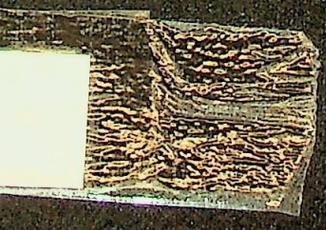
The Development of the 35mm SLR Camera

Declan Greene

March 1988



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" The Development of the 35mm Single-Lens-Reflex Camera "

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THE COLOUR OF THIS SYMBOL `☆' INDICATES THE ORIGIN OF THE QUOTE, A KEY IS INCLUDED IN THE BIBLIOGRAPHY.

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CHAPTER 1

INTRODUCTION

Photography is a magic art, a camera is a little black box that can trap people, strange places and well-loved ones, and bring them all back home.

It is an invention that allows us to make instant images of anything we see, or can't see by bringing together all of the technology that is at mans fingertips today. The modern 35mm SLR has automated the task of taking photographs to the extent of allowing a ten year old child to record image as well as any professional.

In this dissertation I shall trace the development of the 35mm SLR spanning the greater part of this century. The individuals whose genius brought us this far, the cameras along the way, and their influences shall be evaluated. The story of the development began with the materials and technology of the early 20th century. We shall begin the story in Germany and end in Japan.

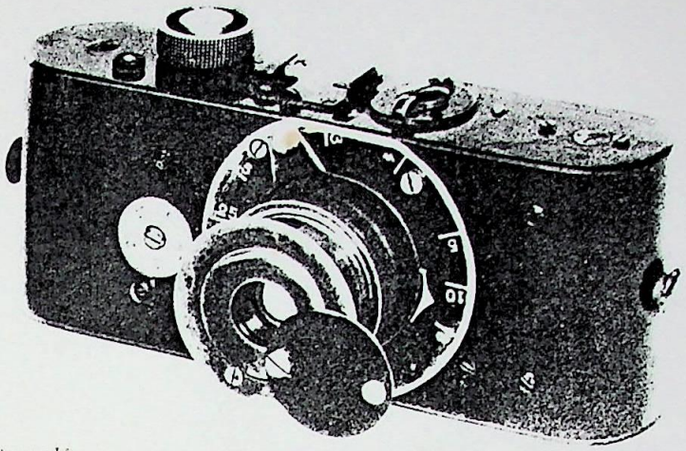
CHAPTER 2

THE LEICA

The Leica started the process of evolution which brought us the 35mm single lens reflex, (SLR). Due to the low tone resolution and sharpness of available lenses, and the graininess of the emulsions used on film, in the 1880's and 1890's enlargements of negatives were always bad. Towards the turn of this century however, some fine lenses, became available but the grain problem still existed. Fast narrow gauge film was being used for cinema work, and here grain was of no consequence, for even though the enlargement of the image on the cinema screen was enormous, what you saw was really a subjective image, compounded by your eye out of sixteen separate images flashing past every second. Also you were viewing the screen from a distance. But beyond considerations of grain the images obtained by early emulsions which were fast enough for cine work did not resolve tones very well.

So in 1917 when Oscar Barnack started work on a camera to use cine film for ordinary still photography, he was faced with the serious limitations of the available film stock - something which no amount of quality in his lenses, or precision in his camera could overcome.

He was well aware that lenses of shorter focal length - lenses which would only cover a very small area of emulsion - had great advantages over the larger lenses needed to cover larger areas. First there was the fact that fast big aperture lenses for small negative sizes could be made with less labour than for big. There was less glass to be ground and polished. The lens was more portable. Second the larger focus lenses have a greater depth of field. That is to say, that for a given aperture, a greater depth of subject matter is sharply represented in the picture using a focus lens compared to a larger lens. This depth of sharpness is a quality of enlargements made from such negatives.



Oskar Barnack's prototype Leica.

To take a very simple example: a lens of 2 in. focal length, covering a negative measuring 1 in x 2 1/2 in. is adjusted for perfect focus at 12 ft. and close it down to f/8 then everything from 8 ft. to 20 ft. from the camera be acceptably sharp.

If you carry out exactly the same exercise with a lens of 4 in focal length covering a negative measuring 2 in. x 3 in., then at f/8 your image will be acceptably sharp for subject matter from only 11 ft. to 13 ft.. However although depth of field becomes greater as focal length becomes shorter, depth of focus, which is quite a different thing, does not.

Depth of field relates to the subject matter of a picture. Depth of focus is the thickness at the image plane, wherein acceptable sharpness of image is to be found. This "thickness" gets smaller with a decrease in the focal length of the lens. What it amounts to is that a short focus lens must be positioned in relation to the film plane with greater precision than a longer lens. That is evident if one considers the focusing movement of lenses. In shifting focus from 3ft. to infinity a lens of 28mm focal length moves just about 1mm. A lens of 85mm focal length (roughly x3) moves through more than 10mm to make the same focusing adjustment. So the shorter the focal length of the lens, the greater the precision called for to focus it accurately. But when it is focused accurately, the image possesses greater depth of field than the image produced by a larger lens of a correspondingly larger camera. To get the most out of a small lens working on a small emulsion area, the camera must be made with great precision (Fig 1).

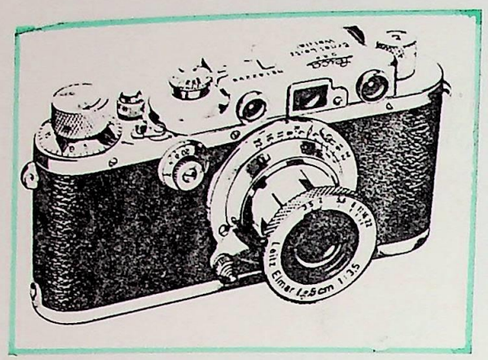
Oscar Barnack must have realised from the word go, that the sort of thinking that applied to the design of larger cameras was not a great deal of use for the purposes he had in mind. His camera would have to be designed in such a way that the settings of focus would be accurate within a tolerance of something like plus or minus 1/1000th of an inch. The end product of his work was a solidly and precisely built little camera that was the prototype for the first Leica, the first successful high precision miniature camera.

Meanwhile the first World War had come and gone and in the general acceleration of technical progress which always seems to take place when killing on a large scale is the order of the day, photographic emulsions had been considerably improved.

Aerial photography had been used for reconnaissance, and to this end small details were often required to be greatly enlarged. So for the purposes of war, emulsions of improved grain and resolution quality were produced. The new emulsions were made use of by Barnack's new departure in Camera design. In 1925 his camera was launched on the market by the old established firm of scientific and optical instrument makers,Ernst Leitz of Wetzlar in Germany which called it the "Leica" for Leitz Camera. The importance of this new camera was comparable to George Eastman's Kodak in 1888.

The first model Leica was of the simple round ended rectangular form, the lens in its focusing mount could not be removed from the camera. The camera had a focal plane shutter with a range of speeds from 1/20 to 1/200 of a second. The Leica had no coupled rangefinder but a rangefinder could be bought as a separate accessory. The action of winding on the film also set the shutter, so that double exposure was impossible. This camera made the small negative a reliable source of greatly enlarged positive prints.

