The Kodak Ciné-Kodak Special
16 mm motion picture cameras

Douglas A. Kerr

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ABSTRACT

In 1933, Eastman Kodak Company introduced the Ciné-Kodak Special professional 16 mm motion picture camera. In 1948, it was succeeded by the Ciné-Kodak Special II. This article describes these cameras in considerable detail, including extensive discussions of various pivotal mechanisms.

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1. INTRODUCTION

In 1923, Eastman Kodak Company introduced 16 mm motion picture film and the first of a series of cameras to use it, the Ciné-Kodak (later known as the Ciné-Kodak Model A). This brought for the first time (in the U.S., at least) practical motion picture photography to individuals, creating an activity later often described as "home movies".

But the potential of this medium for promotional, educational, industrial, medical, and scientific motion pictures was soon recognized. To cater to that, Kodak introduced in 1933 the Ciné-Kodak Special, a remarkable, highly sophisticated, very versatile professional 16 mm motion picture camera. In 1948, it was superseded by the Ciné-Kodak Special II, a very similar camera but which incorporated several very pivotal design improvements. This camera was made until 1961.

In this article we will learn of the history, capabilities, and detailed working of these cameras, which are indeed "special".

2. ODDS AND ENDS

2.1 My approach

There is great continuity between the two cameras discussed here, the "original" Ciné-Kodak Special and its successor, the Ciné-Kodak Special II. So this article is organized into sections for various aspects of these cameras, within each of which I will then compare and contrast the details as they apply to the two different cameras.

The sequence of sections may at first seem odd, but it is intended to lead the reader through the whole matter in a useful way.

2.2 Information sources

This article is based on information from:

- Countless photographs found in the Internet, many from eBay listings offering such cameras for sale.
- The official user manuals for these cameras.
- Kodak promotional literature and advertisements for these cameras.
- Observations from various collectors of motion picture cameras.
- Detailed study of the Ciné-Kodak Special and Ciné-Kodak Special II cameras we are fortunate to have in our personal collection.

2.3 Caveat

During the life of these cameras there were many design changes, some visible to the user and other buried within the machinery. I am not at all acquainted with most of these.

2.4 Terminology

2.4.1 *The cameras*

For conciseness, I will often refer to the Ciné-Kodak Special camera as a "CKS1" and the Ciné-Kodak Special II camera as a "CKS2" (and "CKS" to refer to both collectively).

2.4.2 *That pesky accent aigu*

The word (or particle) "ciné" is widely used in the realm of motion pictures. Its origin is (not surprisingly) French, descending in a number of stages from the word *cinématographe*, coined in the 1890s by the Lumière brothers, pioneers of motion picture photography. It was formed by combining Gallicized forms of the Greek words for "to move" and "to write".

And of course this word appears in the official model names of the cameras we study here (and in the official model names of essentially all Kodak motion picture cameras through the late 1950s, always in the marque "Ciné-Kodak").

But as to the rendering of the model name on camera nameplates, Kodak's practice is erratic, at best. Sometimes the terminal "e" carries its *accent aigu*, and sometimes not.

It is tempting to try and blame this on the standard French typographical rules of the time, in which upper-case letters do not carry accent marks except in certain special cases. The basic reason is

that there are typographical problems in rendering upper-case letters with accent marks. But one of those exceptions is that the upper-case letter “É” should be rendered with the accent mark if that is needed to remove ambiguity as to the word that is meant.

But that doesn’t seem to fit the practice here. On camera nameplates we have “Cine-Kodak” and “Ciné-Kodak” and “CINE-KODAK” and “CINÉ-KODAK” Perhaps the decision was made by the graphic artist that designed the nameplate, possibly based on the tools at his disposal.

And the cameras we discuss here, the Ciné-Kodak Special family, over the years have carried, on nameplates of generally unvarying design both “CINE-KODAK” and CINÉ-KODAK, without apparent rhyme or reason. *Fouille moi*!

3. A FIRST LOOK

3.1 Ciné Kodak Special

In figure 1 we see a typical Ciné-Kodak Special camera (CKS1), equipped with a basic set of lenses.

Figure 1. Kodak Ciné-Kodak 16 mm camera

3.2 Ciné Kodak Special II

In figure 2 we see a typical Ciné-Kodak Special II camera (CKS2).

Figure 2. Kodak Ciné-Kodak II 16 mm camera

We can see that these two models, introduced 15 years apart, are very, very similar.

4. THE FILM

The Ciné-Kodak Special cameras (both models) utilize 16 mm film stock, which can be either single- or double perforated. The film is in "roll" form, actually meaning that it is provided on a spool. It is handled in the camera in a unique fashion, which we will look into later.

The film most commonly used is of the "reversal" type (black and white or color), which produces a positive image after development. But negative film can certainly be utilized when required by the workflow of the "production".

5. THE "CONTROL PANEL"

On both models, many of the control and operating features we will discuss are located on what I will call the "control panel. We see the control panel of a typical Ciné-Kodak II in figure 3. I will reference it at various places throughout the article.

Figure 3. Ciné-Kodak II "control panel"

6. SPRING MOTOR DRIVE AND OPERATION

6.1 The spring motor

The Ciné-Kodak Special cameras (like all Ciné-Kodak cameras) normally operate from a crank-wound spring motor. Contrary to all other Ciné-Kodak cameras, the crank is wound counterclockwise. (But there is a discrete arrow on the control panel to alert us to that!)

When done winding, the crank must be disengaged from the crank shaft (because it rotates when the camera is running). The crank handle can be folded back, disengaging it from the shaft, and "parked" by engaging a hole on the crank handle with a small pin on the right side of the camera near the top. In the CKS2, a spring detent in the handle engages a groove in the parking pin to keep the handle in place. (Yes, the one seen in figure 2 is not properly parked.)

A full wind of the spring is enough to shoot 38 feet of film. At a frame rate of 16 frames/second that is 95 seconds of shooting.

In the CKS2, when winding, a bell sounds when the spring is "3 feet worth" from fully wound. When shooting, when there is only "3 feet worth" of wind left, the bell also rings.

6.2 Frame rate

The camera can be set to operate at any frame rate from 8 fr/s to 64 fr/s by turning a knob on the control panel (see figure 3). The knob

has markings at 8, 16, 24, 32, and 64 fr/s, considered to be the “available frame rates”.

An 8 fr/sec rate had traditionally been used to permit shooting under lower light conditions that would otherwise be possible (as it increases the exposure time). Of course a side effect is that the apparent speed of motion of the moving subject when the film is viewed is twice what it actually was. And of course this doubling of speed can be used intentionally for comedic effect.

The 16 fr/s frame rate is the norm for 16 mm silent motion pictures. A 24 fr/s rate (used for 16 mm sound films) is most often used when a magnetic sound track is to be laid on the film after development, or when the film shot is to be integrated into a production with sound during post production.

The higher frame rates are most often used for “slow motion” effects.

6.3 Continuous operation

The camera is operated by pressing a button located on the front of the camera, below the turret, near the right side. If the button is pressed down after it is pressed in, it locks. allowing the camera to run continuously without any pressure on the button. The button is released by just pressing it upwards.

6.4 Stopping from operation at higher frame rates

When the camera is stopped, it is stopped at a specific phase of the mechanism, with the film properly located at a frame position and the shutter closed. This discrete stopping process is ordinarily “sudden”, typically done by a latch engaging a tooth on a wheel that rotates once per frame.

When the camera is run at higher frame rates, this sudden stopping would put quite a strain on the mechanism. In the CKS cameras, when running at higher frame rates, releasing the run button doesn’t stop the camera ”suddenly”. Rather a brake brings the camera down to about “normal” operating speed before the discrete stopping arrangement is engaged.

6.5 Single-frame exposure

By sliding down a button on the control panel (see figure 3) the camera can be made to expose a single frame. This is useful for stop motion animation. When that button is not needed, it can be retired to where it is flush with the control panel so it will not be inadvertently operated.

6.6 Hand crank operation

A smaller crank (the "hand crank") can be fitted to either of two shafts accessible through the control panel (see figure 3) to operate the camera "by hand" rather than under power of the spring motor. The two shafts have different gear ratios. One will expose 8 frames for each revolution (the same as in classical hand-cranked motion picture cameras, such as the original Ciné-Kodak). The other will expose one frame per revolution.

These shafts can be turned in either direction so as to make the camera operate in the normal or reverse direction. Of course, which direction of rotation is for which direction of camera operation is reversed between the two shafts!

Operation in the hand cranked mode is useful in several situations, including:

- When one must take a continuous shot longer than the time provided by the spring motor when fully wound. The governor that controls the speed of the camera when running from the spring motor is in operation and can be used to regulate the operator's cranking to maintain the desired frame rate.

- When we wish to take a "reversed" shot, perhaps for comic effect (as to make it appear that a diver is shooting out of the water).

- When a section of film is to be exposed twice, perhaps with masks in place to give a "split screen" effect, or perhaps for an actual "double exposure" effect.

In doing the latter, there are (at least) two special considerations:

- We must keep track of exactly how far the film is "wound back" for each pass. Special features to assist in this will be discussed in section 15.3 .

- During the back wind, we must prevent the film from being exposed. A feature that will let us do that is discussed in section 10.3 .

The hand cranking process can get tangled up with the motor drive spring system, and various precautions and maneuvers must be used to avoid catastrophes in that regard. The manual is very thorough about this.

When the hand crank is not being used. it must not be engaged with either of the hand crank shafts. When not being used, the hand crank can be left on the 8 frame shaft, the handle folded back to disengage

it from the shaft, and its knob parked in a little niche on the lower edge of the camera, where it will be held by a spring clip.

Except on the earliest CKS1 cameras, there is a slide that locks the hand crank hub on whichever shaft it might be on so the crank will not inadvertently come free. This is engaged or released with a little button slide on the control panel (see figure 3).

On the earliest CKS1 cameras, the crank is retained by a groove on the crank hub being engaged by a spring ring in the recess around the shaft. But because the crank handle is connected to one side of the hub, it is really tricky to disengage the crank.

Many users of a CKS camera never needed to use the hand crank. So, to prevent losing it, or getting their coat sleeve caught on it, they may have put in a drawer someplace rather than leaving it parked. Thus antique CKS cameras bought at auction often don't have a hand crank.

