



Figure 1

Canon F-1

photographic system

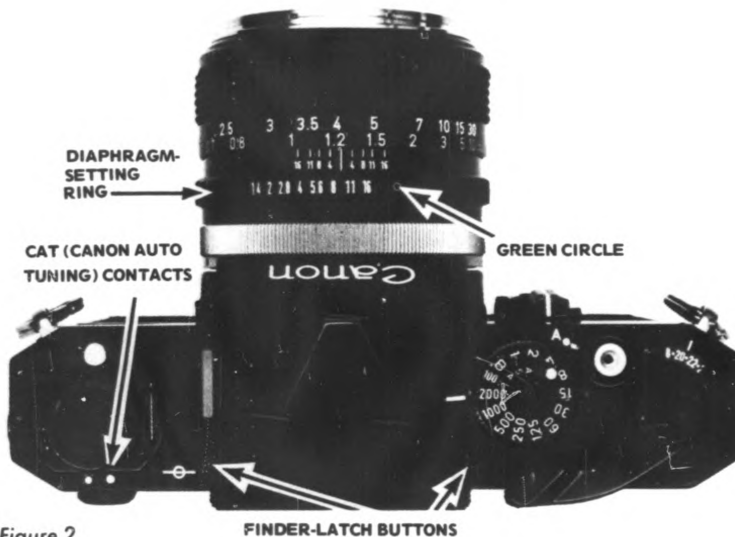


Figure 2

System cameras — not so long ago, that term was interchangeable with Nikon in 35mm formats. But then the challengers swarmed in, making the choice of a 35mm camera system a tough one. Among these, the Canon F-1 system is one of the most alluring.

The F-1's distinction as the nucleus of a true system shows up in the ultra-sophisticated accessories available. Naturally, there's an extensive array of lenses and focusing screens. But the real gems are the elaborate add-ons, like —

● **MF MOTOR DRIVE.** A comfortable, compact motor-drive unit with a maximum speed of 3.5 frames per second. Unlike the first F-1 motor drive (the MD), the MF has no bulky over-

The Camera Craftsman acknowledges with thanks the cooperation of Canon (USA) Inc. in providing the Canon F-1 studied in this article.

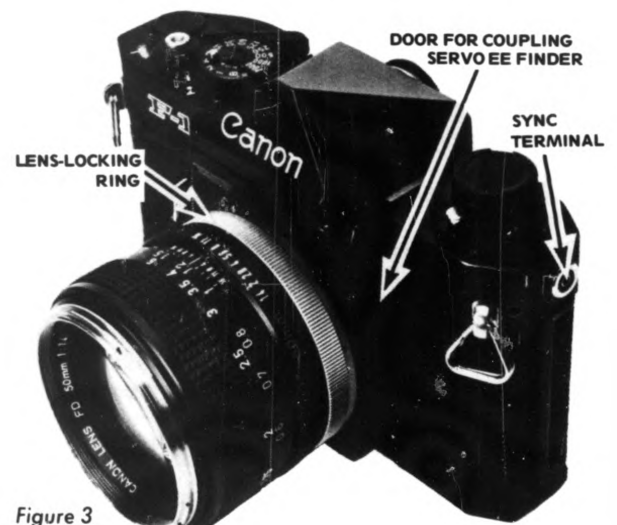


Figure 3

the-shoulder battery case and no pistol grip. But like the earlier unit, the MF attaches quickly and easily to the bottom of the camera. Just unscrew the battery cover and lift off the bottom plate — a slot in the bottom plate hooks over a body lug. Replace the battery cover and attach the motor drive. It's all so simple and convenient that there's only one problem — what to do with the camera's bottom plate while you're using the motor drive.

- **SERVO EE FINDER.** For full shutter-speed-preferred automation, replace the standard pentaprism finder with the Servo EE Finder. Remove the pentaprism finder by first depressing the two finder-latch buttons, Fig. 2; then, slide off the finder toward the back of the camera.

The Servo EE Finder connects to the lens diaphragm through a swinging door at the side of the lens standard, Fig. 3. In use, you set the diaphragm-setting ring to the green circle, Fig. 2, rather than to one of the standard aperture settings. A servo motor then drives the diaphragm to the proper opening size.

Inside the Servo EE Finder, there's a bridge circuit containing the servo motor and the photocells. The film-speed setting and the shutter-speed setting appear as resistance values to complete the bridge. When the bridge is balanced, no current flows to the servo motor; that's the correct aperture setting. But when the bridge isn't balanced, the servo motor drives the diaphragm-control ring to regain the balanced state.

- **BOOSTER T FINDER.** It's not really a booster at all. Rather, the Booster T Finder has its own metering system, completely independent of the camera's built-in system. Replace the standard pentaprism finder with the Booster T Finder for low-light shooting. The shutter-speed dial on the Booster T Finder goes from 60 seconds to 1/60 second. You can't use the faster speeds; but if you need the faster speeds, you don't need the Booster T Finder. To facilitate low-light shooting, the Booster T Finder

illuminates the match-needle system. There's a built-in timing mechanism for the speeds of 3 seconds through 60 seconds. Here, with the camera set at "bulb," the Booster T Finder holds in the release button for the required length of time.

Naturally, such exotic gadgetry isn't inexpensive. Prices range from around \$550 for the MF motor drive, \$390 for the servo system, and \$250 for the low-light system. By the time you add a few lenses, filters, etc., you've got quite an investment. But there's practically no photographic assignment that the fully equipped F-1 can't handle. You can even add view-camera tricks with Canon's new TS lens, a perspective-control optic that both shifts and tilts.

Since the F-1 is a system camera, we felt it deserved a system report. We announced a forthcoming report on the F-1 in our May-June 1974 issue of *THE CAMERA CRAFTSMAN*. But we'll also be doing complete stripdown reports on the major accessories. Our system report on the F-1 system begins in this issue with the camera body.

Features of The F-1

The F-1 made quite a splash when it was introduced with its full line of accessories. Yet the camera isn't really an all-new design. Rather, it seems the F-1 has combined the finest features of Canons past — and added the features necessary to make the camera fully compatible with the many accessory modules.

Shutter-speed control is purely mechanical with a conventional double-roller focal-plane shutter. Borrowing a strongpoint from the Canon Pellix, the F-1 uses titanium curtains. To open the camera back and examine the curtains, first depress the back-latch button on the accessory shoe, Fig. 4; then, pull up the rewind knob.

Full-aperture metering in the F-1 is by the match-needle system using mechanical coupling. A single CdS cell located behind the focusing screen reads 12% of the screen area, regardless of the lens being used. You can see the CdS cell after removing the pentaprism finder and the focusing screen — just use your fingernail to lift the rear edge of the

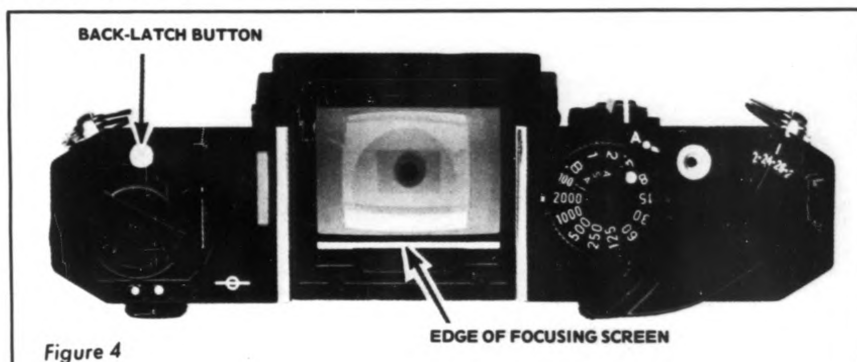


Figure 4

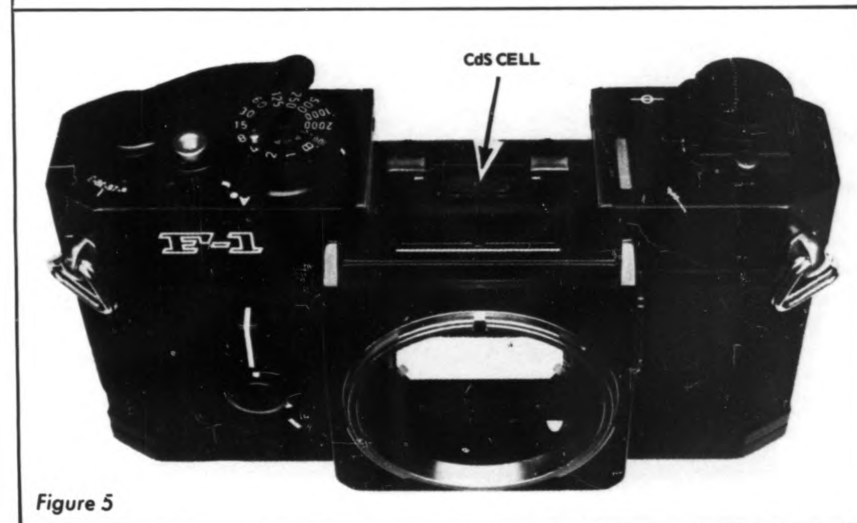


Figure 5

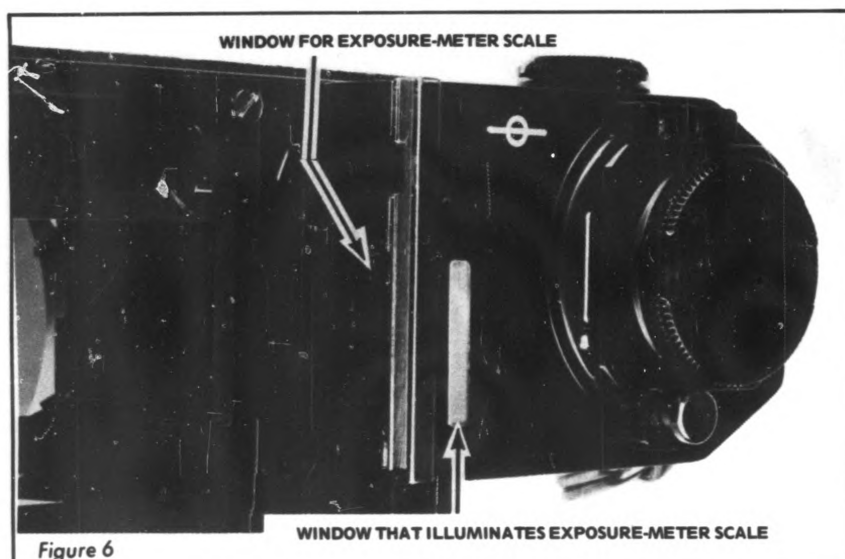


Figure 6

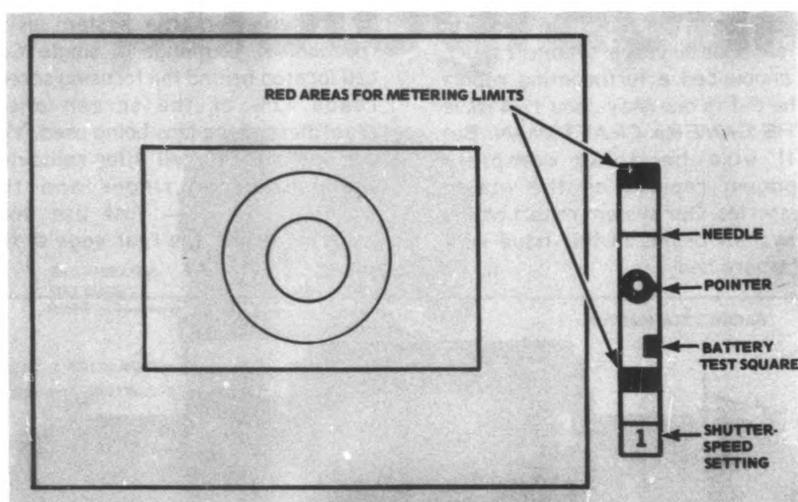


Figure 7

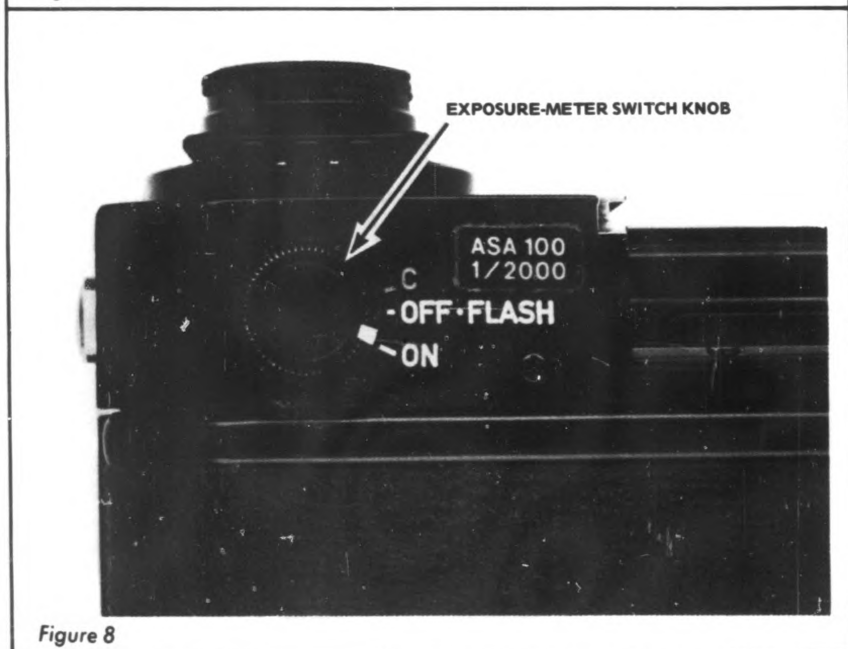


Figure 8

focusing screen, Fig. 4. A beam splitter at the back of the focusing screen routes the light to the CdS cell, Fig. 5.

A window at the rewind side of the finder cavity, Fig. 6, sends the exposure-meter information through the side of the finder. The window uncovers the exposure-meter scale, a scale illuminated by another window at the top of the camera, Fig. 6. Looking through the finder, you see the exposure-meter scale, the pointer, the needle, and the shutter-speed setting, Fig. 7.

Turn on the exposure meter with the exposure-meter-switch knob at the back of the camera, Fig. 8. Then, set the exposure by aligning the pointer over the needle. Changing either the shutter speed or the film speed rotates the galvanometer housing; selecting the diaphragm opening moves the pointer.

The "C" position of the exposure-meter-switch knob is the battery-test setting. To check the 1.3-volt (#625) mercury battery, first set the film speed (lift and turn the speed knob) and the shutter speed as shown by the calibrations next to the "C" — ASA 100 and 1/2000 second. When you then turn the exposure-meter-switch knob to "C," the needle should deflect to the battery-test square on the exposure-meter scale, Fig. 7.

You can see the pointer coupling by looking inside the lens mount. First, remove the lens by turning the lens-locking ring, Fig. 3, in a counterclockwise direction — the conventional Canon breechlock design. Now exposed inside the camera are the **diaphragm-closing lever**, the **lens-sensing lever**, and the **diaphragm-sensing lever**, Fig. 9.

The diaphragm-closing lever swings from right to left as the mirror rises to the taking position; that drives the **diaphragm-opening ring** of the lens counterclockwise (as seen from the back of the lens), Fig. 10. As a result, the spring-loaded diaphragm leaves close to the selected aperture. The other two levers couple the lens to the exposure-meter system.

Each lens in Canon's FD series has the special post shown in Fig. 10. By its height, the post tells the exposure-meter system the maximum aperture of the lens in use. Installing the lens brings the post against the lens-sensing lever, Fig. 9 — that pushes the lens-sensing lever into the camera body. And the lens-sensing lever sets

the initial position of the pointer according to the lens speed.

The diaphragm-sensing lever also couples to the pointer. Changing the diaphragm setting rotates the **diaphragm-coupling ring** of the lens — you can see the tab of the diaphragm-coupling ring in Fig. 10. The tab normally sits on top of the diaphragm-sensing lever, Fig. 9. So as you set a smaller aperture, the diaphragm-coupling ring pulls down the diaphragm-sensing lever. Setting a larger aperture allows the spring-loaded diaphragm-sensing lever to move toward the top of the camera.

Notice that turning the lens-locking ring counterclockwise (as seen from the front of the lens) moves the diaphragm-coupling ring to the position shown in Fig. 10. Consequently, the tab on the diaphragm-coupling ring passes to the top of the diaphragm-sensing lever. As you lock the lens in place, the lens-locking ring frees the diaphragm-coupling ring. Now, the diaphragm-coupling ring follows the rotation of the diaphragm-setting ring.

When you're using the Servo EE Finder, the diaphragm-coupling ring selects the aperture. Here, you set the diaphragm-setting ring to the green-circle calibration — that's the same aperture as $f/16$. Then, you turn the diaphragm-opening ring, Fig. 10, all the way counterclockwise until it latches in place. Since the diaphragm-opening ring no longer has any control, the leaves stop down to the smallest aperture. The Servo EE Finder can now position the diaphragm-sensing lever to turn the diaphragm-coupling ring.

There's a manual diaphragm control for a depth-of-field preview built into the delayed-action cocking control. Push the delayed-action setting lever toward the lens — the diaphragm-closing lever then moves from right to left in Fig. 9, allowing the diaphragm leaves to close to the selected aperture. Even this feature is a carryover from earlier models that use stop-down metering. But in many of the earlier Canons, actuating the depth-of-field preview also closes the exposure-meter switch.

Try looking through the finder while actuating the depth-of-field preview — you'll notice that the pointer swings out of view, toward the bottom of the exposure-meter scale. Yet you can still use the exposure-meter for through-the-lens metering — just

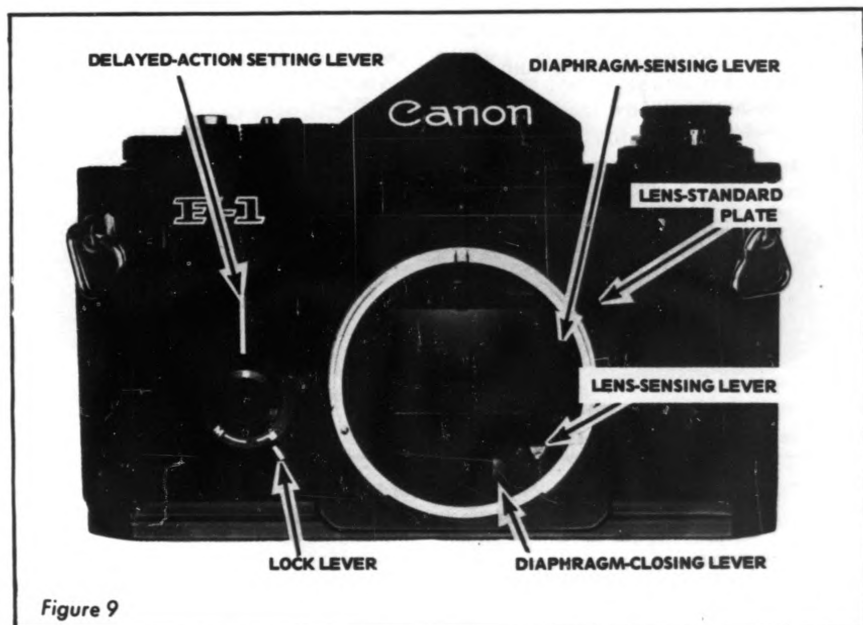


Figure 9

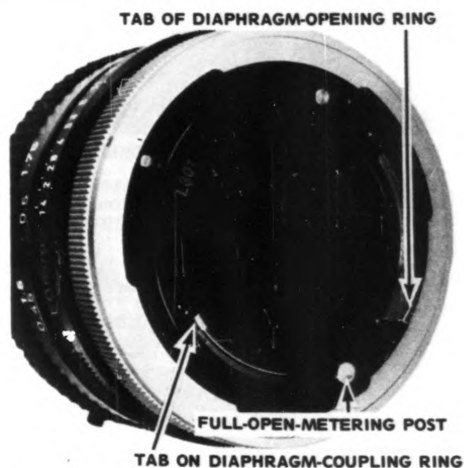


Figure 10

change the shutter or diaphragm settings until the needle centers on the battery-test square.

Locking the delayed-action setting lever in the stopped-down position allows you to use FL lenses with the F-1. The FD lenses provided for the Canon F-1 have all the needed coupling for full-aperture metering. But the FL lenses are designed for stopped-down metering. While holding the delayed-action setting lever in the stopped-down position, turn the lock lever, Fig. 9, to the "L" calibration; that locks the delayed-action setting lever to keep the lens stopped down.

Move the lock lever one more notch — to the "M" calibration — to raise the mirror and lock it in the taking

position. Notice that you must hold the delayed-action setting lever in the stopped-down position before the lock lever can perform its assigned duties. Return everything to normal by moving the lock lever to the white-line calibration.

For the self-timer function, turn the delayed-action setting lever in a counterclockwise direction. There's no override for the self timer; once it's cocked, you have to use it. Release the self timer by depressing the camera's release button.