The "Leica" also established the form of 35mm cameras, and only in the most recent of the mass produced SLRs has this form changed. Although Barnack's technical achievements; and ability to look at a whole new concept in photography, showed great initiative and perseverance, he looked at the project from only the technical point of view. He solved brilliantly almost all of the problems he discovered, but failed to see the relationship between the user's hands, and the position that the camera was held in. The form that he established set a precedent in the market that would not allow any other form to be saleable. This camera was so technically successful, that unless all cameras which followed looked like the Leica the public would not accept them as serious cameras, a type cast had been created.



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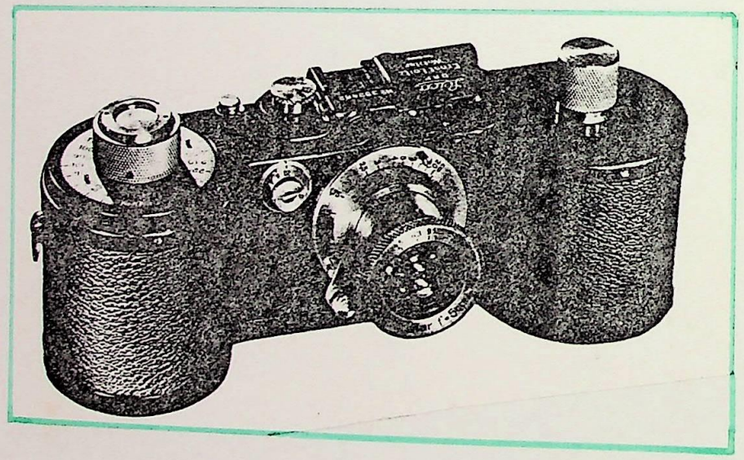

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This phenomenon is very common in product design, for example if we look at the key board of a typewriter, it was laid out originally as a geometric matrix of letters; which were placed in an order which was most practical for the technology of the time. However technology has advanced greatly and keys need no longer be placed on the same geometric grid but could be placed on arcs along which the typists hands move. This would be a more ergonomic way of typing, however, we humans have created a type cast for the typewriter which does not allow us to accept new and potentially better ways of looking at the problem. It would take a manufacturer too long to convince us, so why should he? After all his prime objective is making money, not educating a public with closed minds.

The Leica also set the precedent for the user using two hands to operate the camera. It made the point that any user could be satisfied with the concept of using two hands. It would be possible today for a photographer to use one hand to hold the camera, and operate it, but designers do not seem to approach cameras with the concept as everybody accepts that two hands are necessary.

At the time however the Leica was a big step forward in both weight and volume, when compared to other cameras producing good quality prints. It also initiated the attachments for the shoulder strap (Fig 2). Previous small cameras such as the Brownie and Pocket camera were not designed for carrying on the shoulder. Today this appears a very obvious solution to transportation problems, but it did not appear so at the time, only on the third Leica did neckstrap eyelets appear.

`The Leica 250 was the first camera which could take a large spool of film for the convenience of reporters who might want to take large numbers of pictures in quick succession, without the need for changing films. Basically it was a Leica IIIa with the ends of the body enlarged to form 2 big cylindrical film chambers which could carry ten metres of film´(Fig. 3). The solution to a problem was solved again but with no consideration for the hand of the user. These cameras appear to be suited to a tripod rather than a hand. At the time ergonomics though taken into consideration, was not a studied subject. Any consideration would have been purely intuitive..

In 1930 the Leicas had introduced the completely new concept of interchangeable lenses. This allowed the photographer to take almost any conceivable shot. It was a revolutionary new concept though with disadvantages, as it allowed other manufacturers to make lenses for the Leica. Since their creation the camera and lens had been as one, but now the body could be bought as a separate instrument and a series of lenses allowed the photographer to take a picture of an image a great distance away, or of an image with a wide angle.of view.

Oscar Barnack was not however the only designer of cameras to turn his attention to the use of 35mm film, his greatest competition came from the Contax company. Contax cameras were beautifully made, complex and highly sophisticated instruments. However they cost rather more than their Leica counterparts.

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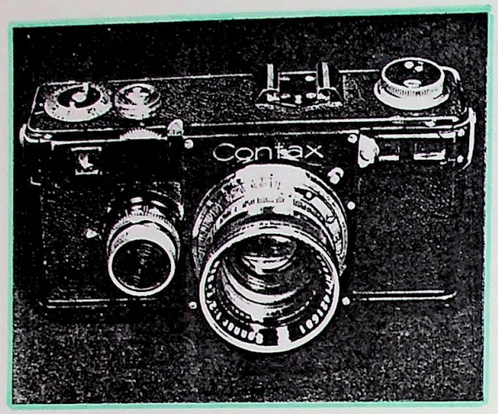
CHAPTER 3

THE CONTAX

Contax was the result of a great conglomeration of camera manufacturers. Five of Germany's manufacturers had joined the Carl Zeiss foundation as a result of the massive inflation in Germany after the War. Their lens manufacturer Carl Zeiss had brought them together because if they didn't survive neither could he. The Carl Zeiss foundation's answer to the Leica was the Contax, now known as the Contax 1. `The Contax was larger and heavier than the Leica. It had rectangular lines unlike the the rounded ends of the Leica, and had a more complex mechanism. This was as a result of Leitz's patenting of the straight forward to self-capping focal-plane shutter design. But the Contax had from the outset, two significant advantages which it was to retain until the mid fifties, a longer base and therefore a more accurate rangefinder, and a set of superior lenses.

Before we go on to consider the models of the Contax which fall into this period, it would be as well to cover some general points in connection with the lenses, and the mounting thereof, particularly in respect of certain fundamental differences between them and the Leica lenses.

All the leica lenses were made in their own focusing mounts. They all carried cylindrical cams which couple them to the rangefinder via a lever. The purpose of these cams is to impart the same amount of movement to the rangefinder, irrespective of how much the lens must move to achieve focus over any given range of distances. As we have seen, the amount of movement needed increases greatly as the focal length of the lens increases.



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On the Contax cameras the system is different. The coupling to the rangefinder is rotary. About 3/4 of a turn moves the rangefinder over its full range of about 3ft. to infinity. The focusing mount for the standard (50mm) lens is a part of the camera and the standard lenses lock into this by what is called the inner bayonet. There is also an outer bayonet, which carries coupled lenses of all other focal lengths longer or shorter than the standard ones.