7. TURRET, LENS MOUNT, AND LENSES

7.1 The turret

7.1.1 *Introduction*

Both versions of the camera are equipped with a two position lens turret. Unlike the turrets found later on many ciné cameras, which are almost invariably round, the CKS turret is basically square, leading to a unified appearance for the camera.

7.1.2 *On the Ciné-Kodak Special*

The turret in the CKS1 is a flat slab, which rotates on a plate mounted on the front plate of the camera, a thick flat slab.

The lenses are attached to the turret with a mount that is unique to this model (it is not even used on the CKS2). It is often called the Ciné-Kodak Special mount. We will discuss it at length shortly.

The turret can be rotated in either direction to switch between lenses; there is no latch to release first. A detent holds the turret in either of its operating positions.

The axes of the lenses are parallel. As a result, if lenses have shades of consequential diameter they may not be able to coexist on the turret. Or, if one lens has a wide field of view, and the other lens is physically long, the second lens may intrude into the field of view of the first lens. This problem will be mitigated by the turret design of the CKS2.

7.1.3 *On the Ciné-Kodak Special II*

The turret in the CKS2 has a "roof shaped" front surface. The result is that the axes of the two lenses diverge, mitigating the possible inter-lens conflicts discussed above. The turret is also slightly wider than the one on the CKS1, giving a further separation in the lens axes. We see this turret configuration in figure 4, adapted from a figure in the patent on the turret.

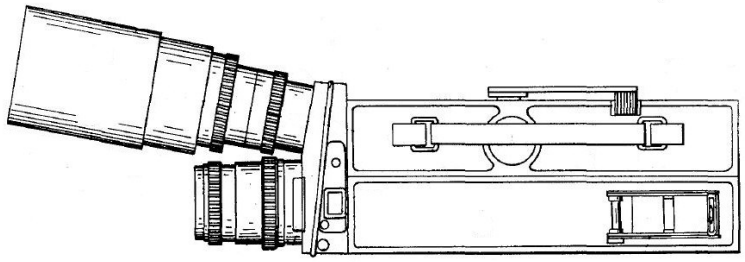

Figure 4. Ciné-Kodak II Turret geometry

So that the active lens will have its axis aligned with the camera axis, the camera front plate, on which is mounted the plate on which the turret rotates, has its front face canted. And it slightly overhangs the camera body to the right, to accommodate the wider turret plate.

The divergence of the axes of the two lenses is actually slightly greater than seen here. The "ridge line" of the roof-shaped front face of the turret is not quite vertical, and as a result the lens we see uppermost in the figure has its axis a little downward as well as being aimed away horizontally.

The turret is equipped with stops so it can be only rotated though a range of 180°.[1] To go from "position 1" to "position 2", the turret must be rotated in one direction. To go from "position 2" to "position 1", the turret must be rotated in the other direction. Prominent arrows on the turret plate show which way it can be rotated from its current situation.

As with the turret on the CKS1, there is a detent to hold the turret plate in either of its operating positions. In this version, the detent will also hold the turret plate in place when revolved halfway between operating positions (in which case, the turret plate being square, it still

[1] According to the patent, this limitation averts some sort of conflict, apparently when lenses with an especially large rearward protuberance are fitted, But that would only work if the problematical lens were fitted in a certain one of the two turret positions, and I can't find any reference to that in the manual. This may be a solution to a problem that had somehow evaporated before the solution arrived.

lines up nicely with the camera's front). We are not sure of the purpose of this feature.

The lenses are attached to the turret with a different mount than on the CKS1, called the Type S mount. We will discuss it at length shortly.

7.2 The lens mounts

7.2.1 *On the Ciné-Kodak Special*

As mentioned above, on the CKS1 the lenses are attached with a mount that is unique to this model, not even being used on the CKS2. It does, however, use exactly the same principle (in a different arrangement) as on two other types of mount, each used on essentially only one other Ciné-Kodak camera model. The mount used here is often described as the Ciné-Kodak Special mount.

We see this mount, of course on a CKS1, in figure 5. The picture is annotated to facilitate reference.

Figure 5. Lens mount on Ciné-Kodak Special

The mount we see is for the "active" lens; we partially see the other lens, upside down, to the left.

On the turret side of this mount there are two studs (S), located at about 5 o'clock and 11 o'clock. The studs are threaded into the turret plate.

The lens itself is fastened into a hub on what I will call the *foot plate* (F) of its mount. That has a "flag" at the top, used to support the viewfinder lens (VL), about which more later. But much of the foot plate is hidden in this view.

A short cylindrical sleeve on the hub (we can see it as C in figure 6, which shows the mount from behind), projecting through the foot plate, fits into a hole on the turret plate.

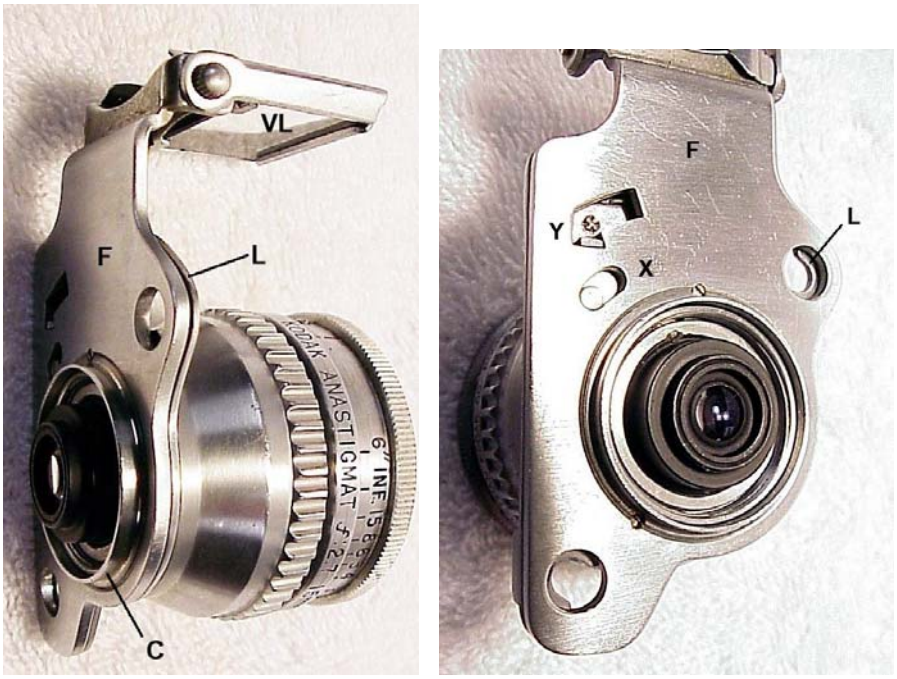

Figure 6. Ciné-Kodak Special mount from camera side

A shoulder on the boss lies against the turret plate (assuming that the mount is pressed toward the camera; it is, as we will see shortly). Thus the lens is precisely located in both lateral position and azimuth (pointing direction).

The foot plate has a hole in it for each of the two studs, so the lens assembly can be put in place with its foot plate located by its engagement with the studs.

In front of the foot plate is another metal plate of generally similar overall shape. I will call this the lock plate (L). It is held in place against the foot plate by a shoulder on the hub, but not tightly. Thus it can rotate on the mount barrel. However, its rotation is limited by a pin extending from the lock plate into a small circular arc in the foot plate. We see that arrangement at X in figure 6, which shows a typical mount of this type from the camera side.

The lock plate is also provided with a hole for each stud, but these are "keyhole" shaped, with their narrow "tails" extending in a

circumferential direction, counterclockwise (as we would see the lens in place).

With the lens and mount ready to be mounted, the lock plate is in a position where the round portions of the keyholes align with the round holes on the foot plate (this is a position slightly counterclockwise from where we see it in figures 5 and 6). Then the whole lens assembly can be put in place over the studs.

Next the lock plate is rotated slightly clockwise (probably by pushing on the button, B, in figure 5, and perhaps also by pressing on the tab, T). The result is that the narrow parts of the keyholes now fit into the grooves on the studs, locking the whole assembly in place. We see the assembly in this situation in both the figures.

Then, a small latch on the back of the lock plate drops into a notch on the foot plate, locking the lock plate against inadvertent disengagement (we see this at Y in figure 6).

When it is time to remove the lens, the user moves button B upward, releasing the latch and allowing the lock plate to be rotated counterclockwise (using the button as a handle, and perhaps also pulling on tab T), releasing the lens assembly for removal from the camera.

Looking into a further subtlety, we can see from the left hand panel of figure 6 that the lock plate, which is thin and made of a springy metal, is slightly “dished” (concave away from the camera). The annular grooves in the studs have tapered faces. The locking features of the lock plate, in its relaxed state, are a little outboard of where they can gladly enter the grooves. But they cam themselves into place along the tapered faces of the grooves, the lock plate flexing toward the foot plate in the process. Thus the retention of the lens assembly to the camera is spring loaded, assuring that the proper lens position is attained in the face of small tolerance variations in the components.

Quite commonly, and as seem in these pictures, the lens assembly may carry, on the “flag” of the foot plate, a viewfinder lens (VL). This will be the front lens of the open eyelevel viewfinder on the top of the camera when this “taking” lens is in place. We will discuss this in section 8. .

7.2.2 *On the Ciné-Kodak Special II*

As mentioned earlier, on the CKS2 the lenses are attached by what is called a Type S mount.

The principle of the Type S mount can be seen in figure 7, which shows the “toward the camera” end of a typical lens with that mount.

Figure 7. Typical S mount on lens

The cylindrical barrel of the mount enters a matching opening in the camera. The single locating pin enters a slot in the camera to assure proper rotational position of the lens. Just above the flange on the mount is a set of fine pitch threads.[2]

Figure 8. Type S mount locking rings on Ciné-Kodak Special II

Figure 8 shows the turret of a CKS2, with an "empty" lens position, allowing us to see how the camera side of the mount is arranged.

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[2] This is a "four start" thread, meaning that there are four separate helical ridges traveling side by side (or "interleaved"). This facilitates "starting" the ring onto the lens, as there are four rotational positions of the ring for which engagement can start.

Actually there are four slots in the camera, 90° apart. This allows the lens to be mounted in one of four rotational positions. This is often needed for various reasons in connection with professional cinematography. We can see two of those slots.

