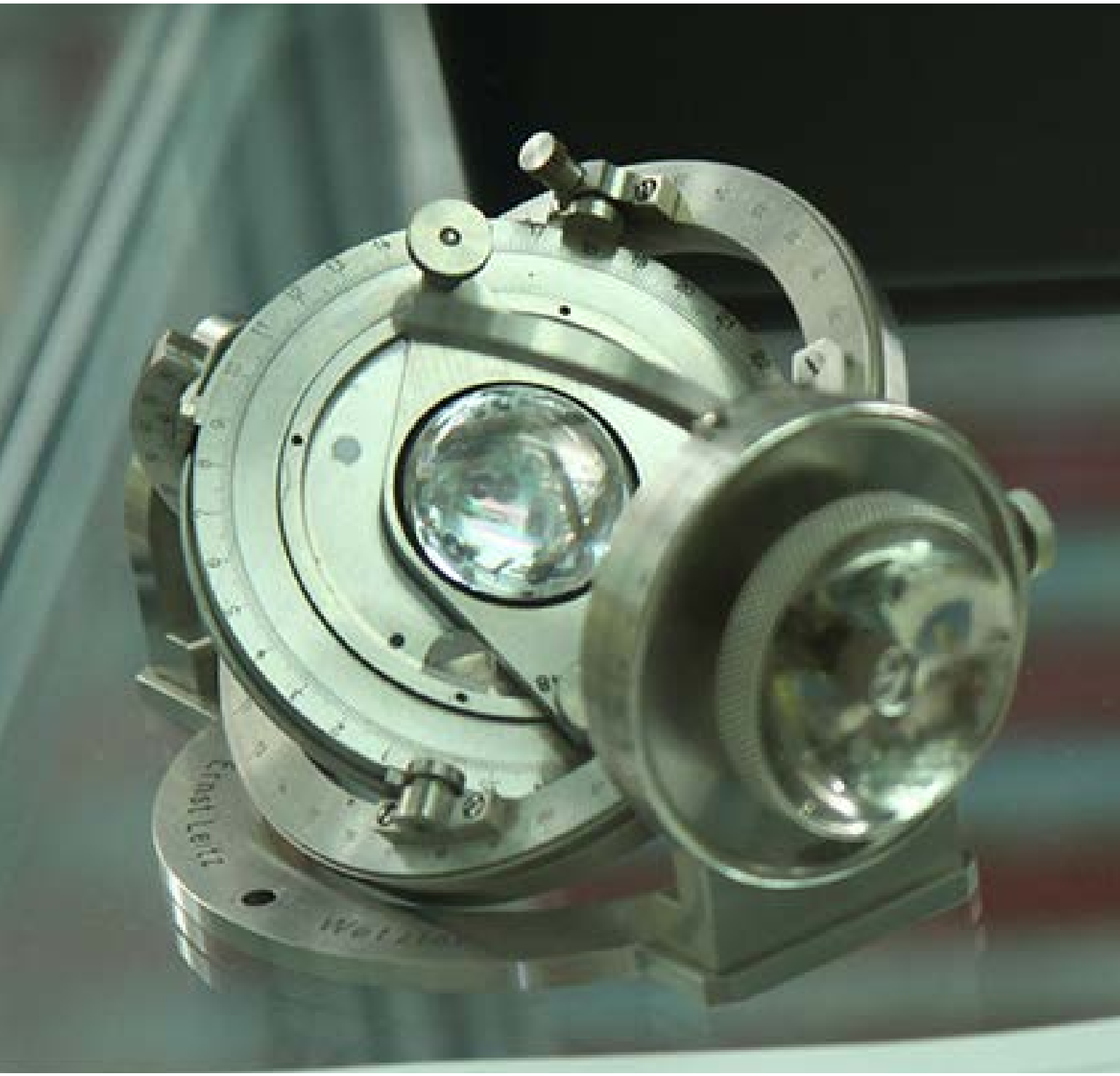
Optomechanix

July-Sep 2020



Technical journal of OMiD, Opto-Mechanical Institute of Design

From front to back: American Optical's Spencer Abbe Refractometer, Hand Held Refractometer, Spencer Spectroscope

Contents

This issue Dedicated to:

University Students in Iran One of my most rewarding experiences was interacting with university students in Iran. They have been abandoned by their greatest minds who are living abroad, and are left behind to learn through their own effort. They read rich classical Persian poetry to get a positive perspective towards their culture, and religion, while getting familiar with western ideas through watching movies, and reading translated self improvement books. They read books by Eckhart Tolle, Wayne Dyer, and other books about becoming more successful. They speak fluent English, and most of them follow their parent's advice to get the best education they could so they would eventually leave to make a good living abroad. Iran is a sanctioned country, so if they make it to America, they are put on a 5-year probation so they can't visit home. If they do go back after 5 years, their visas are most likely revoked, and they can't get in. To put it in perspective, it's something like touring a bird around the garden, then dropping her inside a glass jar, and putting the lid on it.

I was visiting Sharif University one day, and they had a guest speaker telling young girls to work as hard as they could to pursue their dreams. On the Q&A session, I said: "While you ask the youth to work hard so they could achieve, our elite sends their kids to study abroad to enjoy their comfort in Europe, and accomplish almost nothing compared to most of these kids. They'd eventually come back to become their bosses."

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Optomechanix is a quarterly journal of Opto-Mechanical Institute of Design (OMiD), with technical articles for practical, hands-on opto-mechanical engineers. This magazine is privately founded.

Cover page photo: Earnst Leitz Universal stage for minerological microscope
From front to back: Spencer Abbe Refractometer, Hand Held Refractometer, Spencer Spectroscope

Establishing the Opto-Mechanics museum

Ever since I visited California Museum of Photography at Riverside, California, in early 1990's, I hoped some day to establish my own museum of Opto-mechanics. When I signed the M&A agreement with Edmund Optics, they also had me sign a none-compete agreement for 5 years. I decided to go back home for two reasons: One was someone had to take care of my elderly mom, and second, I could start my dream museum. So with all my personal, and a few donor's camera donations, we established OMiD museum. Museums are so hard to maintain these days, but OMiD survived for about five years with the dedication of many students, and we were eventually forced to shut down. But that wasn't the end. It will soon continue through omidmuseum.com for everyone to visit, and OMiD will continue through its publications.

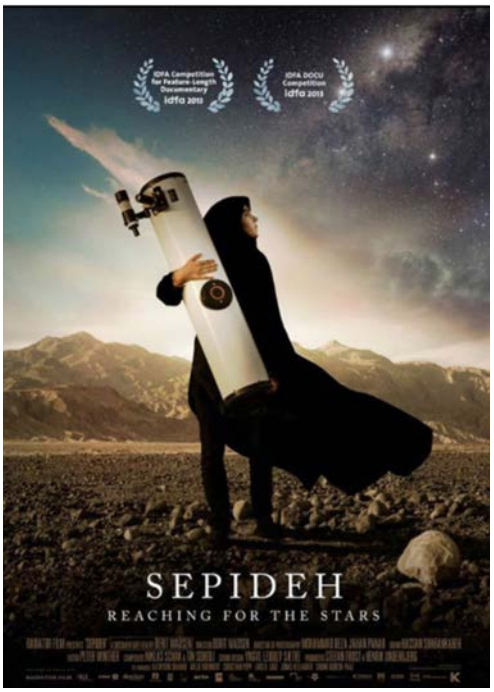
You don't need a million dollars to take care of your parent. They did it with love, we could learn to give it back the same way.

Ali Afshari using the word "Empowermenrt" in an interview at (OMiD) museum. Leica exhibition at Tehran Museum of Photography drew hundreds. I was invited to exhibit at other museums such as the Museum of Cinema for a few months, and a year at the Watch Museum. At Watch Museum, we often had over 100 school childfren visitors a day.

As for my goal to establish a museum for the youth in Iran, it was to fulfil my aspirations to give the current generation the opportunities I had enjoyed here in America. I came to United States during the Shah, like so many other students that were sent abroad to learn skills, and then return home. All that changed after the Iranian revolution in 1979. Iran lost many of its scientific, and intellectual minds who now live all over the world. During my high school years, my strong interest in optics grabbed the attention of my science teacher, Morteza Hashemi. He allowed me to freely come, and go to his lab, even taking home what I was interested to study like microscopes, and other optical instruments. I felt somehow indebted to provide the same opportunities to the youth. It was one trip I had to make to move on with the rest of my life.

Since I was pretty open about wanting to go back to Iran, there were also political challenges that I faced. I remember one day two folks from FBI, and Homeland Security showed up in my office! They asked me in a friendly way, what my intensions were, and while listening to them, I found they were just doing their job, and couldn't understand the feelings of an immigrant in his early 50's. How it really feels like is lavishly illustrated, and explained in the book: "Laufcadio", by Shell Silverstein. In the western world, we talk so much about civil liberties in democratic societies but there are people like Noam Chomsky who say the corporate world tries to undermine our pursuit of happiness. If you live in Middle East, you could see it in broad daylight, how a select few gets all the major contracts, but you could be living here for 20-30 years, and not feel it. We rely on free press, and watch-dog groups to protect us against corporate misuse of power.

They recently did a survey asking ordinary Americans if they could come up with $400 in case of an emergency, and 40% said they couldn't afford it. That tells you how much the corporate world has cared for us to have financial freedom. I have never given my full trust to any system to tell me what's right, and what's wrong for me. Mark Twain says: "Whenever you find yourself on the side of the majority, it is time to pause and reflect". I gained so much trust and hope during this pandemic seeing how ordinary Americans are reaching out for each other in such empowering way, very much on their own. Well, I decided to trust my inner calling, and went back. The price I paid was I lost many of my customers, and I also lost some of my friends. Now when I look back, I realize I gained back my soul. Some of my friends who went on with their lives, thinking more money would bring them more happiness, ended up going to a psychologist, and said: "I am crazy!" Well, may be not that bad, but I like this Bernard Shaw's saying: "My specialty is being right when other people are wrong!"



Sepideh, by director Berit Madsen

Back in 2014 Sundance Film Festival, I was so moved by a documentary film called: "Sepideh, Reaching for the Stars". This movie depicts a young Iranian village girl who dreams of becoming an astronomer, but her family can't afford paying for her education. Anousheh Ansari reaches her by phone from America, and tells her she'll be paying for her school. When I returned to Iran, I found a goldmine of such students with so much devotion for learning science. Well, I think I gave my reasons why, now let's talk about the museum:

Before I began establishing OMiD museum, I remembered how California Museum of Photography (CMP) allowed me to take apart, and study their Leica 0. That was an extremely rare camera, which was recently sold off at an auction for 2.6 Million Euros. By giving me that opportunity, I was able to write my book on Leica history, and it's one of the works that could rarely be replicated again. Museums should be a birth place of research, and not a collection of objects that no one is allowed touch. Even moon rocks are available for those who give proposals to do research on them. When people who run a museum are too afraid to touch anything, they become alienated from their own collection. While I was an invited guest for a year at a watch museum, I asked them if I could carefully flip open the backs of some of their antique watches to photograph their mechanisms to see what caliber they were. They said: "We don't allow anyone to touch our watches". I said then you must have had someone in house in the past who catalogued them to see what they are. They said no, we have never done it in such detail. I said wow, then you are taking great care of things you have no idea what they are!

As for the type of museum I was going to have, my brother Hossein, always said architecture is the mother of all arts, and he actually designed my museum layout while laying on his hospital bed before he passed away by Leukemia. I later thought product design is nothing less. Yes, you could enter a building, and feel a certain way, but while you hold and use a product in your hand, it's not less significant. So a museum on product design was developed in my mind.

While establishing the opto-mechanical museum, I tried from early start to have more openness than other museums, allowing everyone to participate, and I received so much help from the youth. So OMiD museum was finally established, with its name meaning "Hope" in Persian. The museum was an instant success, having the right timing, and the right place for that matter. Inside the glass displays, we spent days trying to prepare its various show cases:

Photographic cameras: Hasselblad, Leica, Canon, Nikon, and other professional cameras like Bronica, and Sinar.
Cinematography: Arriflex cameras, RED, Beaulieu, Bauer, Zeiss, and Angenieux
Watches, and watchmaking: Levin, and Burgeon watchmaking tools, and various watch movements.
Astronomy, and Space: Mock up of Space Shuttle, and Saturn-V, and a digital planetarium with 4 meter dome.
Measurement Tools: Calipers, micrometers, Gauge Blocks mostly made by Mitutoyo
Microscopes: Olympus, Zeiss, and Leica microscopes both biological, metallurgical, and Vintage microscopes.
Optical Instruments: Interferometer, Spherometer, Spectroscope, Telescopes, binoculars, etc.
Holography: Displaying my own Holograms I had taken with a Yag laser on Dichromate Gelatin, etc.
Audio Visual Library: DVD collection of Astronomy videos, and educational films, and optics related books
Patent Library: A library of 10,000 patents categorized in optical fields such as Cameras, binoculars, eye glasses, etc.
Photography, and video studio: To produce educational films, and to photograph products for our publication.
Optical Kits: Optoform, Microbench, Thorlabs Cage System, Nanobench, Erector Set, and many others.

We had sun observations 2-3 times a week, with our 90 mm aperture H-Alpha telescope, and moon and planet observations during some of the nights with an 11" Celestron. Digital planetarium featured a 4-meter dome with a capacity of up to 18 people, to enjoy looking at the heavens, and watching 360 degree videos. The planetarium had a 4 feet wall height to secure the dome. It matched the visual height of visitors sitting on their seats. It took three months to build, including a full HD fisheye projector that worked with Stellarium software. My friend Kieth Miller who works at the Natural History Science Museum in Fremont, helped me tremendously, specially in constructing the dome.

I have had many roles in life from being a film director or flying planes, to working on spacecraft projects, or an inventor, and being an entrepreneur, but being the curator of a museum was my most rewarding role I took part in my life. It really helps when you are passionate about a subject while you are sharing it with others. One of the outcomes of my time there was the Opto-mechanix magazine which I hope many of you enjoy today. If you are stuck at a job, break loose, and try something else. May be you'll stumble across something you'd really enjoy.

Ali Afshari
Editor in Chief,
Optomechanix

Teens doing their projects at OMiD museum. Navid Asadi (sitting) was a brilliant Sharif University Graduate, and always came with a group. In here, they are soldering the wirings for a robotic arm for an international robotic competition. The arm was controlled by a mobile phone. Navid has now the key to the small machine shop I left behind. I feel I have given back what my teacher Mr. Hashemi gave me during my high school years to have full access to his entire physics lab.

The Diverse World of Opto-Mechanics

Opto-mechanics is a diverse field. In my view it even includes watchmaking. The reason is, initially, time keeping was aided through a telescope, by looking at position of stars, and astronomy is timed with clocks. This is especially visible when you visit Palomar observatory: It is basically a huge clock with the telescope as its hands, making a full rotation every 24 hours.