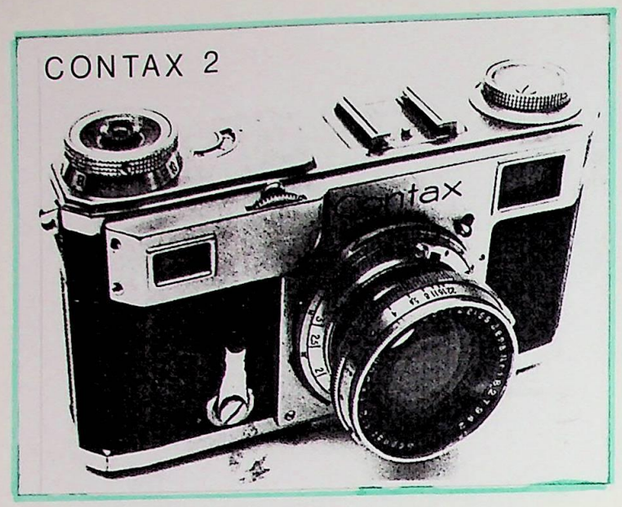
These other lenses are in their own focusing mounts, which move them all over the same focus range for the same amount of rotation although of course they must move the linear distances called for by their focal lengths to achieve this focusing range.

So they all mount onto the camera by the outer bayonet mount, and also couple rotationally to the inner bayonet mount.

This means that to change lenses you must match all settings at infinity, or the rangefinder coupling will be wrong. Lens changing is therefore more difficult than it is on the pre 1939 Leicas, which you could just screw on and off settings.

The Contax 1 (Fig. 4) which appeared in the Spring of 1932 was a very compact and solid little camera, for its time. Even so it was slightly larger than its Leitz contemporary, the Leica II, and weighed a little more. It had a built in coupled rangefinder which makes it very critical and more than twice the base length of the Leica rangefinder which makes it very critical and more useful for the longer focus coupled lenses. The winding knob of the Contax 1 is on the front of the body, just alongside the lens. By means of this knob you select your shutter speed, wind the shutter, and wind the film on as well. So double exposure is not possible.

Shutter speeds on the first batch of Contax 1 cameras ranged from 1/22 sec. to 1/1000sec.. Within a year of the first model appearing, slow speeds were added, and the Contax 1 available in 1933 had a range of shutter speeds from 1/2 to 1/1000 of a second.



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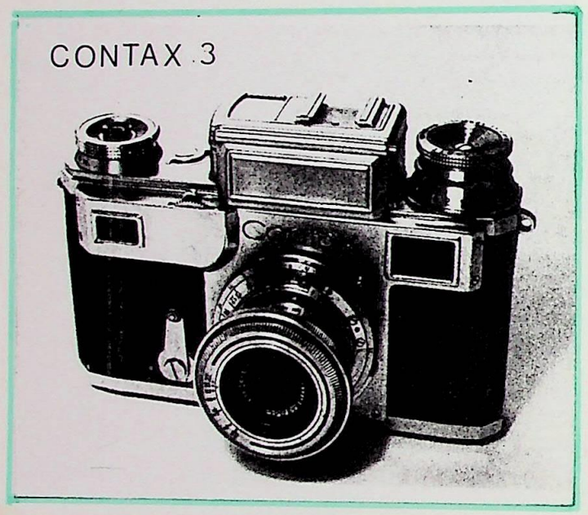

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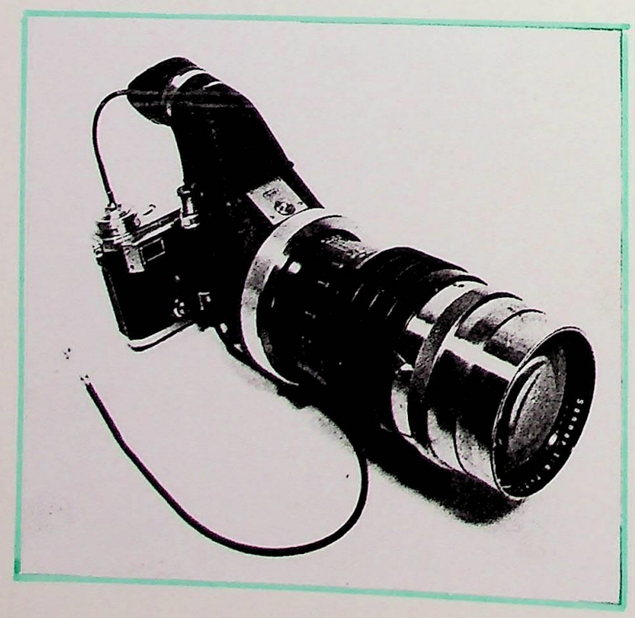

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The actual blind mechanism in the Contax 1 is repeated in the Contax II and III (Fig. 5), and in the Contaflax TLR and is worthy of special mention. It is on all metal blind, made like a very small version of the top of a roll top desk. There was a legend that his blind was so complex as to be unreliable, and that it seized up solid in cold weather. However if untampered with, the Contax shutter, was reliable.

Like the Contessa nettle shutters the Contax shutter has 3 crossing speeds, two of which are controlled by escapements, and one is direct. Slit width is also varied, so that the final exposure depends on both crossing speed and slit width.

The mechanism of these shutters was robust, however they did belong to the older generation of focal plane shutters, in which the slit moved continuously across the plate, and images of moving objects are therefore distorted. The Leica shutter was already moving towards the ideal for its lower speeds - the blind moving fast, even long exposures, and the greater part of the exposure was the period during which the shutter was wide open.

With all pre-war Contax models, there was a choice of standard lenses. Tessars at f/3.5 or f/2.8, and Sonnors at f/2 or f/1.5. Prices ranged from £27.50 to £51.50. The Leica 11, with f/3.5 Elmar which one could equate with the f/3.5 Tessar cost £26.50.

There were also ten other lenses with varying focal lengths. On the Contax, because of the greater distance (compared to the Leica) between the 2 "eyes" of the rangefinder, it was considered practical to couple lenses as much as 180mm focal length. However, there was one famous Contax lens of this focal length, the Olympia-sonnor, at f/2.8, which was used in the reflex housing, called the Flectoskop (Fig.6). In these days, before the coming of the modern SLR with its great facility for telephoto work, this very fast and massive lens was responsible for some very fast and long distance sports photography. Also used with the Flektoskop were sonnor of 300 and 50mm focal length.There was a second type of reflex housing for use with the Contax cameras called the Ponflex. This could be used with suitable long focal lenses, but its main purpose was for very precise macro work with short focus lenses.

The other models of Contax which appeared before the war broke out in 1939 were the Contax II and III. These two cameras came out together in 1936.

They were two versions of the same camera, the difference being that the Contax III incorporated a photo-electric exposure meter. This was a very sensitive meter, which was built into the camera for convenience of use, but was not coupled in any way to the exposure mechanisms of the camera.

So all points of camera design apply to the III as well as the II. Lens coupling was identical with the Contax I, and nearly all Contax lenses will fit any Contax from the first model to the last, which include the two post-war models, the IIa and the IIIa.

The shutter mechanism was basically the same as that of the Contax I, but the winding knob was transferred from the front of the camera to the top right. This was an improvement in "usability", for the major drawback in the use of the Contax I is that one finds one's self changing one's grip on the camera at eye level.

The range of shutter speeds was as the later model Contax, except for the highest speed, which was increased from 1/1000 to 1/1250 of a second.