The lens is pulled into place and held there by a ring, permanently part of the camera side of the mount, but free to rotate, which has internal threads matching the external threads we see on the lens assembly.

The rings in fact have ball bearings at the point they bear on a thrust flange in the fixed part of the mount, an elegant implementation.

The rings are provided with a nice coarse toothed exterior to facilitate its manipulation.

8. THE VIEWFINDER

8.1 Introduction

On either CKS camera, the basic viewfinder is a folding open type, mostly operated as a reverse Galilean type. The rear lens of the viewfinder is mounted in a folding bracket located at the rear of the cameras. (Specifically, on the film magazine.)

In order that the field of view of the viewfinder will correspond to the field of view of the camera as given by the currently active “taking lens”, the front viewfinder lens must have a focal length that is properly related to the focal length of the “taking” lens assembly. In either type of CKS camera, the viewfinder front lens travels with the taking lens on the turret to keep that situation working. But the mechanics of that are quite different between the two versions.

8.2 On the Ciné-Kodak Special

On the CKS1, each lens carries with it, on an upward extension of the mount plate, the appropriate viewfinder front lens. We see such a viewfinder lens in figure 5, labeled as VL.

On the currently inactive lens, its viewfinder lens would extend downward and, among other things, get in the way of the operating button. Thus, the viewfinder lens can be folded back against the lens mount. We see that for the inactive lens on figure 1.

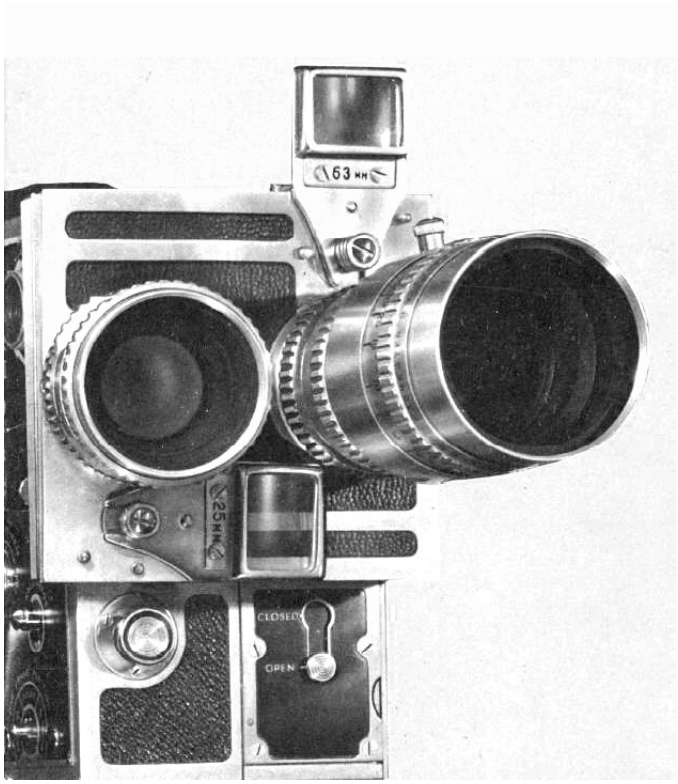

Figure 9. Viewfinder front lenses on a Ciné-Kodak Special II

8.3 On the Ciné-Kodak Special II

The Type S mount lenses used on the CKS2 are intended to be used on various different cameras, and it would not be practical for them to carry an appropriate CKS2 front viewfinder lens. Thus the viewfinder lens is handled separately from the taking lens itself. We see the arrangement on figure 9.

The various viewfinder front lenses are separate items, mounted by sliding a fork on the lens under a spring loaded cylinder on a stud on the camera turret. The rear of the cylinder is convex, and drops into a recess around the fork slot (we can see that in figure 10) to keep the lens in place as we manipulate it. When we get it in place, a hole in the finder lens plate engages a small stud on the turret to keep the lens in place and in the proper position. We can see this on figure 9.

Because this creature on the “inactive” lens position can get in the way of various controls (like the operating button), and because we might in fact for some reason want to retire the viewfinder element on the “active” lens, we can, by leaning the element out to disengage it from the small pin, lay the viewfinder element to the side, where it can drop onto a different pin to hold it there. We see this for the viewfinder element on the “not current” lens in figure 9. A third pin prevents the lens from being rotated to the right of its “operating” position, and helps us put the lens into that position after it has been mounted.

In Figure 10, we see four of the available viewfinder "lenses". The reason that "lenses" is in quotes in the figure caption will be discussed shortly. They cover lens focal lengths of 25 mm, 63 mm, 102 mm, and 152 mm.[3]

Figure 10. Viewfinder "lenses" for Ciné-Kodak Special II

8.4 The "peep sight" mode

For lenses with a large focal length (telephoto lenses), the reverse Galilean viewfinder does not work out well, and for these lenses we resort to a "peep sight" mode of the viewfinder. Here, the front "lens" is not a lens at all, but only a mask (as we see in figure 10 for the 102 mm and 152 mm items). In this case, at the rear of the viewfinder, we retire the lens, leaving only a "peep sight hole".

9. THE REFLEX VIEWFINDER SYSTEM

9.1 Introduction

The Ciné-Kodak Special II professional 16 mm camera includes a reflex viewfinder feature. This allows the camera operator to precisely frame and focus the camera, regardless of the distance to the subject.

When the reflex mode is enabled, a small mirror is introduced into the image path downstream from the lens, before the film plane. The mirror is oriented at 45° to the optical axis. It hijacks the image and sends it onto a small ground glass screen. The operator can observe this screen through a small viewing lens atop the camera.

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[3] These odd seeming focal length choices for the lenses come about because the lens designs were originally based on handy focal lengths in inches: 1", 2.5", 4", and 6".

The system is carefully adjusted so that the screen, as "seen through" the mirror, is in exactly the same location as the film plane and film aperture. Thus when the scene is properly framed on the screen, it will be properly framed on the film. When it is properly focused on the screen, it will be properly focused on the film.

When the camera is started, the mechanism releases, the mirror is retracted and shooting proceeds in the usual fashion.

Both versions of the camera have this feature, but the mechanisms are wholly different (for a reason that will be explained in due course).

9.2 In the Ciné-Kodak Special

In figure 11, we see the reflex mechanism of the Ciné-Kodak Special, as disclosed in the patent.

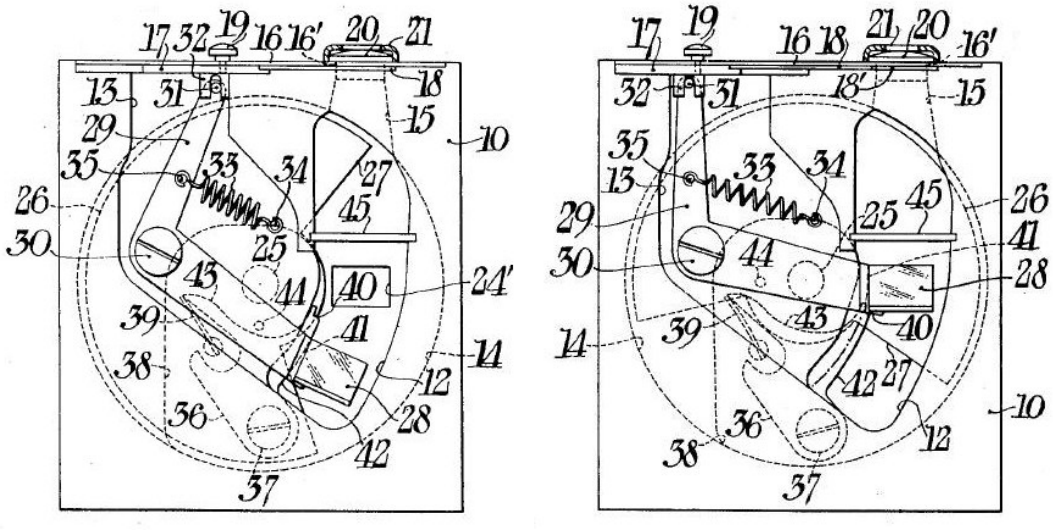

Figure 11. Ciné-Kodak Special reflex viewfinder

9.2.1 *Before activation of the reflex viewfinder*

The view is from in front of the camera looking rearward. This area is just behind the turret, in what I call the camera's "front plate", a thick slab of aluminum, hollowed out to accommodate this and other mechanisms.

The left hand panel shows the reflex finder mechanism "inactive", as it would be during shooting. Item 24 is an aperture window (not the same one called that on the front of the film magazine, but in line with it). Item 28 is the reflex mirror, set at a 45° angle to the optical axis. It is totally out of the optical path in this state.

Items 20 and 21 are the viewing port (21 being a small lens in it). Item 18 is a stainless steel shutter, which blocks any light from entering the battle zone through the reflex finder viewing window.

9.2.2 *Activation of the reflex viewfinder*

To activate the reflex viewfinder, the operator (with the camera not running) slides button 19 to our left. It carries slide 17 with it, which by way of pin 31 on lever 29, carried in a slot in the slide, rotates lever 29 counterclockwise. This puts the mechanism into the state seen in the right hand panel.

When the mirror has reached this position, the corner of the mirror frame, 40, is caught by a notch on the end of an arm of the mirror latch lever, 36, holding the whole mechanism in this new situation.

We see that the reflex mirror is now in front of the port to the exposure gate, Thus the rays from the lens that would normally form an image on the film are directed upward instead. They strike a small ground glass screen, 45, and the image is formed there.

Additionally, as the button is moved, slide 17 withdraws the shutter 18, clearing the operator's view, through the reflex viewfinder viewing window, of the image on the ground glass screen.

The position of the mirror is carefully adjusted so that the focus and framing state of the image on it is identical to that which, with the reflex mirror in it normal position, would obtain on the film. Thus framing and focusing adjustments made by observation of the reflex viewfinder will govern the actual recorded image.

9.2.3 *Resetting the reflex viewfinder*

After the operator has adjusted the farming and focus to her satisfaction, she starts the camera in the usual way. As the shutter, 26, rotates, pin 44 on the shutter hub strikes latch lever 36 at its tip, 43, causing the lever to disengage its hold its hold on the mirror frame at 40. Spring 33 then restores mirror lever 29 to its normal position, removing the mirror from the optical path. This also moves slide 17 back to its "idle" position, which reinserts the shutter, 18, beneath the reflex viewfinder viewing window.