The camera obscura also includes a retard mechanism in its shutter, which is also a modified version of clockworks. Camera obscura also brings in woodworks into opto-mechanics, and also many of its shutters are made of tailored cloth. So this is a field that has wood in it, glass, cloth, anodized Aluminum, shiny steel, colorful plastics, and even liquids. Laser shows are the

Pocket watch history, and development history of balance wheel

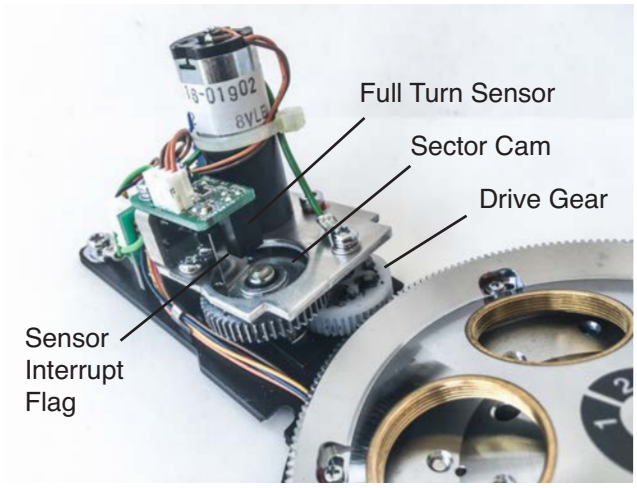
French designed, and manufactured Beaulieu 4008 ZM4 was a professional Super 8 mm camera, and a dream come true for the amateur film makers of 1970's era. The camera utilized a 45 degreee mirror that also acted as the shutter.

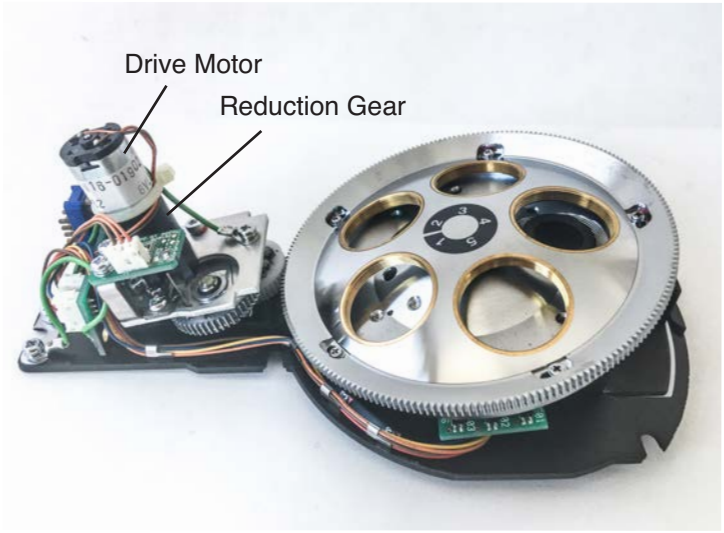
most overwhelming display that is stolen by architecture!

So let's not say architecture is mother of all arts. That had been said before opto-mechanics came about. Without its telescope, mount Plomar, and Keck would be as ordinary as a volleyball court. If you ever visit Palomar, you'll see how watchmaking, and opto-mechanix are really the same art. It is the type of clock work at a scale that you could walk into rather than wearing it in your wrist.

When studying mechanics, students are taught the Geneva gear without illustrating where it is used. That's like wanting to love Calculus without knowing how Hubble estimated the age of universe by taking the slope of velocity vs distance plot of galaxies. Well, the motorized turret (below) is a perfect example where the Geneva gear is used. When each objective is advanced to the next, it is a Geneva gear that rapidly rotates the turret with all its heavy objectives, and suddenly interrupts the rotation by locking it on its next position.

The objective, and eyepiece set for Spencer microscope in wooden box. Each objective has its own centering mechanism for precise alignment with the optical axis of microscope.





Olympus motorized nosepiece (above) uses a Geneva gear mechanism to advance the objectives via a minature motor.

A zeiss slit lamp microscope (left), and Olympus tiltable trinocular head for their BH series modular microscopes.

A polarization microscope built by American Optical in 1960'S for geological rocks research. AO produced these optical instruments under the name brand: "Spencer". This particular microscope features Glan Thompson Calcite prisms for maximum contrast. The color saturation seen through rock sections are indescribable.

1930's Reichert Brass Microscope I purchased from Russia. The entire assembly was disassembled, and re polished cleaned, and re assembled. Once going through this procedure, you get an appreciation of these optical works. The level of detail that has been put into these instruments is just amazing.

Minox Collection

Designed by Walter Zap, and manufactured in Wetzlar, Germany. This is a camera with miniature clock works inside to govern the shutter speed, and focus. The thin film in Minox is pressed flat by an active pressure plate before each exposure.

The two-blade shutter design is unique to this camera, and it's complex enough to be jammed by an untrained camera technician. We have most of the essential accessories made for Minox. The opto-mechanix in Minox is beautifully designed, and hand crafted to perfection. Minox was a private donation to the museum.

Minox slide projector for mounted transparencies

Minox enlarger produces 8x10 prints from tiny negatives

Detail of enlarger

Innovative Viewfinder Designs

After the invention of roof-pentaprism for the SLR (right), manufacturers saw the high cost of producing them, and also wished they could get rid of the bulky prism sticking out from top of the camera. Another issue was mirror vibration, with the mirror going up, and down inside the SLR camera. The mirror going up also didn't allow deeply seated lenses close to the film. So there were many innovations in viewfinder, and mirror housing design to eliminate these problems.

The viewfinder in 16 mm, and 35 mm cameras gets more creative but in full frame SLRs, they mostly utilized the same standard design (right). There were also creative ideas in both viewfinder optics, and mirror mechanisms like flipping it down, or sideways. Visit omidmuseum.com for more after it gets launched!

Contax S, the first SLR with a Pentaprism VIewfinder

In Olympus Pen-F the mirror swings to the side

In Wrayflex, both the focusing screen, and the reflex mirror swing up inside the viewfinder

In Focaflex, the mirror (a beamsplitter) swings down. The result is a flat top camera, and vibration reduction by mirror going down instead of up.

In Bronica S, the mirror lays flat on the bottom of the camera, allowing deeply seated lenses to be installed.

Hasselblad Collection

Ever since the moon landing mission, Hasselblad has been the favorite camera at museums, specially the Hasselblad Lunar camera (right). I made sure we had all the Hasselblads I could get my hands on for OMiD museum, and hoped to eventually write a book on its design, and development.

This camera had a great story behind it from its early start. Leica fans have cherished the history of Oscar Barnack camera whereas Hasselblad fans have not. I think it's because Hasselblads were mostly used in the hands of professionals, who had less interest in collecting them than it was the case for Leicas.

Lunar Camera

500 C/M

SWC/M

Curious girls Tiam, Noushin, and Zahra, looking at a Radio Shack electronics kit. My wife, and I cruised with them at night while they stood through the sunroof of our car listening to loud music. Those moments were the best time we had in my entire stay in Iran. Being so pure, and innocent, children bring the best out of you. Hasselblads were more for grownup-children.

Eyelevel Finder

45 Deg. Inclined Finder

Meterl Finder

Eyelevel Finder

Magnifying Hood

Sports Finder

Hasselblad offered a wide range of viewfinders for its SLR cameras. They corrected for image orientation correction by prisms (above), or utilized a microscope design which focused through a long barrel to the focusing screen at a short distance (right, and top left).

Its minimalist design offered both focusing screen interchangeability, and viewfinder lock down without any button. After the in section of the viewfinder (right), the film magazine was installed to secure the viewfinder in place.

Various backs were offered such as polaroid, sheet film, and square or rectangular film formas.

Space Shuttle Camera

Hasselblad offered a huge line of lenses from 30 mm (left) to 500 mm telephoto (above). We had every Hasselblad lens on display except a very rare 105 mm UV lens.

A Disassembled Hasselblad 500EL/M on display

Rear of 250, f/5.6 shows shutter Charging/Release cams

Leica M3

Leica Collection

Leica is probably the most famous camera around the world. Back in 1990's when I first began on my Leica book, I drove about 2 hours to visit California Museum of Photography to borrow their cameras. When starting OMiD museum, I thought I had to have a collection of my own to finish the book. So I made sure we had every camera model, and lens in house for compilation of the book.

Digital Leica M8, and M9 are a crossover from classical to modern digital age. Leica has preserved its legacy by keeping the same body design as their original Leica M3 introduced in 1954 (left).

Leica IIIC (1938) with spring wound drive

Leica SL2 Mot (1974) with Motor Drive

Replica ofUr Leica (1912)

Replica of Leica 0 (1922)

Leica 1 (1924)

Leica IIIG (1957)

Leica M7 with body Shell Removed

Leica M5 (1971)

Leica M7 (2000)

Leica M9 (2009)

Leica SL (1964)

Leica M3 Mot (1976) with Motor Drive

Leica S2 (2008)

50 mm f/1 Noctilux

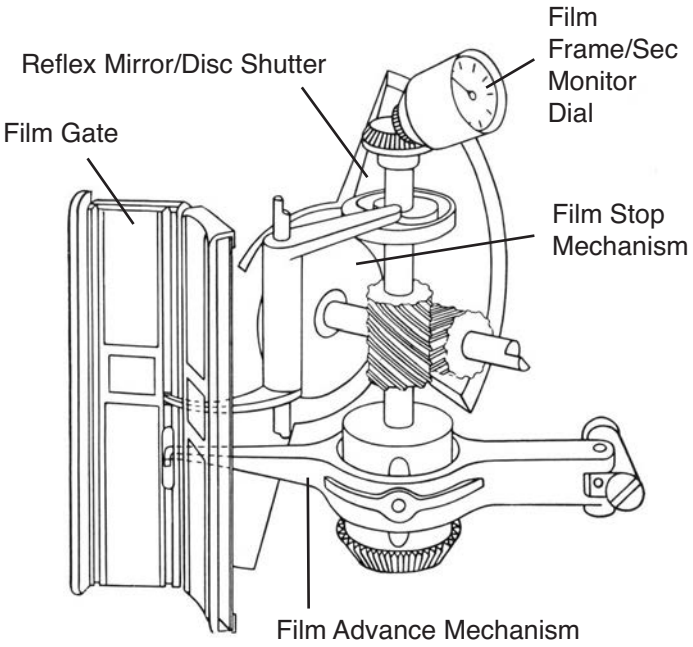
35 mm f/3.5 for Original M3 (1954)

Cut Out of Tri-Elmar 28/35/50, f/4

Arriflex 16S

I saw this camera for the first time when I was in High school. My brother played professional volleyball, and I was sitting back in the gym, watching one of his games. Suddenly a camera crew from Iranian national television showed up, and I remember vividly how they used this camera to film some clips from the game. I learned about news crew, and how they shot the film, and took it to the lab to be processed, so it could be shown on television that very night. When I bought this camera in some 40 years later, I test shot the camera with 16 mm film, and had so much fun developing the film in my own darkroom.

The mechanism in Arriflex cameras are amazing German engineering. The 45 degree oriented mirror acts as both reflex mirror, and its shutter. For every frame of film, the film is advanced while the shutter is closed, and stopped during each exposure (Right).



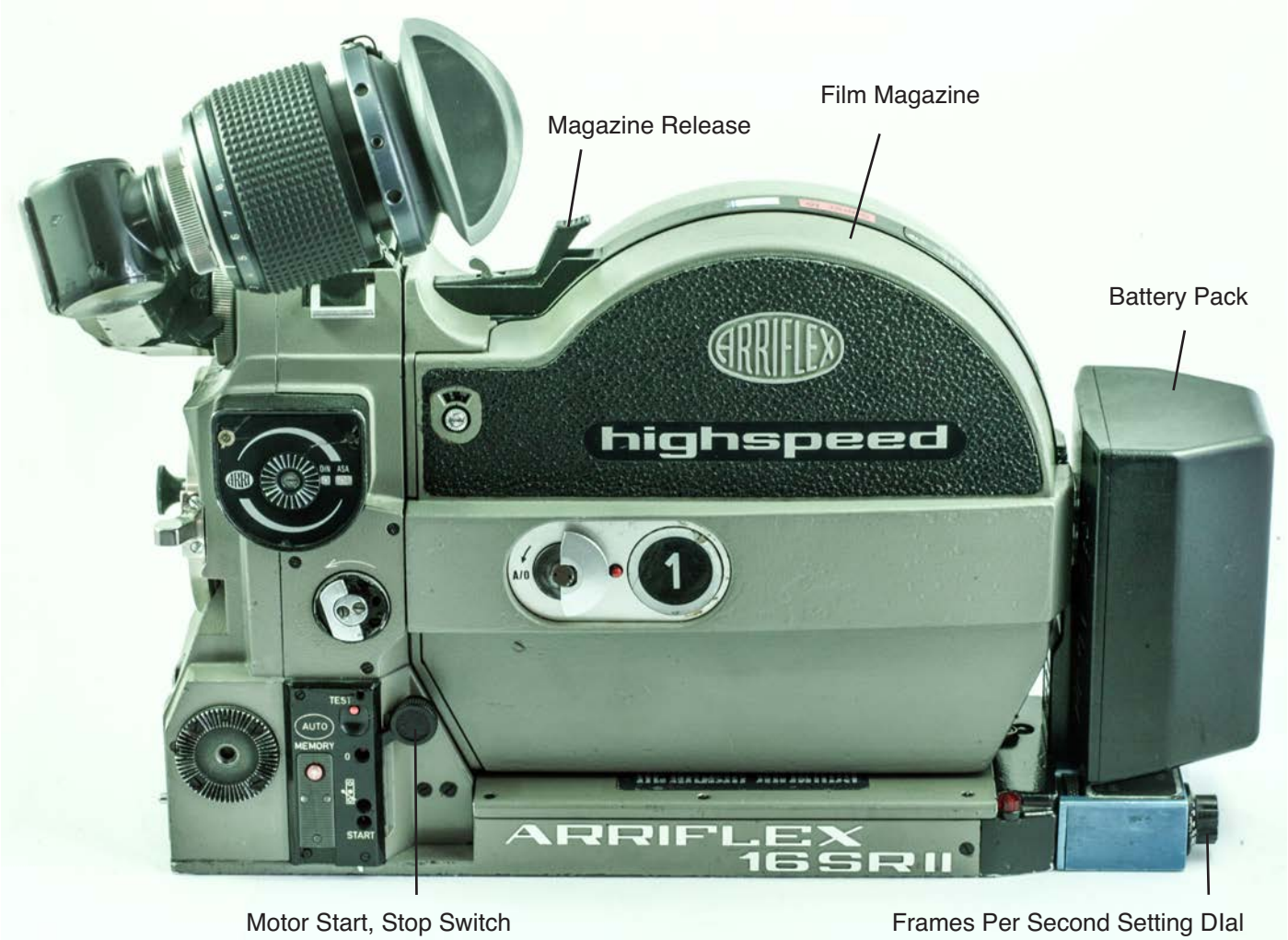
Arri 16S, also known as ST introduced in 1952 was the most successful 16 mm camera ever made.