Rangefinder and viewfinder come together in the Contax II and III, and the mechanism is smooth and precise. As on the Contax I, focusing is effected by the fingertip operation of a small knurled wheel, above the lens at about 11 o'clock. This however lead to the user sometimes covering the rangefinder while attempting to focus.

An extra feature compared to the earlier Contax is the delayed action mechanism. Having set your shutter in the normal way, you then move a small lever on the camera front through about 90^0 anticlockwise. To release you now slide a small button, just above the lever pivot, away from the lens, there is now a ten second delay until the exposure takes place.

The light meter, though very primitive by today's standards, was the most advanced for its time. It was housed on top of the camera body, and the sensitive cell, which faced forward, is covered with a door when not in use. 'This springs open with the touch of a button, and the user sees the needle move under the glass cover on top of the housing. To use the meter, the user must move the knob which he will find at the top left of the camera body. This knob is in three layers with three knurled rims, increasing in size downwards.

The top rim is in the rewind knob for the film. The middle rim is used to set the speed. The bottom rim is used to adjust the balancing circuit in the meter, it is turned until the meter needle comes to rest on a clearly marked datum. Now the user can read off his possible combinations of shutter speed and aperture on a pair of engraved scales just above the bottom rim.

Between the two great wars the camera as a precision machine had been transformed from a wooden box with glass plate negatives, to a metal machine small enough to be carried on a shoulder strap. It had shutter speeds of up to 1/1250 secs., and a system of lenses capable of recording wide angle and telephoto images. The images produced were of excellent quality. Photographs would be taken, and the camera would go unnoticed, as Alfred Steiglitze proved again and again.

The key to these phenomena had been, miniaturisation, and mass production, competitiveness and Oscar Barnack. If we look at other products and their development we see that one individual initiates the process, his product is the incarnation of an idea, produced using the technology of a particular time. If the product was successful, it became the standard to which all others were compared, they must be alike, or with tremendous advantages over the original product. If the product did not look like the original it failed.

Today it appears that increased education, and greater wealth, have led to more openmindedness and a greater or more rapid degree of change is accepted. As technology advances with great speed, products feature's and their forms are allowed to change, so the consumer's attitude must also. His or her horizon of accessible technology is broadening every day. A fear of being left behind forces people to be aware.

Between the wars, technology was advancing, though with nothing like todays speed. A products life was unlikely to be shortened by changing technology. The pocket or 35mm cameras used manufacturing techniques which remained stable for 10 - 20 years. The technological advance which occurred was the development of the built in light meter. Other changes were slow modifications of a basic principal, or completely new markets being created and then exploited. Oscar Barnack was so early in the development of serious photography that he had nothing on which to base his concept for a 35mm camera's form. His design needed to inform its user of the options, (aperture and shutter speed) available. The range was indicated using an arithmetic series engraved onto steel dials. This solution made the Leica look like a technical instrument, or machine. Barnack paid no attention to the style of his time, and he went on to ignore any trends in architecture or product design.

It appears that the camera for the journalist or serious photographer is still treated as a machine. Amateur photographers buy the camera which is closest to that which the professional uses, so that he or she will look as though he is richer, more intelligent, or serious than the people that see him. To-day we see 4cm wide shoulder straps brashly proclaiming the user an owner of a Nikon or Canon camera.

The 35mm camera never really attempted to become a product dependant on aesthetic appeal to attract consumers. It was like no other product because of the complex nature of the buyers system of values. If we look at another product like the vacuum cleaner the different system of values becomes clearer.

The vacuum cleaner would not have been used by serious, intelligent, professionals. It was not a precision instrument, and did not have a complex system of variables to display to the user. Its task, like most other consumer products, was very simple, so that if it was to sell it needed to look easy to operate, it needed to make 'women or servants', feel able to control it. The product would have to look domesticated, it was after all to be used in cosy homes. The camera was doing a professional man's job, he didn't want frills.

CHAPTER 4

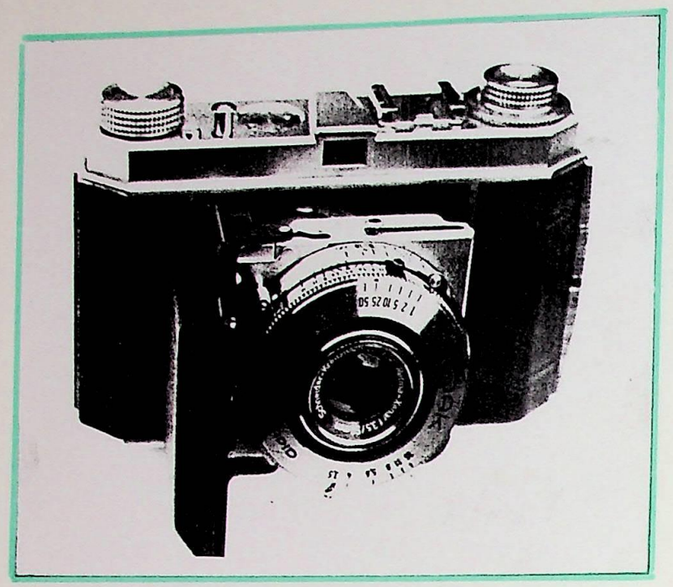
MINIATURE CAMERAS

Following in the success of the Leica and Contax a large number of other miniature cameras appeared. Some took 16 exposures, each slightly larger than the standard 35mm frame, some used perforated 35mm film and there were some which took the new Kodak 'Bantam 828' size, which was in effect unperforated stock. Apart from the first miniature SLR cameras such as the Exacta, there were two basic types to be found in these miniatures, irrespective of the type of film used.

There were the 'solid' cameras which resembled the Leica in broad configuration. And there were the miniature bellows cameras which were very positively self erecting, and form perhaps the most intriguing area of small camera design.

Taking the solids first, one chunky little camera from Kodak was the Pupille which used VP film, and dates from 1936. It had no rangefinder and used lens colour focusing, and a compur shutter. Houghtons (of England) who produced the Multex, also used VP film.

Also of this period are the earlier robot series which took negatives about one inch square on 35mm film, and had clockwork power film wind and shutter setting. This enables the operator to take up to 24 frames in rapid succession. The miniature bellows cameras are manifold. Zeiss Ikon, makers of the Contax, produced a very nice one about 1935 called the Super-nettal. This incorporated the same sort of rotating wedge rangefinder that was found on Super Ikontas, a Contax type shutter. It was made with either a 3.5 or a 2.8 Tessar and the smaller aperture camera was the nicer one of the two. At this period, an aperture of f2.8 tended to push the computation of the time a bit too far, though the modern Tessars of this aperture have not this limitation.



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Probably one of the best known and the best series of cameras in the bellows-miniature field are the Kodak Retinas. These come from their Stuttgart factory and owe a lot to the redoubtable Dr Nagel.

All of the Retina I cameras are non-rangefinder cameras using 35mm film and compur shutters. Pre-war Retinas were black-finished, it was not until after the war that the satin-chrome finish became available. They were fitted with Schneider Xenon lenses of f/3.5 aperture. They had double exposure prevention and the very precise helical focussing moved the complete shutter and lens assembly.