9.2.4 *After reset*

After the reflex viewfinder mechanism has been reset, we no longer need the pin 44 to be able, on each revolution of the shutter, to strike the tip of latch lever 36, nor do we want it to. So when the mirror lever 29 reaches its "idle" position, it cams latch lever 36 away from the path of the pin (as we see in the left hand panel).

When the reflex finder is next activated, as the mirror lever 29 moves toward the "activated" position it allows the latch lever to move toward the path of the pin, so that it will be able to catch the mirror at

40 and be able to later be released by the pin, 44, when the camera is next started.

9.3 In the Ciné-Kodak Special II

9.3.1 *A fly in the ointment*

This arrangement is very straightforward and, as near as I know, worked well.

But in the Ciné Kodak Special II, the camera front plate had to have a slanted front surface to accommodate the new turret geometry (as described in section 7.1.3). Thus, on its right side (the left side as we see it in from the front, looking rearward), it was then very thin, and there is just not the space for it to accommodate the reflex viewfinder mechanism used in the Ciné Kodak Special.

Accordingly, a whole now reflex viewfinder mechanism had to be developed, one that is considerably less straightforward, and full of what we might call “finicky” parts. But this is often the price of progress.

9.3.2 *Before activation of the reflex viewfinder*

In figure 12 we look at the front of the camera with the turret assembly removed. The reflex finder is in the “inactive” mode (as when we might be shooting the camera).

Figure 12. Reflex finder (inactive)

AW is an aperture window (not the same one called that on the front of the film magazine, but in line with it). In this figure it is blocked by the camera's rotary shutter, which is just behind it.

On the top, at V, we see the reflex finder view port (a little stainless steel housing with a rectangular lens in it). With the reflex finder in the inactive mode, the underside of the port is blocked by a little black trap door, T (not actually visible in this view). This prevents light from entering the finder compartment through the view port.

The ground glass screen on which the image will be formed by the reflex finder system is represented by white rectangle G; we can't see it as it is behind a light shield, S. The reflex mirror, M, is parked out of the way.

9.3.3 *Activation of the reflex viewfinder*

The operator, with the camera not running, can engage the reflex finder by pushing down on plunger P, which extends from the top of the rack slide, R.

In figure 13, we see the result.

Figure 13. Reflex finder (active)

Pressing the plunger P has moved down rack slide R, which carries a short rack, r. That rotates a partial pinion, p, rotating the mirror assembly clockwise and up into place. Its exact final position is controlled by it striking an upstop at U (hard to see the upstop itself).

Then, at L (hard to see the details), a latch drops under the curved light-colored plate on bottom of the mirror assembly, latching the mirror assembly in the active position.

Also, trapdoor link TL pulls down the trapdoor, T, opening the path through the view port V to the ground glass screen, G.

The upstop, U, is on the end of a pivoting upstop lever, UL. In order that the mirror position can be precisely adjusted, that lever can be moved by the upstop eccentric, UE. That can be reached with the turret in place, through the turret port in the "inactive" position with that lens removed.

9.3.4 *Resetting the reflex viewfinder*

When the operator, having adjusted the framing and focus, starts the camera for the shot, knockoff pin K, mounted on the shutter, strikes the tip of the latch lever, LT. This in turn disengages the latch at L (the detailed mechanism not being visible). With the lens assembly free to rotate back to its inactive position, and being urged to do so by the rack slide, r (because of a spring under it), the entire arrangement returns to its inactive position in time for the upcoming frame to be exposed.

9.3.5 *After reset*

We do not want knockoff pin K striking the tip of knockoff lever LT on every shutter rotation during camera operation. However, whenever the mirror assembly is not near the position where the latch becomes relevant, a mechanism not seen moves the latch lever so its tip is not in the path of the knockoff pin, K. (For example, in figure 12 we do not see much of the latch lever tip, it being almost below the window through which we do see it clearly in figure 13.)

9.3.6 *A risk of damage*

We note that there is a serious design problem with this mechanism. The plunger, P, is long and thin, and emerges from the camera near a corner. This makes it very likely that it can be struck on something as the camera is maneuvered. This will almost inevitably bend the plunger (perhaps at its bottom where it joins the rack slide). Then, when the plunger is depressed, the plunger will drag on the side of its hole, and the reflex finder mechanism will be jammed in its "active" mode (and thus no pictures can be taken).

This situation was much better in the CKS1. The reflex finder system there is quite different, and it is actuated by sliding a little button on the top of the camera front plate, just right of the center. We can see it in figures 1 and 11.

10. THE VARIABLE SHUTTER

10.1 Introduction

In a typical motion picture camera, there is a rotating shutter whose purpose is to expose the frame while it is stationary and block the film while it is moving to the next frame position. Often this shutter has one "blade" and rotates once per frame. Typically the open portion of the shutter has an included angle of perhaps 165°, so, simplistically speaking, the film is exposed for a little less than half the frame time. Taken together with the frame rate, this determines the exposure time for each frame (corresponding to the shutter speed in a still camera).

10.2 The variable shutter of the CKS cameras

In the CKS cameras, the "open angle" of the shutter can be varied from a maximum of 165° (considered "full", labeled "open") down to zero (in which case of course all exposure is cut off).

This is done by the shutter actually comprising two shutters, lying right against each other, both with an open portion 165° in extent.

The two shutters rotate together, except that through an ingenious gear system the relative angle between them can be varied. Thus the actual net "open" portion can be varied in extent from 165° down to 0°.

The open angle is set by the user with a lever on the camera's control panel (see figure 3), operating in a slot with notches at positions "open", "1/2 open", "1/4 open", and "closed".[4] But the variation in angle is continuous over the range of the lever.

One might wonder what is the significance of the little curved notch on the side of the variable shutter lever slot between "1/2 open" and "open". This is so, when we go to remove the control panel itself, the little knob on the variable shutter lever can slip though the slot!

10.3 Uses of the variable shutter feature

One use of this facility is to provide an additional variable for controlling exposure (just as we do with shutter speed in a still camera). For example, we may wish to use a large lens aperture to get a small depth of field for artistic effect (to blur the background, perhaps), but such a large aperture might not give the proper exposure

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[4] There is an oddly shaped notch in the large space between "open" and "1/2 open". Its purpose is to allow the permanently-attached knob on the end of the shutter angle lever to pass through the control panel plate if we need to remove the panel.

under usual operating conditions. But by reducing the shutter angle, we can get the needed exposure.

The shutter angle laver can be moved with the camera running, which allows another use: the making of fades in the shot. We can “fade in” at the beginning of a scene by starting with the shutter lever at “closed” and then moving it smoothly to “full” as the shot proceeds. Then, as the scene ends, we can “fade out” by moving the lever smoothly to “closed”.

Since doing this requires some attention from at least one of the cameraman’s hands, it is often convenient to lock the operating button on during the shot. But during the “fade out”, when the shutter lever reaches closed (the end of the fade and thus the end of the shot), the latch on the operating button is automatically released, and the camera conveniently stops.

An elaboration of this maneuver can be used to produce a “crossfade”, where one scene fades out while another fades in. At the end of the “season” of the first scene, we do a fade out, just as I described. We then backwind the film to the place where the fade out started, and start a shot of the second scene with a fade in.

Of course, we must avoid the film being exposed at all during the backwind. We can do this by setting the shutter angle lever to closed during the backwind. Of course in the specific scenario I described, it is already at closed (its state at the end of the fade out on the first scene) when we are ready to start the backwind, so this all works out very handily.

11. THE FILM MAGAZINES—BASICS

11.1 Introduction

The CKS cameras all utilize what can be described as a “magazine” concept of film handling. The film is loaded into a magazine which is then attached to the camera. Thus, a photographic team could have several magazines loaded with film, swapping them out as each was exhausted. Or there could be magazines on hand loaded with different types of film, which could be swapped out as conditions dictated.

There are two types of magazines, differing in their film capacity. One type would accept up to 100 foot film spools, the other up to 200 foot spools.

In fact, these magazines contain the entire film transport system of the camera, including the exposure gate and the intermittent pulldown mechanism.

The integration of these magazines with the camera body itself is so slick that when one looks at a CKS camera equipped with the 100 foot film magazine it looks like a single unit. When the magazine is unlatched and removed, it looks as if half the camera is being removed. Figure 14 shows this on a CKS2 with a 100 foot magazine, where the magazine has been detached from the camera proper and moved away just a bit.

Figure 14. Ciné-Kodak Special II with 100 foot film magazine detached

Figure 15 shows a CKS2 with the 200 foot magazine in place. It gives the camera the iconic "movie camera" profile.

Figure 15. Ciné-Kodak Special II with 200 foot film magazine

This magazine detaches from the camera body in exactly the same way as the 100 foot magazine. As with the 100 foot magazine, this magazine contains the entire film transport system, but the details are a bit different.

The magazines of either capacity are interchangeable on the CKS1 and CKS2 cameras.

11.2 Or are they “film chambers”?

Later in the life of these cameras (1936), Kodak introduced, for use in another new line of cameras, 16 mm film in handy “magazines”, which were purchased preloaded with film, and which could just be dropped into the new cameras designed for them. In 1940, 8 mm film (itself introduced in 1932), became available in such magazines, again for use in a new line of cameras designed for them.

This was of course a rather different use of the term “magazine” than in the CKS cameras, and so at some point, to avoid any misunderstanding, Kodak began referring to the magazines used in the CKS cameras as “film chambers”. (We have various Kodak documents in which this transition is incompletely executed!).

Later Kodak literature consistently (more or less) uses the term “film chambers”. I will nevertheless consistently refer to these items as “film magazines”.

12. DETACHING AND ATTACHING THE MAGAZINE

12.1 Introduction

The mechanical arrangements that govern the attachment and removal of the film magazine are very complex. I will only discuss in detail the most pivotal (we will see shortly what a bad pun that is) aspects of this matter.

12.2 The dark slide

When the magazine is detached from the camera body, we no longer have the shutter (which is in the front plate of the body) to keep light away from the frame that is currently in the gate (and from spilling around the gate and perhaps exposing film that is in transit in the magazine). It is an objective of the CKS system that we should be able to remove the magazine (perhaps partway through a roll of film, perhaps to attach one with a different kind of film), and later replace the first magazine and pick up where we left off.