Arriflex SRII, High speed

Arriflex cameras are a masterpiece of opto-mechanical engineering. The film transport in this camera is so well balanced and silent that gives the name to camera (SR stands for “Silent Reflex”). Good old mechanics is being missed in cinematography. One of the most memorable sounds in film making was the “Brrrr” sound of film transport next to cameraman’s ears.

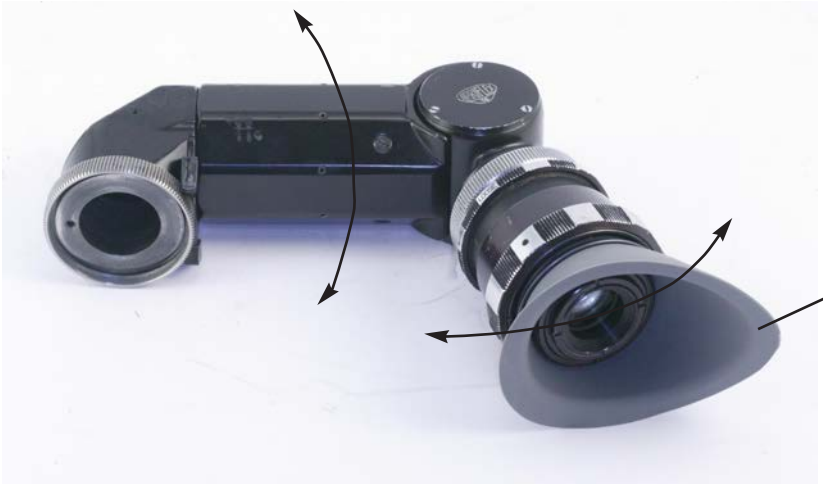
In some museums I visited, they thought the sound proof housing (Blimp) around these cameras were underwater housings! To record sound in close-up shots, a sound proof housing had to be devised to reduce the noise from the camera, specially in 35 mm format. The modular design of Arri SR is versatile: Battery pack is magnetically locked in place behind the 400 feet film magazine, while the film magazine snaps into place with extreme alignment between the film pressure plate, and the film. The film alignment between the exposures is guaranteed to be less than 1/400 of the Super 16 frame height.

Arriflex SRII High speed camera could shoot up to 150 fps, and up to 200 fps with third party modification.



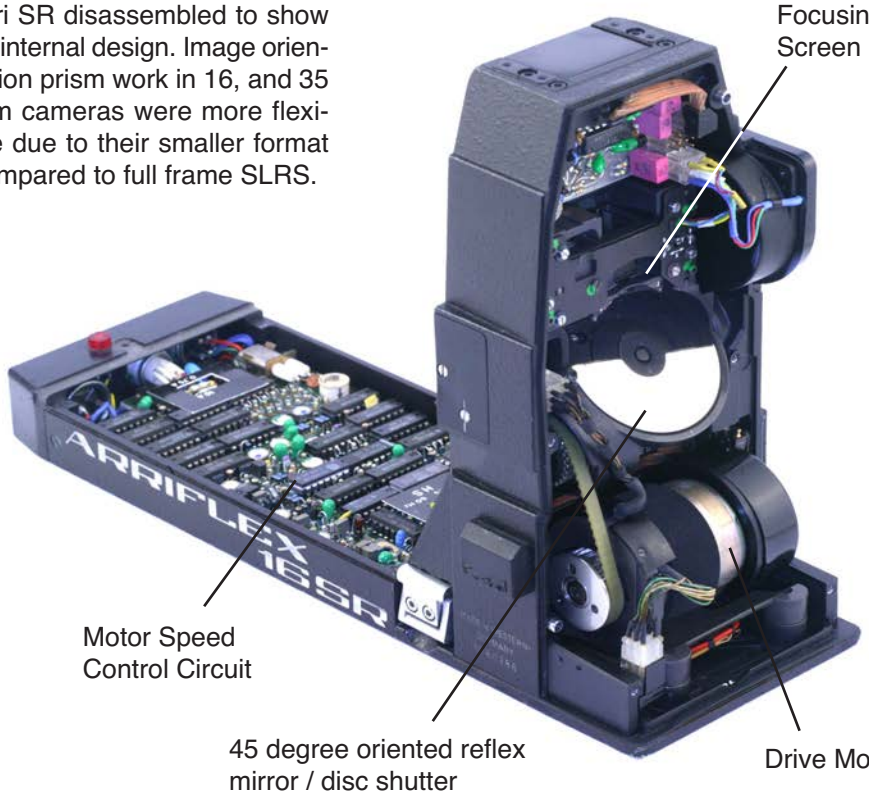
The optomechanics inside Arri SR series viewfinder is brilliant: The image counter-rotates, as the viewfinder arm is positioned at various angles. Schmidt-Pechan prism is like a folded dove prism. It is utilized to rotate the image to keep it upright all the time.

The eyepiece also has auto light blocking eye-lids: When the cameraman pushes his/her eye lids on the eycup (right), there is a two blade eye-lid that opens up to allow the image to go through. When the pressure is removed form the eyecup, the lid closes to block the light from entering the viewfinder, and to the focusing screen.



Automatic image orientation correction mechanism in Arriflex SR viewfinder.

Arri SR disassembled to show its internal design. Image orientation prism work in 16, and 35 mm cameras were more flexible due to their smaller format compared to full frame SLRS.



Cinematic Lens inventory at OMiD museum: Angeniux 25-625 (center) was a long rage zoom of its time for the 35 mm motion picture format. Stanley Kubrick shot one scene with this lens in “Thin Metal Jacket” utilizing its 25X long zoom range. There are Zeiss Compact Primes for full frame, super speeds for both 35 mm, and Super 16, and Super 8 mm formats. We also had Red cameras on display, and its range of accessories but Iranian film makers only cared for Arri Alexa.

RED Camera: The lessons Learned

RED camera seemed to be an important camera to have at that time because it was the hottest cinematography camera in the market. I was in the middle of directing a documentary film, and most of my work flow went well with a Sony HD camera. To make that worse, some of the historical footage I was using wasn't that high quality either, and Post editing with RED required so much computer memory, and took so much disc drive capacity. So I decided to loan my RED cameras to the museum.

Red Epic

Overall, our RED display turned out to be a waste of money! We could have used a mock up instead of the real camera. They ended up never being used by students.

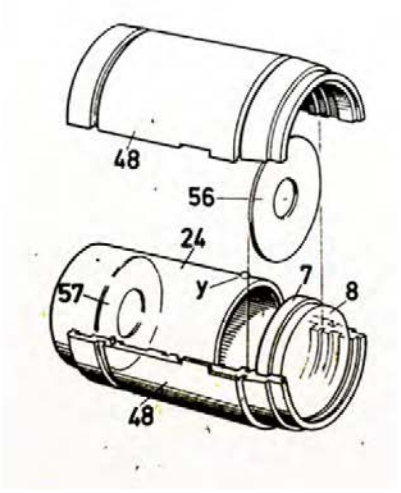
We tried to work with museum of Cinema to allow the youth to use the cameras but they didn't have any youth programs in place. A young screen writer was working on a project with Oscar Winning actor Shahab Hosseini, who was supportive of the youth projects. She was going to use the RED to shoot her film, but that also kept being delayed.

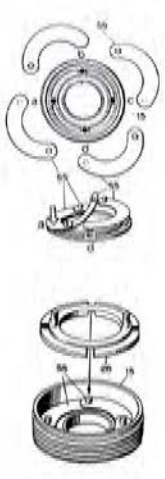
I did interact with some film directors of Iranian cinema and I think there could have been a program to put in place to utilize our cameras for youth education. I also met Asghar Farhadi but the discussion about the RED never came up. His most famous films in US are: "A Separation", and "The Salesman" because he won the Oscar for both of hem. Almost all movies in Iran are shot with Arri Alexa cameras.

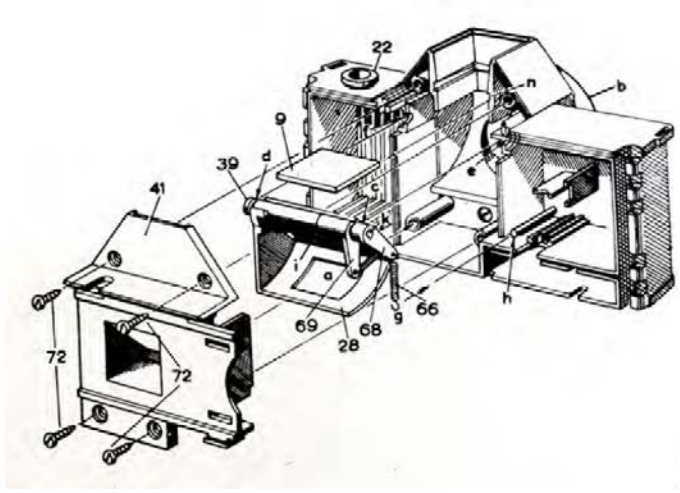

Asghar Farhadi

Opto-Mechanical Kits

I have always had enormous fascination with optical kits. They are many instruments inside a box, and treat children like engineers. We had probably 20 different optics kits from Spindler & Hoyer, down to building a simple radio kit. There are tremendous variety of optical kits, and vintage instruments to find on eBay that should be preserved in a museum. See the article: "80 years development of the optical erector set" to see some of our kits.







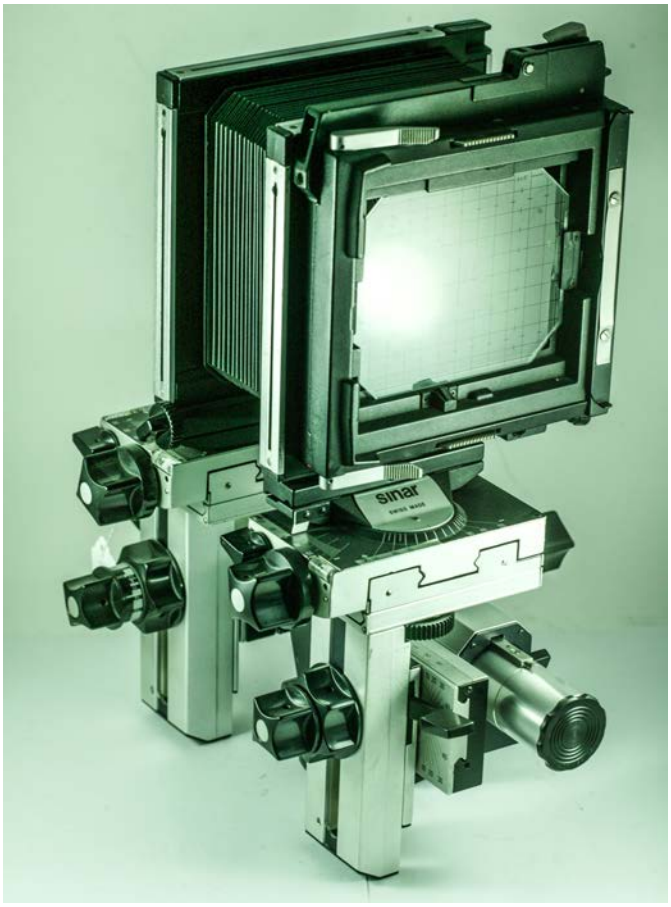
Phtography studio

So much emphasize was on documenting cameras, and their designers at OMiD photography studio. We produced several educational videos on camera design, such as a video on “Leica Design History”, and one on Persian rug design called: “Grandfather’s Rug”.

One of the goals of the books we published was to preserve the names of camera designers that are being forgotten through time. The history of camera design is an important part of product design history. No other product has seen so much innovation in time.

Watchmakers have meticulously recorded all the design variations of watch mechanisms through time, and there are so many books written on watchmaking, and their manufacturing, and repair. That’s not true at all about cameras.

It’s as if the opticians have put this responsibility on mechanical designers, and mechanical designers have placed the responsibility of recording things on electronics engineers. The result is so many years of opto-mechanical design has been neglected by authors, and publishers alike.