There are some 31 variants of the Retina I (Fig. 7), all dating from before 1939, and broadly speaking, the simpler ones are the earlier ones.

The Retina II showed up about 1938 and this had a coupled rangefinder. Many Retina II cameras however are post-war. Broadly speaking, the ones with separate rangefinders and viewfinders are pre-war. The post-war models have a combined rangefinder and viewfinder. Some Retina II cameras were fitted with f/2 Schneider Xenon lenses. Evidently Schneider, whose xenon was very like the Tessars felt that 3.5 was the biggest aperture the design could be pushed to.

Retinas were very compact and possibly the most pocketable high performance cameras of an era. The Second World War heralded the end of an era, and with it the end of an age of cameras. The Retinas and the Zeiss Contessa, carried the breed over into the years after the war.

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CHAPTER 5

THE SINGLE LENS REFLEX

The Kine Exacta (Fig. 8) was introduced by Ihagee og dresden in 1936. It was the first single lens reflex (SLR) camera for 35mm film. This camera was of all metal construction and was fitted with a multi-speed plane shutter, flash, and interchangeable lenses. With the exception of the viewfinder, the camera bears a remarkable resemblance to the modern 35mm SLR camera. Though this is the first example of a 35mm SLR, there had been many SLRs for the other film formats.

Most portable pre-photographic camera obscurers were of the reflex form in which light, after passing through the lens is reflected by a mirror inclined at 45^0 to produce an image on a horizontal ground-glass viewing screen or on thin drawing paper shaded by a hood. The image, viewed and drawn by the user standing behind the instrument was upright. Despite the popularity of this type of device, hardly any photographic cameras made before about 1890 used the reflex principle. Nearly all of them produced an upside down image on a focusing screen which, for exposure was removed and then replaced by the plate holder.

'Thomas Sutton was the first to patent a design of photographic camera using the single lens reflex principle. His camera was manufactured by optical instrument makers but was not made in any numbers. Using an ordinary mirror the image on the ground-glass was blurred due to reflections from the front and rear mirror glass. A metal reflector (or glass silvered on the surface) was required to produce a sharp reflected image and this was thought to add to the expense.'

The design of successful SLR cameras was something of a challenge. The presence of an inclined mirror, and the necessity of a focussing hood to shade the ground-glass screen made the camera larger and heavier than the more popular folding bellows cameras.

Nevertheless the SLR design had several advantages to set against these disadvantages. The users could see exactly what they were taking right up to the time of making the exposure. They could use rising front and other movements which were more difficult to use on a hand camera equipped with a small reflecting viewfinder. Using the ground-glass screen of a reflex camera was more akin to focusing on the ground-glass of a stand or a studio camera, with added advantages that the image was the right way up.

With the larger aperture lenses common after the introduction of the anastigmata, focusing was critical and hand cameras were often equipped with inadequate focusing scales. A further advantage of reflex cameras was that they were fitted with focal plane shutters which permitted very brief exposures and allowed the use of interchangeable lenses.

For these reasons quarter-plate SLR plate cameras increased in popularity after 1900 despite the fact that they were generally quite expensive. They had a faithful following particularly amongst older workers used to using the earlier field or stand cameras.

They seem rather heavy for hand use and were, no doubt, often used on tripods. Nevertheless, they were designed as hand cameras and the ability to observe, focus and expose very quickly made them particularly suitable for a new brand of photographer, the photojournalist.. Hence, earlier SLRs were often referred to as press reflexes. Nowadays a press camera for use at waist level would not be considered suitable for many press situations.

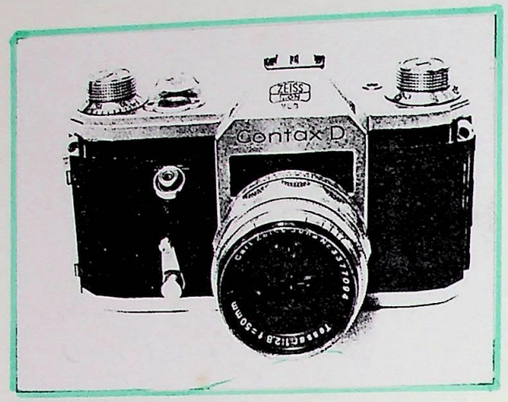
As early SLRs could only be used in the upright position with the horizontal ground-glass screen at waist level, many of the quarter plate cameras were fitted with a square reversing back which could carry the dark slide in either the vertical or horizontal image in the ground-glass screen. Most of the early SLRs have a rising movement of the lens without the crossing movement.

'To take a photograph with one of the early SLRs the loaded dark slide is placed in position and the covering slide withdrawn. The image is focused and the shutter release lever is pressed. This releases the mirror which, by means of springs, rises to a horizontal position releasing in turn the focal plane shutter. To reset the camera the mirror is allowed to return to its original inclined position and the shutter is reset.'

The large wooden bodied SLR plate camera continued to be advertised into the 1930's, but by that time they looked old-fashioned compared with the newer, smaller metal cameras which had been designed in the 1920's and 1930's and which were much more convenient to use. At the beginning of the century the serious photographer had the choice of magazine box cameras, hand and stand cameras, or the SLRs. In the thirties the magazine box cameras were obsolete but the newer twin-lens reflexes and miniatures and precision cameras (mainly in Germany) were ousting the old style cameras.

By the 1950's the 35mm SLR had not become more popular than the rangefinder which had proved its reliability during the war. However the Japanese had now entered the list of precision camera manufacturers.

The image on the focussing screen of a traditional reflex camera is of course a mirror image and is thus seen laterally reversed. A device to correct this, and allow a small reflex camera to be used at eye level, is the pentaprism viewfinder. After being reflected from an odd number of surfaces (the reflex mirror and then two internal mirrors of the pentaprism the photographer sees a right-way-round image. Reflex cameras with built-in pentaprisms were described in British patents of 1941 and 1947 but the first production single lens reflex pentaprism design came from Germany.



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In 1949 Zeiss Ikon of Dresden (in East Germany) introduced the first single lens reflex pentaprism 35mm camera, the Contax S (Fig. 9). It had a focal plane shutter with a shutter speed range of 1 to 1/1000. In 1954 Zeiss Ikon of Stuttgart (in West Germany) announced the arrival of its new 35mm SLR. It used a pentaprism, focussing was done at full aperture, on pressing the shutter release the mirror was released, the diaphragm closed to a pre-selected stop, and the shutter fired. Winding the film on reset the shutter and mirror.

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CHAPTER 6

THE JAPANESE CAMERA INDUSTRY

The Nippon Kogaku Company's first photographic products were lenses. These lenses were made as early as 1937. The company's first cameras, which appear to be based on Contax designs, were produced in 1948. However, it was not until they marketed their Nikon F (Fig.10), their first SLR 35mm camera, that the company made an impact on western camera sales

With the Korean war western journalists found it difficult to repair Leica or Contax cameras because there were few agents in the east. The journalists were forced to look at whatever the locals could produce. They tried the Nikon and were very pleased.