To make this possible, there is a “dark slide” at the very front of the magazine, which we can close (before we begin to remove the magazine) by sliding up a little button on the exposed part of the front of the magazine. We see the arrangement in figure 16.

Figure 16. Front of magazine, dark slide closed

12.3 Removing the magazine

There are a number of interlocks associated with the magazine removal and replacement process. One of them makes it impossible to detach the magazine unless we have closed the dark slide. Another makes it impossible to run the camera mechanism if the magazine dark slide has been closed, or with the magazine removed.

Figure 17. Magazine separated from camera

Once we have closed the dark slide, we release the magazine latch by rotating a lever on the lower rear corner of the right side of the camera, which then pops outward under spring force). Then we can swing the magazine clockwise around some mysterious pivot point, which frees the magazine from the camera so it can be lifted free.

In figure 17 we see the magazine and the camera with the magazine detached and placed in "butterfly" position with respect to the camera.

We can see, near the front lower corners of the two players (to our left), the two sides of a rotary coupling that, with the magazine in place, allows the camera mechanism to drive the mechanism inside the magazine, which operates the entire film transport system (including the intermittent pulldown system). We see these two parts of the coupling more closely in figure 18.

Figure 18. Magazine drive coupling

We see that the camera side of the coupling has two pins, which will engage two holes in the magazine side of the coupling. This coupling, when the camera is running, rotates once per frame. Thus it is vital for the camera and magazine members to always engage in the same relationship (else the pulldown mechanism in the magazine will be puling the film down while the shutter, in the camera, is open). Yet it would seem that the two members of this coupling could engage in two ways, one correct and one incorrect by 180°.

But if we look closely, we see that the coupling is not quite symmetrical. One of the pins is closer to the center than the other. So if the two coupling sides approach precisely on a common axis, they can only engage in the proper phase.

But suppose that when they approach they are not lined up, angularly, for this heavenly union (as is likely, and as is the case in the picture). The two pins on the camera side are spring loaded, and can retreat if they are not perfectly lined up with the holes in the magazine side. Then, when the camera side starts to turn (when the camera is next run), the pins will drop into the corresponding holes in the magazine part of the coupling at the appropriate moment.

But we can see that it is critical that the camera and magazine coupling members share a common axis, rather precisely. To assure that, there is a short thin wall around the camera part of the coupling. This fits into an annular groove around the magazine part, assuring that the two members are precisely coaxial.

When we begin to remove the magazine, and unlatch its lower rear corner, and rotate it, it rotates about the axis of this coupling, the wall and annular groove (still engaged at this stage of the proceedings) serving as a bearing for that rotation. This is the "mysterious pivot point" I spoke of earlier.

When we go to replace the magazine, with the magazine at an angle from its eventual position, we first engage the ring around the camera side of the coupling with the annular groove around the magazine side of the coupling. We then rotate the magazine counterclockwise into its final position, in which it engages with the camera in several places, and then engage the magazine latch by pressing in the magazine latch lever and rotating it to the locked position.

Then we reopen the dark slide by sliding the button downward. Only now can the camera mechanism be started.

13. FILM TRANSPORT PRINCIPLES

13.1 Functions

The film transport mechanism of a motion picture camera is usually charged with three primary functions.

13.1.1 *From the supply spool*

The film must be withdrawn from the supply spool in a disciplined (usually steady) way and led to the *exposure gate*, where the actual photography takes place.

13.1.2 *The intermittent pulldown mechanism*

At the *exposure gate*, the film must be moved in an intermittent fashion, frame by frame. At each frame location, the film must remain stationary while that frame is exposed, after which the film must be moved to the next frame position.

In the cameras being discussed (and in most, but not all, movie cameras) this intermittent motion is done by a *pulldown claw*. One or more teeth on this claw engage sprocket holes (often called *perforations*) in the film and then "drag it" to the next frame position, during the interval between frame exposures. This movement is necessarily in the downward direction, thus the name of the component. Then the claw moves back to its starting position, and then engages the film for the next stroke.

13.1.3 *The exposure gate*

The gate typically consists of two primary members. An *aperture plate*, nearest the lens, with the film just behind it, defines the plane in which the film will lie, and contains an aperture that defines the scope of exposure of the frame. Behind the film is a pressure plate, which serves to keep the film in contact with the aperture plate. One or the other of these (which one differing between different designs) is spring loaded against the other.

Cooperating with the intermittent pulldown mechanism is almost invariably a shutter, rotating or reciprocating, synchronized with the pulldown operation. It opens the path from the lens to the film while the film is stationary for the exposure of a frame, and closes that path while the film is moving between frame positions. In the CKS cameras, the shutter is a rotating one, in the camera body, just in front of the "nose" of the magazine.

13.1.4 *To the takeup spool and onto it*

The film must then be conveyed in a disciplined (usually steady) way to the takeup spool, where, under the influence of a controlled torque on the spool, the spool winds up the exposed film. This must be done in such a way that the resulting tension on the film does not "try to help" the intermittent pulldown mechanism.

13.1.5 *The need for two "loops"*

With the film being led from the supply spool toward the exposure gate at a steady pace, and from the gate toward the takeup spool at a steady pace, but moving intermittently, frame by frame, through the gate, we recognize that there must be some slack in the film before and after the gate to let this happen. The slack is ordinarily

substantial, such that it forms into what is called a “loop” in each of these regions. We will hear about these loops in a bit.

14. THE FILM TRANSPORT MECHANISMS IN DETAIL

14.1 Introduction

As mentioned above, for the CKS cameras, the entire film transport system, including the exposure gate and the intermittent pulldown mechanism, is contained in the magazine (as I will continue to call it).

That mechanism is driven from the camera body through a coupling that engages when the magazine is attached to the body, which was discussed in section 12.3 .

14.2 Compatibility and evolution

The magazines are identical for use with either the CKS1 or CKS2. However, the magazines provided for use with early CKS1 cameras have a different design of the intermittent pulldown mechanism from that used later. We will only discuss the “later” arrangement.

Figure 19. 100 foot magazine on a Ciné-Kodak Special II, with loading door open

14.3 The 100 foot magazine

Figure 19 shows a 100 foot magazine with the loading door open.

Figure 20 shows the film path when the magazine is threaded (adapted from a figure in the manual).

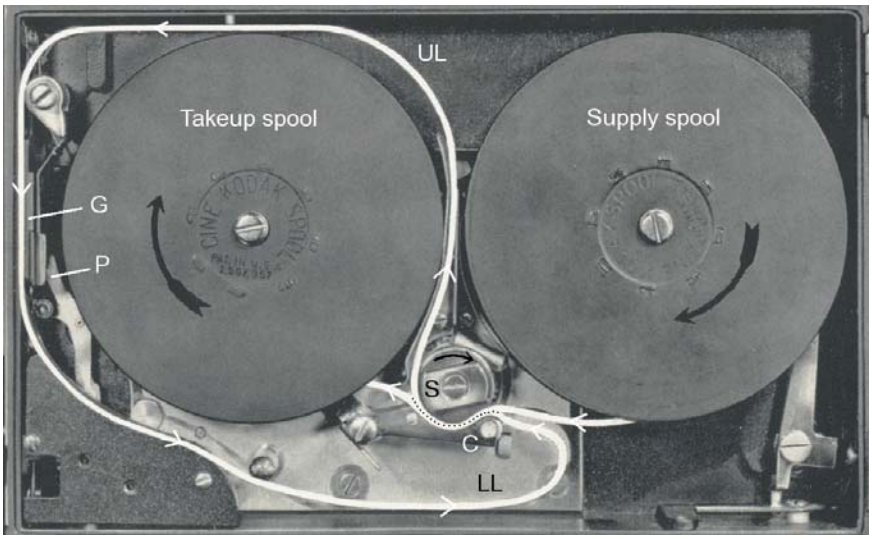

Figure 20. Film path of 100 foot magazine.

There is a single sprocket, which serves to regulate the film movement from the supply spool and also its movement toward the takeup spool. A pivoting sprocket clamp. C, serves to hold the film in proper engagement with the sprocket. It can be swung slightly aside, after releasing a latch by pushing on a small knob (just to the right of the label "C"), in order to insert the film.

The clamp engages the film through two rollers. Their profile is such that they only touch the film in the sprocket area so there is no risk that they will scuff the film in the image area.

The sprocket only has teeth on one edge of the film (the edge away from us). In the case of "single perforated" film (used when a magnetic sound track is to be laid on the developed film) there are only perforations on that edge.

After the film passes around the sprocket, under the two rollers of the clamp, it is led up through a narrow channel between two polished metal plates. From there, it goes to our left under the "roof" of the magazine, and then turns down to go into the exposure gate, G. This part of the film constitutes the upper loop (thus the marking "UL").

In the gate, the film is moved by the pulldown claw, P, which has a tooth that engages a single film perforation. The claw moves down to move the film down by one frame distance, then is withdrawn from the film, then moves up to where the next perforation is, then moves into that perforation, and then again moves down.

Leaving the gate, the film travels down a polished "chute" to the floor of the magazine, then along the floor until it is below and to the right of the sprocket. Then it turns back and passes through the sprocket a second time, now lying in contact with the film passing through the

sprocket on its way from the supply spool. This part of the film constitutes the upper loop (thus the marking “LL”).

Figure 21 is a sketch that makes more clear this situation at the sprocket.

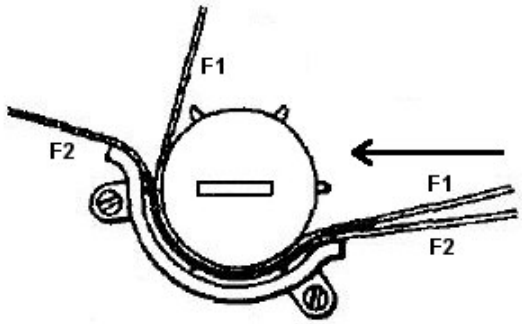

Figure 21. Double layer of film around sprocket

We see that in this layout the upper and lower loops are rather spread out, unlike the situation in typical motion picture cameras, where the loops are formed “in thin air” over a short distance from the sprocket to the gate.