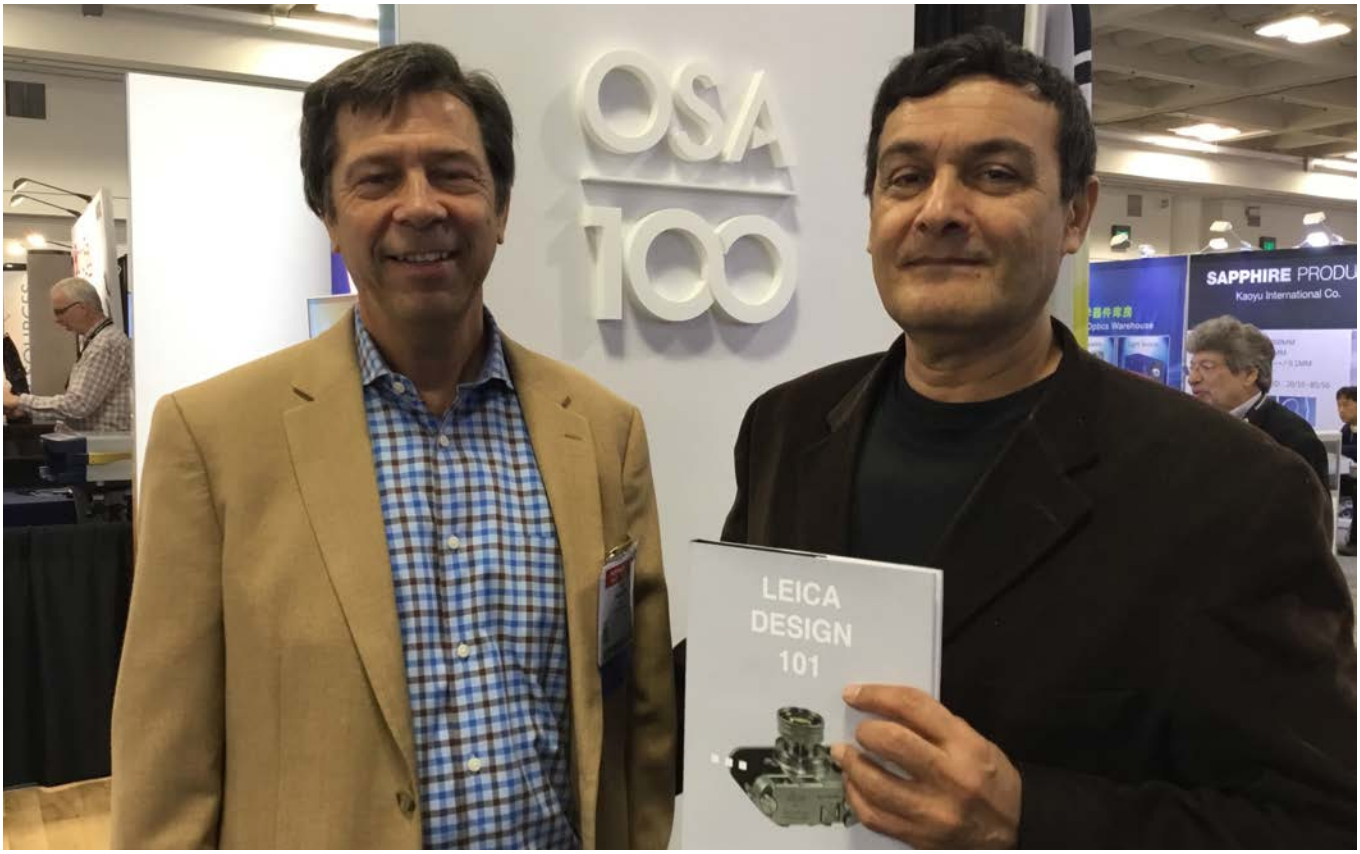
Sinar Versatile Studio Camera

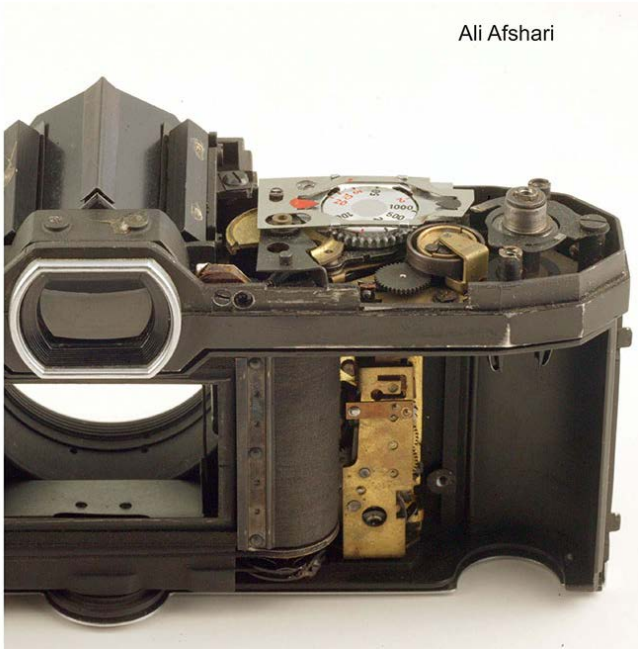
Majid Ghohroudi, a world renown photographer takes photos of museum artifacts, at OMiD photo, and video studio. The setup on the right was developed to photograph the bright frame lines through every Leica rangefinder camera with an iPad for “Leica Design 101” book.

See our Sept 2018 issue for a short history of Camera Design (left).

Book Release

Two books came out of OMiD museum, one on the history of Leica called: “Leica Design 101”, and one on history of SLR cameras called: “Restoring the SLR”. Both books are currently out of stock on Amazon.com

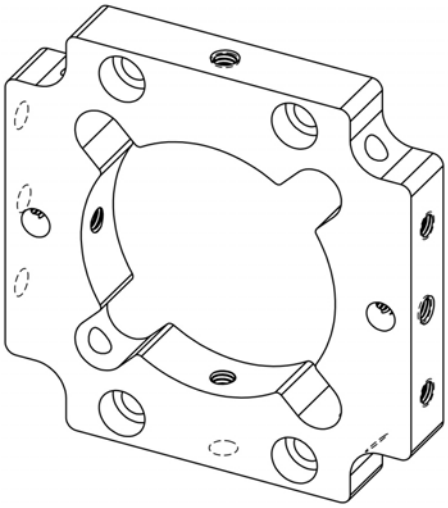




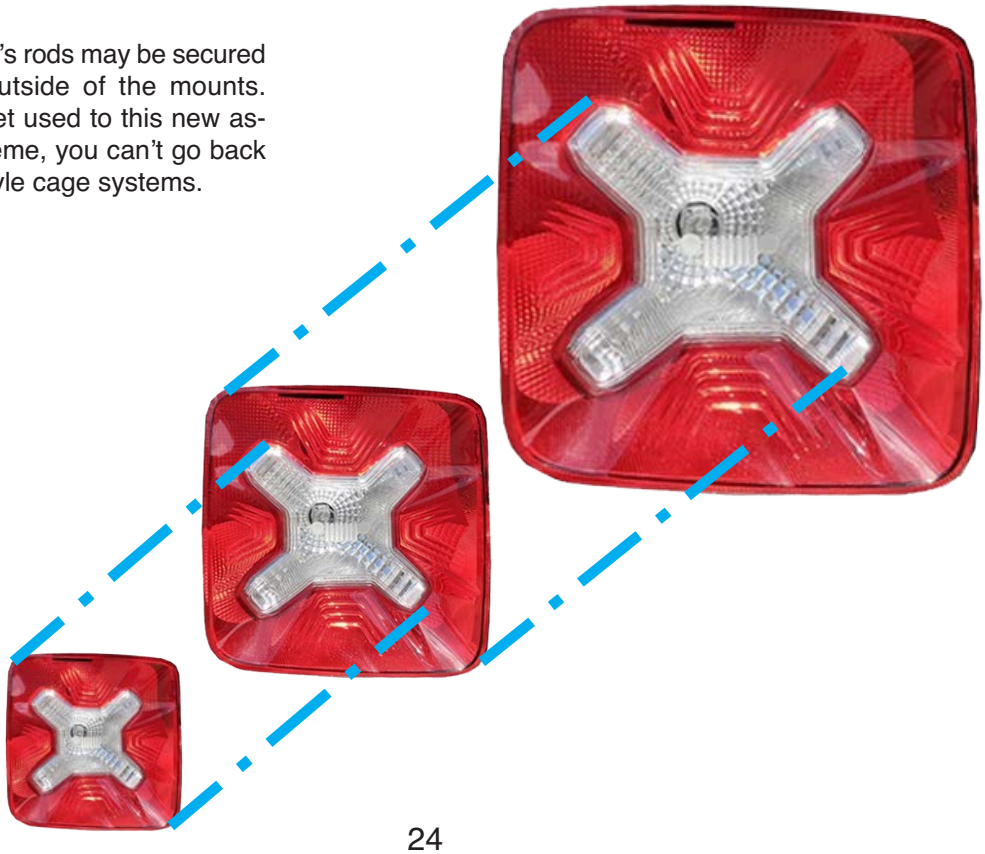
Inventing the New Optoform 40 Cage System

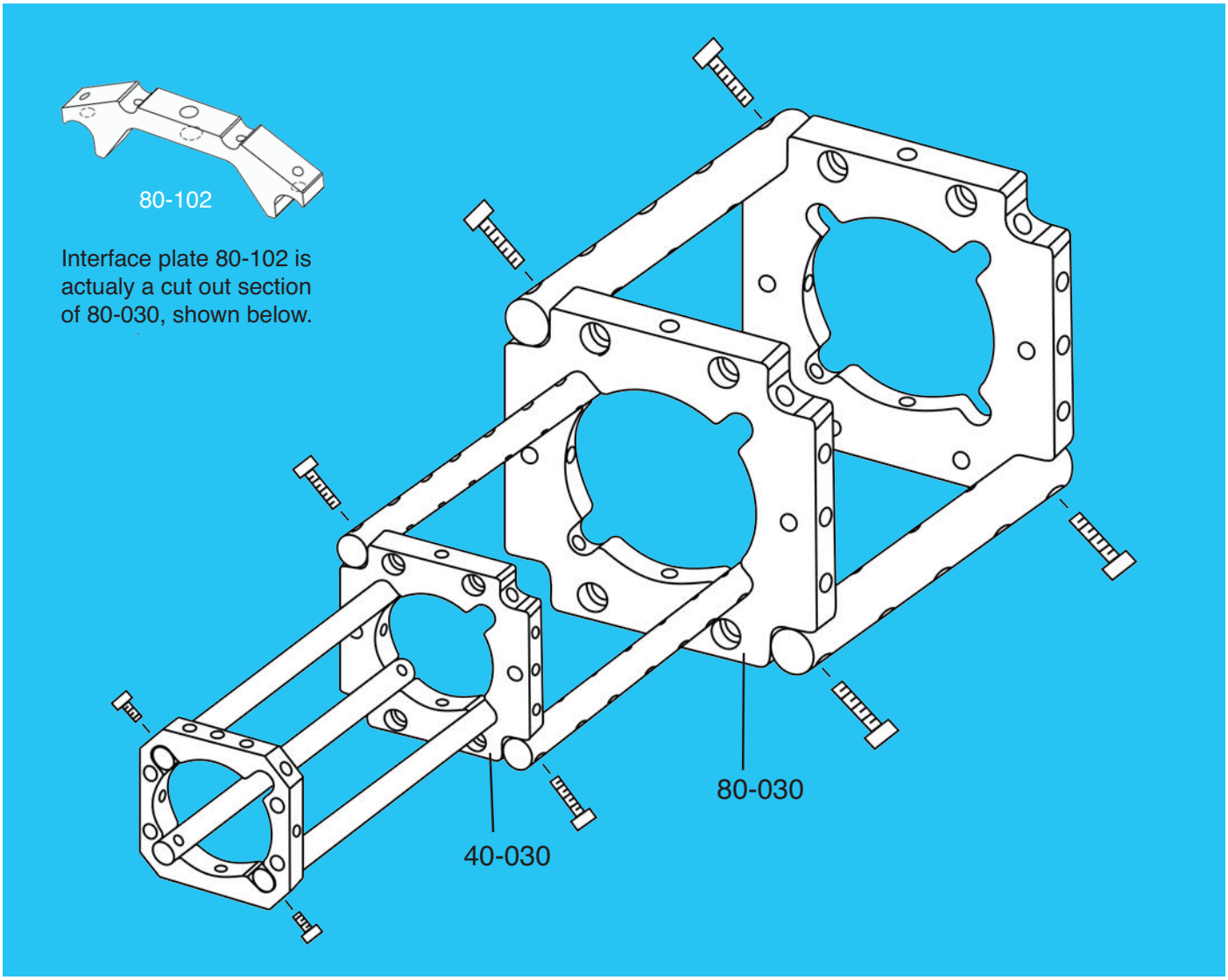
The idea of the new cage system came to me while looking for a parking spot at Photonics West 2018. In front of me, there was a jeep Renegade with peculiar tail lights. I felt so connected with its simplistic form, and I wanted to use it in Optics. So the new Optoform 40 was derived from its shape.

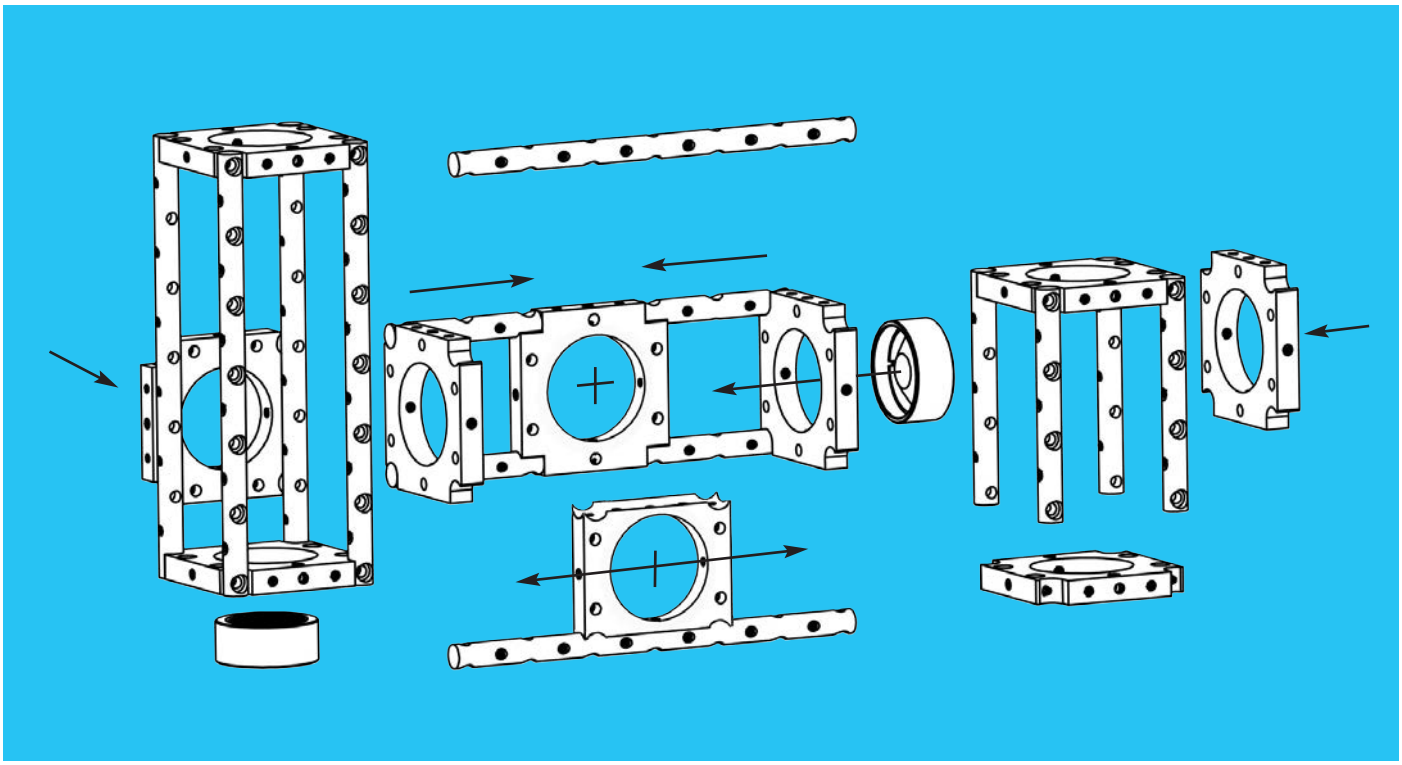
In product design, sometimes all you have to do is to look around for a shape that you could use. In this case, I really didn't try to copy or imitate the shape. I just tried to imagine how it could use it in my design. After I invented the new cage system, and filed for the patent, and began designing catalogs for it, I remembered that's where it had originated in my mind. Design is like a fish that if you wait long enough, it jumps out of water from the bottom of ocean.