One other feature we should mention is the automatic selection of the sync-delay time according to the shutter-speed setting. The single sync terminal, located at the rewind end of the camera, provides either X or FP

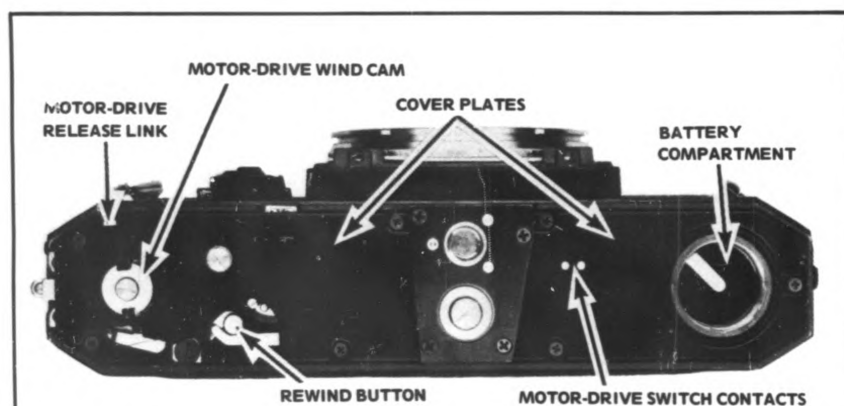


Figure 11

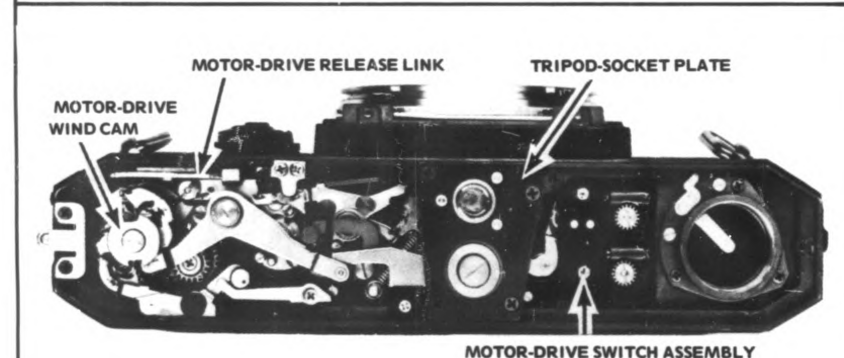


Figure 12

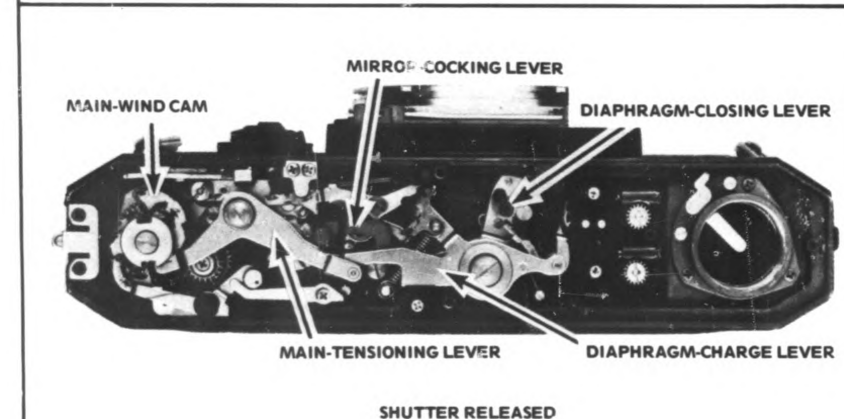


Figure 13

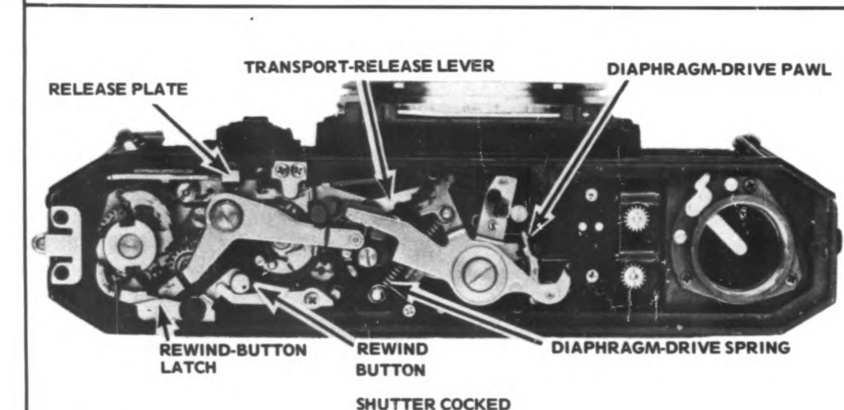


Figure 14

sync. If your shutter-speed setting is 1/60 second or slower, you get X sync. At faster speeds, the camera shorts out the X-sync contacts to provide an FP-sync delay.

Servicing Materials for The F-1

Praises to Canon — there is a good service manual and parts list available on the F-1. You can get the manual either from Canon or from National Camera Parts Department. The manual is also available on microfiche from National Camera.

The service manual uses an effective technique for showing the disassembly sequence. Going by sections of the camera, the manual provides an exploded drawing of the parts to be removed — each part is numbered according to the disassembly sequence. The same page also shows the parts numbers.

Once you're familiar with the theory of the camera, this disassembly-at-a-glance technique provides a handy reference. By then, you won't need a rehash on the theory we'll be covering here. But, unless you specialize in F-1's, you may need a reminder.

The service manual also includes reassembly instructions, adjustments, timing procedures, and factory specifications. Right at the start, the manual emphasizes the importance of maintaining the critical factory tolerances. The reason is that the F-1 must accept several different accessory modules — that makes precision especially vital. On disassembly, be very careful to note the positions of the many washers and spacers; make certain each one gets returned to its original position. We won't call out all of the washers during disassembly — they vary from camera to camera.

Transport Mechanism in The F-1

The mechanism at the bottom of the F-1 is nearly identical in design to earlier Canon models. To reach the transport system, remove the bottom plate and the two cover plates, Fig. 11. Careful: There are spacers under the cover plates, one at each screw position. A dab of adhesive holds the spacers to the camera body. But during disassembly, the spacers usually come loose and seem to enjoy falling into the camera.

Both the **motor-drive wind cam** and the **motor-drive release link** pass through cutouts in the wind-side cover

plate, Fig. 11. Fig. 12, with the cover plates removed, also points out these parts. There's one other motor-drive part that distinguishes the bottom view of the F-1 from other Canon models — the **motor-drive switch assembly**, Fig. 12. To get a better view of the motor-drive switch assembly and the rest of the transport mechanism, remove the tripod-socket plate — it's held by four screws, Fig. 12.

Before the exposure, the tab on the **diaphragm-closing lever** holds the motor-drive switch closed, Fig. 13. Notice that the switch blades sit against a black insulator around the tab. When the diaphragm-closing lever stops down the diaphragm leaves, it swings from right to left in Fig. 13; that allows the motor-drive switch to open.

After the exposure, the diaphragm-closing lever again closes the motor-drive switch. So the motor drive gets the signal to advance the film to the next frame.

The remaining gears and levers at the bottom of the camera advance the curtains, tension the mirror, and tension the diaphragm-closing system. If you're not familiar with Canon SLR's, you might take a moment to study these actions. At first glance, the mechanism may appear complex. But that's just because everything happens at once. The sequence is easier to follow if you examine each of the three actions in turn.

Probably the first lever you'll notice at the bottom of the camera is the **diaphragm-charge lever**, Fig. 13. The diaphragm-charge lever actually performs three different jobs in the camera. But it's named (by Canon) after its most obvious role in the operation of the diaphragm-closing system.

In Canon SLR's, cocking the shutter simultaneously tensions the diaphragm-closing system. Advancing the wind lever rotates the **main-wind cam**, Fig. 13, in a clockwise direction. One of the two lobes on the main-wind cam then drives the **main-tensioning lever** clockwise (on the next cocking cycle, the other lobe does the work). A downward-projecting stud on the right-hand end of the main-tensioning lever pushes the diaphragm-charge lever to the tensioned position, Fig. 14.

Here, the **transport-release lever** engages the diaphragm-charge lever; that holds the diaphragm-charge

lever against the tension of the diaphragm-drive spring, Fig. 14. Notice that as the diaphragm-charge lever swings in a clockwise direction, the **diaphragm-drive pawl** drops into engagement with the tab on the diaphragm-closing lever; the diaphragm-drive pawl mounts to the end of the diaphragm-charge lever.

Depressing the release button brings the sloped tab of the **release plate** against the transport-release lever (the release plate attaches to the end of the release shaft). Now, the release plate pushes the transport-release lever out of engagement with the diaphragm-charge lever. And the diaphragm-drive spring pulls the diaphragm-charge lever in the release (counterclockwise) direction.

The diaphragm-drive pawl carries the diaphragm-closing lever in the same direction, Fig. 15. So the diaphragm leaves stop down to the selected aperture. The diaphragm-drive pawl continues to hold the

diaphragm-closing lever for the duration of the exposure.

After the exposure, the diaphragm leaves must reopen to the largest aperture. That means the camera must somehow disengage the diaphragm-drive pawl from the diaphragm-closing lever. But as yet you can't see the part that disengages the diaphragm-drive pawl — it's hidden underneath the motor-drive switch assembly.

Remove the motor-drive switch assembly by taking out its two screws (you'll want it removed anyway, both for observation and for disassembly). You can now see the **disengaging link**, Fig. 16. The disengaging link attaches to the shaft of the mirror-return gear, a gear inside the camera that engages the closing-curtain take-up roller.

As the closing curtain crosses the focal-plane aperture, the disengaging link rotates clockwise (the direction of the curved arrow in Fig. 16). Then, at the end of the exposure, the

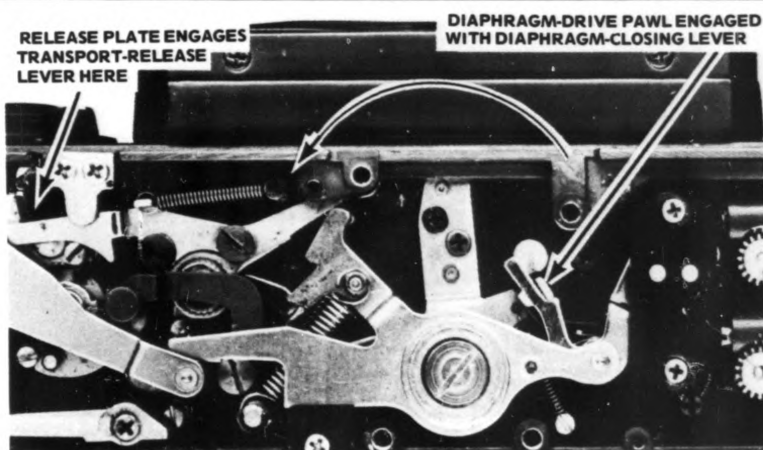


Figure 15

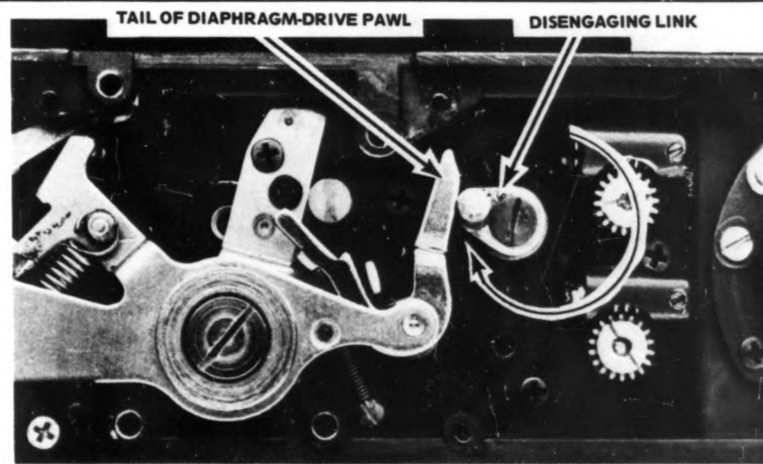


Figure 16

disengaging link strikes the tail of the diaphragm-drive pawl. Thus freed, the spring-loaded diaphragm-closing lever returns to its "rest" position.

Besides tensioning the diaphragm-closing system, the main-tensioning lever cocks the mirror. Moving counterclockwise, the main-tensioning lever comes against a stud on the **mirror-cocking lever**, Fig. 13; that pushes the mirror-cocking lever toward the front of the camera. A lug on the mirror-cocking lever passes through the bottom of the camera to engage the mirror-tensioning lever on the mirror cage.

The **mirror latch** then engages the mirror-cocking lever, Fig. 17. As long as the mirror latch holds the mirror-cocking lever, the mirror-lifting spring (on the mirror cage) remains tensioned. But the mirror can't rise to

the taking position until the mirror latch disengages the mirror-cocking lever.

Disengaging the mirror latch is the second function of the diaphragm-charge lever. Remember, the diaphragm-charge lever swings counterclockwise to close the diaphragm. At the end of its movement, the diaphragm-charge lever strikes the mirror latch. Now, the spring-driven mirror rises to the taking position.

The third action visible at the bottom of the camera tensions the curtains and releases the curtain transport. As you advance the wind lever, the **main-wind gear** (under the main-wind cam) rotates—that drives the intermediate reduction gear, the sprocket gear, and the transport-cam gear. The transport-cam gear is part

of the **main-transport cam**, Fig. 17; it's underneath the main-transport cam and isn't yet visible.

Right now, the main-tensioning lever pretty well obscures the main-transport cam. But the main-transport cam is the key part in the curtain-tensioning sequence. So in Fig. 18, we have removed the main-tensioning lever to provide a better view.

Notice that there are two pawls mounted to the main-transport cam—a tension-type spring hooks to each pawl. The pawl toward the front of the camera is the **transport latch**. Yet it does more than latch the transport mechanism; it also advances the curtains.

As the main-transport cam rotates counterclockwise, the transport latch engages a notch in the **opening-curtain cam**. The opening-curtain cam attaches to the curtain-wind shaft, a shaft running to the opening-curtain wind gear at the top of the camera. Now, the curtain-wind shaft rotates with the main-transport cam. And that turns the opening-curtain wind gear, drawing the two curtains to the tensioned position.

The main-transport cam continues to rotate until its cutout is above the end of the release plate, Fig. 18—here's the only position at which you can depress the release rod. At any other point in the cocking cycle, the main-transport cam blocks the downward travel of the release plate.

In the curtain-tensioned position, the opening-curtain latch at the top of the camera engages the opening-curtain wind gear. The opening-curtain latch is the part that the mirror disengages to release the curtains. But before the curtains can release, the transport latch must disengage the opening-curtain cam. And that's the third function of the diaphragm-charge lever.

Moving counterclockwise, the diaphragm-charge lever pushes the transport-release lever against the eccentric stud of the transport latch. So the transport latch swings out of engagement to free the opening-curtain cam.

Removing The Top-Cover Plates

The F-1 has two separate top-cover plates—one on the wind side and one on the rewind side. It makes no difference which plate you remove first. But in either case, you'll have to take off the lens-standard plate, Fig. 9. So take out the four cross-point

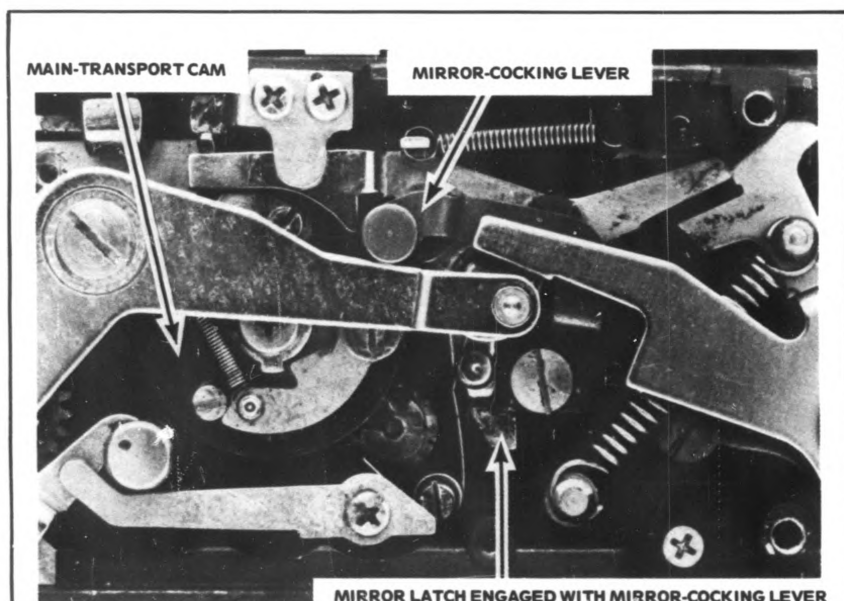


Figure 17

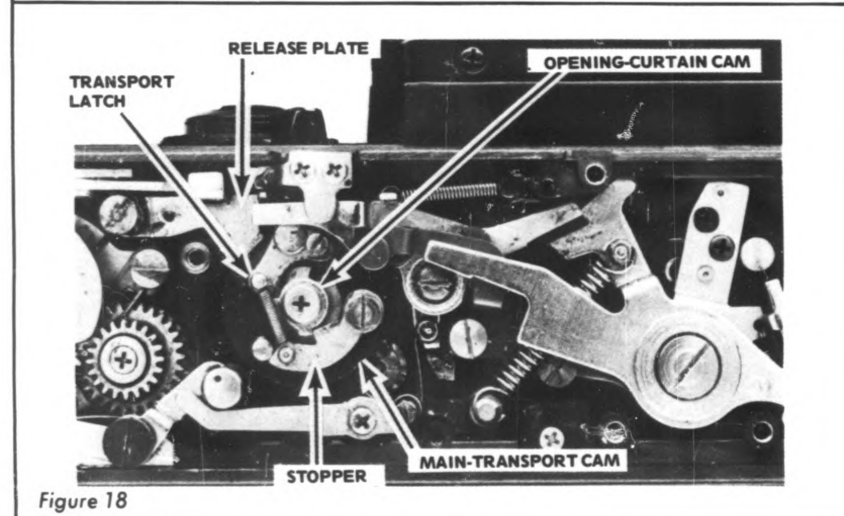


Figure 18

screws — two at the bottom and one at each side — and lift off the lens-standard plate.

You can now see the four screws holding the lens-mounting ring, Fig. 19. The lens-mounting ring provides the adjustment for the flange-focal distance — 42.14mm in the F-1. One way to check the flange-focal distance is to place a flat block at the focal-plane aperture; the block must fit the film-guide rails. Then, hold open the shutter on "bulb." Using a depth micrometer or a depth gage, measure between the front surface of the lens-mounting ring and the block. However, there are more accurate methods of measuring the flange-focal distance — methods that allow you to simultaneously check the parallelism of the lens-mounting ring to the film-guide rails. A feature article coming soon in **The Camera Craftsman** describes several such techniques.

If the flange-focal distance isn't correct, remove the lens-mounting ring. You'll then find a series of spacers between the lens-mounting ring and the front plate of the camera. Your adjustment is by adding or removing spacers, thereby changing the distance between the lens-mounting ring and the film-guide rails.

Now, starting with the rewind-side top-cover plate, wedge the rewind shaft and unscrew the rewind knob (careful — the rewind shaft is quite thin and can break). Remove the three screws holding the accessory shoe. As you lift off the accessory shoe, watch for the triangular spacer that's loose. Unscrew the sync terminal from the end of the top-cover plate. And use your Multispan wrench to remove the screw holding the exposure-meter-switch knob.

Two cross-point screws hold the rewind-side top-cover plate — notice that one of the screws, formerly covered by the lens-standard plate, lacks the glossy-black finish. Remove both screws and lift off the rewind-side top-cover plate.

You can now see the galvanometer assembly, Fig. 20. The prism sitting next to the galvanometer housing — called the **information prism** by Canon — catches the light coming through the top-cover-plate window. It then sends the light through the exposure-meter scale, mounted vertically on the finder wall, and into the finder.

The red flag sitting beside the information prism warns of the

underexposure metering limits. When you try to align the pointer and needle — but the light level is too low for the metering system — the **metering-limit flag** moves over the information prism. Then, the exposure-meter scale seen through the finder turns red; that warns you that the exposure meter can't handle the shutter settings.

Removing The Wind-Side Top-Cover Plate

Remove the wind lever by taking off its cover screw; watch for the coupling cam and the spring washer which sit between the cover screw and the wind lever. Lift off the cocking cam that couples the wind lever to the wind-lever shaft.

The locking ring around the release button allows you to lock the release

button and prevent an accidental exposure. Loosen the three setscrews holding the collar above the locking ring. Careful: There's a small (1.2mm) ball detent under the collar that provides the two click-stop positions for the locking ring. Lift off the collar, the ball detent, and the locking ring. The compression spring for the ball detent remains inside the collar.