In fact, here the film will likely slide along the “ceiling” and the “floor” of the magazine. These surfaces are not provided with polished shiny metal surfaces for the film to touch. They are however nicely smoothed. And they have a slightly curved surface (like a shallow trough) so that the film gliding along these surfaces will only touch them at the film edges, where we are not concerned with possible scuffing.

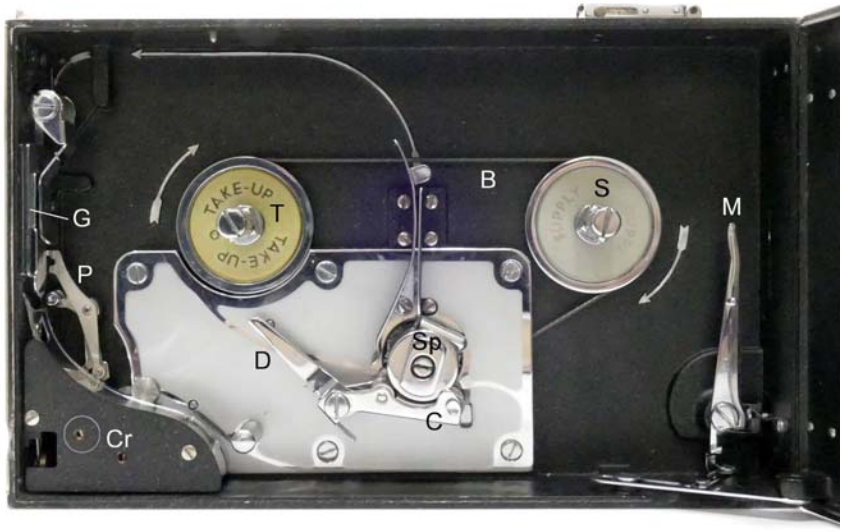

Figure 22. Film transport system

In figure 22 we look at the film transport area again, this time with some annotations, so we can see some further features of the transport system.

At S and T we see the supply and takeup spindles and the associated pulleys. And we've already met some of the other critical players.

As to the takeup drive, on two consecutive gears in the train leading from the drive coupling to the sprocket there are small pulleys (they are hidden below the light colored plate). A small diameter spring belt, B, serpentines around these two pulleys; the arrangement gives considerable traction on the belt. The belt also goes around a fairly large pulley located behind each spool spindle.

These pulleys can drive the associated spindles through one way clutches. The one at the takeup spool spindle can drive the spindle only in the clockwise direction (as is needed for this spindle to drive the takeup spool during "forward" operation). The one at the supply spool spindle can drive the spindle only in the counterclockwise direction (as is needed for this spindle to drive the takeup spool, in its role as "takeup spool", during "backup" operation).

The pulley ratios are such that the mechanism tries to turn the driven spindle at a rate that is greater than needed to wind up the oncoming film even only a little film is on the spool core. So the belt slips on the spindle pulley as needed.

Measurement lever M, when the loading door is closed, rests under spring pressure on the film on the supply spool (on the edge of the film so it cannot scuff the picture area). It operates a pointer on the available footage indicator on the rear of the magazine (more on this in section 15.1).

When the loading door is open, this lever is retracted so it does not get in the way of mounting the supply spool.

Drag lever D, when the system is in its operating state, rests under spring pressure on the film on the takeup spool (again, on the edge of the film so it cannot scoff the picture area).

When we have exposed the entire roll of film, and even the trailer has been run through the transport mechanism, the trailer would not be wound tight on the film roll (there being no tension on it). But we depend on the film being wound tight to prevent light from the room from penetrating the film roll after we open the loading door to retrieve the film.

The purpose of drag lever D is to keep the end of the trailer in place until we can put our fingers on the film roll.

To keep lever D out of the way while we mount the takeup spool and thread the magazine, we can pull it back, whereupon it latches in an out of the way position.

When loading is complete, ideally we will push down on the lever, releasing it from the latch and allowing it to drop into the takeup spool.

But if we forget, when we close the loading door, a boss on it pushes down on the lever, releasing it.

The gray circle Cr represents the crank that drives the pulldown claw, P; it is hidden beneath the black cover we see. In Figure 2323, we see this area with the cover removed and some annotations.

Figure 23. Pulldown claw drive

The is a “crank and radius arm” pulldown mechanism. The crank, C is not visible; it is on a shaft leading from gear G2. The pulldown claw, P, runs from an off center pin on the crank and is supported at the end of radius arm R. E represents the “elbow” of the claw, a point at which the claw can bend (against a spring force) if needed, so the claw will yield if it attempts to put its tooth, T, into the film where there is no sprocket hole.

The crank is driven by gear train G1-G2. G1 is on the drive coupling shaft, and rotates once per frame, as does gear G2 (which rotates

clockwise). G2 is supported on arm A, which in turn is clamped onto a post below G1 through which the G1 shaft goes.

By loosening the clamp screw (near the marking "A"), the arm can be rotated slightly in order to make a fine adjustment of the vertical position of the claw. This allows making the position of the film, when pulled into explore position by the claw just right (so the exposed frame will have the proper relationship to the sprocket holes).

When the arm is moved, it also slightly changes the phase of the pulldown mechanism. But when the claw is at the bottom of its stroke (the "bottom dead center" of the crank) small changes in the crank phase have little effect on the vertical position of the claw.

14.4 The 200 foot magazine

The overall principles of the film transport in the 200 foot magazine are the same as in the 100 foot magazine, but the arrangement is rather different. We see the film path in the 200 foot magazine in figure 24 (adapted from a figure in the manual).

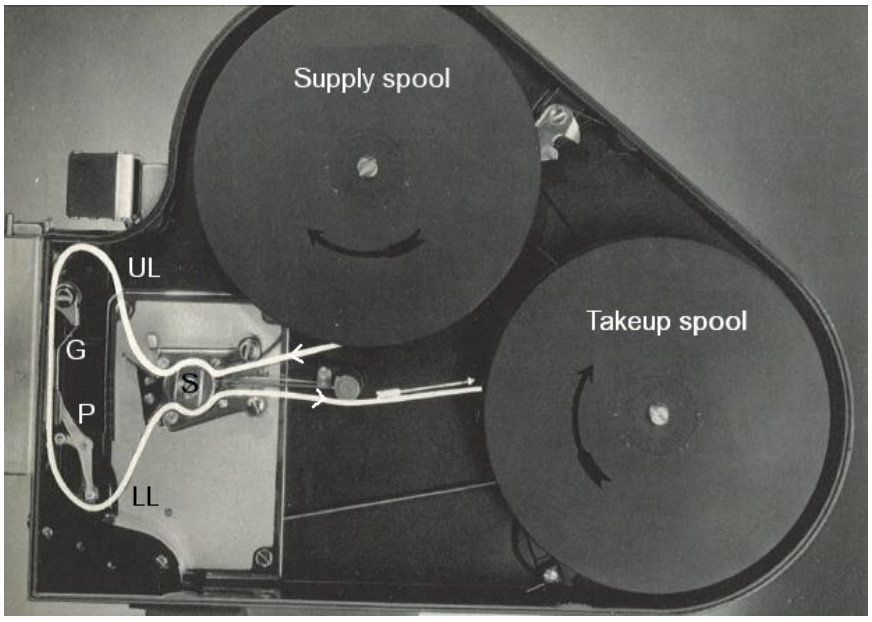

Figure 24. Film path of 200 foot magazine.

We see that the relative positions of the supply and takeup spools are (more or less) reversed from the situation in the 100 foot magazine. Although a single sprocket is again used, here the film paths from the supply spool and to the takeup spool here utilize opposite sides of the sprocket, rather than traveling though the same part of the sprocket "piggy back" as in the 100 foot magazine.

In this arrangement, the upper and lower loops are more "conventional" than in the 100 foot magazine, fairly short and "hanging in thin air" (as in most other cameras).

14.5 Aperture axial positioning

The gate assembly (which includes the aperture plate), part of the magazine, floats in an axial direction, urged toward the lens by a spring.

In figure 25 we see part of the front face of the film magazine.

Figure 25. Ciné-Kodak Special—front face of 100 foot film magazine

AW is the aperture window, now closed with the dark slide. The gate presents itself as two rails, R, which protrude slightly from the front face of the magazine.

In figure 26 we see the left part of the back side of the camera front plate, against which the front face of the magazine fits closely.

Figure 26. Back of camera front plate

When the magazine is put in place, the two rails on the gate, R, press against this surface, driving the gate back into the magazine as needed to precisely locate the gate axially, so that focus will be proper (especially if focus has been set precisely with the reflex viewfinder—see section 9.). We can in fact see four little scuff marks where the tips of the rails have pressed on this surface over the years.

14.6 The earlier version of the 100 foot magazine

The 100 foot magazine provided with the Ciné-Kodak special during its first few years used a different pulldown claw mechanism than that we saw above. (This design may well apply to the 200 foot magazine of that era as well.)

Here, the claw enters the film from the lens side. The claw does not have a "yielding elbow". Rather, if it attempts to enter the film where there is no sprocket hole, the pressure plate retreats, and the film with it.

Figure 27 shows the pulldown claw area of this style of 100 foot magazine, with some annotations.

Figure 27. Pulldown claw mechanism in early 100 foot magazine

As before, this is a crank and radius arm pulldown claw mechanism, with the crank at C. The crank is actually on the drive coupling shaft, and thus rotates once per frame (counterclockwise). The pulldown claw, P, is connected to an off-center pin on the crank, and is supported by radius arm R.

An interesting feature is that on the side of the claw, just below the tooth, there is a tiny spring, S, let into a groove in the claw. When the claw is at the bottom of its stroke, that part of its edge comes very close to the flank on post P, compressing the little spring. We see this situation in figure 28.

Figure 28. Pulldown claw at the bottom of its stroke

We do not know the purpose of this. Perhaps it is to take up any slack in the joints of the claw mechanism to assure that the claw tooth has a consistent position on every stroke, for maximum consistency in film registration.

15. KEEPING TRACK OF THE FILM

15.1 Film available in the magazine

The amount of unexposed film remaining in the magazine is indicated by an “unexposed film meter”, which is operated by a spring loaded finger that rides on the film on the supply spool (described in section 14.3). For the 100 foot magazine, the indication is given by a meter-like display at the rear of the magazine. (See figure 29.) For the 200 foot magazine, the indication is given by a display on the right side of the magazine.