Optoform 40's rods may be secured inside, or outside of the mounts. Once you get used to this new assembly scheme, you can't go back to the old style cage systems.





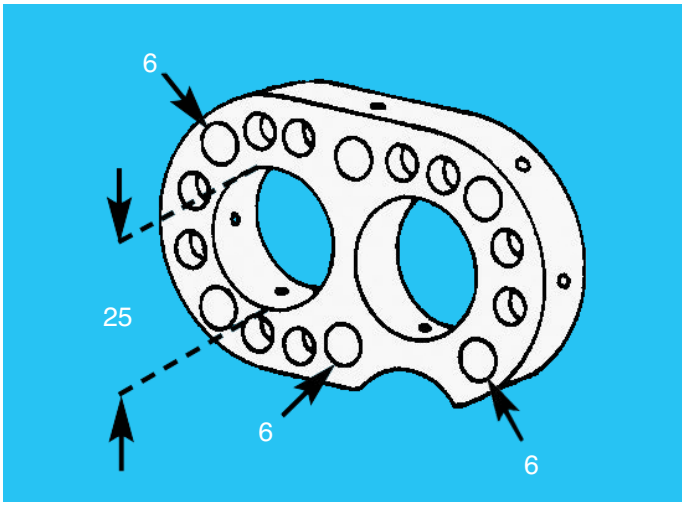


The idea of bore pattern on the rods sounded unthinkable before Optoform 40 came about. The skeptic would say why? The inventor said: “Why not?” The result is a new matrix of mounting possibilities that were unthinkable before.

The greatest Advantages of New Microptic 40

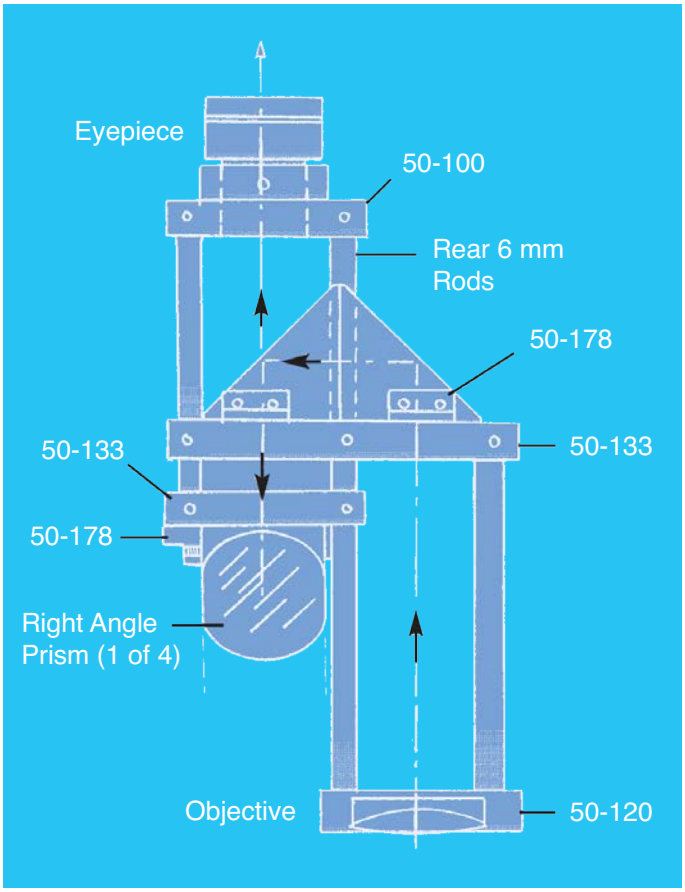
While testing the first prototypes for our larger optical mounts 100, and 150 mm in diameter (Minioptic, and Macroptic), I realized it was difficult to re position the mounts along the rods because they simply locked in place. So I came up with the idea of utilizing oval bores instead of round holes used in smaller mounts. So sliding along the rods is not a good option for larger mounts.

Well, that's exactly what the new design is good for since there is no longer sliding action along the rods. The new design would also allow irregular shaped mounts, especially suitable for opto-mechanical instrumentation. For example, for Microptic 50, we hardly were able to produce a Bioptic mount 50-133, which we soon discontinued. This mount allowed constructing a Porro prism arrangement for binocular applications.



Bioptic Mount 50-133 for Microptic 50 was designed to setup complex arrangements such as binoculars (right). Sliding along the 6 mm rods proved to be a bit difficult.

Bioptic Mount 50-133 utilized to make a microscope stand (right), and a porro prism arrangement (left). Below left, note how the corner connectors are utilized to secure prisms in place.

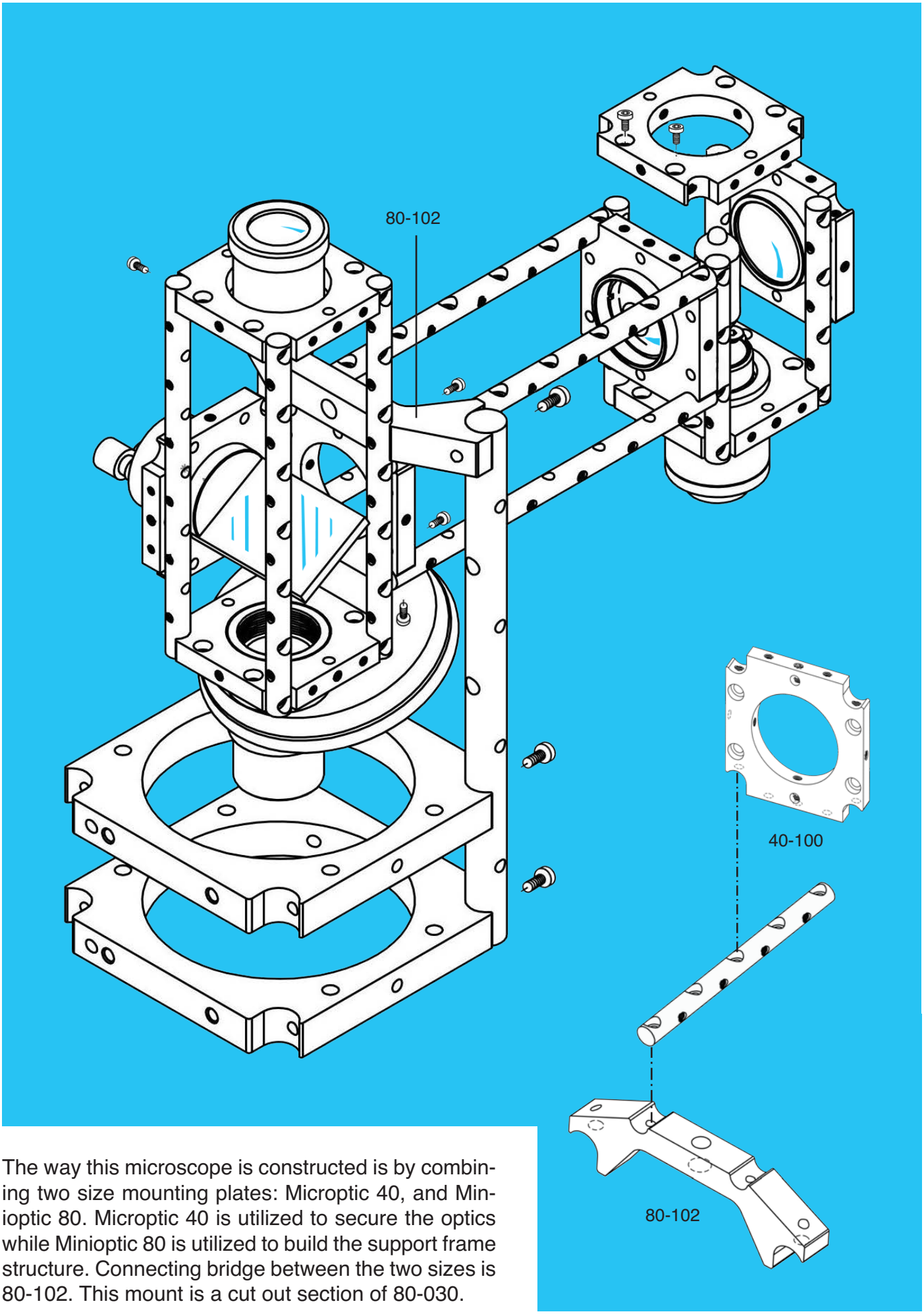


With the new design, things get a lot easier. Not only the mounting plates could be built in any shape, and size, the rods could also be irregular shaped. The possibilities are limitless.

In opto-mechanical instrument design, the main body is part of the optical structure. That's how microscopes, and telescopes are made. So each mounting plate in new Optoform not only secures the inner optical elements, it would also be part of the body chassis itself. now let's build a microscope assemblyby just utilizing standard Optoform components, and then we'll build something utilizing iregular shaped plates.

Modules vs Discrete Parts

Let's expand on this idea to see what I mean by modules. We'll begin with the simple task of making a microscope. Optoform is the only system that could create form in addition to function. So why is form so useful? What if it allows you to replace any part of the microscope with a real functional module made by Optoform? I'll show you how that's possible.



The way this microscope is constructed is by combining two size mounting plates: Microptic 40, and Minioptic 80. Microptic 40 is utilized to secure the optics while Minioptic 80 is utilized to build the support frame structure. Connecting bridge between the two sizes is 80-102. This mount is a cut out section of 80-030.

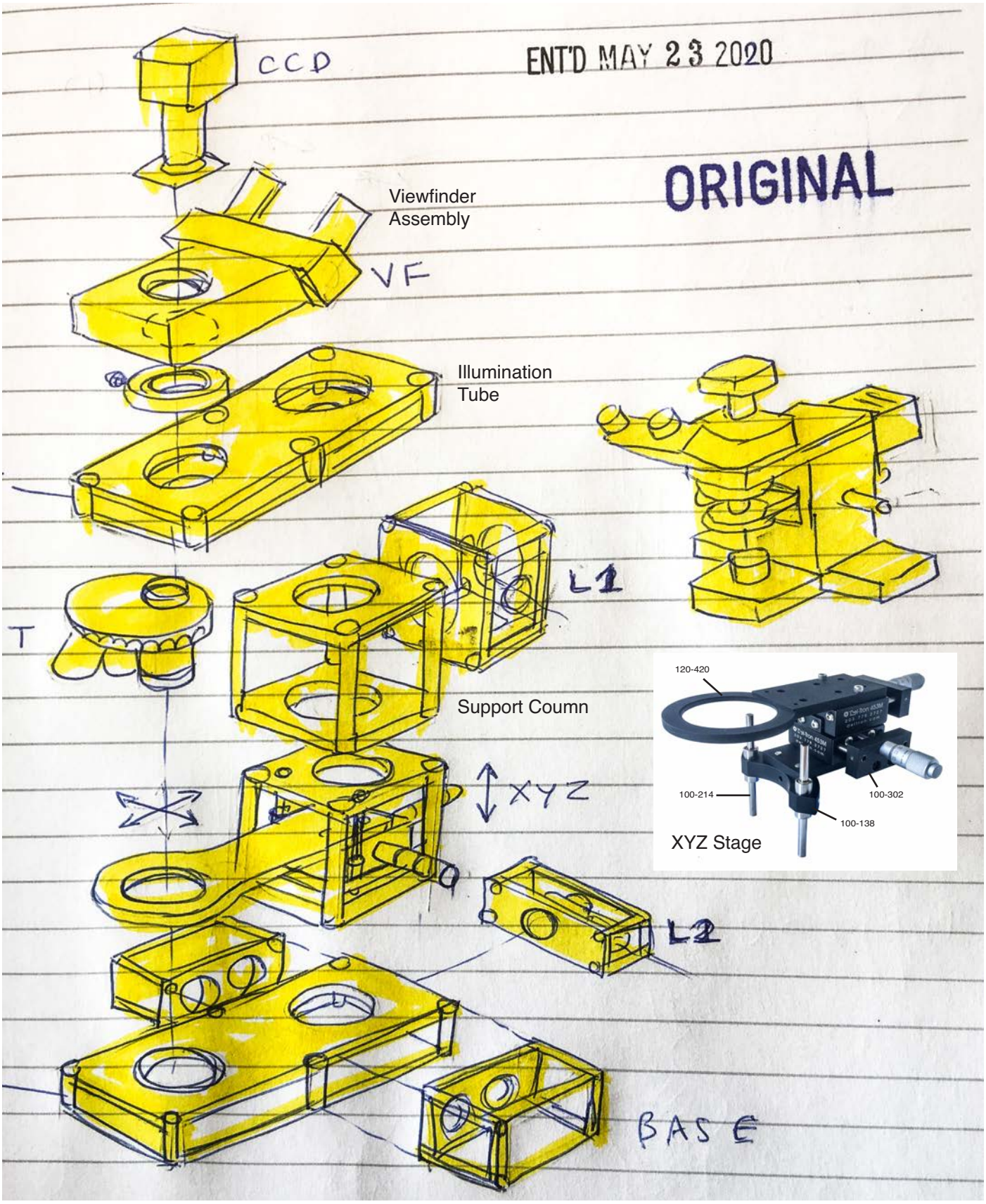


Fig.1 Conceptual hand sketch drawaing of the microscope assembly being designed using Microptic 40 and Minioptic 80 mounts: Since rods are merely structural support elements, they could be oriented in any direction to suit our purpose. IL1, and IL2 are for incident, and transmission illumination respectively using L1, and L2 as their light sources. Note how rod orientations are chosen to solve various opto-mechanical requirements. The base is basically a T-joint while the main support column is built by two mounts, and four rods. The illumination tube is a stackable simple cube. The viewfinder housing is another T-joint with a 45 degree tilt to provide comfortable viewing. Because both form and function are preserved, you could replace any part of this assembly with alternative parts such as a trinocular viewfinder, or lamp housing, etc. The XYZ module consists of 100-302 X-Y stage, and 100-214 linear bearings (Above, right).

Designing the individual Microscope Modules

I'll show you how I construct the microscopy modules with Optoform 40 as shown in Fig.1. I still rely on a pen and paper to do my designs. Solidworks is a good tool but Dieter Rams still hand sketches to design his new ideas. It's an old discipline many people lack. It keeps design from jumping to conclusions too quickly, and brings about more creativity.

In any case, we'll start with the binocular head that's more challenging. **To adjust for the eye distance in a binocular head, the sliding mounts 40-110 are designed to function in this way** (Fig. 3). As it is shown, two cubes are constructed, and mounted against 40-110 mounts to construct the assembly. The optical design is shown in Fig.4. It reveals the 90º, and beamsplitter prisms. The dotted yellow lines represent mechanical link. The two simple cubes are attached to sliding mounts 40-110 that ride on upper pair of 6 mm support rods, so their distance could be adjusted to match the user's eyes. The beamsplitter is mounted on a lower sliding mount 40-110 which rides on lower pairs of support rods. This compact design similar in size and shape to off the shelf binocular head viewfinders (Fig.2). They utilize a rack and pinion link between the two eyepiece movements so their optical path length is kept identical.