There's not really a timing consideration when removing the speed knob; and nothing flies out of position. But a stud on the underside of the speed knob must pass into the slot in the meter-cam post (that's the cam that moves the galvanometer for shutter-speed and film-speed changes). And it's possible to replace the speed knob 180 degrees out of

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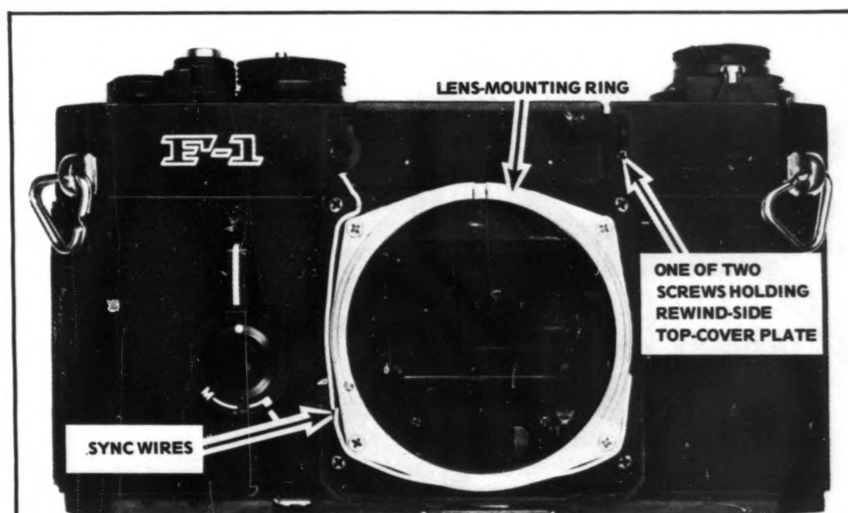


Figure 19

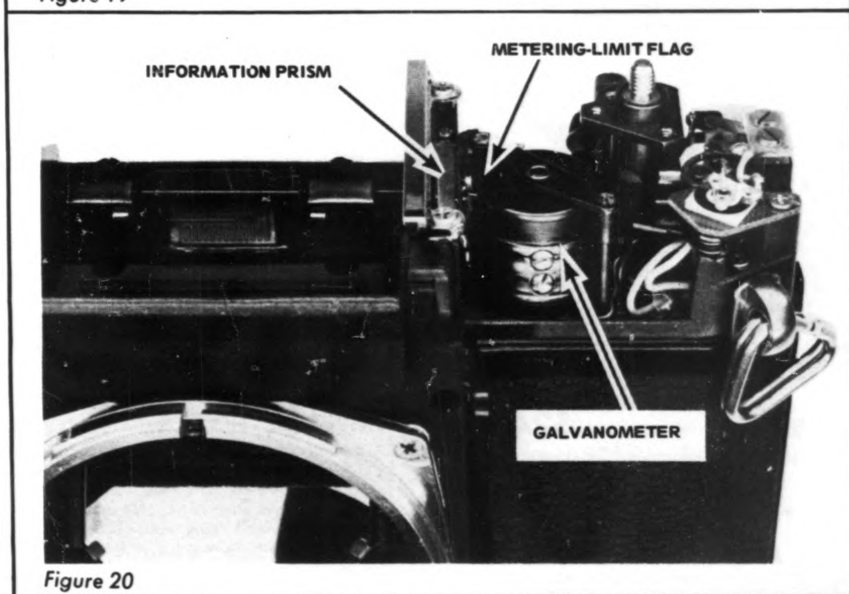


Figure 20

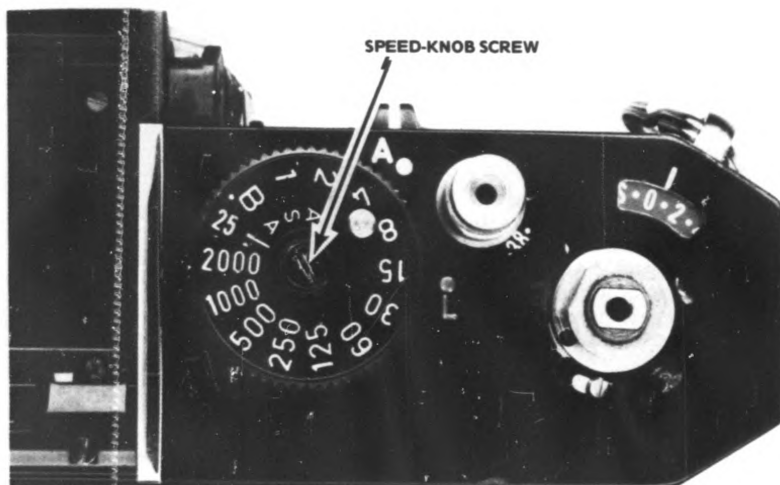


Figure 21,

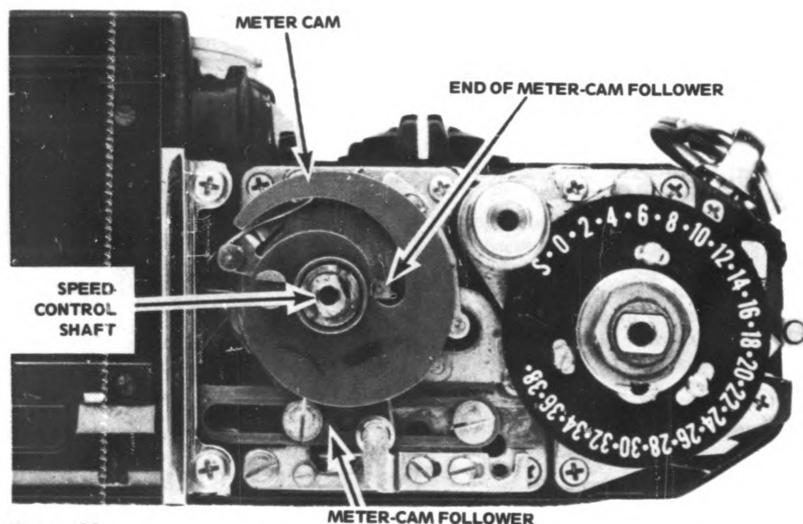


Figure 22

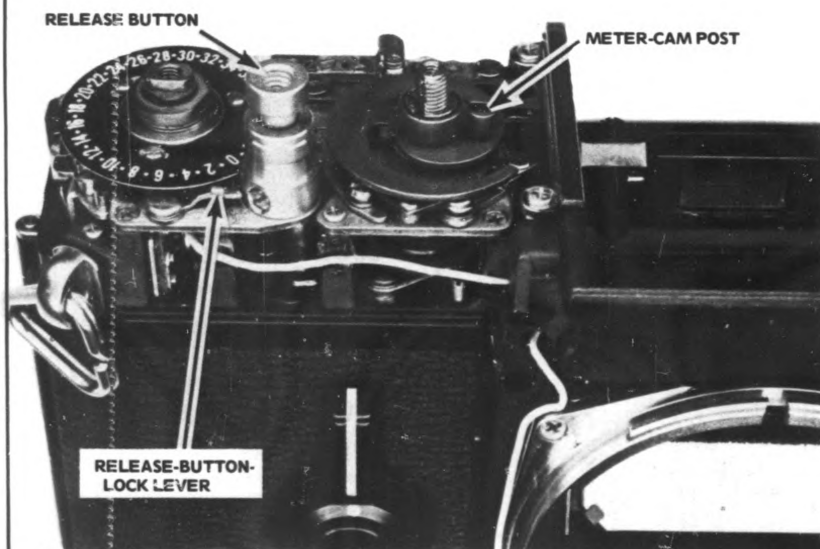


Figure 23

position with respect to the speed-setting shaft. So, for reassembly reference, set your shutter speed to 1/2000 second and your film speed to ASA 25. As you'll see in a moment, it's easy to position the meter cam at these settings for reassembly.

A screw holds the cap in the center of the speed knob, Fig. 21. But there's a small, round decorator disc in the center of the cap; and the decorator disc hides the screw. Carefully peel off the cemented decorator disc. Then, remove the screw, the cap (spacer underneath), and the speed knob.

Finally, remove the three cross-point screws and lift off the wind-side top-cover plate. Cross-point screws, incidentally, are used throughout the F-1 (as well as in most modern cameras). If you have a good cross-point screwdriver, these screws are really a blessing — tight though it may be, a cross-point screw usually looks as good after removal as it did before. Granted, a good cross-point screwdriver isn't always easy to find. But one we can strongly recommend, now being carried in the **NC Flasher**, is the cross-point screwdriver originally distributed as a special tool for Kodak Pocket Instamatics.

Fig. 22 shows the meter cam at the settings of 1/2000 second and ASA 25. With the speed-setting shaft at 1/2000 second, it's pretty easy to find the ASA 25 position of the meter cam — just turn the meter cam all the way counterclockwise. The **meter-cam follower** then stops the meter cam at the ASA 25 setting.

Now's a good time to replace the speed knob — you can then set the various combinations of settings to check the adjustments. Just be sure that the stud on the underside of the speed knob fits into the slot in the meter-cam post, Fig. 23. Also, replace the wind lever to cock the shutter.

There's only one problem in operating the camera — the spring-loaded **release-button-lock lever**, Fig. 23, moves under the release button. Normally, the locking ring on the top-cover plate holds the release-button-lock lever disengaged. To depress the release button, push the release-button-lock lever against its spring tension (toward the back of the camera). Or, simply remove the spring.

Exposure-Meter System In The F-1

As mentioned earlier, the F-1 uses a mechanical cross-coupling system; setting the shutter speed or the film speed rotates the galvanometer housing. But rather than Canon's typical geared rack with all its timing considerations, there's a simple wire link. The wire link, running behind the photocell, connects the meter-cam follower to the **galvanometer-control slide**, Fig. 24.

Looking underneath the speed-control bridge, locate the screw that holds the wire link to the meter-cam follower, Fig. 25 (you may have to rotate the speed knob to see the screw). Also, locate the loop in the end of the wire link that fits over the eccentric stud on the galvanometer-control slide, Fig. 24.

Turning the speed knob — either to change the shutter speed or the film speed — rotates the meter cam. And the meter-cam follower, tracing against the edge of the meter cam, moves the galvanometer-control slide via the wire link. A spring-loaded arm — part of the galvanometer housing — rides against a lug on the galvanometer-control slide. It's the spring on the galvanometer arm that keeps the meter-cam follower against the edge of the meter cam.

If the galvanometer rotates all the way counterclockwise, its arm contacts the metering-limit flag. The galvanometer arm then pushes the metering-limit flag over the information prism.

We also mentioned that changing the diaphragm setting moves the pointer. But it's pretty difficult to see the pointer — it's nearly hidden behind the information prism. So in Fig. 26, we have removed the finder-guide rail and the information prism to show the pointer.

Note: There's a sliding adjustment on each of the finder-guide rails. It's recommended that you only remove one of the finder-guide rails at a time. You can then use the pentaprism finder to adjust the position of the finder-guide rail on reassembly. In later illustrations, we have removed both finder-guide rails to better illustrate the various parts.

You can now see the remaining exposure-meter parts — the needle from the moving coil of the galvanometer and the pointer, Fig. 26.

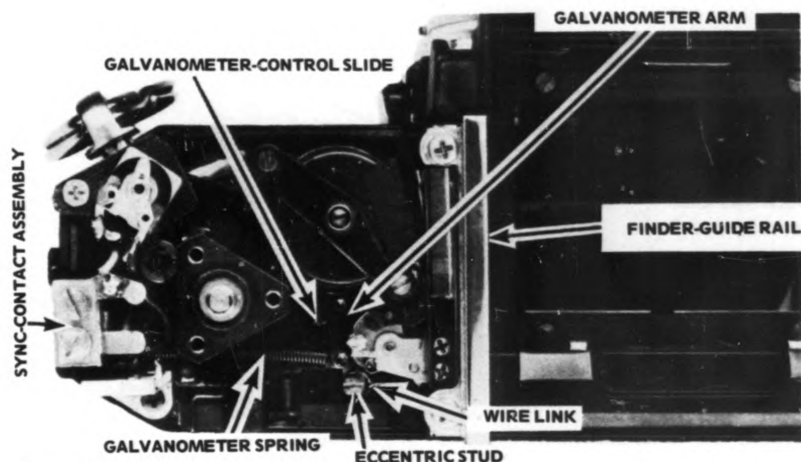


Figure 24

SCREW THAT HOLDS WIRE LINK
TO METER-CAM FOLLOWER



Figure 25

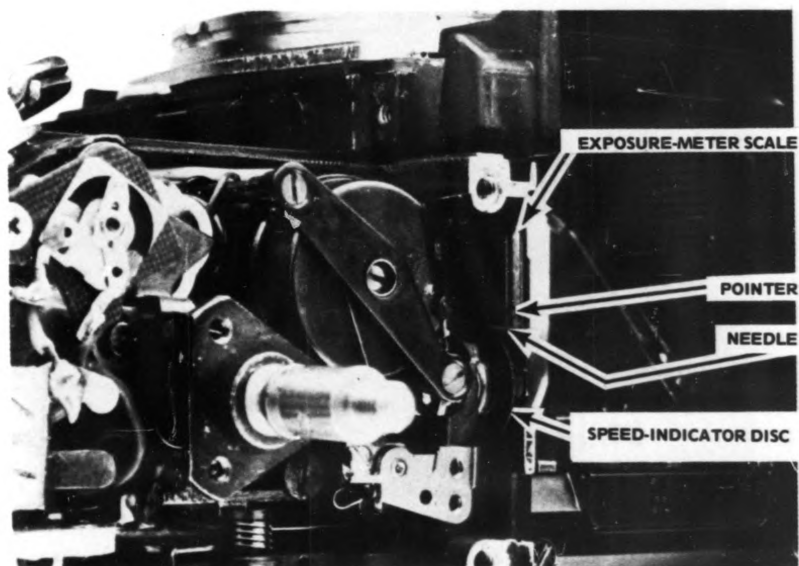


Figure 26

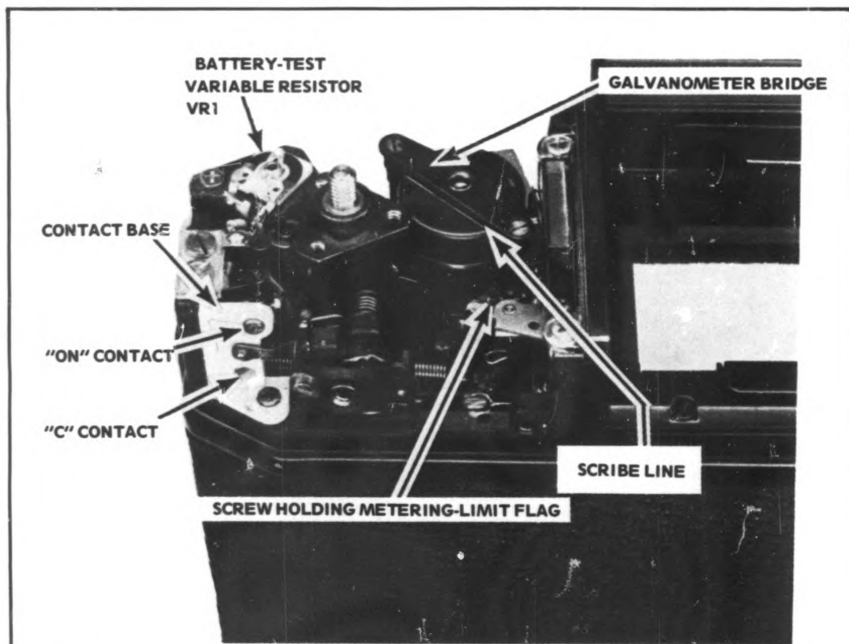


Figure 27

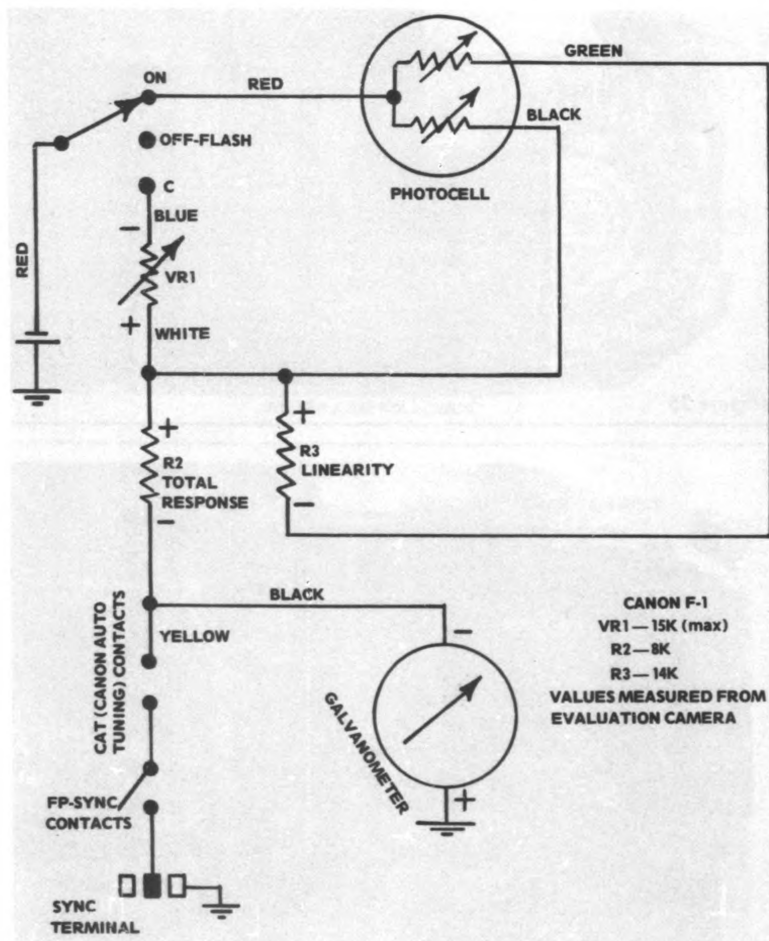


Figure 28

The pointer perches on top of a lever mounted to the side of the mirror cage. Changing the diaphragm setting moves this **pointer-control lever**; and the pointer-control lever carries the pointer along the exposure-meter scale.

Another part visible in Fig. 26 — though it has nothing to do with the exposure meter — is the **speed-indicator disc**. A cord couples the speed-indicator disc to the shutter's speed-setting shaft. As you change the shutter speed, the speed-indicator disc rotates until the corresponding shutter-speed calibration is alongside an opening in the exposure-meter scale. So the information prism sends both the shutter-speed setting and the exposure-meter information into the finder.

Mechanical Adjustments On The F-1 Exposure Meter

There's only one timing adjustment on the exposure-meter linkage — that's the coupling between the wire link and the meter-cam follower, Fig. 25. Both screw holes — one in the tab at the end of the wire link and one in the meter-cam follower — are elongated. By first loosening the screw, you can shift the position of the wire link.

Here, the manufacturer provides a very convenient timing reference. Notice the scribe line on the top of the galvanometer housing. At the settings of **ASA 100** and **1/125 second**, the scribe line should align with the side of the galvanometer bridge, Fig. 27.

If the galvanometer doesn't time properly, loosen the screw, Fig. 25, and change the timing between the wire link and the meter-cam follower. When you disassemble the camera, you must remove the screw shown in Fig. 25. So, on reassembly, it's necessary to retune the linkage.

Note: Some earlier models of the F-1 don't have the adjustment screw shown in Fig. 25. Instead, solder holds the wire link to the meter-cam follower. Adjustment is then by disconnecting the wire link and resoldering it at a different position. Thank goodness (and Canon) for the modification.

There's also a mechanical adjustment on the metering-limit flag. Check the metering-limit flag by

setting your film speed to **ASA 100** and your shutter speed to **1/2 second**. Here, the metering-limit flag should cover the information prism. Turning the speed knob to 1/4 second should uncover the prism. If necessary, loosen the screw shown in Fig. 27 and shift the position of the metering-limit flag.

For a mechanical cross-coupling system, the F-1 linkage is a near-ultimate in simplicity; and that makes it a pleasure to service. There's only one thing we miss. The eccentric accessible through the supply-spool chamber failed to carry over from other Canon designs. That eccentric rotates the galvanometer housing, a most convenient total-response adjustment for exposure-meter accuracy. The F-1 does provide a similar mechanical adjustment — the eccentric stud used to hook the wire link to the galvanometer-control slide. But the adjustment has very little effect.

Electrical Operation Of The F-1 Exposure Meter

Not only do we miss the convenient total-response adjustment of earlier Canons, we also miss the electrical linearity adjustment. There's only one variable resistor in the F-1 — that's the battery-test variable resistor VR1, Fig. 27.

When you turn the exposure-meter-switch knob to the "C" (check) position, the exposure-meter-switch blade engages the lower contact of the contact base, Fig. 27. And in the schematic, Fig. 28, the arrow portion of the switch blade touches the "C" contact. Current now flows through VR1, through the fixed resistor R2, and through the galvanometer.

Moving the exposure-meter switch to the "on" contact switches out the variable resistor VR1. Now, the current flows through the CdS cell. Notice that the CdS cell has two resistance paths in parallel to improve the linearity of the response.

The current flowing through the black photocell lead passes through fixed resistor R2 on its way to the galvanometer. But the current flowing through the green wire passes through both R2 and R3. So resistor R3 provides a linearity control. Since all the galvanometer current has to flow through resistor R2, R2 provides a total-response control.

Making an electrical adjustment for accuracy requires changing the

values of R2 and R3. That's not too easy. Both fixed resistors, gloved by an insulator sleeve, sit underneath the variable resistor VR1. By pulling out the resistors and removing the insulator, you can see that there's quite a bit of soldering involved to remove and replace a resistor.

Probably the easiest way to find the required resistance values is to hook two pots in place of the two fixed resistors. Then, adjust the pots until the exposure meter reads properly through its entire range of response. Measuring the resistances of the pots tells you the values needed. That way, you only have to solder and unsolder twice.

Perhaps the reason the F-1 lacks more convenient adjustments relates to Canon's parts-supply policy — the factory supplies the photocell, galvanometer, and resistors as a complete, matched unit. According to Canon's service manual, you can't get individual replacement components — you just replace the whole works. That's fine for damaged components. But it sure seems like an extreme for calibration.

Removing The Exposure-Meter Assembly

If you're going through a complete disassembly, you'll probably find it easier to remove the exposure-meter assembly first — before removing the front-plate/mirror-cage assembly. And it's easier to replace the front-plate/mirror-cage assembly before replacing the exposure-meter assembly.

However, it's also possible to remove the front-plate/mirror-cage assembly with the exposure meter still in place. At times, that'll be the best bet. After all, there's no use disturbing the timing of the galvanometer and the tensioning of the speed-indicator disc if it's not necessary.