The refined markings in the vicinity of 50 feet and 100 feet (for the 100 foot magazine) are intended to help us keep track of when we have, after loading the camera, run off the “leader” film (with 50 and 100 foot spools, respectively).

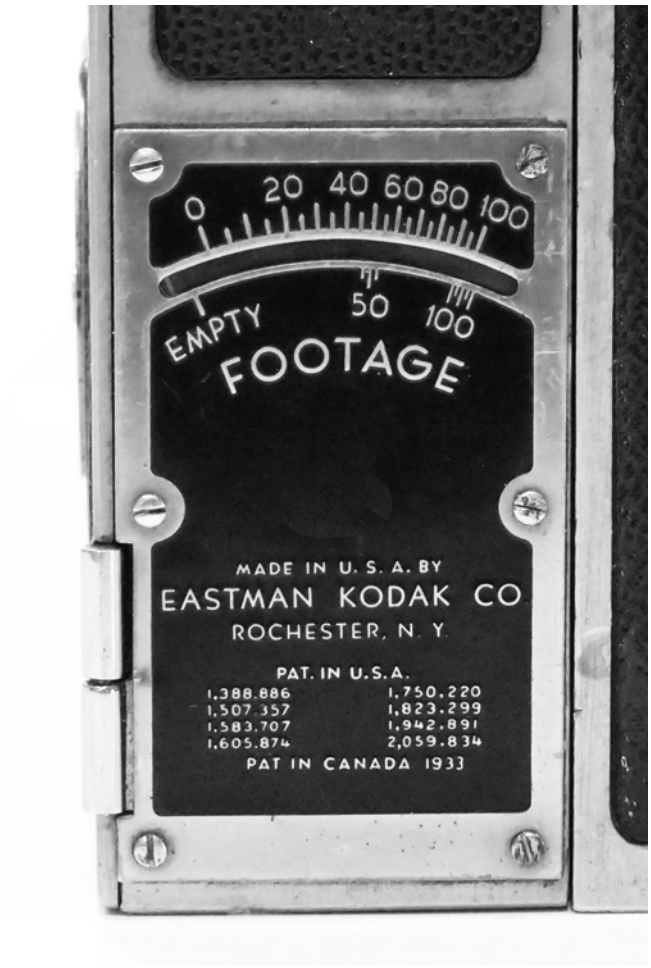

Figure 29. Remaining footage indicator on 100 foot magazine

15.2 Amount of film shot

The amount of film shot (perhaps since the current magazine was put in place) is indicated by a dial on the top of the camera. The dial is marked in feet, and one rotation of the dial corresponds to 100 feet of film passing through the camera. The dial can be set (normally to zero, after mounting a fresh magazine) by turning it with the thumb. We see this dial in figure 30.

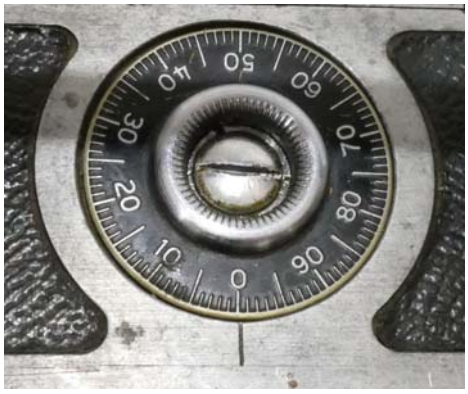

Figure 30. Footage exposed indicator (on a Ciné-Kodak Special II)

15.3 The frame counter

Except in the very earliest CKS1 cameras, the CKS cameras are equipped with a frame counter, an indicating dial visible through a circular window at the upper left of the control panel (see figure 3). This rotates once per foot of film passing through the camera, and is marked in frames from 0 through 39, there being 40 frames per foot of film. (Every even frame mark is labeled.)

By referring to the frame counter and the "amount of film shot" indicator, the operator, when doing special effects, including those involving backwinding of the film, can reset the film to exactly the correct point after each phase of the operation, even if the backwind is very lengthy.

16. FOCAL LENGTH

In photography we use lenses of differing focal length to attain different fields of view. (Field of view is the size, which we can measure in different ways, of the hopper shaped region of three dimensional space that is mapped onto the two dimensional camera frame.)

The less the focal length the greater the field of view.

For various historical reasons, in the realm of the 35 mm full frame still camera, a focal length of 50 mm is considered "normal", so that lenses of substantially lesser focal length are considered "wide angle" lenses, while lenses of substantially greater focal length are considered "telephoto"[5] lenses.

The diagonal size of the frame used in 35 mm full frame still photography (with dimensions 36 mm × 24 mm) is about 43.3 mm. Thus it is often said, in the world of still photography, that the "normal" focal length is on the general order of the frame diagonal dimension.

The diagonal dimension of a 16 mm motion picture film frame is about 12.7 mm, so we might expect that a focal length of perhaps 15 mm would be considered "normal" in that realm. But in fact the "basic" lens provided on many non-interchangeable lens 16 mm Ciné-Kodak cameras, and the lens commonly provided as the "starter" lens on interchangeable lens Ciné-Kodak cameras (including the CKS1 and

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[5] Formally, the term telephoto is properly not used for any lens of "greater than normal focal length" but rather only for lenses using a special optical design principle so that their physical length need not be on the order of their focal length. But I will here follow the common, if not accurate, practice.

CKS2) has a focal length of 25 mm.[6] And indeed in the world of 16 mm motion pictures, a focal length of 25 mm is widely considered "normal". The rationale for this is beyond the scope of this article.

During most of the life of the CKS1 and CKS2 cameras, the stable of lenses offered were ones with these focal lengths (in mm): 15, 25, 40 or 50, 63, 76, 102, 114, and 152. The odd-sounding numbers come from the fact that, during the era of the CKS1, lens focal lengths were denominated in inches (except for the 15 mm lens) and the lenses all had nominal focal lengths that were handy in inch notation (*e.g.*, the 2-1/2 inch f/2.7 lens, with a focal length in mm of 63 mm).

17. MOUNTS FOR THE LENS ARSENAL

The earliest Ciné-Kodak cameras did not have interchangeable lenses. Some models were made in two versions with different lenses (typically one having a larger maximum aperture than the other).

But before long, interchangeable lenses became the norm on new camera models or versions. At the least, there would typically be available for a certain camera model a "normal" lens (the one that probably came on the camera), a wide angle lens, and a telephoto lens. But soon there came to be, for the more sophisticated cameras, a wider roster of telephoto lenses.

In general, a given basic lens design (in terms of the optical system itself) would potentially be useful on many camera models. But as we've already seen hinted at, in general each camera model had a distinct lens mount scheme. Thus, for each basic lens design, several versions had to be manufactured, having the various mounts. Another nightmare in the making!

To put a stop to this madness, sometime in the early 1930s Kodak developed a new mount, known as the Type S, which was intended to be a universal mount for future camera and lens products.

The transitional scheme would that that for each important lens design, a new version would be made with the Type S mount. The versions with other mounts would be taken out of production.

When a camera owner wanted to augment his lens arsenal, he would buy the lens he wanted, with a type S mount, and also buy an adapter that would adapt the particular mount on his camera to accept lenses with the Type S mount.

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[6] In some of the earliest Ciné-Kodak models, the "starter lens" had a focal length of 20 mm.

Of course, adapters for each of the several exiting mount types had to be designed and put into production. And it was not as simple as one might think. Almost all of these existing lens mount systems depended on the lens to furnish the matching viewfinder front lens. Now, providing the appropriate viewfinder front lens became the task of the adapter.

The result was that in general, two or more types of adapter needed to exist. Some could support lenses of several focal lengths by having a "book" of lenses and masks, the needed one for the lens in use being flipped into place.

We can see how this played out for the Ciné-Kodak Special in 1937 in figure 31, taken from the CKS1 manual, 1937 edition.

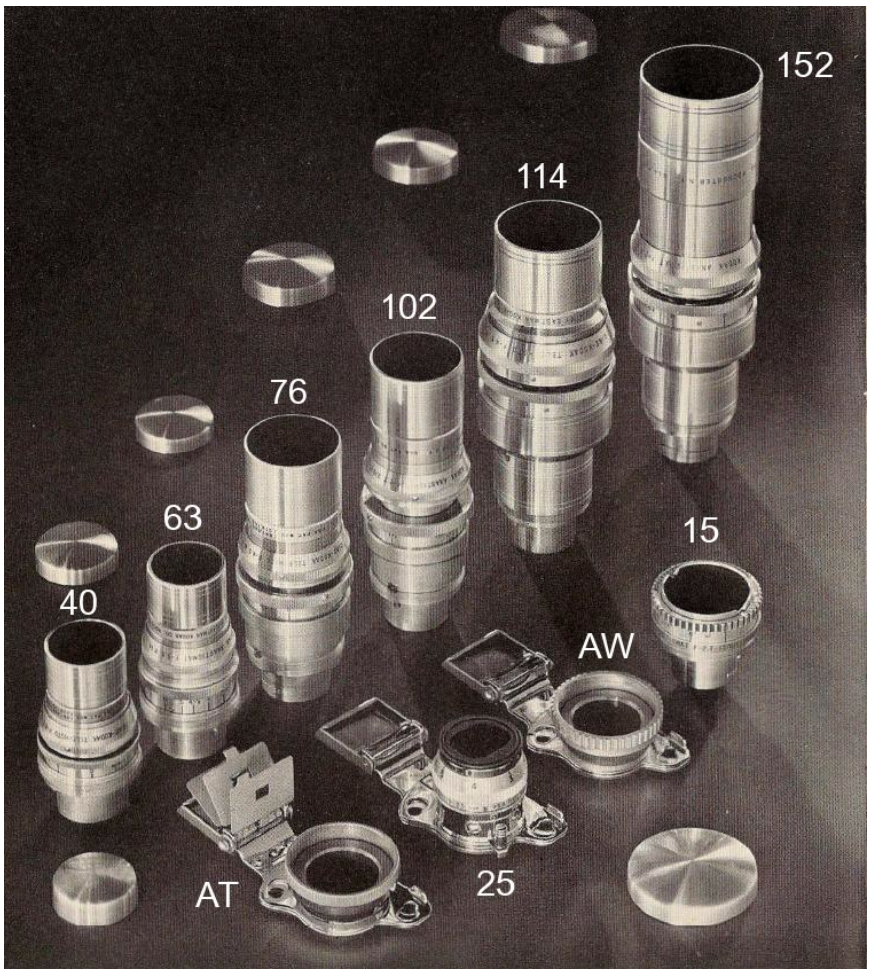

Figure 31. Ciné-Kodak Special lens repertoire (1937)

The figure shows the entire repertoire of available lenses for the CKS1 (as of 1937). I have labeled them all with their focal lengths in millimeters, even tough all of them except the 15 mm) were then actually labeled in inches. I have not shown their respective maximum apertures.