The trinocular assembly we constructed is for those who want to have their own custom binocular head. In most cases, the user may not want to use a custom made observation head so an off the shelf module could be used insted. The inclined observation heads, utilize a beamsplitter/Litterow prism (right). A trinocular head prism beamsplitter (right) consists of a Litterow prism, and a cemented prism to divert 30% of the light to a CCD camera. **We'll continue this design on the next issue.** In the next section, we'll set some rules for constructing modules.

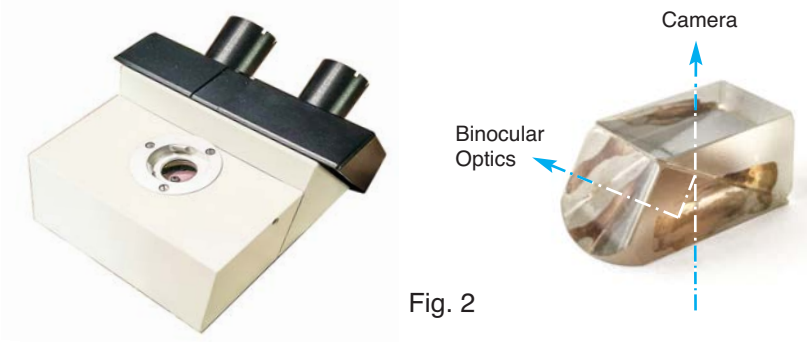
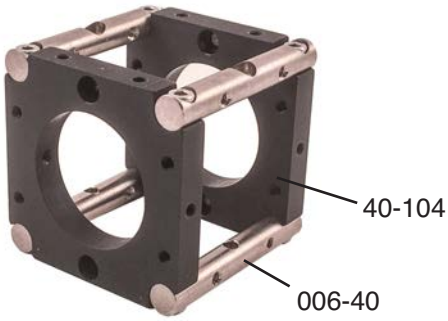


Fig. 2



A Simple Cube Module

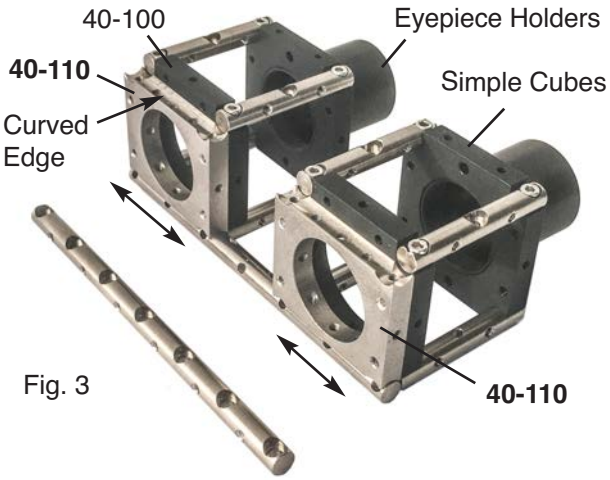


Fig. 3

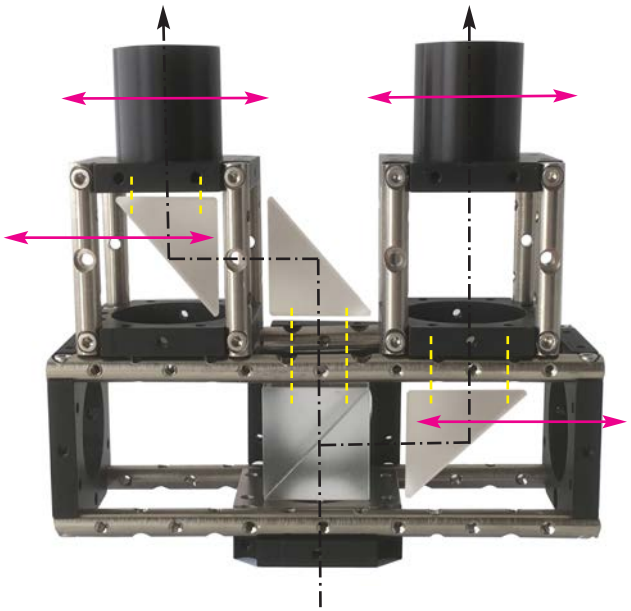


Fig. 4 Top View of Binocular Head

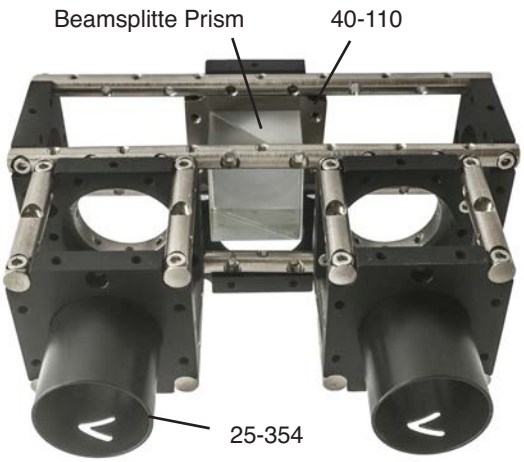
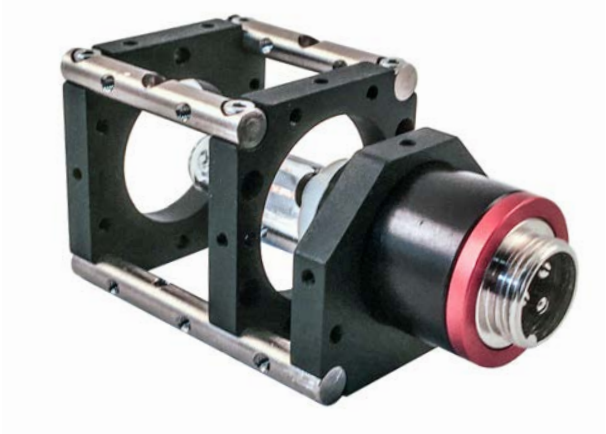


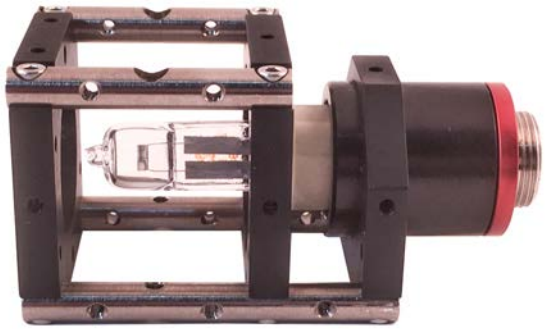
Fig. 5 Rear View of Binocular Head

When designing Optoform modules, I follow these basic principles.

1) Anything less then it wouldn't be functional

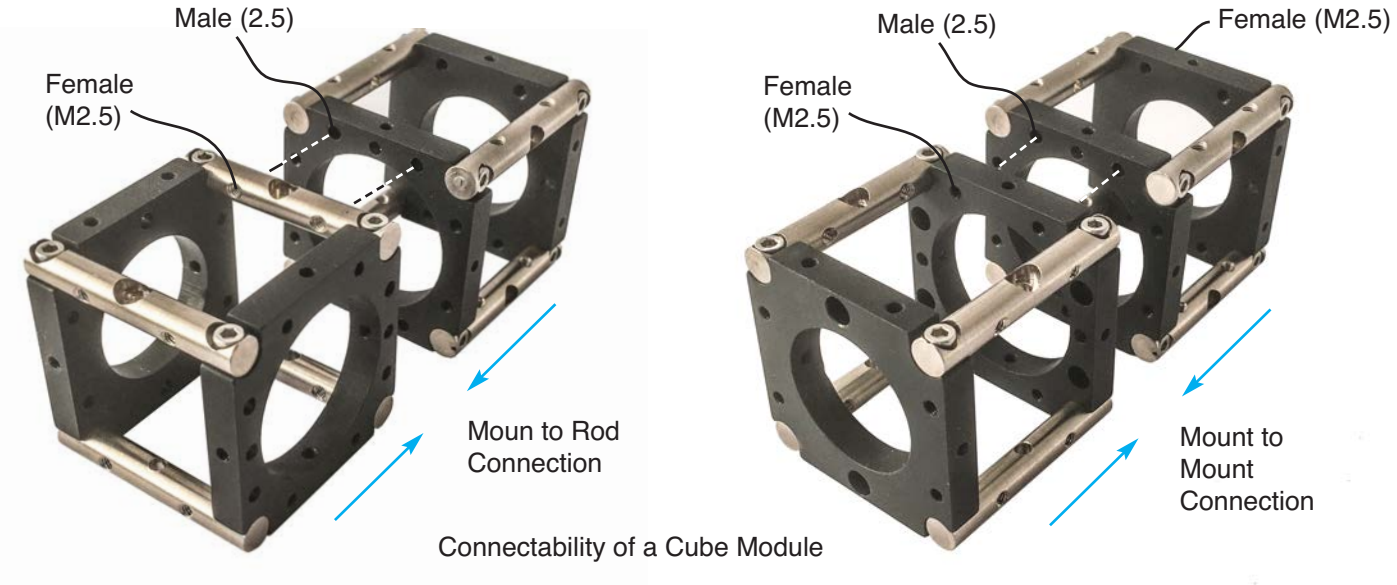
That's the philosophy I try to follow in module design. For those who have mathematical minds, a module is like an optimized equation. Once you simplify an equation to its minimal form, then you could save it, and use it anytime later.



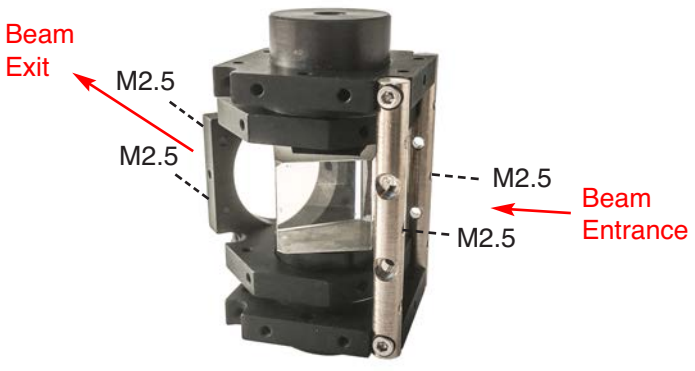


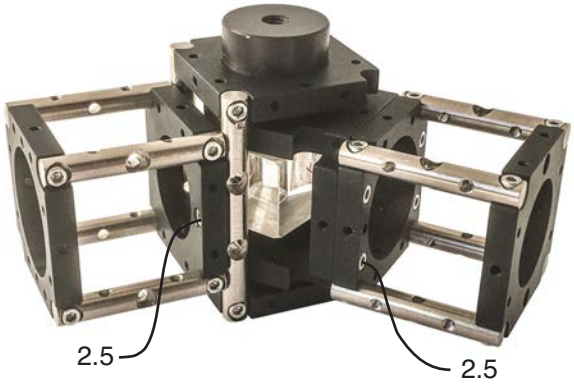
2) Modules Should Allow Chain Connections

It's usually a good idea to have male on one side, and female on the other end as shown in short rod assemblies below.



Connectability of a Cube Module

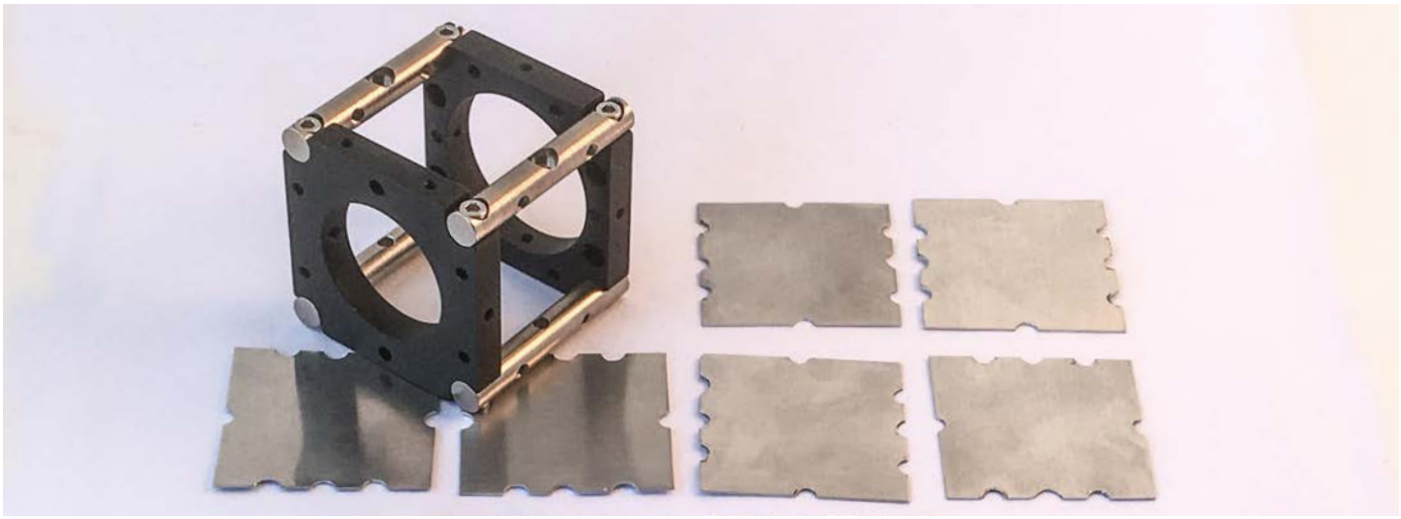




Two arms could be attached to the input/output of Swivel module (left) via M2.5 screws to build a spectroscope (right).