The Nikon F became as popular and relied upon as the Leica and the Contax had been. The 'F' was part of a system of photography. It was the body with which one could use a variety of lenses, focussing plates and film. The camera had a motor drive facility which allowed the user to shoot up to three frames per second. In 1957 the Nikon SP was the first camera to accept a battery-powered motor drive.

The 'F' featured a bayonet mount for the lenses, which the Hasleblad 500C (a roll film camera) had developed in the early 1950's.

The Japanese until this time had been producing imitations of the Leica and the Contax. The 'F' was a new departure. It was the first time a Japanese camera manufacturer had come up with a new concept, or way of using technology. The form of the 'F' had its origins clearly based on the status quo rangefinders, but with a large box over the lens, this was the pentaprism. The cameras was very heavy, using almost entirely metal and glass, the form was utilitarian, it was the smallest possible to carry out the required task. It was as though the designers attached the necessary components to the light-tight box. The result was once more a very machine-like object with little styling.

The dials, as on other cameras were small and smooth running. They would not facilitate a users gloved hand but then again no other camera manufacturer attempted to either. The cameras were built to withstand operating at low temperatures and the manual manipulation of the dials was not considered a problem in these conditions.

The Nikon F might be said to mark the beginning of an era when a professional photographer was more likely to choose a Japanese camera than a German one. It was only a few years after the introduction of the camera that the total number of cameras of all types produced in Japan for the first time exceeded the number made in Germany. The Nikon F was available for about a dozen years during which time the range of lenses, viewfinders and accessories was increased to produce a system of photography hitherto unavailable.

Throughout the 1960's Japanese cameras continued to be manufactured by traditional engineering methods with the materials that precision was then seen to require, steel, brass and an abundance of glass. The instant returning mirror in the 35mm SLR had been developed by the Japanese, though the Swiss manufacturers of the Alpa reflex cameras did come closely behind

By 1962 the exposure meter had been coupled with the lens aperture and shutter speed. It took the form of the Nikon's first photomic finder, which was 'the box ', placed on top of the Nikon F body. The removable pentaprism allowed the user to look through the viewfinder at waist level, allowing the photographer to choose. With time the operator began to choose the pentaprism and later 35mm SLRs had non-removable pentaprisms.

There were many producers of 35mm SLRs, throughout Japan but Nikon was possibly the most innovative, and reliable, though very expensive.

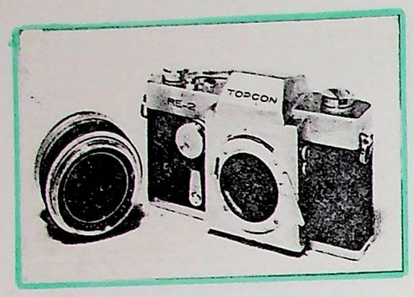
With the evolution of electronic technology the photoelectric cell began to adapt more to cameras. They began to automate the balance between shutter speed; light available; and the aperture. One of the earliest examples of this was the Zeiss Ikon Contaflex Superb (1965). In this camera a selenium photo cell determines the lens aperture and exposure. There is a manual override.

In Japan, the Chiyoda Kogaku Seiko K K of Osaka, first became known for Minolta cameras in the 1930s. When Europe and America were becoming aware of the Japanese Camera industry in the early 60's, Minolta Cameras made a large inroad. In 1961 the Minolta was advertised as one of the most popular SLRs available. In the same year Minolta claimed to be the manufacturers of the world's first automatic electric eye SLR.

They were talking about the 'Minolta E R'. This camera is a pentaprism reflex with a selenium cell on the front of the pentaprism. The iris diaphragm is automatically set by the photocell. The shutter and the film speed are set manually. The cell did not read from light coming through the lens, which would have given the true light reading for the image to be recorded. That however was to come shortly.

By 1968 the Praktica Super TL was available. It was a pentaprism reflex with through the lens metering. Part of the light came through the lens and was deflected to cadmium sulphide cell which provided the metering system. In use a photographer (after setting the film speed) would preselect either the exposure speed or the aperture. He would then depress the metering key. While the key was depressed either the aperture or the exposure speed would be altered to bring the meter needle, (seen in the viewfinder), to a centre point. The camera would then be focused and the shutter released.

In 1972 Asahi Pentax released the Spotmatic II, a 35mm SLR with through-the -lens (TTL) metering. This was the most sophisticated form of built-in exposure meter in which the brightness of the actual lens image can be measured.



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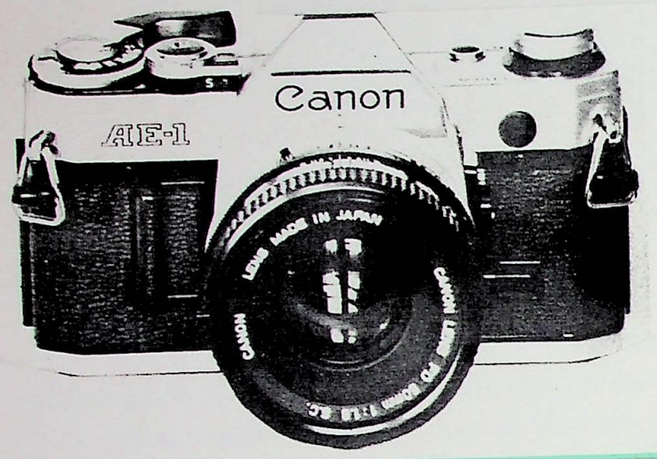
The Spotmatic had two cadmium sulphide cells, one on each side of the mirror in the pentaprism viewfinder. A pointer with + or – correction is fitted in the viewfinder with an on/off switch on the side of the lens housing. This allows the photographer to carry out any required adjustments such as focusing while looking through the viewfinder.

'Through the lens', metering first came on to the market in 1963 with the Topcon RE Super. The Topcon RE2 (Fig. 11) was issued shortly afterwards with the same metering system. The exposure meter was an integral part of the reflex mirror. 'Narrow 0.002inch non-silvered strips in the mirror surface permitted 7% of the light transmitted by the lens to reach the meter without obstructing the view seen in the pentaprism viewfinder. The strips were located to give an average reading for the whole subject area.'



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CHAPTER 7

THE ELECTRONIC REVOLUTION

Overall the 35mm SLRs form had changed little, it appeared to be a Leica with pentaprism stuck on. Some of the cameras had become more boxy, and machine-like, though getting smaller and lighter. The sides of the camera were still wallpapered with letherette. Only the inner form was changing.

By 1976 another successful Japanese camera manufacturer produced a very advanced camera, the Canon AEI (Fig. 12). This camera maintains the 35mm SLR standard form externally. In fact it is a sophisticated precision instrument incorporating a micro-processor which handles three of the basic functions of a computer; calculating, memory and control. This enables the camera to sense information and transmit it to the control processing unit where it is analysed, and from this in turn are sent out commands which control the automatic exposure meter. By 1980 4,000,000 AEIs had been sold, it was the best selling SLR ever made. Part cut aways of the AEI reveal that the electronic circuitry of the camera was wrapped around the existing form of the SLR, though the circuitry could have taken any form!. The viewfinder includes two light emitting diodes indicating whether there is enough light to shoot, and whether the camera is manually or automatically set. The aperture selected is indicated on a scale which can also be seen in the viewfinder.