If you just want to remove the front-plate/mirror-cage assembly, there're only two wires to disconnect. These are the two white wires coming from the FP-sync contacts on the side of the mirror cage. Both white wires pass through a hole in the front plate, Fig. 19. Tracing one white wire to the wind side of the camera, you can find where it connects to the X-sync contacts, Fig. 29. The solder joint is a

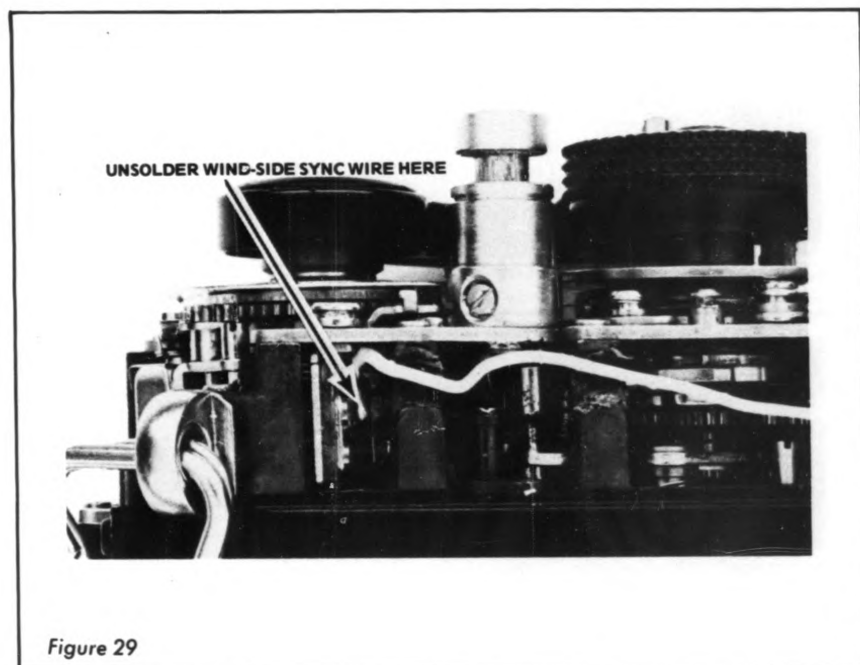


Figure 29

SYNC-CONTACT ASSEMBLY

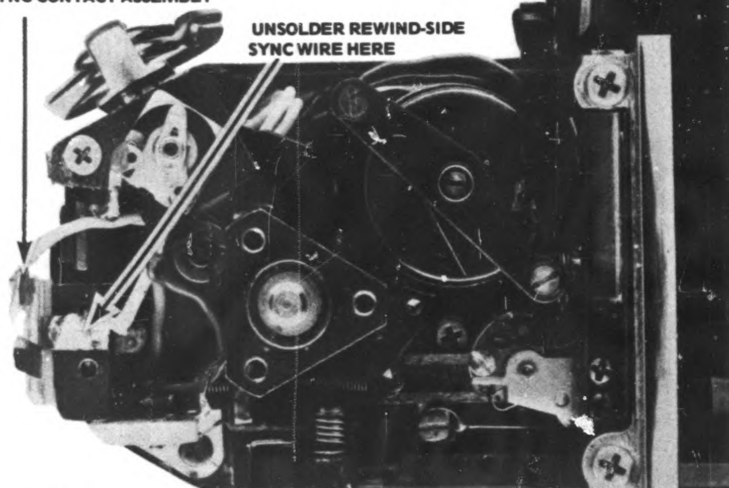


Figure 30

SPEED-SHAFT PULLEY

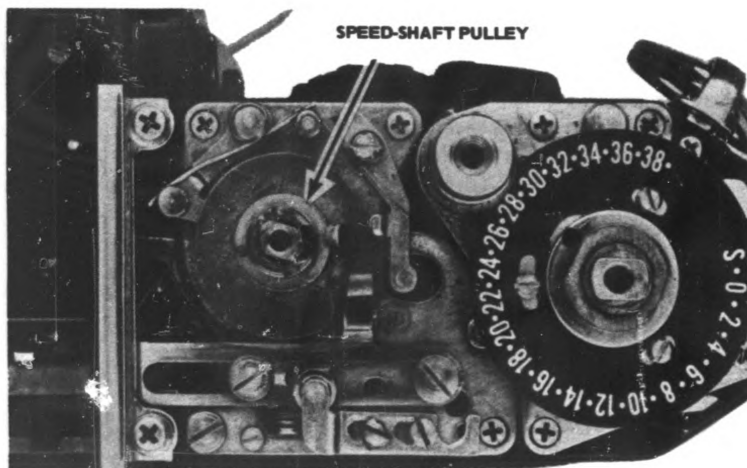


Figure 31

RESISTORS

SCREW HOLDING VR1

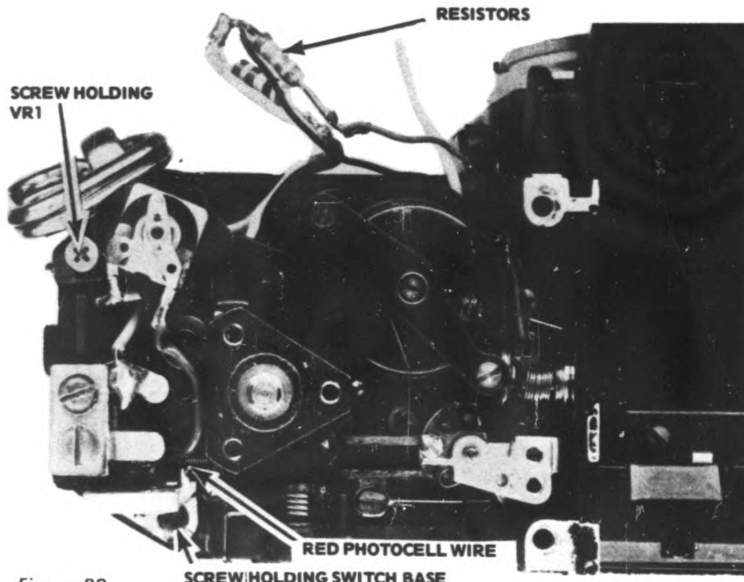


Figure 32

little hard to reach. But with care (and a small tip on your soldering pencil) you can unsolder the wire.

The other white wire goes to the sync-terminal contact on the rewind side of the camera. And it's even tougher to reach. However, matters are a little easier if you first remove the two screws holding the **sync-contact assembly**, Fig. 24. Then lift the sync-contact assembly high enough to find where the white wire connects, Fig. 30. Unsolder the white wire.

A later topic describes the remaining procedure for removing the front-plate/mirror-cage assembly. But we'll proceed here with the exposure-meter disassembly. Remove the speed knob, the meter cam, and the washer underneath the meter cam. You can now see where the coupling cord for the speed-indicator disc hooks to the speed-setting shaft. Notice that there's a pulley formed around the speed-setting shaft — a knot in the end of the coupling cord fits into a hole in the speed-shaft pulley, Fig. 31. A touch of cement adds to the cord's security.

Disconnecting the coupling cord releases the initial tension of a spring — the spring that drives the speed-indicator disc. Replacing the initial tension on reassembly is a little tricky. However, there's no choice in the matter — if you're going to remove the exposure meter, you have to let off the initial tension. So disconnect the coupling cord and allow the spring on the speed-indicator disc to unwind. We'll describe the initial-tensioning procedure in a moment.

Pull the coupling cord to the rewind side of the camera. Now, remove the finder-guide rail and the information prism (parts we removed earlier while discussing the exposure-meter operation). Disconnect the looped end of the wire link from the galvanometer-control slide. And pull the insulator sleeve from the two fixed resistors — you'll have to get to the resistors to unsolder the photocell leads.

The photocell leads are easy to identify — they're the three small wires. Unsolder the red photocell lead from the terminal at the top of the switch base, Fig. 32. Unsolder the green photocell lead from the end of resistor R3, Fig. 33. And unsolder the black photocell lead from the other end of R3, the point where the two fixed resistors connect.

Next, remove the screw holding the variable resistor VR1. Lift aside the variable resistor, leaving the wires attached. Remove the two screws holding the sync-contact plate (as we did earlier when describing the first part of the front-plate/mirror-cage removal). Lift aside the sync-contact plate with the yellow wire still attached.

One screw holds the switch base, Fig. 32. Notice that the switch blade stays with the switch shaft — and the switch shaft remains on the camera body. Remove the screw. Then, being careful to avoid damaging the switch blade, lift aside the switch base. A blue wire remains attached.

Now, disconnect the spring from the **rewind-shaft-lock lever**, Fig. 34. Take out the rewind-shaft-lock lever by removing its shoulder screw; the spring remains seated around the screwhead. Disconnect the galvanometer spring from the hooking lug on the camera body.

There are three screws holding the galvanometer assembly; two are countersunk. Remove all three screws, Fig. 35. Then, carefully lift the side of the galvanometer assembly that faces the exposure-meter scale. With a little tilting and turning, you can now remove the galvanometer assembly. The coupling cord remains attached to the pulley that's part of the speed-indicator disc.

Finally, remove the two photocell-mounting-plate screws, Fig. 36. Lift out the photocell, pulling the three wires through the clearance slot in the finder wall.

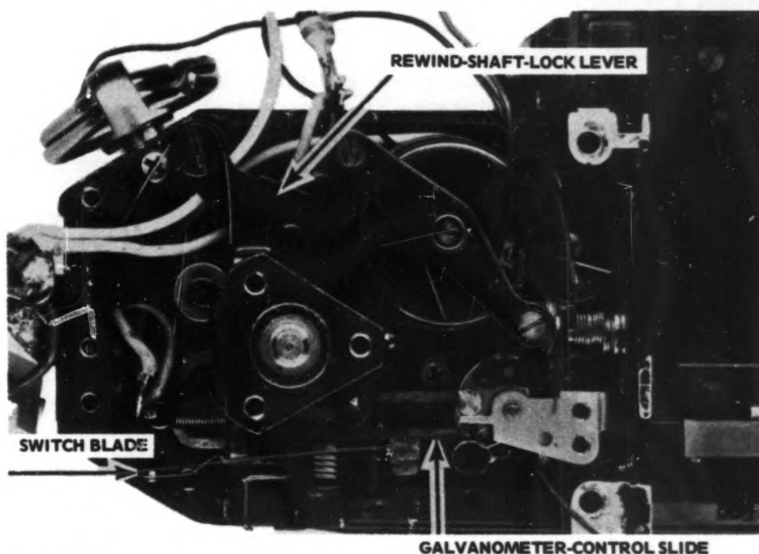


Figure 34

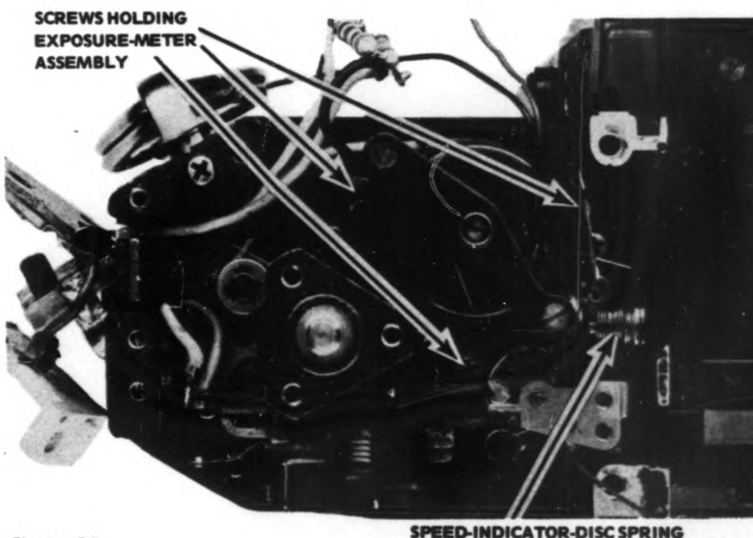


Figure 35

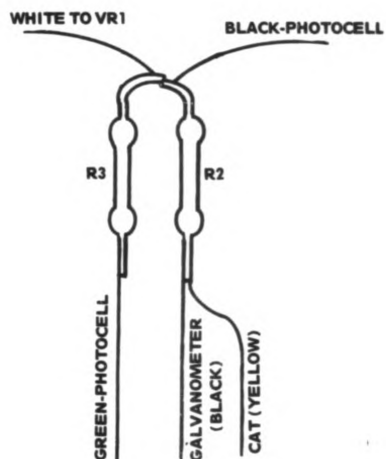


Figure 33

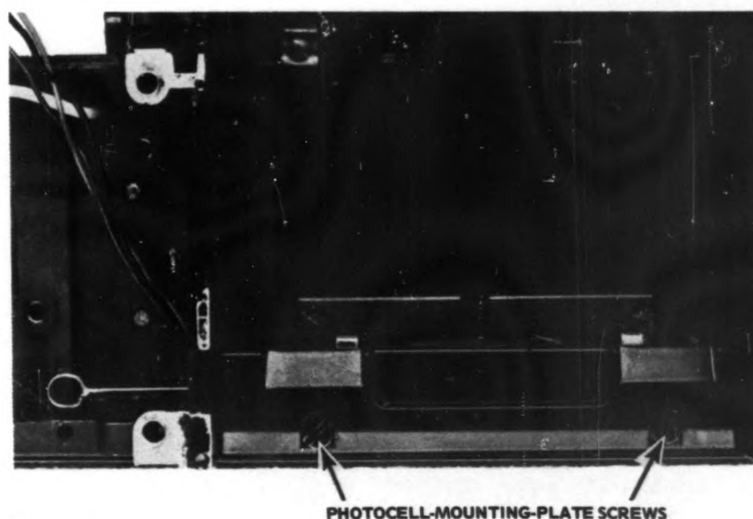


Figure 36

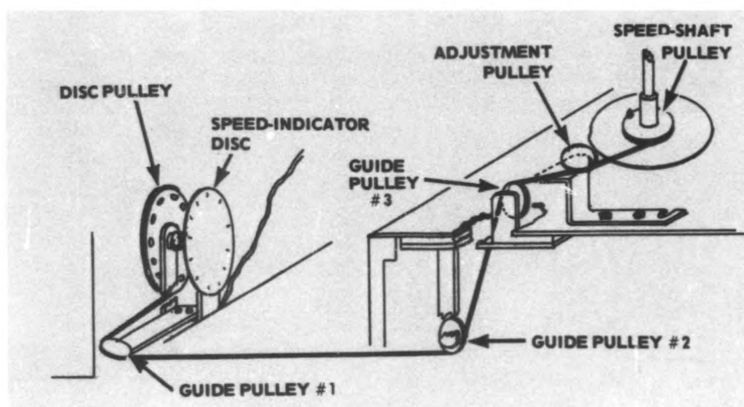


Figure 37

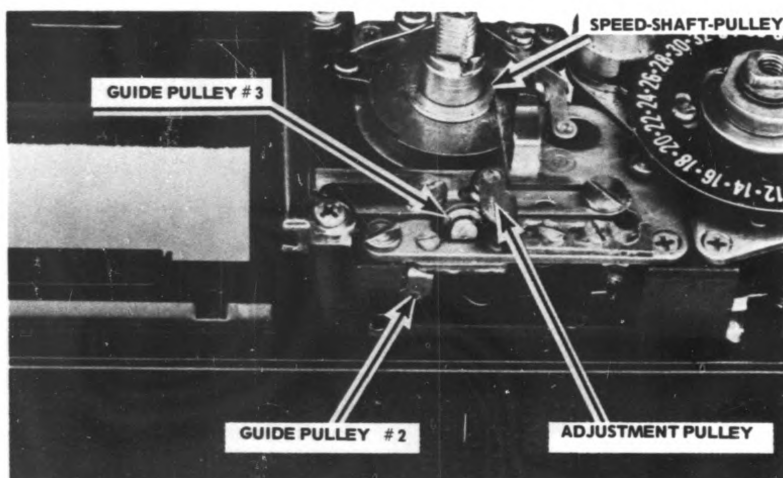


Figure 38

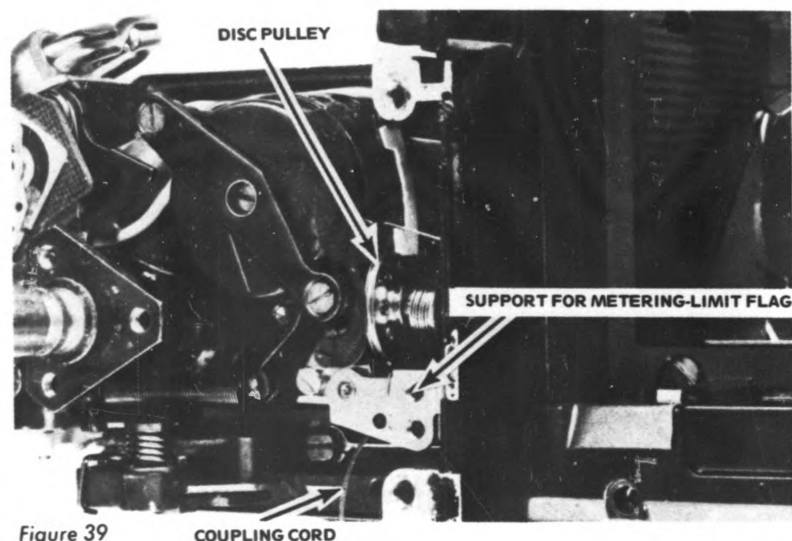


Figure 39

Replacing The Coupling Cord For The Speed-Indicator Disc

The only tricky thing about replacing the galvanometer is rehooking the coupling cord for the speed-indicator disc. First, there's the problem of getting the cord routed properly. And second, there's the problem of applying the initial tension to the spring for the speed-indicator disc, Fig. 35.

Fig. 37 shows the route of the coupling cord. First, the coupling cord wraps around the pulley attached to the speed-indicator-disc shaft. From there, the coupling cord passes around the guide pulley behind the speed-indicator disc, across the track behind the photocell, and around the bottom of a guide pulley under the speed-control bridge. Then, the coupling cord passes through a cutout in the speed-control bridge, over the top of a third guide pulley, and around the adjustment pulley before finally attaching to the speed-control shaft, Fig. 38. Whew!

Routing the coupling cord over and around all the pulleys isn't as tough as it might sound. The complication is in simultaneously applying the initial tension to the speed-indicator-disc spring. Many times, we hear camera repairmen wishing that they had three hands. Here's one place a third hand would indeed be helpful.

In describing the reassembly, we're starting with the exposure-meter assembly installed — only the coupling cord remains disconnected. The coupling cord should now be coming off the bottom of the disc pulley; that is, the hole in the disc pulley that receives the knotted end of the coupling cord is toward the bottom of the camera. Notice in Fig. 39 that the coupling cord passes under the support for the metering-limit flag.

Now, remove the two screws holding the photocell-mounting plate. Pull aside the photocell, toward the front of the camera, to expose the track for the wire link and the coupling cord.

With everything at the ready, you can apply the initial tension to the speed-indicator-disc spring. There's a series of holes in the disc pulley; so you can turn the pulley with one pair of tweezers while preventing the pulley from turning in the opposite direction with another pair of tweezers.

Turn the disc pulley two complete turns in a clockwise direction

(clockwise when looking at the side of the pulley shown in Fig. 39). Make sure that the coupling cord does not wrap around the pulley as you apply the initial tension. The knot in the coupling cord that hooks to the disc pulley must still be down, toward the bottom of the camera.

Now, the trick is to hold the cord taut with one hand to prevent the spring from unwinding — and then to feed the cord through the finder-wall cavity and along its route to the speed-shaft pulley. If you wish, you can lock the disc pulley to prevent the speed-indicator-disc spring from unwinding; that leaves both hands free to route the coupling cord. In Fig. 40, we have locked the disc pulley by inserting curved-point tweezers through one hole.

Once you've hooked the coupling cord around the adjustment pulley, wrap it counterclockwise around the speed-shaft pulley. Then, hook the knotted end of the coupling cord within the pulley's hole.

You can now replace the speed knob to check the operation of the speed-indicator disc. If the speed-indicator disc rotates properly as you change the shutter speeds, check the timing. Here, you must replace the information prism, the finder-guide rail, the focusing screen, and the finder. Looking through the finder, see if the shutter-speed calibration agrees with the shutter-speed setting. Also, check to see that the shutter-speed calibrations center within the window in the exposure-meter scale at all positions of the speed knob.

If adjustment is required, loosen the two screws holding the adjustment-pulley bracket, Fig. 38. Slide the bracket until the proper calibration centers at each shutter speed. Finally, when everything's right, apply a dab of cement to the knotted end of the coupling cord and the hole in the speed-shaft pulley.

Removing And Adjusting The Pointer

The pointer shows up more clearly with the exposure meter removed, Fig. 41. A spring clip on the pointer-control lever holds the pointer. And a touch of cement locks the pointer's adjusted position.

Canon recommends that you remove the pointer before taking out the front-plate/mirror-cage assembly. The reason is that the pointer-control lever comes out with

the mirror cage. So, unless you take the proper precautions, you may bend the pointer during disassembly.

To remove the pointer, just pull it up and off the pointer-control lever. That's pretty easy now, with the exposure meter removed. But pulling off the pointer with the exposure meter in place is more difficult (though not impossible). It's then tricky to reach — or even to see — the pointer.

If you're aware of the pointer's position — and of its fragility — you can leave it in place. There's a clearance cutout in the camera body through which the pointer may pass. Either way, you'll have to readjust the pointer's position on reassembly.

Adjusting the pointer's position is also easier with the exposure meter removed — that's the main reason for installing the front-plate/mirror-cage assembly before installing the exposure-meter assembly. Here, you'll again need the information prism, the finder-guide rail, the focusing screen, and the finder in place. You can then look through the finder and locate the exact position of the pointer along the scale.

Say that you've just installed the pointer on the pointer-control lever. Only the spring clip now holds the pointer — there's no cement as yet. You can now move the pointer as indicated by the double-ended arrow in Fig. 41; that's the adjustment.