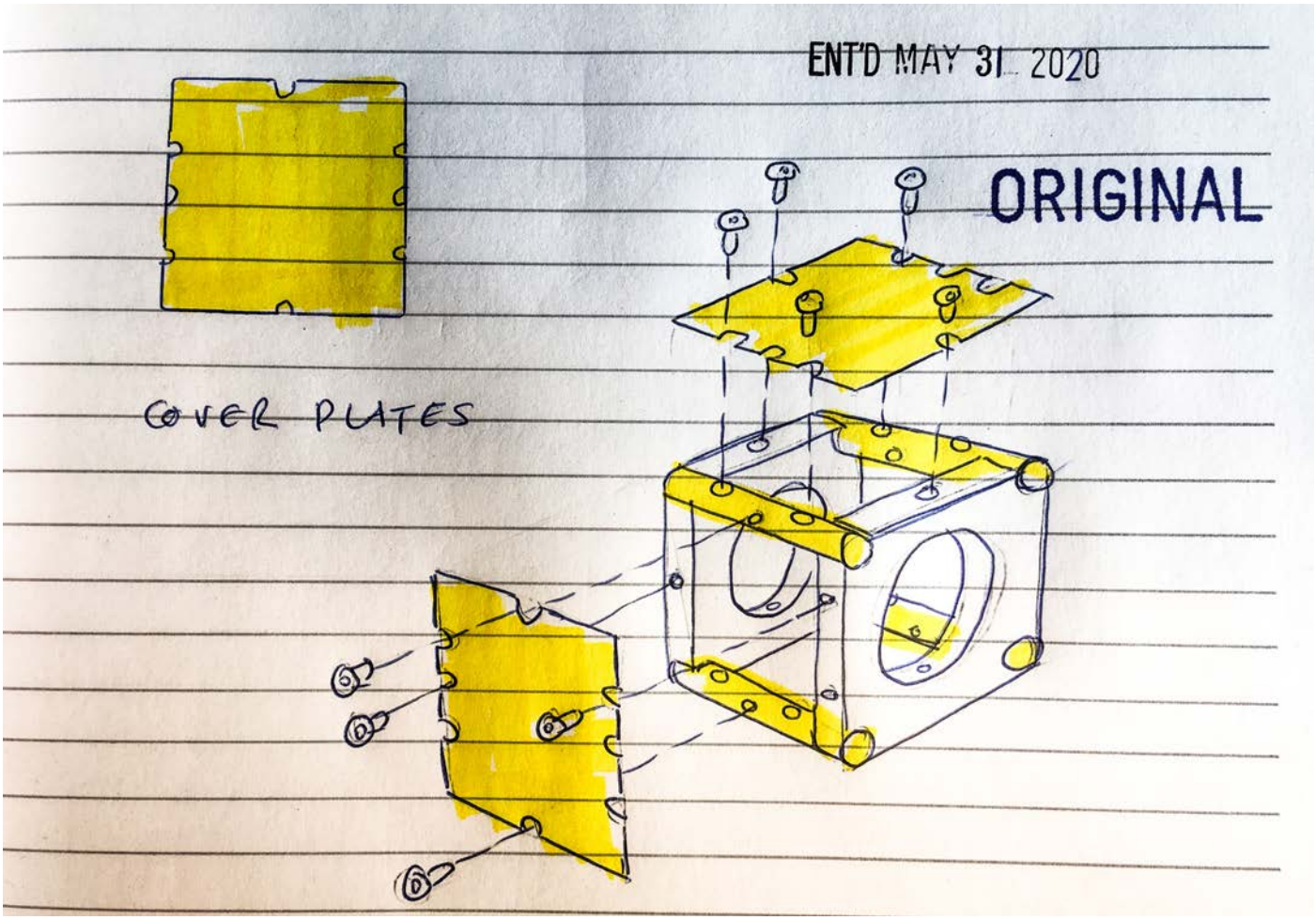
3) A Module Must be Low Cost

I think this would be the outcome of following rule number one: Optoform 40's lower cost plays a significant role. To start with, compare the price of our cube below to any other cage system cube avilable on the market. You won't need to disassemble it. It is saved aside as a formula to be utilized later. So please don't disassemble it! Just use it as a module.



Designing the Light Seal Covering For Microptic 40

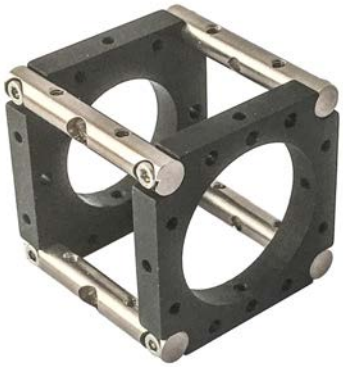
For original Optoform, we devised thin tube covering. They basically slid over the already assembled mounts along the rods to light seal the system. Well, for new concept, we'll do the same, but this time with thin flat Aluminum sheets. In the beginning, I didn't like the look of it but as I began using it, it has become an inseparable part of the new system.

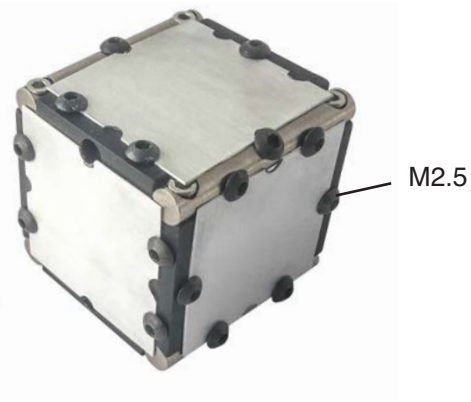


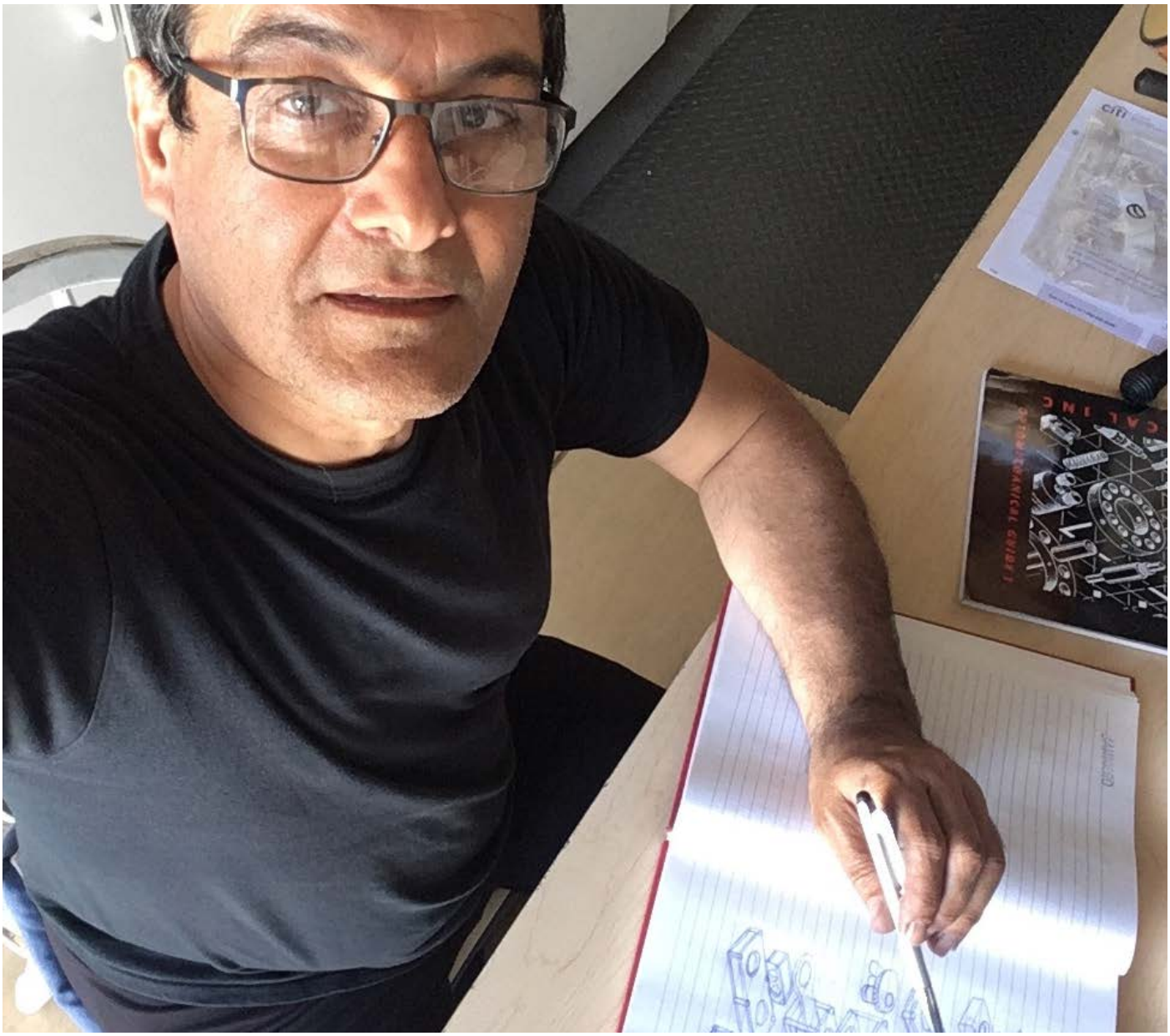
Developing the idea for new Optoform covers.

Thin Aluminum sheets are so easy to cut to shape, and easy to drill, and one could utilize a Nibbling tool to cut it to any shape very professionally to fit, i.e., opto-electronics devices. They could be anodized, and made available in various colors, and are so easy to engrave with the name of a product developed by an end user.

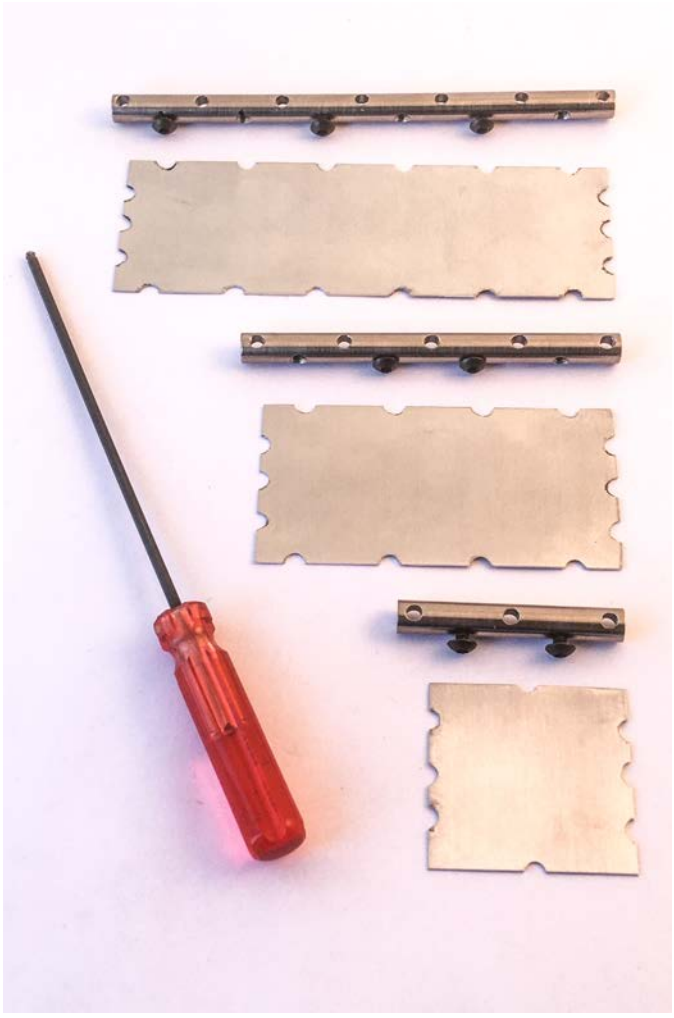
There could be special coverings made for lamp housings to allow cool air flow, and various other ideas that would emerge. Below, right: All the screws that could be installed to secure the covers. It could actually be done with just a few.



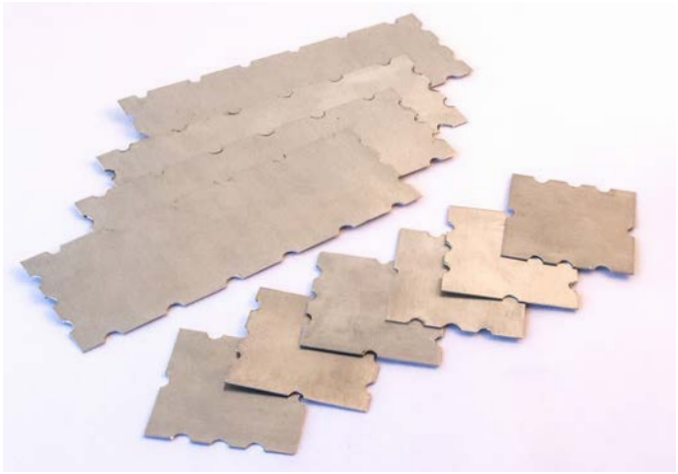




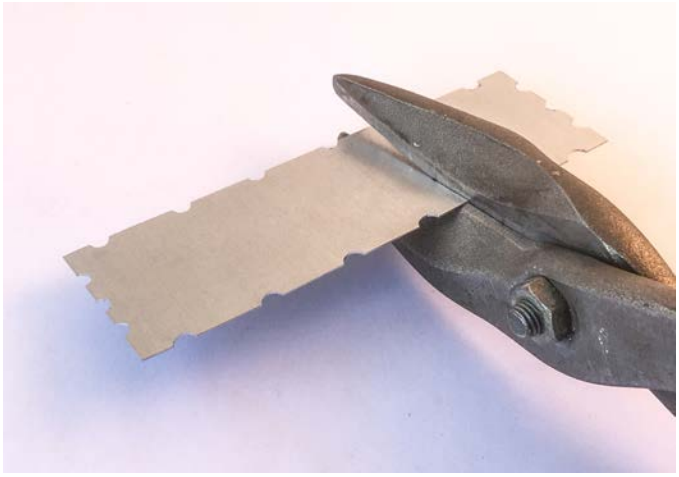
It would be unusual for me to take selfies, but I wanted to record this moment of inspiration: This idea was pretty cool!



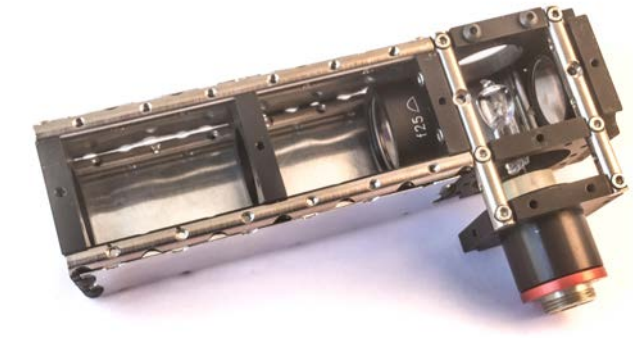
Cover lengths Matches with rod lengths



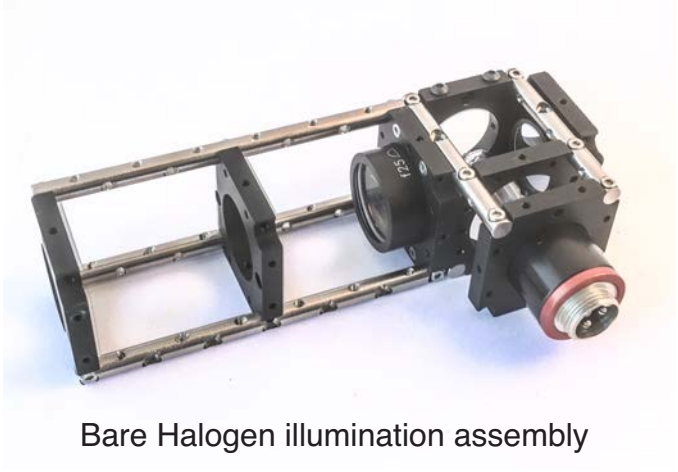
Thin Aluminum covering is so inexpensive



Thin Aluminum covering is so easy to cut



Lamp Assembly with partial Covering



Bare Halogen illumination assembly

Illumination Assembly with full Covering

Covers could form a mosaic

The Ambiguity of Spiritual Path: Self Esteem

By Ali Afshari

I have often talked about inspirations in past issues. I have always said the inspired self has been the biggest achiever in human history. Have you ever thought about how that is? We are one of a kind species that could use our thoughts to liberate our minds! Allen Watts says that's like trying to life yourself by pulling up on your bootstraps!