The Canon AI was manufactured in 1978, the most advanced camera of its time. It had five automatic exposure modes; shutter speed priority, aperture priority, programmed automation stopped down, and electronic flash.

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These can be summarised as follows. 'With the camera set for shutter priority the aperture is set correctly, the diaphragm remains open for focusing and viewing but stops down before the actual exposure is made. The programmed automation mode computes both aperture and shutter combination for a given lens setting and allows the photographer simply to point and shoot. The stopped down mode provides automatic exposure control even while the aperture is manually stopped down for close-work. The electronic flash mode regulates automatically shutter speed and aperture according to the light emitted. The camera can also be used manually. All the information related to these functions can be read out on a digital display in the viewfinder.' A motordrive unit which operated at 5 frames per. sec. was available for the Canon A-I (Fig. 14).

The Nikon F had done for the Nikon Company what the Model T had done for the Ford motorworks. The 'F' had created professional appeal, for photojournalists. Its reliability, and range of accessories,meant that professionals would never have to leave the Nikon range, because the most up to date accessories could be attached to the 'F's' body. When the Nikon F2 became available, photographers could buy the body and continue to use the old accessories. Being the first system 35mm SLR camera, meant that nearly all photojournalists chose it, they have stayed with the system to this day.

It appears that the solidness and high precision of the Nikon cameras was always accepted as most suited to non-stop all-year-round use. The Canon AEI, and A-I were each two years ahead of similar Nikon cameras,(technologically). Nikon still however has the aura of being the finest 35mm SLR.

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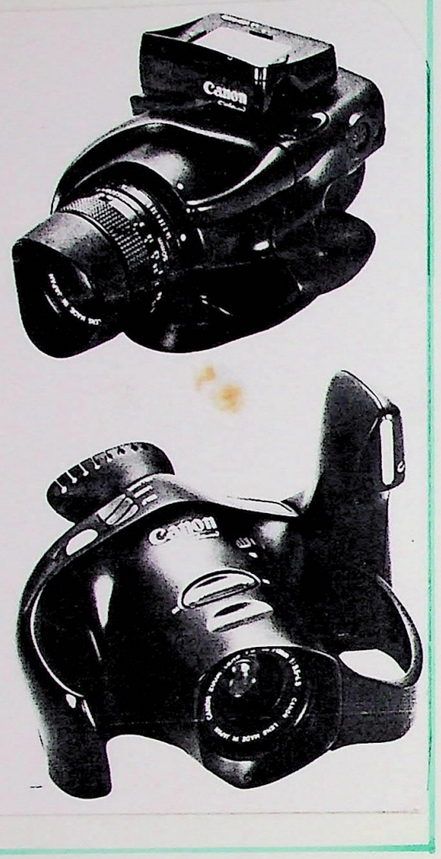
The `T70´ is visually similar to the `T50´

(pictures of the `T50´ are unavailable in Ireland)

As the seventies began, so did the revolution in materials and technology that was to complete the decline of the German Camera Industry and provide the foundation for the total Japanese domination of camera manufacturing. As the decade wore on camera designers made vastly increased use of engineering plastics instead of metals for camera casings and film transport gearing. They installed electronically timed shutters of great accuracy and extended speed range instead of shutters timed by mechanical escapement derived from the watch industry. Electronic exposure-measurement systems to replace the electro-mechanical galvanometer based meters that had been used in early exposure systems were also devised. All of these developments greatly reduced the weight of the camera; dramatically increased the range of facilities it offered, and functions of which it was capable; and most significantly of all, drastically reduced its real cost. When we compare camera prices of 1970 and the mid-1980's, remembering that the cost of living quadrupled, we find the following. In 1970 the Nikon Photomic F Tn with 50mm f/1.4 Nikkor lens cost around £ 311 17s. When we multiply this by 4 we get £1240, the cost to-day however of the Nikon F3 with F/1.4 Nikkon lens is £500. The F3 is a very much more advanced, and lighter camera than the F, as we can see its real cost has dropped very considerably.

The electronic revolution that we are finding so difficult to deal with had just brought us the Canon A-1. The next great leap came in the form of the Canon T50 (Fig. 14).

The large manufacturers in Japan, though revolutionary in the electronic design of cameras had never paid too much attention to the external image of the camera. The changes that they made were very small. Miniaturisation of the workings however gave the designers freedom to change the form of the camera. Canon made the first changes and all of the other manufacturers followed suit.



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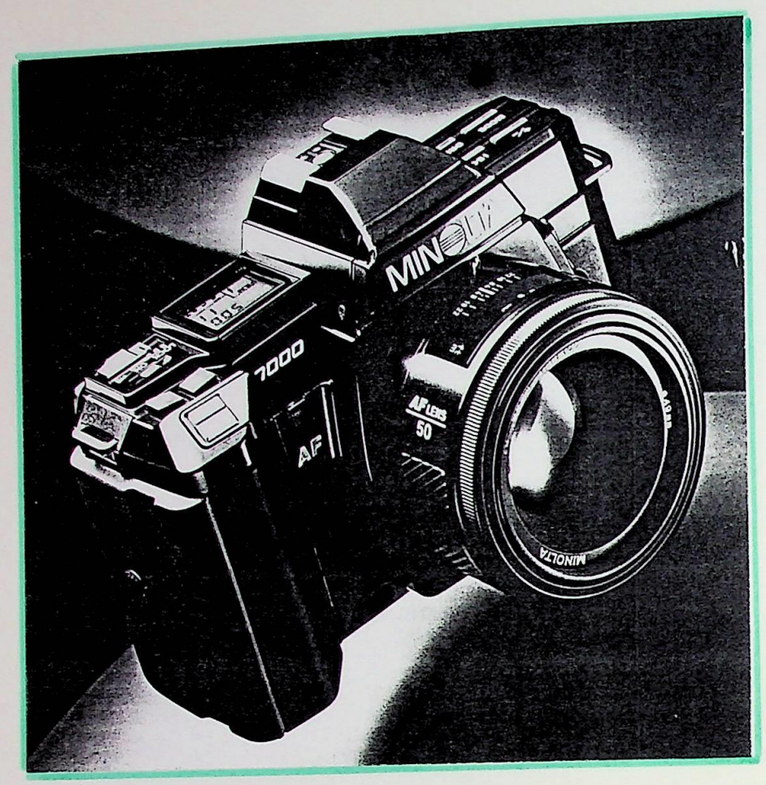
CHAPTER 8

THE NEW FORM

Canon first began to look at the whole concept of the camera's form when, with technological advance, the inclusion of a motor to wind the film on made the wind-on handle obsolete. Push buttons rather than dials could be used: and LCD displays could be used to display information. Wataru Nagaska, (General Manager of the Canon Industrial Design Division), decided to "design the camera from scratch".