We see that the 25 mm lens (such as typically furnished with the camera as the "starter" lens) has the CKS mount. But the other 7 lenses all have the Type S mount, so an adapter would be involved in mounting them on a CKS1. For the 15 mm lens, we would use the "wide angle" adapter, AW. It has a viewfinder front lens to match a 15 mm taking lens. What about other wide angle lenses? There weren't any.

For any of the other 7 lenses, we would use the "telephoto" adapter, AT. It has the front finder lens for a 50 mm taking lens, and the needed masks for three of the six other focal lengths (where we operate the finder in "peep sight" mode), all pivoting in "book" fashion so we can move just the one we need into place. The desired three masks from the set of six furnished with the adapter can be installed in the adapter by the user; only certain combinations of three can be installed.

Note that earlier in the life of the CKS1, this picture would have shown all the available lenses with a CKS mount.

18. EXPOSURE RECKONING

18.1 Introduction

In order that the brightness scale of the scene be transformed into appropriate brightnesses in the captured image, the "photographic exposure" (a term that embraces the combined effect of aperture and exposure time) must be appropriately chosen. The underlying relationship depends on the range of brightness of the scene and the sensitivity of the film.

An instrument called a "reflected light exposure meter" can measure the average scene brightness and then, by what amounts to a circular slide rule, will reckon and then "recommend" to the photographer combinations of aperture and shutter speed that "should" produce the desired result. (In the case of motion picture cameras, "shutter speed" was determined by the frame rate and the "shutter angle", which determined the fraction of a frame time the frame was actually exposed (the shutter had to be closed as the film was moved to the next frame position).

18.2 Scene lighting descriptions on the aperture indicating plate

But when Kodak started the "home movie" business in 1923, practical exposure meters were in the future. Thus from almost the very beginning of the Ciné-Kodak camera dynasty, Kodak provided empirical recommendations of lens aperture based on "described" scene lighting conditions. These were not only given in the camera manual, but were in fact recited on the aperture indicating plate.

When the Ciné-Kodak Special emerged in 1933, it was no exception. And we see this in figure 32.

Figure 32. Ciné-Kodak Special aperture indicating plate

We see the plate in greater detail in figure 33, with no lenses in the way.

Figure 33. Ciné-Kodak Special aperture indicating plate

We see that there had to be two sets of these recitations of scene lighting situations, one for each lens on the turret.

We also note here another idiosyncrasy of all early Ciné-Kodak cameras. On the aperture plate (here, for each lens' part of it) there is a series of small rectangular cutouts, arranged in an arc around the lens. In a little protuberance on the lens' aperture ring, there is a spring-loaded plunger that rides over these cutouts. This constitutes a detent that will assure that the lens aperture is set to exactly one of the "preferred" positions: the aperture values to which the various scene lighting descriptions relate.

In other lenses, the lens side of the detent is not a plunger in a little protuberance but rather a bump on the bottom of the aperture indicating lever, whose tip runs on the set of aperture f-numbers.

But some of the "more complicated" lenses, such as the telephoto lenses of greater focal length, did not have such a detent member (nor even an aperture indicating lever). On these lenses, one just set the aperture on a ring (in the way that later became the norm on all lenses), and used the text on the aperture indicating plate as a "table" of suggested apertures.

18.3 But it got complicated

Now the desirable aperture for a certain scene lighting description depends on the film sensitivity and the exposure time (which for a ciné camera depends on the frame rate, which is adjustable over a wide range in the CKS cameras, and the shutter angle, which is adjustable over a wide range in the CKS cameras). So, the set of scene lighting descriptions, which correspond to aperture settings, carries the caveat that it is predicated on a certain type of film and a certain frame rate. (The shutter angle is ordinarily set to "open" during normal shooting, so that is not really an issue here.) For other situations, "adjustments" were recommended in the manual.

You can easily imagine that, as more and more types of film came into use, and as newer camera models more frequently offered various frame rates, that this approach soon became quite a white elephant. (Recall that this was going on over the entire range of Ciné-Kodak cameras, not just the CKS cameras, once they emerged).

18.4 Stop the madness—the Universal Guide

To put an end to the madness, Kodak, in 1940, introduced the Ciné-Kodak Universal Guide. This was a dial-type exposure "calculator" which was set up for a particular film (and thus for its sensitivity) by inserting into the Guide a little printed card for that film type. From early 1940, all Ciné-Kodak cameras then in production had

a Universal Guide mounted on them, almost always on the left side of the camera, which is almost always the loading door. In the case of the CKS1, the Guide went on the loading door of the film magazine.

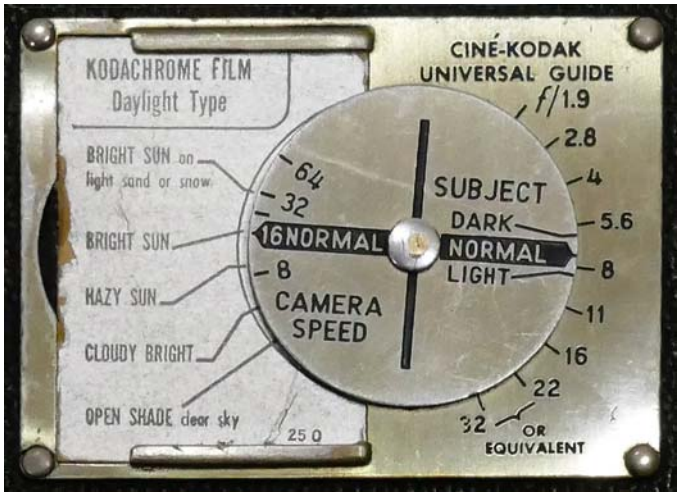

Figure 34. Ciné-Kodak Universal Guide on Cine-Kodak Special II

Figure 34 shows a typical Universal Guide (this one in fact on the magazine on a Ciné-Kodak Special II). We see in it the card for Kodachrome daylight film.

We see on the left of the dial arrows for the available frame rates of the camera, and on the right, three arrows that provide what we today call “exposure compensation” for three kinds of subjects. They lead to apertures of the “standard” recommended value (“normal”), 1/2 stop greater (“dark”), and 1/2 stop less (“light”).

The cards, by the way, were printed on a silver ink background, presumably to match the stainless steel frame of the Guide itself.

Subsequently, each package of film included a little silver card for that kind of film. Since that took a while to get fully underway (owing to the “pipeline” of film distribution), for a while every camera included a packet of little silver cards for all the film types that (at the time) were usable with that camera.

And the cameras made from that time on (all Ciné-Kodak models) no longer had that cluttered array of scene descriptions on their aperture indicating plates. The space cleared up was in many cases used to present the model name of the camera (earlier relegated to a nameplate in some obscure place, perhaps under the carrying handle).

Owners of Ciné-Kodak cameras made before that time (any model!) could have a Universal Guide fit to their camera by the Kodak factory, for a nominal fee ($1.00 in 1940). And this included replacing the aperture indicating plate with one of the new style for that camera, without scene lighting descriptions.

There were Universal Guides made to suit the particulars of all Ciné-Kodak cameras, whether still in production or not. And of course there were replacement aperture indicating plates for all Ciné-Kodak cameras, whether still in production or not

Yes, one nightmare was replaced by another, very thoroughly planned and implemented.

As a further part of the new order of things, the notion of an aperture detent was gradually eliminated. On new camera designs, for which there were specific lenses, the lens aperture ring did not have a detent plunger (or aperture lever with a detent bump), and the aperture indicating plate did not have the array of little cutouts.

In the world in which the Ciné-Kodak Special cameras were used, exposure metering eventually came into common use. Thus, getting advice on a shooting aperture from even the very handy and adaptive Universal Guide became less important, and I think that eventually CKS2 camera magazines no longer had a Universal Guide.

19. EN CASA

We are very proud to have in our collection of Kodak motion picture cameras lovely specimens of both the Ciné-Kodak Special and the Ciné-Kodak Special II. Both are indeed “special”.

The Ciné-Kodak Special was made in 1933, one of the earliest ones made (serial number 330; the numbers probably started with 100 or 101). We see her in figure 35.

Figure 35. Our Ciné-Kodak Special

She exhibits the earliest design of the CKS1, in which there is not yet a frame counter dial or hand crank latch, and the pulldown claw mechanism in the magazine puts the claw in from the front of the film rather than from the back as in later CKS magazines (as discussed in section 14.6).

In addition, the 6" (152 mm) f/4.5 lens on the camera is mounted with the "native" CKS mount. That might not seem remarkable. But, very shortly after this camera was made, Kodak went to almost all such lenses being equipped only with the new "universal" mount (Type S) and being mounted on a cameras such as a CKS1 with a mount adapter (itself a lovely thing). Thus, copies of this lens with the CKS mount are very rare.

Figure 36. Our Ciné-Kodak Special II

In figure 36, we see our Ciné-Kodak Special II.

She was doubtless made in either 1948 or 1949, and had initially been the property of Charles T. Chapman, a noted still photographer, then daredevil newsreel photographer, then documentary producer. Through contact with his grandson, Greg Chapman, who has taken on the daunting task of curating a gigantic collection of Charles Chapman's works and photos of him at work, we have gained considerable insight into Chapman and his work. We are hopeful that there will be discovered a photo of Chapman shooting with this very camera. (Chapman died in 1949.)

20. ACKNOWLEDGEMENTS

Thanks to Michael Cleveland, one of the recognized experts in the history of motion picture cameras, for his help with some of the more obscure details of this story.

Thanks to Greg Chapmen for helping to understand the provenance of our Ciné-Kodak II.

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