As human beings, we could be controlled, dominated, and imprisoned by our minds, but inspirations are so rebelliant, and so liberating like a free spirited dance. The problem is we seldom dare to break the rope to set ourselves free. Anthony Queen says: "A man needs a little madness to accomplish that". I was very shy when I was young, but I met this young girl one day in a study group that I felt I wanted to protect against some jerk who was perusing her, so I started chasing her myself! The two of us competed with each other up until the dance floor. At that point, I could either watch them dance, or step in, and start dancing for the first time. That gave me the chance to break loose from my self inflicted prison. My philosophy of dance began right there. By stepping onto that dance floor, I stepped on all my shyness and danced over it. That dance made me the brute force I am today at trade shows. There is no one like me at the show floor when it comes to promoting a product. I also learned how to become good at public speaking! Do you want to hear that story?

Well that's when I was a student at Glendale college in southern California, taking singing lessons! One day, there was this international fair, and many countries were participating live in front of a reasonably large crowd. I was sitting on the back watching the whole thing from above. There was a Tinikiling dance demo from Philippines, where two people sat on two ends of a pair of long Bamboo poles, and they hit them on the floor, and then to each other in a rhythmic way. Dancers followed the rhythm and skillfully jumped between the poles. Students were invited to participate in the dance. So they lined up, and they entered the center of the rods, and danced between them being careful not to be caught! There was this crippled girl that I saw every week at the college, whom I always felt for. Lo and behold, she got up, and wanted to participate! I thought everyone was looking at her waiting to see how she'd perform.

You won't believe what happened when it was her turn. The lady who was very well spoken, and was introducing the event, got up, and announced on her microphone: "Thanks everyone, now we'll move on to the next performance". I watched that girl turn around, and sat down in silence. I looked back at everyone's faces, and saw no reaction. Well, it seemed to be an ordinary event, but I never cared to take that path because ordinary paths in life, lead to ordinary outcomes. So I decided to learn public speaking. I said to myself: "I should have been holding that microphone!"

My story of learning how to become a public speaker began like this: I stood up in front of a crowd, and began speaking. Not only I wasn't invited to talk, I was being waved at by someone in the audience to sit down! I think it was about a minute into my speech that someone grabbed my arm, and led me to sit. I got up again, and turned toward the crowd, and said: "You will most likely forget this by tomorrow, but I am going to learn public speaking!". I remember someone in that audience responded by giving me a genuine smile. I learned that this world with all its seemingly demanding people, are willing to put up with you until you learned to be good at something! Well, isn't that true with most of our elected public officials? We are foolish enough to vote for them, and then have to put up with all their mistakes until they learned how to be better at their job! This is also true for many of our genuinely gifted singers, and musicians. I used every opportunity to master public speaking skills until I eventually became good at it. After establishing OMiD museum, I gained popularity among the youth, and I was often invited to speak at universities in various towns. I learned that in public speaking, you are allowed to speak your mind until people start listening to you! There were actually two type of speakers: The short term, and long term. Long term speakers, are those who have been speaking for may be 25 years, but no one has been able to get much out of!

Tinkiling, a traditional bamboo dance of the Philippines

Public speaking is supposed to liberate you, and others. You won't learn that skill from just speaking at Toastmasters.

In any case, that's how I learned public speaking. I tell you these stories because most of us don't follow our inspirations because we are too afraid to follow them through. In general, I think we are too ill prepared for what we were born to accomplish in this world. Life is really short. I remember calling this girl that I got to know, and admired, and asked her if she'll consider marrying me. She said she wasn't interested. I was about to hang up, and she said: "Mr. Afshari, you are so much in a hurry! Don't you want to persist a little bit"? I said: "I am sorry, but I don't have time for that!

It didn't take long until I found the love of my life. You'll meet the right person when you are not looking, but you'll miss it unless you know deeply in your heart what you want in a relationship. I just bought a box of energy bars and I saw this written on it: 1 1/2 Egg Whites, 3 Almonds, 2 Cashews, 1 Date, No B.S.

So it's all about what we do with our inspirations. Do we act upon them or just write them down in our diaries. The truth is our minds are too limited without inspiration. When you watch children, you see they simply begin by trying new things, and they learn by doing. I don't know what happens in between childhood, and adolescence, that we become so timid, and afraid to try. Inspirations are the brute force that push you forward to act. While you were a child, it was your parents that backed you, and gave you self esteem. In adolescence, it's the inspirations you get. When you see a Chaplin movie, you know you are looking at an inspired self. When you listen to Mozart or Beethoven, you are looking at an inspired self. Ravi Shankar says: "While you are performing, pay attention to your own heart. If there is a place within you that is receiving it with joy, then the audience is also loving it". This self awareness is achieved only by interacting with the outer world, and going through the necessary trial and error to validate your inspirations.

The inspired self is a kind, and giving self. There is a big difference between an ice cream man who sells the ice cream, and just receives money, and someone who is inspired. The inspired ice cream man, looks at people to see how he could increase his/her service. May be a child doesn't have enough money, and is standing at a corner. The inspired ice cream man often finds ways to give that child a free ice cream. Free ice creams, are so good for business and if everyone knew it, they'll be doing it. OZ optics has been giving ice creams at most trade shows, and that's good marketing (this was an unpaid commercial!).

Persian Dance

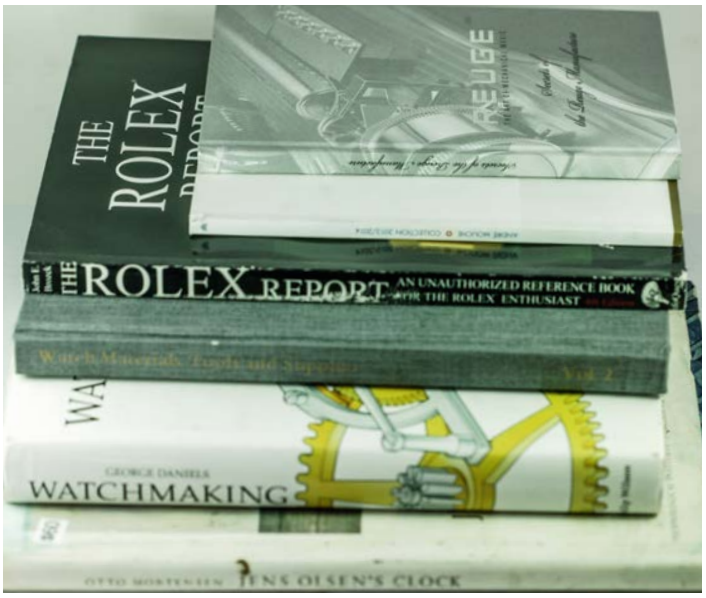
When I look back in my life, I see everything I learned was built on what my mother gave me with her love, and that's the foundation of all my real self esteem. If you lack self esteem, it's time to emancipate yourself by changing your mind about yourself. If you are a parent, and have ever criticized your child in the past, the best way to undo your harm is to reach them, and apologize. Promise you won't ever do that again. Self esteem is what we condition ourselves to step onto the dance floor, and to break all our barriers. There is a beautiful line in the movie: "Firelight" when the father wants to stop the caregiver for disciplining his spoiled daughter so she would learn how to read, and she tells the father: "You want her to love you, but I want her to be loved". Every encounter we have in our spiritual path, leads us to the love we already received. The love we could give is a natural extension of all the love we ever received. It all happens in timeless realm of connecting with the source, and it makes no sense if one can't think with their heart. Brian Tracy, ends his book: "The Psychology of Achievement" by this adaptation of C.T. Studd's poem:

Only one life, twill soon be passed,
Only what's done with love will last.

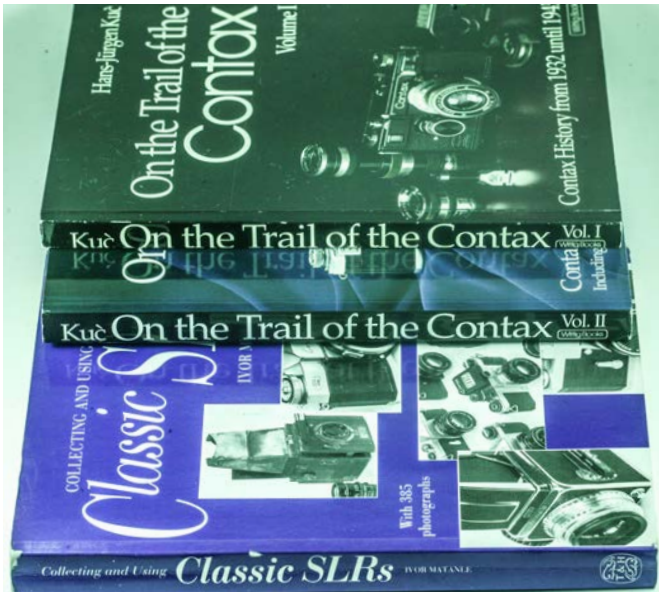
Available Books on Opto-Mechanical Design, and Watchmaking

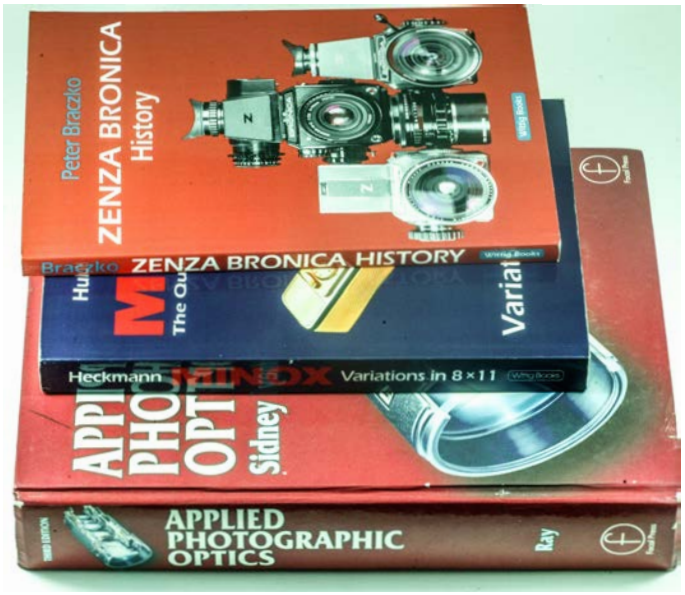
Have you ever entered a bookstore, asking for books that showed you how something worked? The photography section of most bookstores have every book about photography, and nothing on cameras. There are rarely any books written on camera design, and if you are lucky, you'll find one on Amazon or eBay. Service manuals on vintage cameras have poorly drawn exploaded views without much explanation about how they worked.

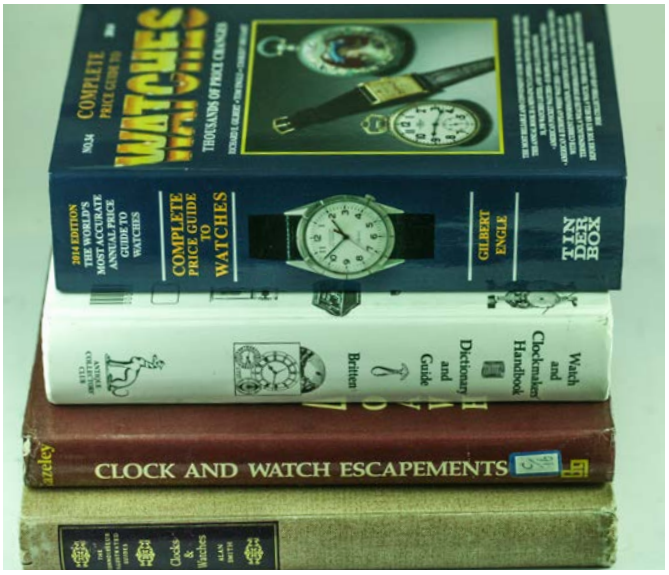
National Camera Institute in Denver Colorado, had a good library of books on cameras, and my teachers there used to call me Mr. Copy for always copying literature on their copy mahine. The reality is, if people want to learn opto-mechanics, they'd have no choice other than taking them apart, and learning them on their own. I hope omidmuseum.com with all its publications will some day be the Wikipedia of opto-mechanics.

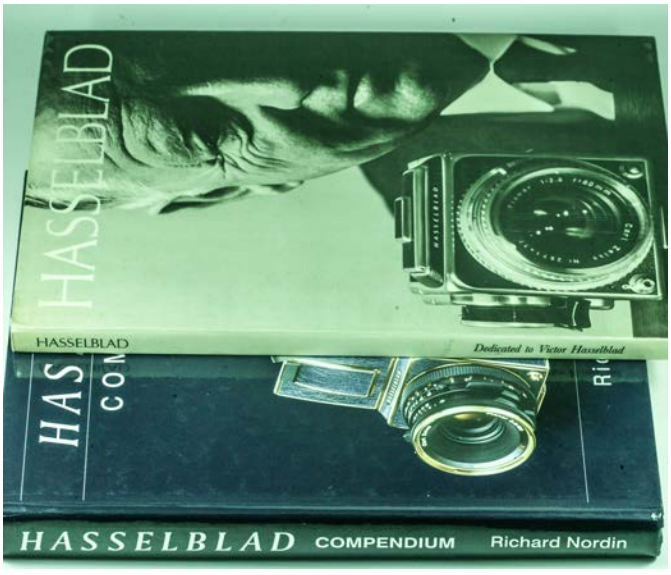


51 books picked from OMiD's library of opto-mechanics, and watchmaking. While I was collaborating with California Museum of Photography in Riverside, they had 30,000 items kept in humidity controlled vaults. OMiD had around 1,500.









The audio visual, and book Library

Hasselblad, and Cinematography Section

Empty displays before closure