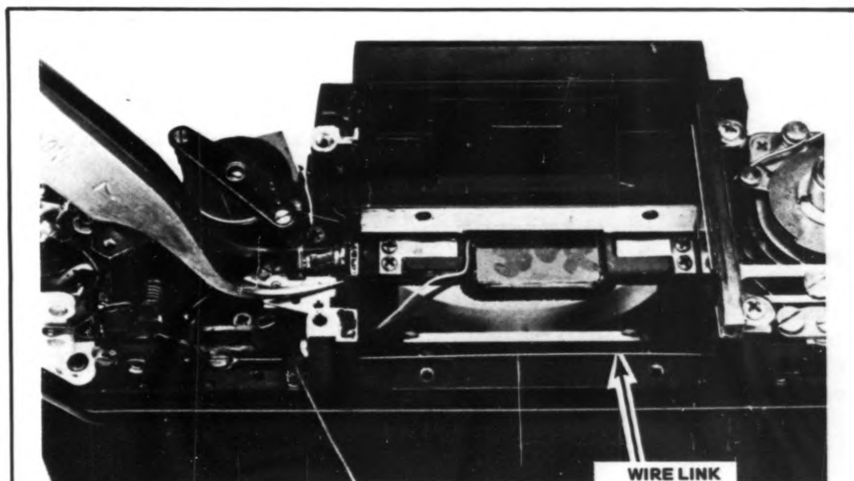


Figure 40

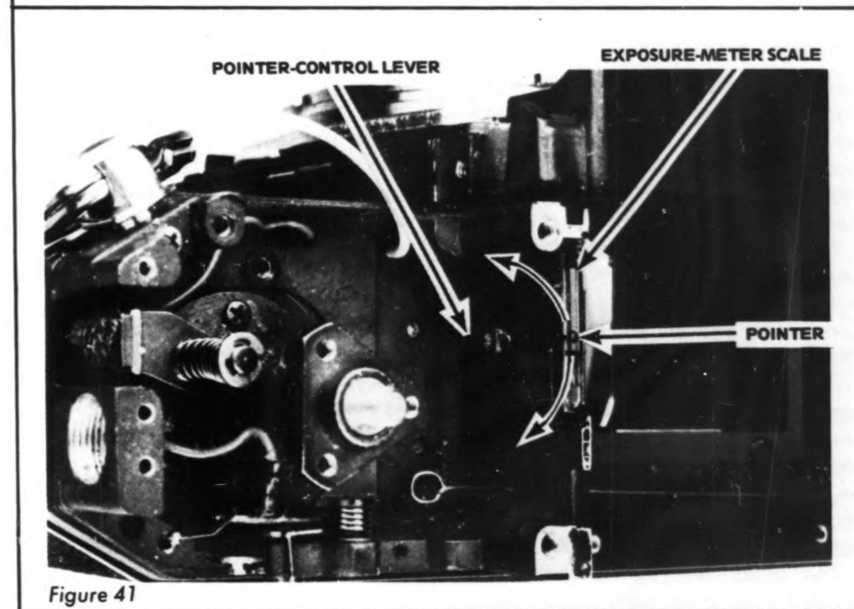


Figure 41

Courtesy, Canon

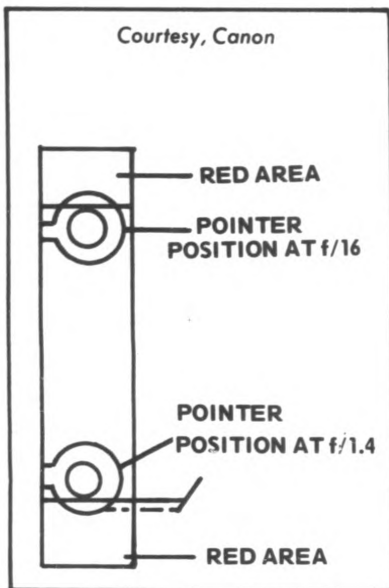


Figure 42

Install the 50mm f/1.4 lens. Now, check the pointer's position at the largest aperture (f/1.4) and at the smallest aperture (f/16). Fig. 42, from Canon's service manual, shows the proper position for the pointer at each setting. Notice that the circle at the end of the pointer just enters the red area of the exposure-meter scale — at each setting, the width of the pointer overlaps the red area.

Move the pointer as required until the adjustment is as shown in Fig. 42. Then, put a dab of cement at the base of the pointer to hold the adjusted position. ◇

(continued in next issue)

by Lawrence C. Lyells

This is the second part of a series on the Canon F-1 system. Part 1 appeared in the Nov/Dec 1974 issue.

Canon F-1 photographic system

Part 2

Removing the Front-Plate/Mirror-Cage Assembly

In many SLR's, removing the mirror cage together with the front plate is a matter of convenience. But in the F-1, it's a matter of necessity. The front plate and the mirror cage make up one unit — they can't be separated.

First, peel off both front sections of leatherette. Removing the delayed-action setting lever does make it a little easier to pull the wind-side front leatherette. But it's not really necessary. A slit in the leatherette at the side of the delayed-action cocking lever (right-hand side, looking at the front of the camera) provides the needed clearance, Fig. 43.

At the bottom of the camera, locate the two screws holding the extension arm of the diaphragm-closing lever, Fig. 44. The extension arm passes to the front of the mirror cage — it's the part that actually engages the diaphragm-opening ring in the lens. Remove the two screws shown in Fig. 44. Then, slide out the extension arm toward the front of the camera.

Make sure that you've unsoldered the two sync wires. Then, remove the six front-plate screws — two short screws at the corners of the delayed-action side, four long screws near the corners of the lens-mounting ring. Also, cock the delayed-action escapement to prevent it from running down past the released position.

As you lift out the front-plate/mirror-cage assembly, you'll probably feel a catch — something is still holding on. So slightly advance the wind lever until the front-plate/mirror-cage assembly is free. Lift out the front-plate/mirror-cage assembly and pull the rewind-side sync wire through its hole in the camera body.

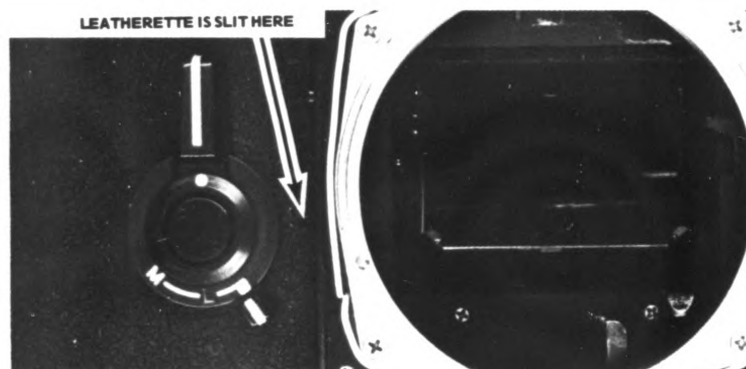


Figure 43

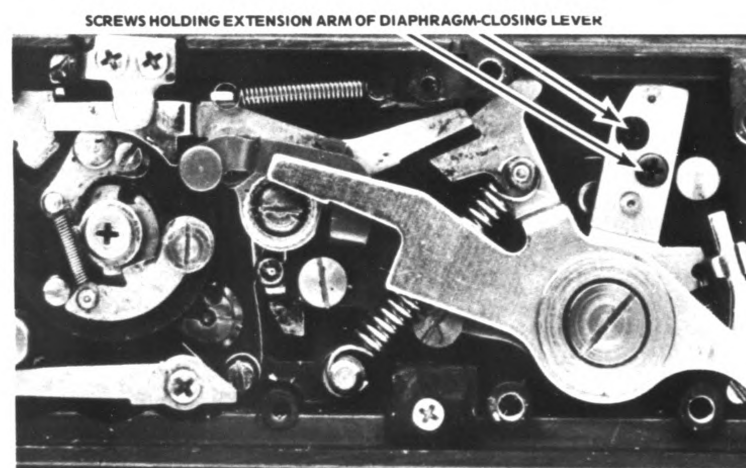


Figure 44

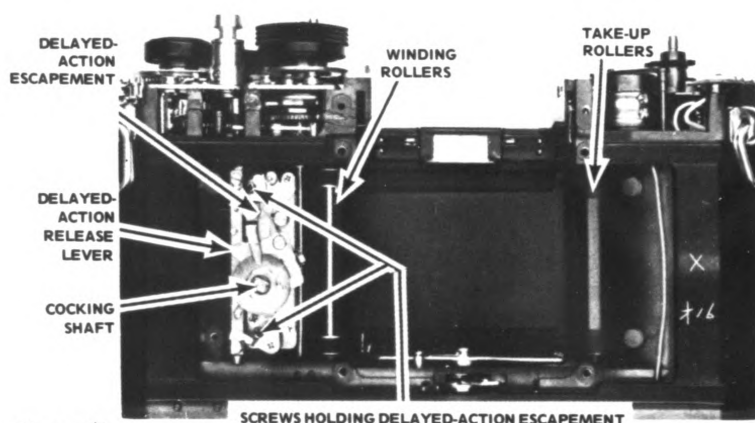


Figure 45

One part is now loose — the joint that couples the delayed-action setting lever to the cocking shaft in the delayed-action escapement, Fig. 45. (Notice that Fig. 45 shows the exposure-meter assembly still in place — as we indicated earlier, you can remove the front-plate/mirror-cage assembly without removing the exposure meter.) The joint may remain with the front plate, Fig. 46; or it may still be perched on the cocking shaft. In either case, remove the joint before it decides to fall out on its own.

You can remove the delayed-action escapement as a unit by taking out its two retaining screws, Fig. 45. To operate the delayed-action escapement for cleaning purposes, just push down the delayed-action release lever. But you'll again want the delayed-action escapement in the cocked position before replacing the front-plate/mirror-cage assembly. So rotate the cocking shaft in a counterclockwise direction until its two flat sides run parallel to the bottom of the camera.

Operation of the Mirror-Cage Parts

The mirror-control parts are on the delayed-action side of the mirror cage; the pointer-control parts are on the other side. Fig. 47 shows the mirror-control parts with the mirror in the taking (up) position.

Looking for a moment at the camera body, locate the tab extending through a light trap, Fig. 48 — this tab is on the mirror-cocking lever. As you advance the wind lever, the tab on the mirror-cocking lever moves toward the front of the camera. The tab then comes against the stud on the **mirror-tensioning lever**, Fig. 47. So the mirror-cocking lever pushes the mirror-tensioning lever toward the front of the mirror cage.

There's no latch on the mirror-tensioning lever. But, as you'll recall, the mirror latch on the bottom of the camera engages the mirror-cocking lever. Consequently, the mirror-cocking lever holds the mirror-tensioning lever. And the mirror-lifting spring, Fig. 47, remains tensioned.

As the mirror-tensioning lever tensions the mirror-lifting spring, another vital action takes place — the **mirror-catch lever** drops into engagement with the **FP-contact-closing lever**. Right now, it's a little difficult to see this action; the FP-sync contacts nearly hide the mirror-

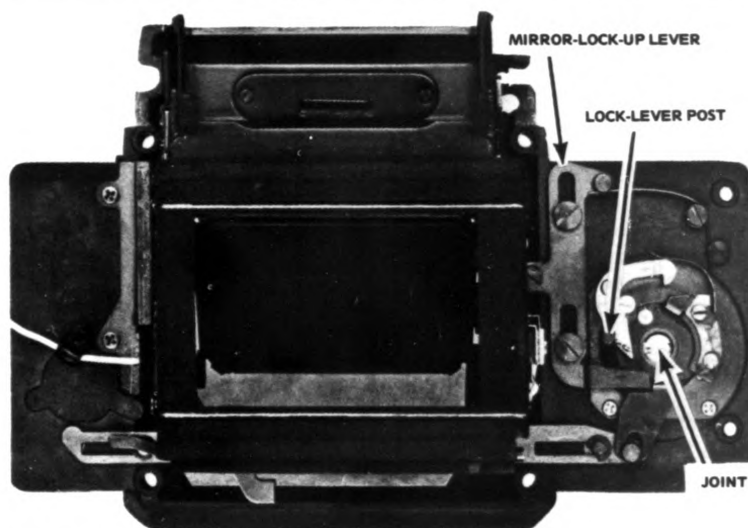


Figure 46

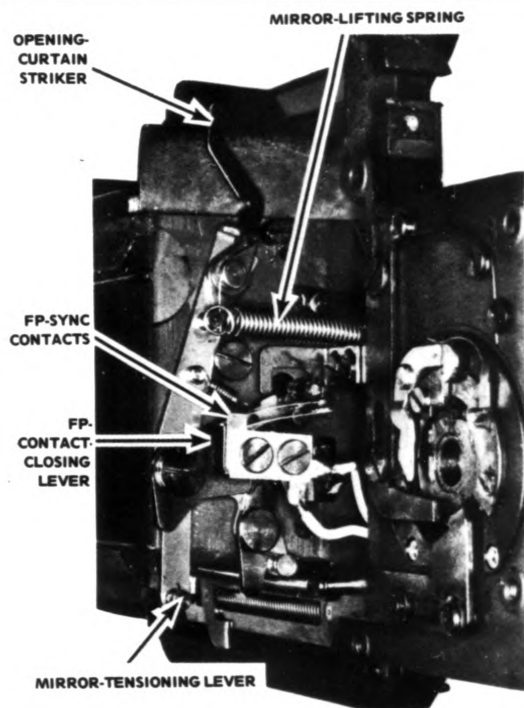


Figure 47

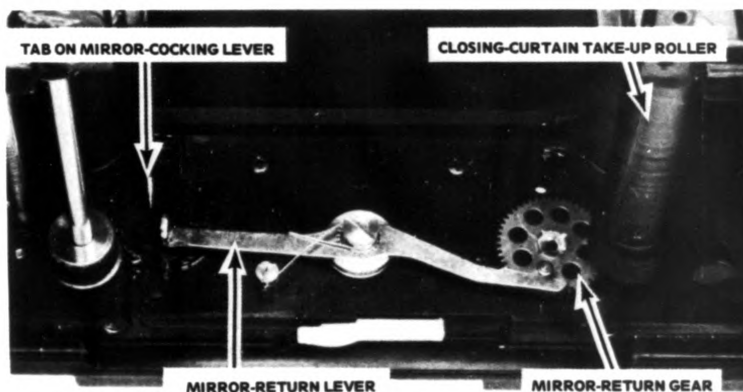


Figure 48

FP-CONTACT-CLOSING LEVER

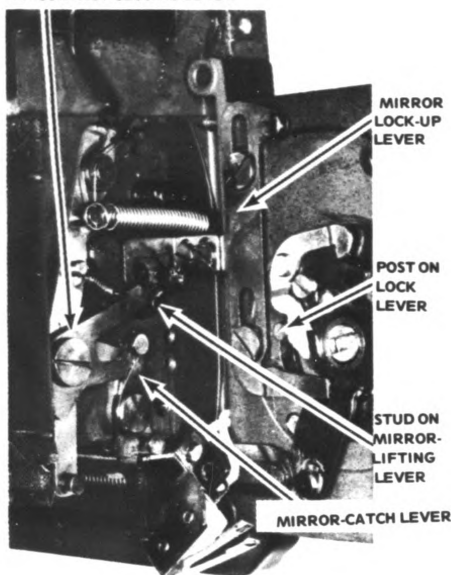


Figure 49

OPENING-CURTAIN LATCH

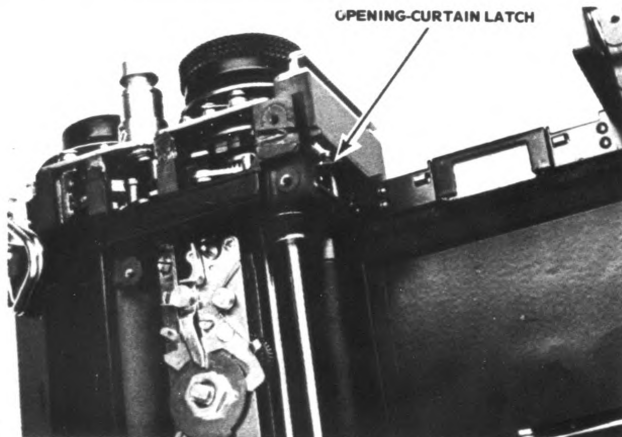


Figure 50

POINTER-CONTROL CAM

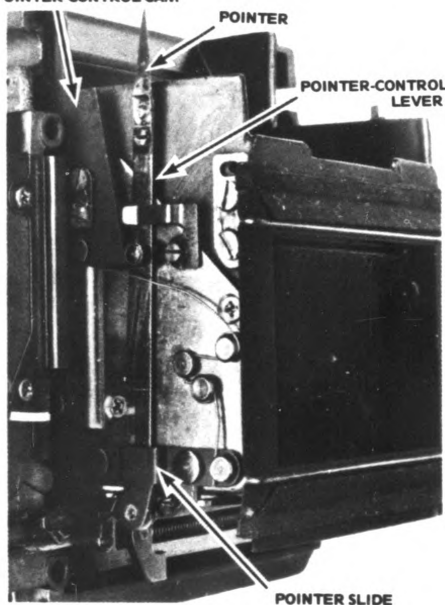


Figure 51

catch lever. So in Fig. 49 we've removed the bracket that mounts the FP-sync contacts — that makes it easier to see the mirror-lifting sequence. Notice that the mirror-catch lever is now engaged with the FP-contact-closing lever.

Depressing the release button frees the mirror-cocking lever. Now, the mirror-lifting spring pulls the upper end of the mirror-tensioning lever toward the front of the mirror cage. And the mirror-catch lever, mounted to the mirror-tensioning lever, pulls down the FP-contact-closing lever, Fig. 47 and Fig. 49.

Moving down, the FP-contact-closing lever comes against the **mirror-lifting lever**, Fig. 49. The mirror-lifting lever is on the inside of the mirror-cage wall; you can just see its stud, passing through a slot in the mirror-cage wall, in Fig. 49.

Now, the mirror-lifting lever drives the mirror to the taking position. And the FP-contact-closing lever closes the FP-sync contacts, Fig. 47. During this sequence, the mirror releases the opening curtain.

The **opening-curtain striker** mounts to the top of the mirror-tensioning lever, Fig. 47. As the upper end of the mirror-tensioning lever swings toward the front of the mirror cage, the opening-curtain striker releases the opening curtain. You can just see the opening-curtain latch in Fig. 50 — the opening-curtain striker pulls the opening-curtain latch toward the front of the camera to disengage the opening-curtain wind gear.

So the opening curtain fires across the focal-plane aperture and releases the closing curtain. The **mirror-return gear**, Fig. 48, turns as the closing curtain crosses the aperture. Notice that the mirror-return gear engages a pinion at the bottom of the closing-curtain take-up roller.

The mirror remains in the taking position until the closing curtain nears the end of the focal-plane aperture; that's because the mirror-catch lever continues to hold the FP-contact-closing lever against the mirror-lifting lever. At the end of the exposure, the mirror-return gear strikes the **mirror-return lever**, Fig. 48. The mirror-return lever then pushes the mirror-catch lever out of engagement with the FP-contact-closing lever. And the mirror returns to the viewing position.

Another lever engages the mirror-lifting lever for the mirror lock-up feature. A post on the lock lever (the

lever under the delayed-action setting lever) extends through the front plate. Turning the lock lever to the "M" position brings the post against the **mirror-lock-up lever**, Fig. 46 and Fig. 49. The mirror-lock-up lever then presses the mirror-lifting lever toward the bottom of the mirror cage to raise the mirror.

On the other side of the mirror cage, Fig. 51, you can see the pointer-control lever and the **pointer-control cam**. The pointer-control cam mounts to the diaphragm-sensing lever (the lever that couples to the lens). As the diaphragm-sensing lever moves down, the pointer-control cam also moves down. And the pointer-control lever, spring-loaded to ride against the cam, swings toward the front of the mirror cage.

The lens-sensing lever controls the lower end of the pointer-control lever. Looking at the bottom of the mirror cage, locate the lens-sensing lever and the coupling link, Fig. 52. The lens-sensing lever — how far depends on the maximum lens aperture. And the lens-sensing lever pushes the coupling link against the **pointer slide**, Fig. 52 and 51. The pointer-control lever mounts to the pointer slide; so moving the pointer slide positions the lower end of the pointer-control lever.

There's one more lever running across the bottom of the mirror cage — the **stop-down lever**, Fig. 52. The stop-down lever couples to the manual stop-down control for the diaphragm. When you push the delayed-action setting lever toward the lens, the stop-down lever moves from left to right in Fig. 52.

The diaphragm-closing tab, Fig. 52, then comes against the extension arm of the diaphragm-closing lever — that allows the diaphragm to stop down to the selected aperture. And the raised lug on the stop-down lever engages a finger at the bottom of the pointer-control lever. Now, the stop-down lever pushes the pointer-control lever toward the back of the mirror cage; and the pointer disappears from the finder.

One last point while we're at the bottom of the mirror cage — note the adjustment screw for the 45-degree mirror angle, Fig. 52. Unfortunately, it's tough to reach the adjustment without removing the front-plate/mirror-cage assembly. One way is to remove the mirror-cocking lever at the bottom of the camera (we'll later describe the disassembly

of the transport mechanism). Then, hold open the shutter on "bulb." Looking through the back of the focal-plane aperture, you can see the screw. And you can reach the screw by inserting a screwdriver blade through the mirror-cocking-lever slot in the bottom of the camera.

Normally, there's no reason to disturb the mirror-angle adjustment. If the image at the focusing screen is out of focus, you can adjust the height of the focusing screen — there're spacers under the focusing-screen seat, a plate held by four screws to the top of the mirror cage.

Replacing the Front-Plate/Mirror-Cage Assembly

There's only one unique trick involved in replacing the front-plate/mirror-cage assembly — getting the opening-curtain striker to the back of the opening-curtain latch

(between the opening-curtain latch and the back of the camera).

Replace the delayed-action joint in the front plate. Then, as you seat the front-plate/mirror-cage assembly, hold the opening-curtain latch to the front of the camera. Make sure the opening-curtain latch sits to the front of the opening-curtain striker. Finally, rotate the delayed-action cocking lever counterclockwise (toward the cocked position) until the joint seats on the delayed-action cocking shaft.

Removing the Counter Assembly

You can disassemble the wind-side parts without removing the exposure meter or the mirror cage. However, removing the speed-control bridge does require that you disconnect the coupling cord for the speed-indicator disc. Fig. 53 shows the wind-side mechanism with the exposure meter and the meter cam still installed.

