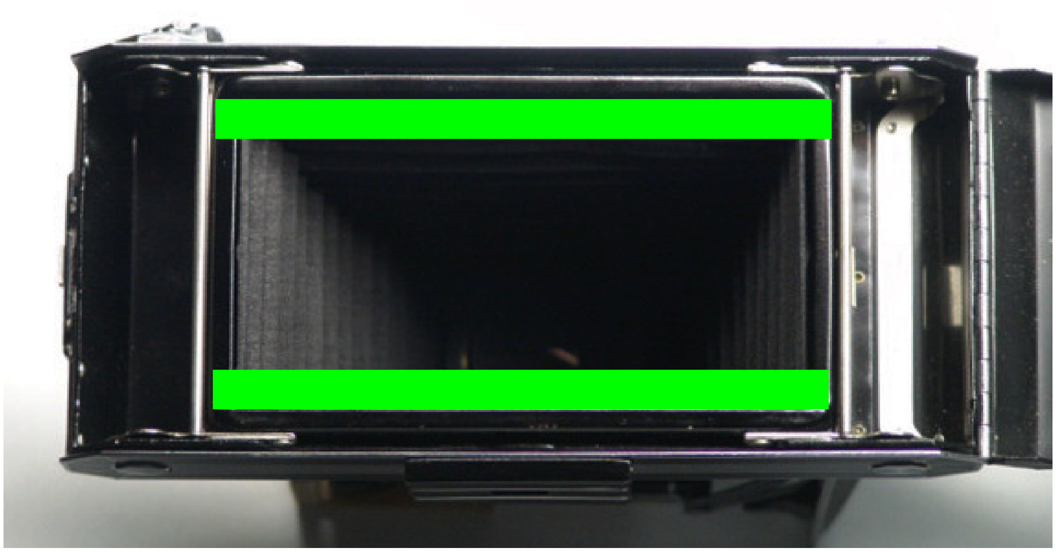


The following scaled view again shows “Section A-A”, but instead of the original 616 film, 120 film is now shown, together with the masking strips whose width was sized to yield a 2” negative width.

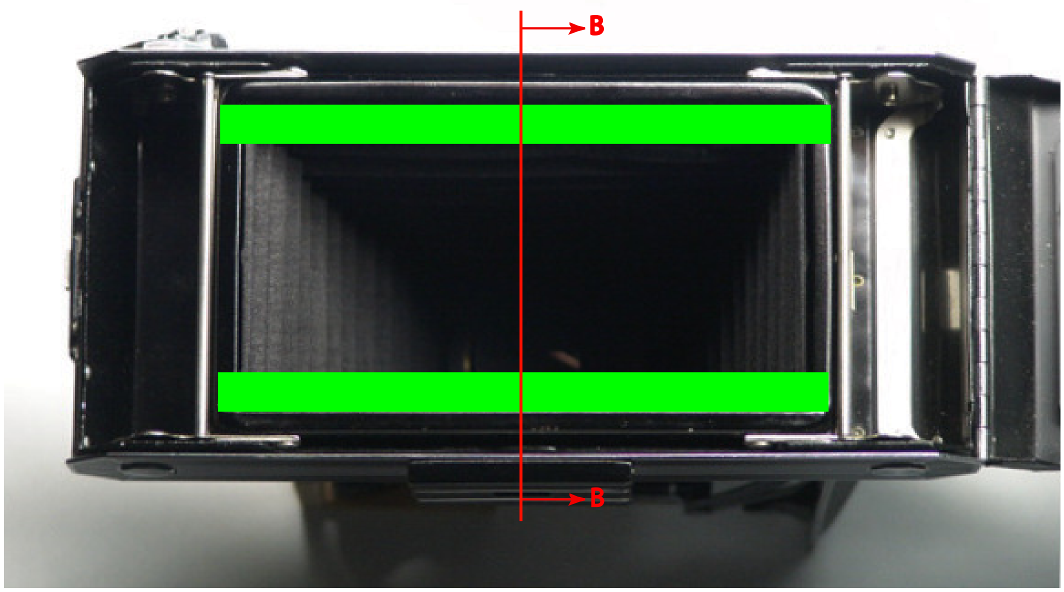


Section A-A

With the use of ***only two masking strips***, made from 0.40” styrene plastic stock, sized and placed to produce the 2 inch “panoramic height” (as discussed on page 12), the 120 film is now positioned, relative to the “rails” and “valleys” of the camera body, in a manner similar to that of the original 616 film.



One final aspect of the masking strips involves the need to reduce the intrinsic flexibility of such a long, relatively slender strip of plastic. To better understand how this can be achieved, consider “Section B-B” in the following view



“Section B-B”, shown below, is taken through both the middle of the rails that form the original film gate, and through the plastic masking strips. Also shown in this view is the black tape (preferably, the rubberized, electrical variety.). This tape is applied along the entire length of the masking strip. By applying the tape in the sequence described in Step 2 f on page 16 of the conversion procedure, the masking strips will be tightly positioned against the inner edge of the rails of the original film gate. This

Section B-B