He was to be helped in the task of rearranging the form, by the visionary ' bio-form' designer Luigi Colani. Colani had a fascination with the world beneath the sea, and found that this knowledge helped him look at products with a new insight. He was not affected by the cast forms already in existence He designed his products using curves rather than straight lines. If we look at nature, or the human form, we are hard pressed to find straight lines, so why are man made products so geometrically regular ? The answer is quite simple, it is easier to technically draw, and make tools for straight line objects. Colani did not let this motivation affect him. His designs for Canon were outrageous by Canon standards (Fig. 15), however they gave Nagasaka some fresh ideas. He saw that the curves were more comfortable, and therefore tried to encapsulate the type-cast 35mm SLR with the new curvaciousness, he wanted to show the world a camera that would not alienate users, but would make them feel that the camera was modern, very sophisticated but also a 35mm SLR, and comfortable to use.

The camera was treated as one unit, the handle became integrated with the body. The areas where the hand came into contact with the camera were shaped to fit the hand, whereas up until this point the users hand was forced to grapple with rectangular boxes. The transformation is similar to that which took place when Fiskers came up with their revolutionary new scissors handle, which almost all quality manufacturers now use.



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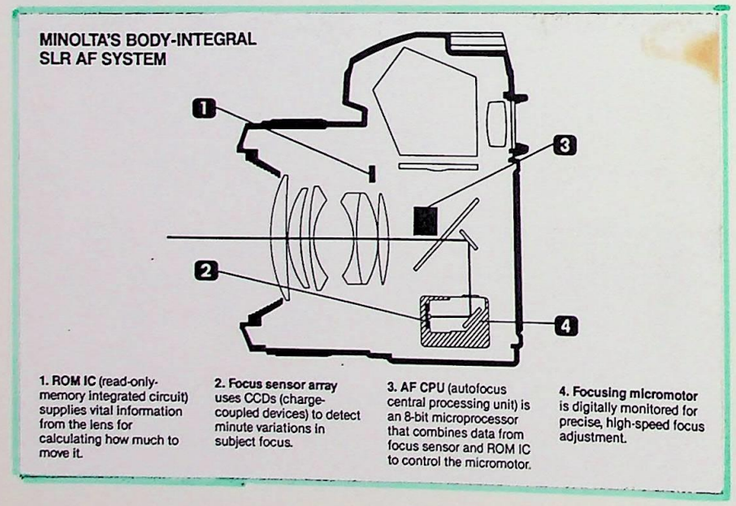

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In 1985 Minolta released the first camera with a built in auto-focus,(A.F.). The body of the Minolta 7000 (Fig. 16) had a built in motor which automatically focused the images seen by the user. Light from the image seen by the user pass through the reflex mirror and is electronically processed, the amount of movement necessary in the lens is then calculated and carried out by a motor built into the camera body (Fig. 17).

As early as 1978, Konica had produced an A.F. camera. It was a compact 35mm. The camera contained what was basically an optical rangefinder, but the human factor, is replaced by the visitronic Auto/Focus Module, on integrated circuit devised by Honywell Inc. The Minolta 7000 and almost all 35mm SLRs have since used this technology to become auto-focus cameras with interchangeable lenses. The Minolta uses all push-button mechanisms with information displayed on a LCD screen on the upper surface. Though the camera was designed after the Colanis Canon T50 the Minolta is very much less curvy, but does have the lump grip for the operator's right hand. The shutter release on the Minolta is on an angled surface which is more ergonomically pleasing to use.


Canon
EOS
650
CANON LENS EF 50mm 1:1.8
CANON LENS MADE IN JAPAN

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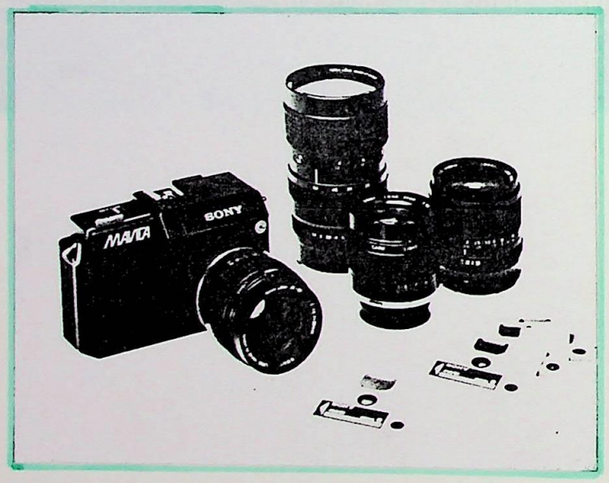

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Since the late seventies, many compact 35mm cameras had included in them built-in electronic flashes. However it was not until 1985 that 35mm SLR cameras began to include built-in flashes. Now almost all up-market SLRs include a small flash which is either built into the pentaprism or handle (Fig. 18). This means that combined with autofocus, the user can take pictures (in focus) in complete darkness. The cameras with built-in flash use infrared light beams as a means of focusing. The camera sends out the beams of light and calculates the distance of the object by measuring the amount of time that it takes for the infrared light to return. This information is then sent to the autofocus device which focuses the lens in 0.3 of a second. Mode choice is quite simple, with a cart wheel beside the shutter release. By moving it with the index finger of the right hand, and locking the mode with a push-button on the left of the camera the choice is very simple. The form of the EOS (Fig. 19) is very graceful, and curvaceous, Colani having had great influence. Though the grip for the right hand appears large it is extremely comfortable to hold and use.

The 35mm SLR has become an electronic piece of machinery. It is very comfortable and easy to use and has dropped very considerably in real cost. The facilities made available to the user would have been inconceivable to anyone 20 years ago, the rate of technological advance being very great. When we look back to Oscar Barnack's Leica, and its steadfastness over a 25 year period, we then get some idea of the rate of change !

The 35mm SLR still has a great sense of identity however, in fact so much so that the newest form of camera,Sony's electronic still camera, the Mavica (Fig. 20), has borrowed the form of the 35mm SLR, eventhough the Mavica needs nothing like the same form to function. When Colani presented Canon with his original concepts for the new 35mm SLR,they would not accept them because they were too alien to earlier form.

Canon like most large manufacturers realise that peoples environments are changing with greater speed than at any other time in man's evolution. To make the user less intimidated, Canon have not allowed their designers to depart too far from the Leica shape with a pentaprism stuck on top. They use this form to help people recognise the camera. This philosophy is very easy and makes commercial sense but can be very disenchanting for designers.

CHAPTER 9

CONCLUSION

The 35mm SLR has now automated all of the tasks that photographers used to carry out. The photographer only has to choose the image that he or she wishes to record. There is no need to be expert "to take photographs like an expert" as Nikon state

To achieve this state of the art camera, it has taken 60 years. It is due to the work of many designers, their knowledge of technology, and simple inspiration. Luigi Colani individually changed the way in which the whole camera industry looked at ergonomics, while Oscar Barnack created the whole concept of the 35mm camera. When we realise how much one individual can contribute, by looking at these men,it makes the task of industrial design a very challenging and worthwhile one.

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