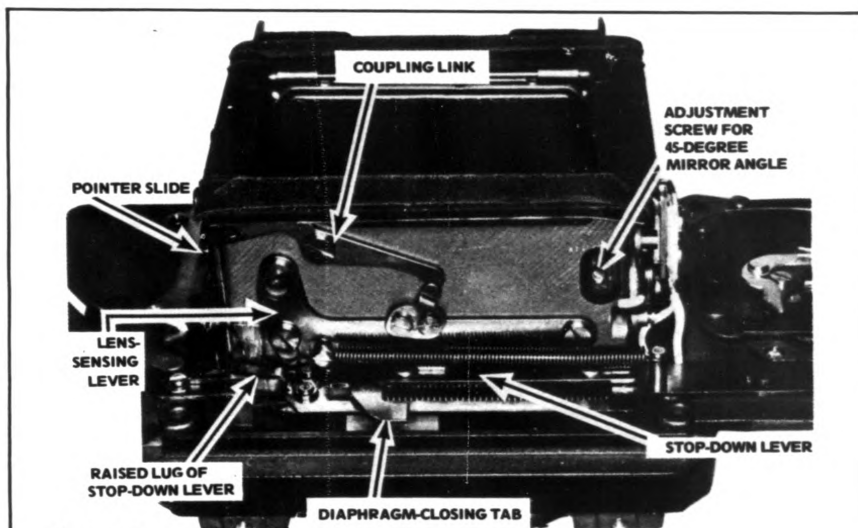


Figure 52

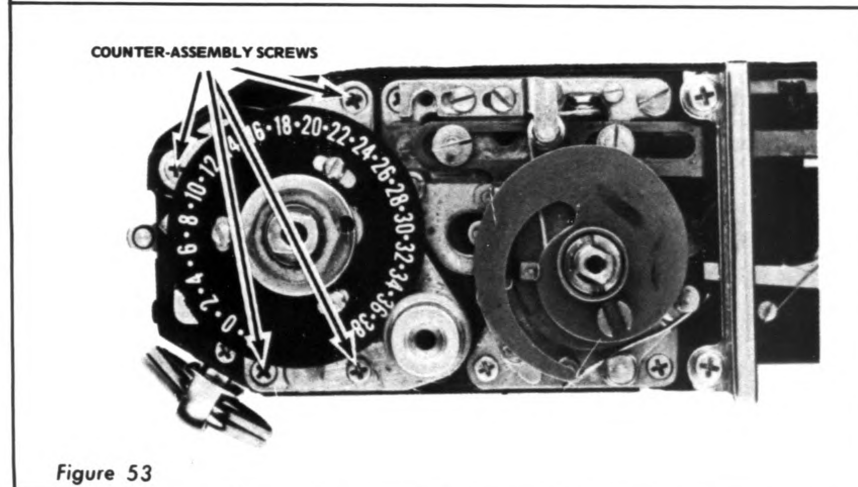


Figure 53

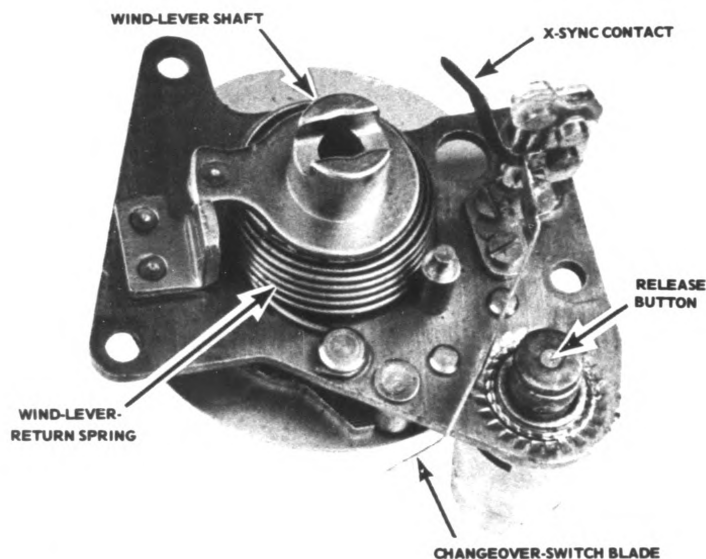


Figure 54

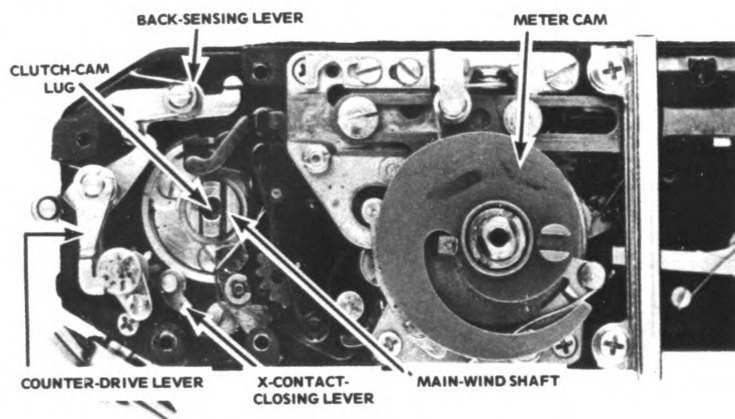


Figure 55

Take out the four screws holding the counter assembly, Fig. 53. Notice that two of the screws are countersunk. Now, lift out the counter assembly — be careful to avoid bending the long contact blade extending from the X-sync contact, Fig. 54. Also, be aware that the cable-release pin passing through the center of the release button is loose.

Both the wind-lever shaft and the wind-lever-return spring remain with the counter assembly, Fig. 54. But the main-wind shaft — the shaft that reaches to the bottom of the camera — stays with the camera body, Fig. 55. In Fig. 55, you can see the one-way clutch at the top of the main-wind shaft; the fork in the wind-lever shaft fits over the two flat sides of the lug atop the **clutch cam**.

Thanks to the one-way clutch, the motor drive can cock the shutter without moving the wind lever. Advancing the wind lever turns the clutch cam counterclockwise (as seen from the top); the clutch cam then picks up and turns the main-wind shaft. Yet the clutch cam can turn freely in a clockwise direction.

The motor drive turns the motor-drive wind cam at the bottom of the camera. And the motor-drive wind cam attaches directly to the lower end of the main-wind shaft. So the motor drive rotates the main-wind shaft in a counterclockwise direction (again, looking at the top of the camera) to cock the shutter. The clutch cam, held by the wind lever, remains in place.

On reassembly, turn the clutch cam

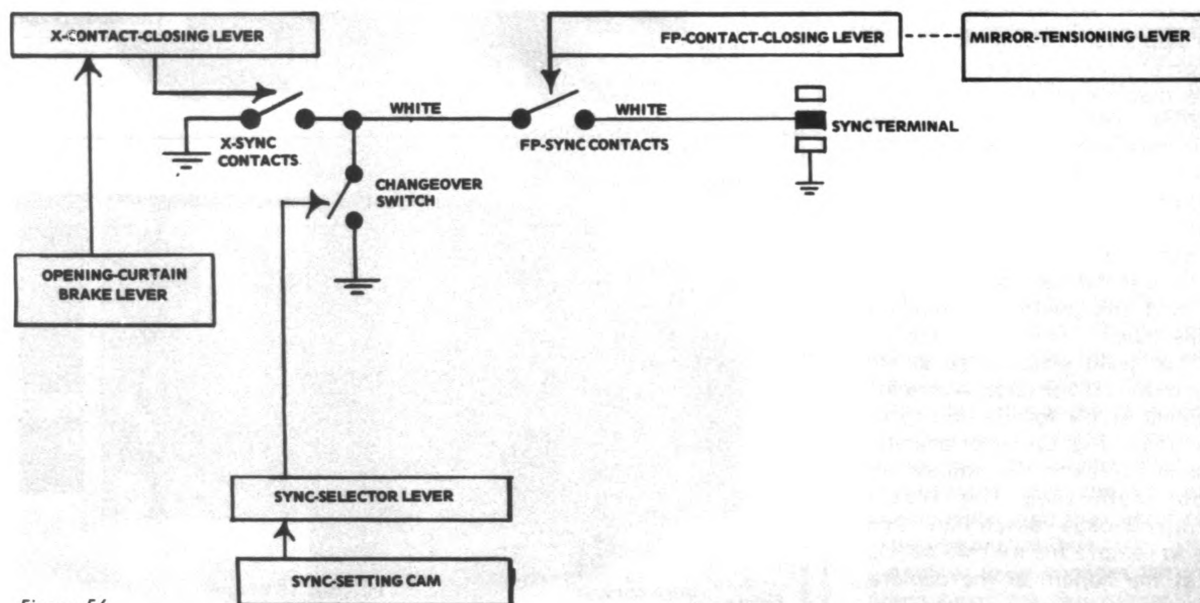


Figure 56

to the position shown in Fig. 55; remember, you can turn the clutch cam freely in a clockwise direction. The fork on the wind-lever shaft then keys properly to the clutch cam.

Sync System in the F-1

With the counter assembly removed, you can get a better look at the X-sync operation. You'll recall that you disconnected one sync wire from the X-sync contact; this sync wire runs to the FP-sync contacts on the side of the mirror cage.

The sync system in the F-1 is, for the most part, quite basic — X contacts closed by the opening curtain, FP contacts closed by the mirror. The only thing that's out of the ordinary is the automatic changeover from FP sync to X sync. As mentioned earlier, the camera delivers X sync at the full-aperture speeds. And at the slit-width speeds (1/125 second and faster), the camera delivers FP sync.

So with the exception of the **changeover switch**, the schematic of Fig. 56 looks familiar. The schematic shows the electrical arrangement when the shutter's at a full-aperture speed. As the mirror rises to the taking position, the FP-contact-closing lever closes the FP-sync contacts. But the flash can't as yet fire — the X-sync contacts, completing the circuit path to ground, are still open.

When the opening curtain crosses the focal-plane aperture, its brake lever drives the **X-contact-closing lever**, Fig. 55, against the X-contact blade. Now, the X-contact blade completes the circuit to ground through the X-contact-closing lever. And the flash fires for X sync.

Setting a slit-width speed closes the changeover switch. The **sync-setting cam**, visible after removing the meter cam in Fig. 57, turns with the speed-setting shaft. At 1/125 second, the sync-setting cam pushes the **sync-selector lever**, Fig. 57, toward the wind-lever end of the camera. A downward-projecting stud on the sync-selector lever then comes against the blade of the changeover switch, Fig. 54. So the changeover switch connects the X-contact blade to ground through the sync-selector lever.

In effect, the X-sync contacts are now constantly closed — they're shorted by the changeover switch. Consequently, the flash fires as soon as the FP-sync contacts close for FP sync. Canon's specification for the FP-sync-delay time is 10.5 to 13.5 milliseconds.

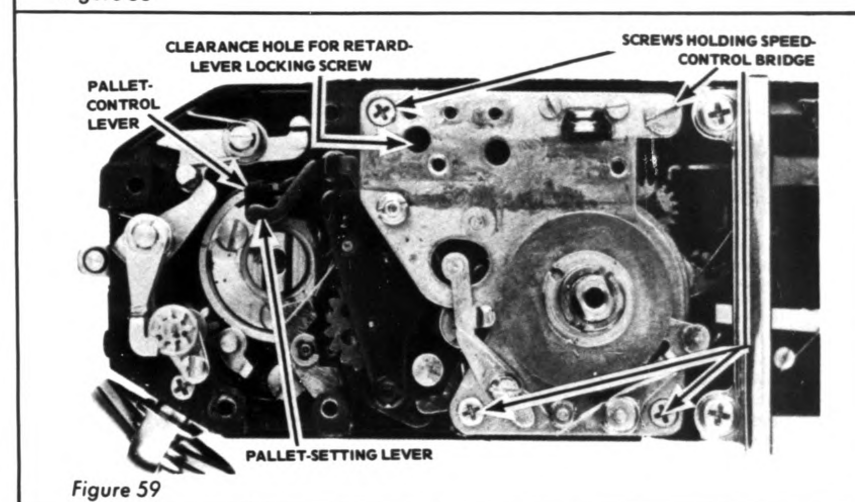
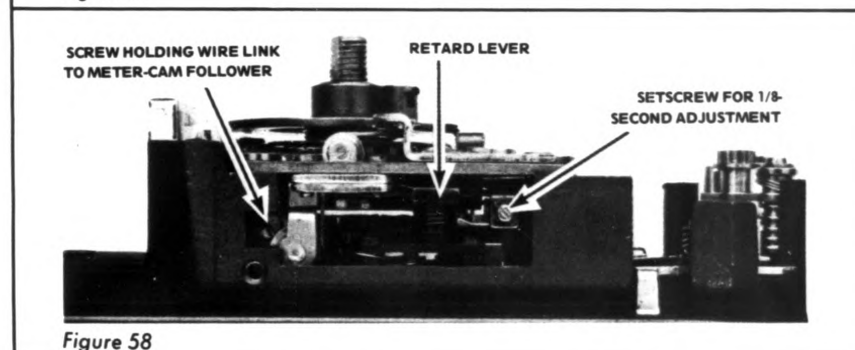
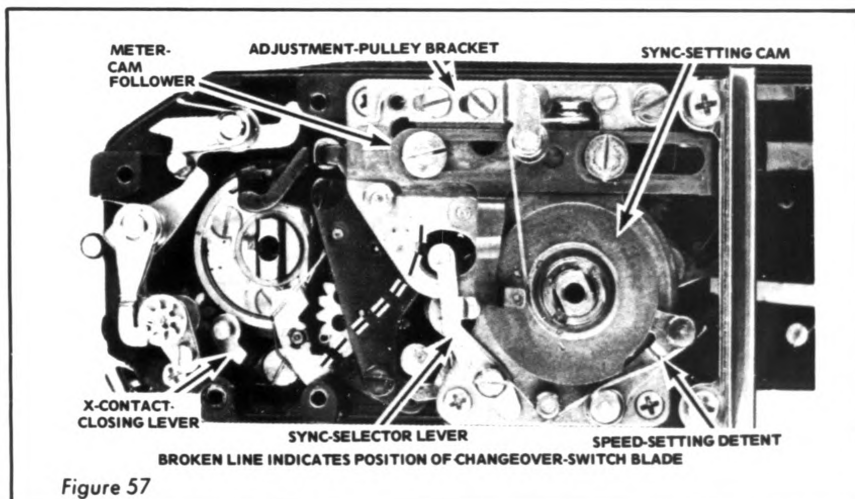
Removing the Speed-Control Bridge

If your exposure meter is still in place, disconnect the coupling cord from the speed-shaft pulley. You'll then have to retime the speed-indicator disc on reassembly, a procedure described earlier.

Now, take out the screw that holds the wire link to the meter-cam follower, Fig. 58. It's not really necessary to remove the meter-cam

follower; but removing the meter-cam follower does make it easier to reach a shutter-speed adjustment, as we'll describe in a moment. If you do remove the meter-cam follower, watch for the two small spacers sitting under the screws.

Yet it is necessary to remove the adjustment-pulley bracket; the bracket covers one of the screws holding the speed-control bridge. Then, take out the four speed-control-bridge screws, Fig. 59. Be sure to note



the different screw shapes — two screws are countersunk and one has a conventional screwdriver slot rather than a cross-point slot.

Next, locate the retard lever at the back of the camera, Fig. 58. Hold the retard lever against its spring tension, away from the speed-control mechanism. While holding the retard lever, gently lift off the speed-control bridge.

The speed-control cam stack and the pallet-setting lever remain with the speed-control bridge, Fig. 60. The speeds escapement and the curtain latches stay with the camera body, Fig. 61. Fig. 61 also points out the end of the wire link; if you've removed the exposure meter, pull out the wire link toward the wind-lever end of the camera.

Already, you may have noticed one twist from conventional double-roller design — and one that presents a problem when it comes to timing the curtains. The opening-curtain wind gear is staked to the curtain-wind shaft! So there's no way you can conveniently change the gear timing to alter the curtain positions. That's kind of a shame — one of the advantages the double-roller design normally has over the drum-type design (from a service standpoint) is the ease by which you can time the curtains.

So how can you change the overlap? Well, you can always peel off the opening-curtain tapes and recement them in slightly different positions. Changing the position of the closing

curtain is more difficult — it's virtually impossible to peel the closing curtain off its winding roller without damage to the tissue-thin titanium.

If you're going to replace the curtains, there're some timing points you can note right away. Slowly cock the shutter by turning the motor-drive wind cam and check the overlap — there's not quite a full-bar overlap. By Canon's specifications, the closing-curtain bar (toward the front of the camera) should overlap the opening-curtain bar by 2 - 2.5 millimeters all the way across the focal-plane aperture. That's around a 3/4-bar overlap.

Now, hold the release shaft depressed and disengage the opening-curtain latch, Fig. 61 (just pull the visible end of the opening-curtain latch toward the front of the camera). With the shutter held open on "bulb," note the position of the closing curtain. As with other double-roller designs, it's a good idea to scribe the position of the lead edge of the closing-curtain bar. Your scribe line indicates the correct timing position for the closing curtain.

Shutter-Speed Adjustments in the F-1

Shutter-speed adjustments in the F-1 are plentiful, but they're not all easy to reach. With the speed-control bridge installed, you can only reach one of the slit-width adjustments. The others require that you remove the

speed-control bridge to make an adjustment — and replace the speed-control bridge to check the adjustment.

The hard-to-reach adjustments are for 1/1000 second and 1/125 second, Fig. 62. Adjust 1/125 second by turning the eccentric on the high-speed-cam follower. The high-speed-cam follower, mounted to the closing-curtain latch, is the part that the release cam strikes to free the closing curtain. When setting the slit width, the high-speed cam, Fig. 60, positions the high-speed-cam follower.

Adjust 1/1000 second by changing the position of the release cam. Three screws hold the release cam to the opening-curtain wind gear — after loosening the screws, you can rotate the release cam. Fig. 62 indicates which way to turn the release cam for the desired result.

The adjustments you make on the high-speed-cam follower and on the release cam affect all of the slit-width speeds. So you may have to alternate between the two adjustments — the high-speed-cam follower for 1/125 second and the release cam for 1/1000 second — to bring all of the slit-width speeds into tolerance (except, perhaps, 1/2000 second which has its own adjustment). You can then replace the speed-control bridge for keeps; the other adjustment points remain accessible.

(NOTE: As you replace the speed-control bridge, hold the retard lever against its spring tension — the slow-speed-cam follower on

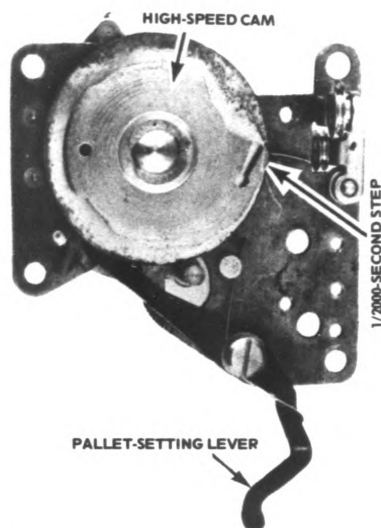


Figure 60

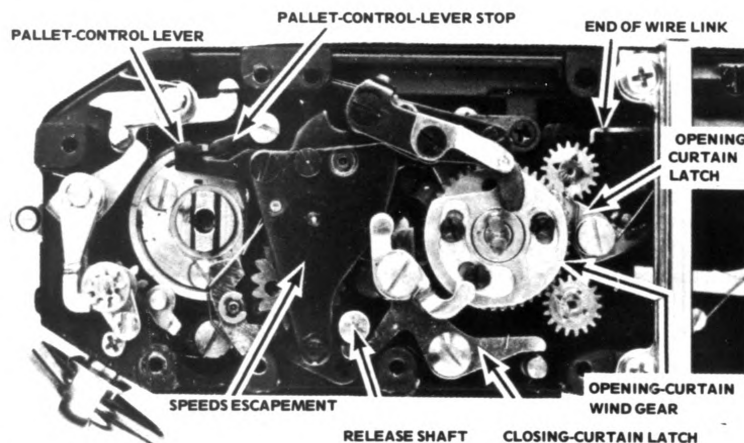


Figure 61

the retard lever must ride between the two brass discs on the speed-control-cam stack, against the slow-speed cam. One more trick is necessary to fully seat the speed-control bridge. Reach under the speed-control bridge and turn the high-speed-cam follower against its spring tension — until the high-speed-cam follower rides against the edge of the high-speed cam.)

An adjustment on the high-speed cam affects only 1/2000 second. Locate the slit in the high-speed cam behind the 1/2000-second step, Fig. 60. Making the slit wider provides a faster speed; compressing the slit provides a slower speed. You can reach the slit with the speed-control bridge installed; work underneath the speed-control bridge, from the front of the camera, with the shutter set at 1/2000 second.

There are two adjustments on the speeds escapement for the slow speeds. A setscrew on the slow-speed-cam follower controls the depth of retard-lever engagement. And an eccentric by the pallet controls the depth of pallet engagement, Fig. 62.

To make the 1/8-second adjustment, first work through the clearance hole shown in Fig. 59 to loosen the locking screw, Fig. 62. Then, turn the setscrew visible at the back of the camera, Fig. 58. For a faster speed, turn the setscrew clockwise. For a slower speed, turn the setscrew counterclockwise; then, push the setscrew-end of the slow-speed-cam follower in, toward the speeds escapement, to keep the setscrew against the retard-lever post. Be sure to retighten the locking screw.

Turning the pallet eccentric, Fig. 62, without removing the speed-control bridge is a little awkward. But it can be done. Use the eccentric to adjust the 1-second exposure.

In the F-1, the pallet engages the star wheel at shutter speeds of 1 second through 1/8 second. At 1/15 second, the pallet-setting lever on the speed-control bridge, Fig. 60, comes against the pallet-control lever in the speeds escapement, Fig. 61. (Fig. 59 shows these parts with the speed-control bridge installed.) So at 1/15 second, the pallet can't engage the star wheel. Kind of unique, such a long range of pallet speeds. But it means that both slow-speed adjustments affect the entire range of slow speeds — 1/8 second through 1 second.

Consequently, you'll probably have to work back and forth between the two adjustments.

Disassembly to Reach the Curtain Brakes

In Fig. 61, you can just see the end of the spring for the closing-curtain latch. Disconnect the visible end of the spring. Then, remove the closing-curtain latch by taking out its retaining screw and lift out the spring.

For cleaning and lubrication, you'll also want to remove the opening-curtain latch. Disconnect the opening-curtain-latch spring, Fig. 61. Remove the screw that holds the opening-curtain latch; the spring stays with the screw. And lift out the opening-curtain latch.

Three screws hold the speeds escapement. Since two are countersunk, there's no shifting

adjustment for the shutter speeds. The third screw holds a positioning stop for the pallet-control lever, Fig. 61. Remove all three screws and the positioning stop. While holding the retard lever toward the back of the camera, lift out the speeds escapement.

The long lever now exposed is the **pallet-disengaging lever**, Fig. 63. Sitting next to the pallet-disengaging lever is the **closing-curtain brake lever**.

At the end of the exposure, the closing-curtain wind gear (under the opening-curtain wind gear, Fig. 63) strikes the closing-curtain brake lever — that drives the closing-curtain brake lever clockwise, as seen in Fig. 63. In turn, the closing-curtain brake lever drives the pallet-disengaging lever against a stud on the underside of the pallet-control lever. So the pallet disengages from the star wheel.

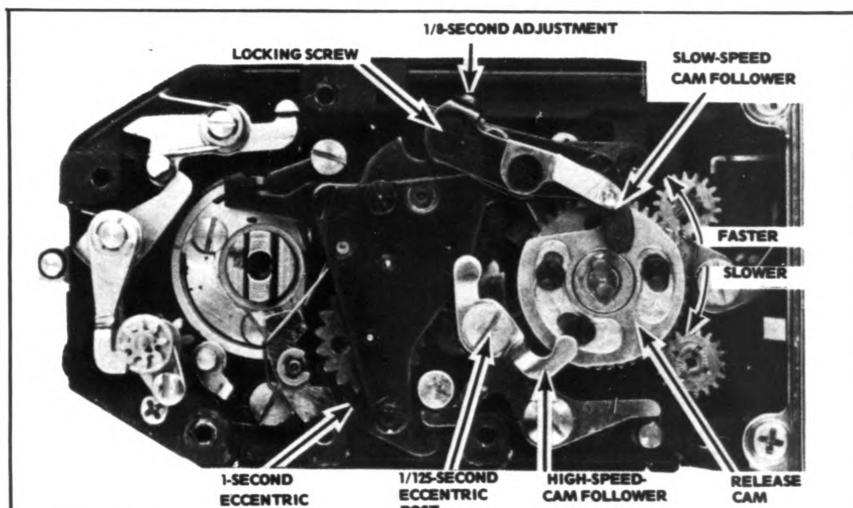


Figure 62

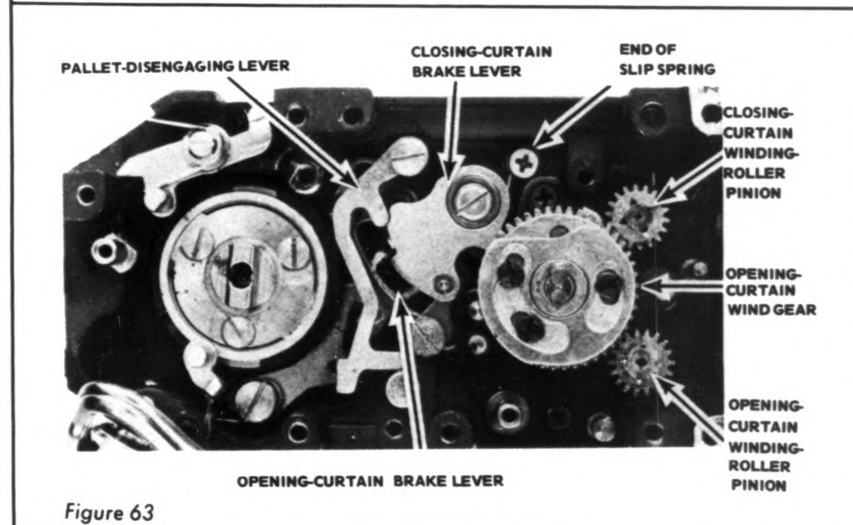


Figure 63

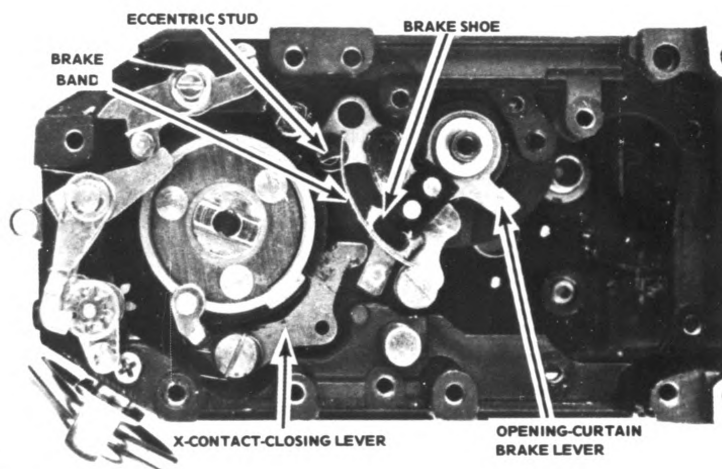


Figure 64

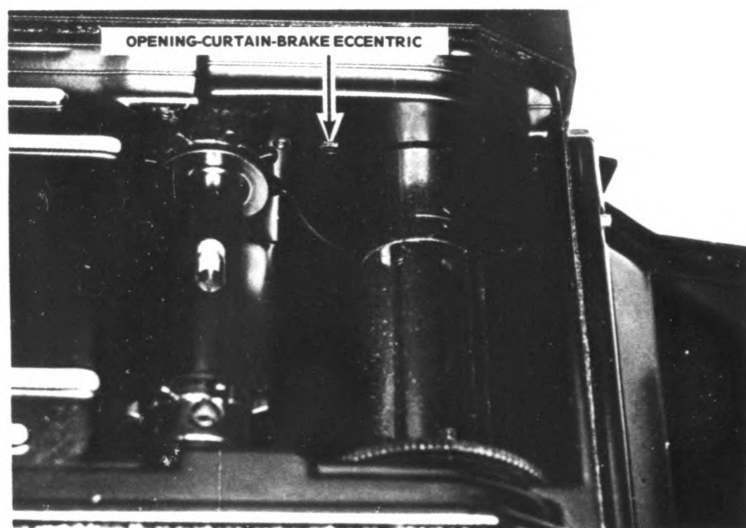


Figure 65

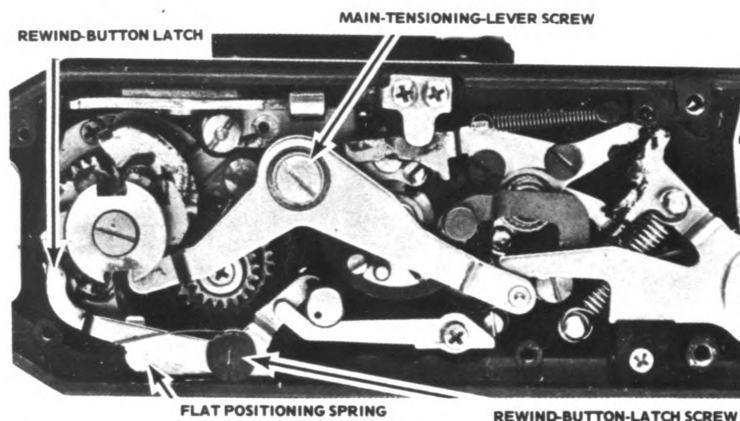


Figure 66

And the spring-loaded first-gear segment on the retard lever returns easily to its "ready" position.

A slip spring underneath the closing-curtain brake lever provides the braking action — you can just see the free end of the spring, held to the camera body by a screw, in Fig. 63. The slip spring allows the closing-curtain brake lever to turn easily in a clockwise direction; that's when the closing-curtain brake lever moves into position to intercept the closing-curtain wind gear. But on the release cycle, the slip spring tightens on the brake-lever shaft. The damping action that results cushions the closing curtain to prevent bounce.

The part that drives the closing-curtain brake lever to the "ready" position is the **opening-curtain brake lever**. The opening-curtain brake lever, barely visible in Fig. 63, sits underneath the closing-curtain brake. In design, the two brakes are completely different.

In Fig. 64, we've removed the wind-gear assembly and the closing-curtain brake lever. We'll cover this disassembly procedure a little later. But we're jumping ahead because it's a little difficult to visualize the operation of the opening-curtain brake with the wind-gear assembly in place.

Notice that a projection on the opening-curtain brake lever extends over the area occupied by the wind-gear assembly — this projection intercepts a lug on the curtain-wind shaft. So the opening-curtain brake applies its braking action directly to the shaft that carries the opening-curtain wind gear.

Consider the action as the opening curtain nears its rest position. The curtain-wind shaft then drives the opening-curtain brake lever in a clockwise direction. And the shoe on the opening-curtain brake lever has to move against the pressure applied by the **brake band**, Fig. 64.

The pressure applied by the brake band determines the amount of braking action — the greater the pressure, the harder it is for the curtain-wind shaft to turn the opening-curtain brake lever in a clockwise direction. Notice that one end of the brake band sits against an eccentric stud, Fig. 64 — the eccentric stud is your adjustment for the amount of braking action.

In an earlier F-1 variation, the eccentric is at the other end of the brake band — closer to the front of the

camera. And you have to disassemble the camera this far to correct opening-curtain bounce. But in current models, the eccentric extends through the camera body; it's accessible inside the take-up spool chamber, Fig. 65. That's a pretty nice feature; you can adjust opening-curtain bounce with the camera fully assembled.

One thing we can't explain — the Canon service manual also shows a closing-curtain-brake adjustment next to the eccentric in Fig. 65. We've yet to see a Canon F-1 with a second eccentric adjustment (the hole next to the eccentric in Fig. 65 merely receives a screw holding the opening-curtain-brake assembly). And, since the pressure of the closing-curtain brake comes from a slip spring, we're curious as to what the second eccentric might control. It seems that the only adjustment for closing-curtain bounce is to replace the slip spring.

Checking the opening-curtain braking action in our evaluation camera, we first held open the shutter on "bulb." We then measured the distance between the closing edge of the focal-plane aperture and the edge of the opening-curtain bar — 3mm in our sample F-1. If you're planning a complete camera disassembly, you may wish to scribe the position of the opening curtain. Then, after you've set the curtain tensions, you can check the amount of opening-curtain braking action with reference to your scribe line.

The opening-curtain brake lever performs one other function in the camera. As mentioned earlier, it closes the X-sync contacts. Swinging clockwise, the opening-curtain brake lever drives the X-contact-closing lever against the X-contact blade.

On the next cocking cycle, the camera reverses the direction of control. Now, the X-contact-closing lever actuates the opening-curtain brake lever. A cam attached to the main-wind shaft (underneath the one-way clutch and not visible in the illustrations) pushes the X-contact-closing lever clockwise; that opens the X-sync contacts and simultaneously pushes the opening-curtain brake lever counterclockwise to its "ready" position.

En route, the opening-curtain brake lever comes against a downward-projecting pin on the closing-curtain brake lever. So the closing-curtain brake lever moves in the same

direction. Now, both brakes are ready to cushion the curtains on the next release cycle.

Disassembly of the Transport Mechanism

There're no special problems in the disassembly at the bottom of the camera — and no timing to worry about until you reach the main-transport cam. Just be careful to note the positions of the many washers and spacers.

Starting with Fig. 66, remove the main-tensioning lever by taking out its screw. It's not really necessary to remove the rewind-button latch unless you plan on pulling the main-wind shaft. But assuming you're going further, disconnect the rewind-button-latch spring, Fig. 66, and remove the screw. Lift out the rewind-button latch and the flat positioning spring.

Looking under the diaphragm-charge lever, locate the tension-type spring that hooks to a hole in the diaphragm-closing lever, Fig. 67. The diaphragm-closing lever tends to

cling to the diaphragm-charge lever during disassembly. So disconnect both the diaphragm-closing spring and the diaphragm-drive spring in Fig. 67.

Now, remove the screw holding the diaphragm-charge lever. Lift the diaphragm-charge lever up and off its pivot post. The diaphragm-closing lever may come out with the diaphragm-charge lever; if not, remove it next. Then, lift out the mirror-cocking lever, Fig. 68, which sits over the same post.

Two screws hold the **release-plate guide**, Fig. 68. Notice that a tab on the release-plate guide positions the release plate; the tab holds the release plate against the transport-release lever. Remove the two screws and lift off the release-plate guide (watch for spacers).

Both the transport-release lever and the mirror latch sit over the same camera-body post; the transport-release lever holds the mirror latch in position. Disconnect the tension-type spring from the lug on the transport-

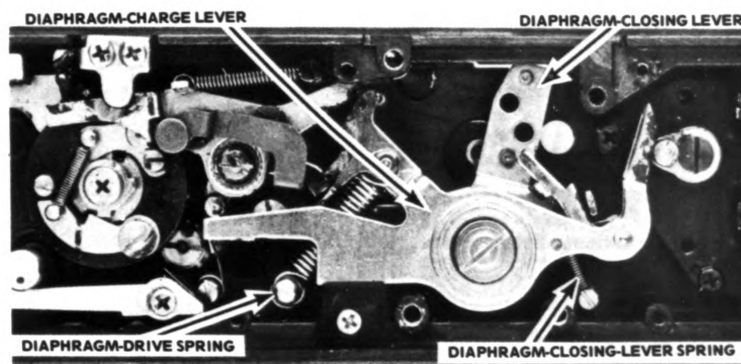


Figure 67



Figure 68

release lever, Fig. 69. Remove the transport-release lever by taking out its screw. Then, disconnect and remove the mirror-latch spring, Fig. 70. And lift out the mirror latch.

Before removing the main-transport cam, check its timed position. Try turning the main-wind cam until the slot in the main-transport cam centers over the release plate. Here, note the position of the main-wind cam, Fig. 66. When you're ready to replace the main-transport cam, just turn the main-wind cam to the position shown in Fig. 66. Then, install the main-transport cam with its slot centered over the release-plate tab.

Now, disconnect and remove the

tension-type spring that hooks at one end to the transport latch and at the other end to the stopper, Fig. 70. Swing the transport latch and the stopper clear of the opening-curtain cam. For reassembly reference, carefully note the position of the opening-curtain cam — since it sits on a squared shaft, it could be replaced in any one of four positions (not to mention upside down).

Remove the opening-curtain cam by taking out its retaining screw. You can then see the threaded ring that holds the main-transport cam; there're two notches in the threaded ring for a Multispan wrench. Unscrew the threaded ring and lift off the main-transport cam.

(continued in next issue)

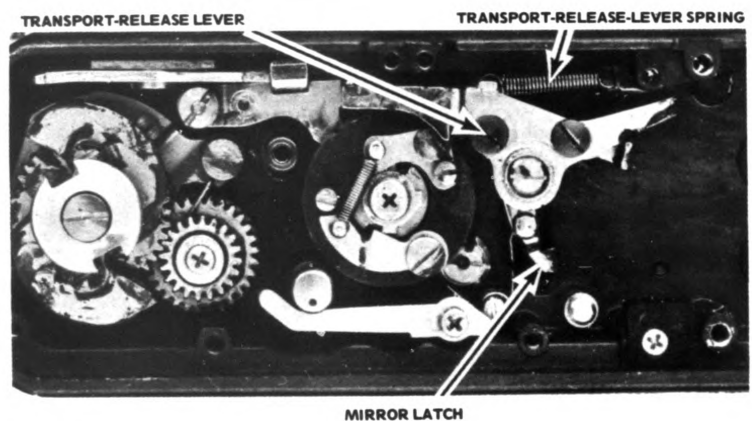


Figure 69

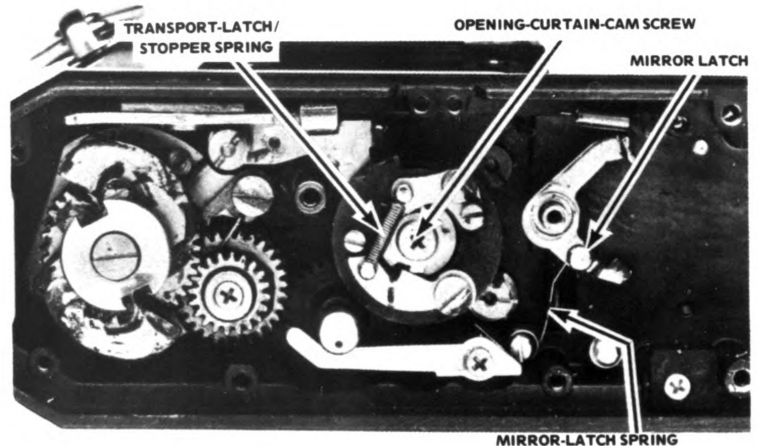


Figure 70

by Lawrence C. Lyells

This is the third part of a series on the Canon F-1 system. Part 1 appeared in the Nov/Dec 1974 issue, and Part 2 in the Jan/Feb 1975 issue. The series will continue in the July/Aug 1975 issue.

Canon
F-1

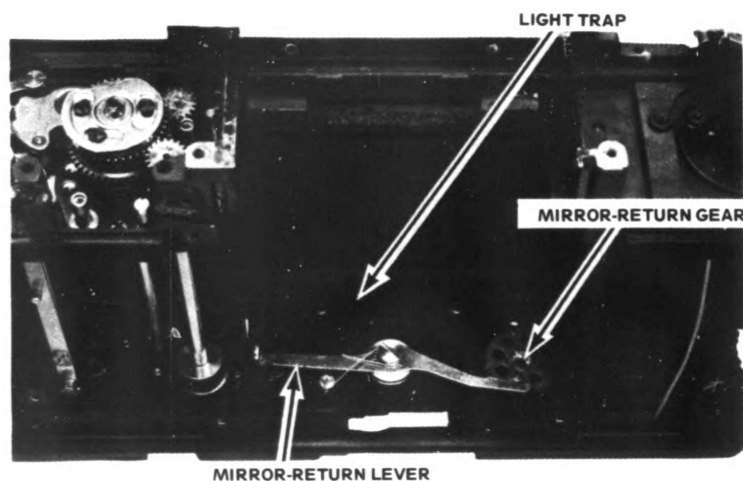


Figure 71

photographic system

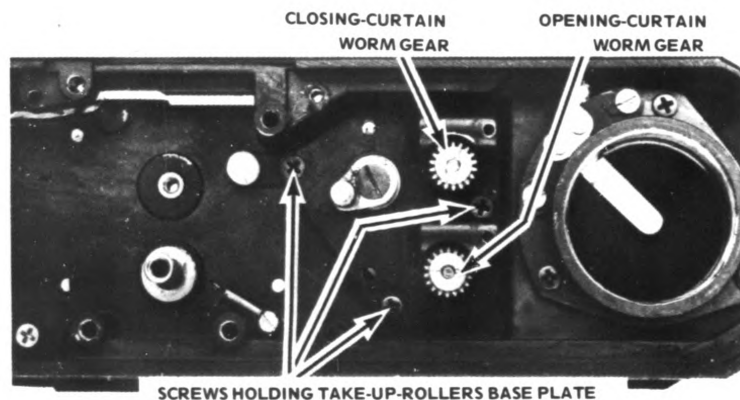


Figure 72

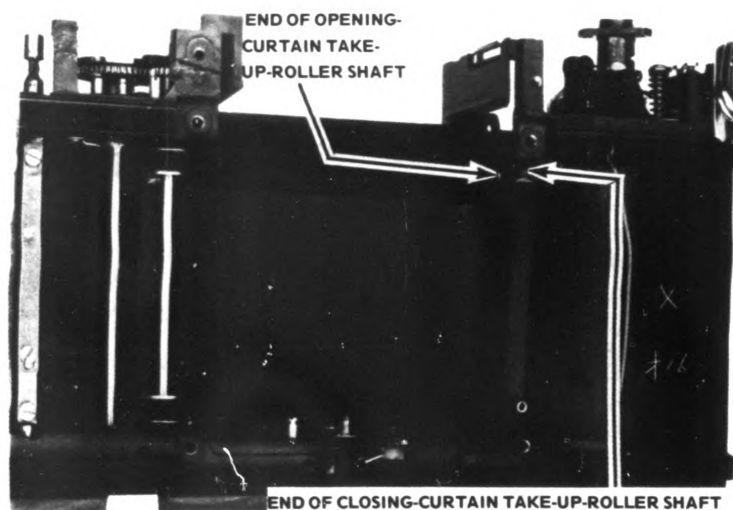


Figure 73

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NOTE: In the first part of our Canon F-1 article, we described removing the screw holding the speed-knob cap. In our evaluation camera, a small leatherette disc covered the screw. Later models have gone to a one-piece cap over the speed knob — you have to unscrew this cap. But pliers will damage the one-piece cap. Use a tool that fits over the speed-knob cap — such as a split collet or the chuck in a pin vise.

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PART 3

Removing and Replacing the Curtains

Compared to cloth curtains, titanium curtains have a lot going for them. They can stand greater stress and they're virtually impervious to wear under normal conditions. Those abnormal conditions are what hurt. Probing fingers can cause instant damage. So replacing the curtains in the F-1 may be a more common repair than one might expect.

Just as the owner must be careful to avoid touching the curtains, the technician must be careful when handling the curtains. The slightest mishandling results in a kink or bend.

Fortunately, a new set of curtains is moderately priced. But unfortunately, they're pretty tricky to install. Unlike most double-roller designs, you can't easily disassemble the curtain-winding rollers and the curtain-wind gears — that's because the opening-curtain wind gear is staked in position. Consequently, you have to be extremely precise in cementing the new curtains in exactly the same positions as the original curtains; it's tough to change the timing of the wind gears to correct curtain positions and overlap. In this respect, the curtain-changing procedure is very similar to that in a drum-type shutter.

Although it's not essential, you may wish to remove the light trap and the mirror-return lever shown in Fig. 71. Getting these parts out of the way helps a little.

There are now several routes you can take to install the new curtains. We'll discuss a couple. But in any case, you'll want to remove the take-up rollers. To let off the initial tensions, first remove the setscrews that lock the tension-setting worms. Turn the worms counterclockwise to slowly let off the initial tensions. Then, remove the worms from their housings.

Unscrewing the tension-setting worm gears can be a problem. There're no screwdriver slots in the tops of the take-up-rollers shafts. So it's pretty tricky to hold the shafts stationary as you unscrew the worm gears. Although you can reach the shafts just above the take-up rollers, chances are you won't be able to get a good enough grip — those worm gears are mighty tight.

One technique you can use is to first remove the three cross-point screws holding the take-up-rollers base plate, Fig. 72. Then, pull the base plate away from the camera body. The shafts of the take-up rollers move down, with the base plate, until their upper ends clear the bearings at the top of the camera, Fig. 73. You can now grasp the upper ends of the central shafts as you unscrew the worm gears (clockwise — they have left-hand threads). A handy tool to avoid damage to the shafts is a parallel-jaw plier with a hole drilled in the ends of the jaws.

After unscrewing the worm gears, remove the base plate. Watch for the loose guide roller and spacer at the top of the opening-curtain take-up roller. The mirror-return gear remains with the base plate — it'll

have to be retimed on reassembly, a procedure we'll later describe.

Now, peel back the opening curtain until you can see where its end is cemented to the take-up roller. Scribe the take-up roller to note the end of the curtain. Exactly where you cement the curtain around the circumference of the take-up roller isn't important. But the scribe mark will help you in cementing the new curtain squarely. Also, scribe the ends of the closing-curtain tapes at each end of the closing-curtain take-up roller.

It's the other end of the curtains — the winding-rollers end — where position is critical. The closing curtain must be at a precise position on the closing-curtain winding roller. Then, the closing-curtain bar aligns with the focal-plane scribe mark you made earlier (while you were holding open the shutter on "bulb"). And the opening-curtain tapes must be precisely located on the opening-curtain take-up roller; that controls the overlap.

One curtain-installation technique you can use is to first remove the wind-gear assembly. You can then scribe the positions of the original curtains on the winding rollers. But it's not easy — you have to pull the curtains up through the cutout in the top of the camera body, Fig. 74.

Or you can borrow a technique that's popular for replacing the curtains in drum-type shutters. Here, you can leave the wind-gear assembly in the camera. Using a straight edge as a guide, cut the closing curtain along the closing-curtain winding roller — leave just the end of the

original closing curtain still cemented to the roller. Also, cut each opening-curtain tape and leave the ends of the tapes cemented to the ends of the opening-curtain winding roller.

Now, peel off the old closing curtain and the old opening-curtain tapes (except for the ends that remain on the rollers). Using the original closing curtain as a pattern, cut the new closing curtain to the same length. And use the old opening-curtain tapes as patterns to size the new opening-curtain tapes. This custom-sizing is necessary to make up for the material remaining on the winding rollers.

You'll then have to sneak each of the new opening-curtain tapes into position — route the tapes behind the guide rollers on the closing-curtain winding roller. As you cement the new tapes in position, butt their ends against the cut ends of the old tapes still remaining on the winding roller.

Then, slip the new closing curtain around the back of the closing-curtain winding roller (here, titanium has an advantage over cloth — it slides into place more easily). Butt the end of the new closing curtain against the cut end of the old closing curtain. And cement the curtain in place.

The nice thing about this technique is that the curtain and tapes remaining on the winding rollers mark the proper positions. But the procedure is nonetheless awkward — it takes a lot of patience and dexterity to get everything aligned precisely. You may find matters easier if you completely remove the wind-gear assembly. And that involves some new complications.

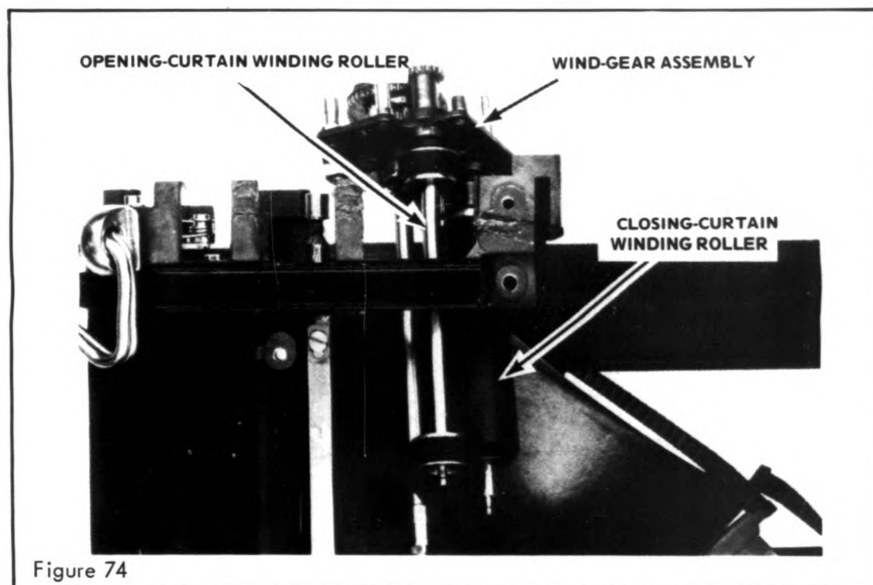


Figure 74

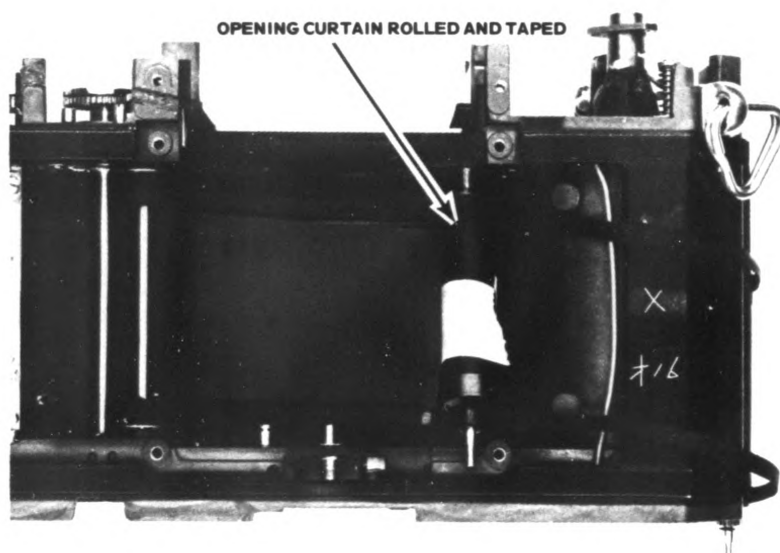


Figure 75

Those new complications aren't so much in disassembly. Rather, they're in replacing the wind-gear assembly with the new curtains installed. It's difficult to pass the curtains through the camera-body cutout, Fig. 74, without damage. Most likely, you aren't concerned about damage to the original curtains — after all, this whole business is to replace them. But you must be very careful in replacing the wind-gear assembly to avoid damage to the new curtains.

And what if you do want to preserve the original curtains? One trick we found helpful (though it may be frowned upon by many technicians) is to first wind all of the opening curtain onto its take-up roller; then, use a piece of masking tape to hold the curtain in place, Fig. 75. That allows the opening-curtain take-up roller to pass easily through the camera-body cutout without catching and kinking the curtain edges.

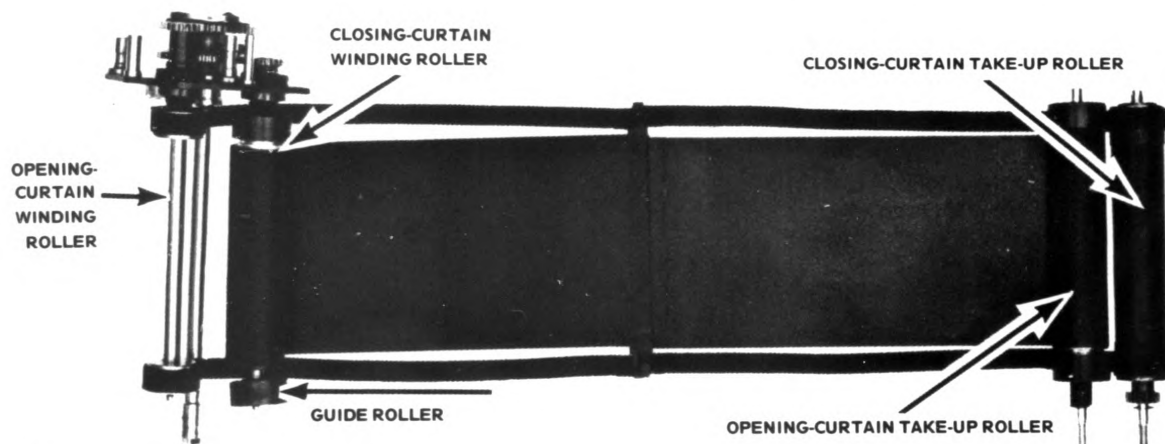


Figure 76

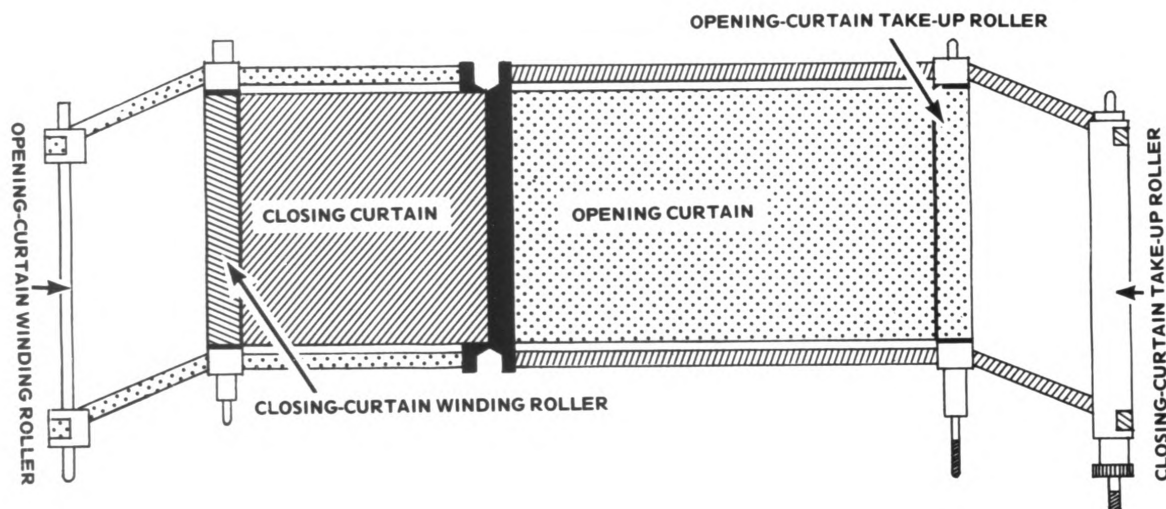


Figure 77

Now, remove the four screws (two are countersunk) holding the curtain-mechanism plate. Also remove the closing-curtain-brake-lever screw and the screw holding the end of the closing-curtain-brake spring. Lift the curtain-mechanism plate high enough to work out the closing-curtain brake lever.

As you lift the wind-gear assembly, you'll probably feel a catch — that's the opening-curtain brake lever getting in the way. So turn the opening-curtain brake lever all the way counterclockwise (as seen from the top). You should then be able to lift the wind-gear assembly free of the camera body, Fig. 74.

The closing curtain is now in danger. To prevent damage, turn the closing-curtain wind gear as far as it will go in a clockwise direction — that winds the closing curtain onto its winding roller. Then, lift the wind-gear assembly up and out of the camera. Pass the take-up rollers through the camera-body cutout as you're lifting out the mechanism.

Fig. 76 shows the curtains still attached to the winding and take-up rollers. The guide roller at the bottom of the closing-curtain winding roller is loose — it normally remains in the camera body. In the drawing, Fig. 77, you can see how the curtains sit in the camera.

Notice that the opening curtain runs behind the closing curtain (between the closing curtain and the back of the camera). Small tabs at the ends of each bar bend over the tapes. When the curtains are properly oriented, the tabs on the closing-curtain bar face the front of the camera. And the tabs on the opening-curtain bar face the back of the camera.

With the wind-gear assembly removed, it's a lot easier to install the new curtains. Peel the closing curtain from the winding roller until you can see the end of the curtain — scribe the winding roller to note the curtain's position. Do the same thing with each of the opening-curtain tapes. Then, peel off the old curtains.

Fig. 78 shows the wind-gear assembly with the curtains removed. Now's a good time to clean and lubricate the mechanism. Looking under each of the winding-roller pinions, notice the ball races; the ball bearings are well exposed for cleaning and lubricating (shutter oil).

There's one hazard in working with the wind-gear assembly. In our evaluation F-1, we found it was

possible to tilt the opening-curtain winding roller far enough to disengage its pinion from the opening-curtain wind gear — that loses the timing for the opening curtain, the timing you so carefully noted by scribing the tape positions. But this hazard can also be a benefit; it provides a handy technique for adjusting the overlap with the curtains assembled, as we'll later describe.

If you do have to disassemble the mechanism further, scribe the timing between the winding-rollers pinions and the curtain-wind gears (otherwise, your scribe lines for the curtain positions won't mean anything). Then, remove the setscrews holding the tape rollers to the opening-curtain pinion shaft. Slide off each tape roller. And watch for the loose 1mm ball bearings as you lift out the pinion shaft.

Looking at the opening-curtain pinion shaft, notice that one end of each screw hole is beveled. On reassembly, align the screw holes in the tape rollers over the beveled ends of the screw holes in the pinion shaft.

The disassembly of the closing-curtain winding roller is very similar. One setscrew holds the winding roller to the pinion shaft. Again, watch out for the loose ball bearings.

You can now see what's necessary to retime the curtain-wind gears. Changing the timing of the closing-curtain wind gear requires that you first remove the setscrew holding the pinion shaft. Then, it's possible to lift the closing-curtain pinion shaft high enough to clear the closing-curtain

wind gear. Similarly, you could change the opening-curtain timing by removing the setscrew on the upper tape roller. But, as we indicated earlier, it may be possible to simply tilt the opening-curtain winding roller and disengage the gears.

Proceeding with the curtain installation, lay out the new curtains and determine which is which — the closing curtain should be slightly longer than the opening curtain. In our evaluation camera, the original closing curtain was 88mm long (measured from the end of the curtain to the outside edge of the curtain bar); the opening curtain was 85mm long. Yet both of our replacement curtains measured 93mm. So before installing the new curtains, we found it necessary to trim them to the same lengths as the originals.

Also, check the lengths of the tapes on the new curtains. Our original closing-curtain tapes measured 111mm (measured from the roller end of each tape to the outside edge of the curtain bar); the original opening-curtain tapes were each 102mm. But rather than going by our figures, just compare lengths — trim the tapes of your new curtains to the same lengths as the tapes of your original curtains.

Comparing the lengths of the new curtains to those of the original curtains is more difficult. Chances are the old curtains are badly wrinkled at the ends that were once cemented. You'll have to make careful measurements and cut your new curtains to the same dimensions.

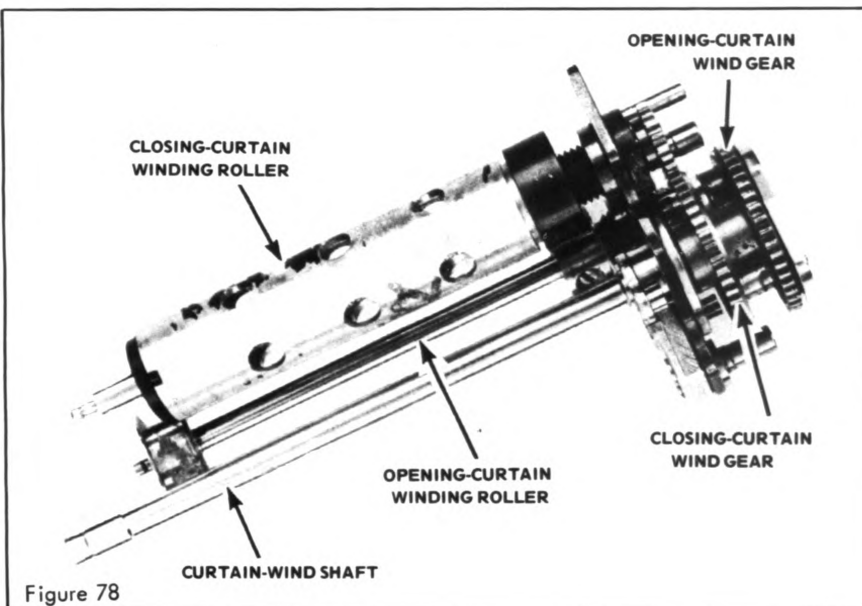


Figure 78

Now, align the end of the new closing curtain with your scribe line on the winding roller. And cement the closing curtain in place. Precision here is critical — remember, if you make a mistake in cementing the curtain, it's nearly impossible to pull off the curtain without damage. The opening-curtain tapes are more tolerant. Using the scribe lines for reference, cement the new tapes to the opening-curtain winding roller. If necessary, you can later peel off the tapes and recement them to adjust overlap or parallelism.

The next step — inserting the curtain assembly with the curtains attached — is where things get tricky. You must be very careful to avoid damage to the titanium curtains. Barely touching the edge of a curtain against the camera body results in a kink or a bend. Start by seating the lower guide roller for the opening-curtain tape over the camera-body post.

Now, roll the entire opening curtain onto the opening-curtain take-up

roller. If you wish, you can use masking tape to hold the curtain — that makes it a little easier to insert the take-up rollers through the camera-body opening.

You'll also want the closing curtain wrapped tightly to avoid damage. Orient the wind-gear assembly as it would normally sit in the camera. Then, turn the closing-curtain wind gear clockwise (as seen from the top) until it's stopped by the stop pin (the stop pin is under the closing-curtain wind gear). The closing curtain should now be almost completely wound around its winding roller, Fig. 79; here, we're pulling the take-up roller to tighten the curtain and see exactly how much curtain extends from the winding roller.

When trying this procedure, you may get the result shown in Fig. 80. Here, there's too much curtain extending from the winding roller; that means you'll have to wrap the closing curtain once more around the closing-curtain winding roller. Once you've wound up the closing curtain,

you can hold it in place with a piece of masking tape.

The tapes of the opening curtain must also wrap once around their winding roller. From the position shown in Fig. 81, wrap each tape once around its tape roller. Notice in Fig. 82 that the upper opening-curtain tape now passes around the guide roller at the top of the closing-curtain winding roller. The lower opening-curtain tape must pass around the guide roller in the camera body — you'll have to feed the lower tape into position as you install the wind-gear assembly.

Drop both take-up rollers through the camera-body opening. Then, carefully seat the wind-gear assembly — make sure that the lower opening-curtain tape passes around the guide roller in the camera body. You may have to help the two winding rollers into their camera-body bearings. And, before seating the wind-gear assembly fully, replace the closing-curtain brake lever.

The wind-gear assembly may refuse to seat all the way. You'll probably have to move the opening-curtain brake lever back and forth until the mechanism drops into place. Then, replace the two countersunk screws to hold the curtain-mechanism plate in position.

Carefully remove the masking tape from the curtains. You can use a little rinsing solution to clean off any residue left by the masking tape (along with any fingerprints the curtains may have picked up). Now, orient the curtains in their proper positions — remember, the opening curtain runs behind the closing curtain. It may be necessary to pass the closing-curtain take-up roller through the opening-curtain tapes.

Finally, reassemble the take-up rollers. The closing-curtain take-up roller, you'll recall, goes to the front of the camera; its tapes pass around the guide rollers on the opening-curtain take-up roller.

Checking the Curtain Positions

To check the curtains, apply some initial tension to the take-up rollers — just enough to draw the curtains and tapes tightly on their rollers. You can now check the closing-curtain position and the opening-curtain overlap.

Temporarily install the closing-curtain latch. Then, rotate the opening-curtain wind gear clockwise to draw the curtains to the tensioned position.

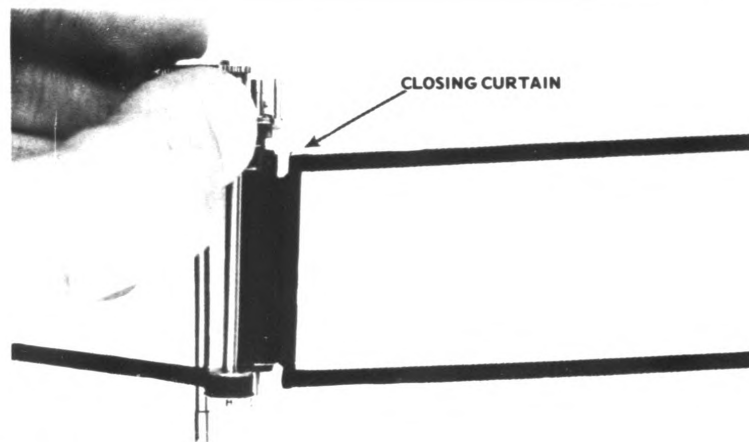


Figure 79

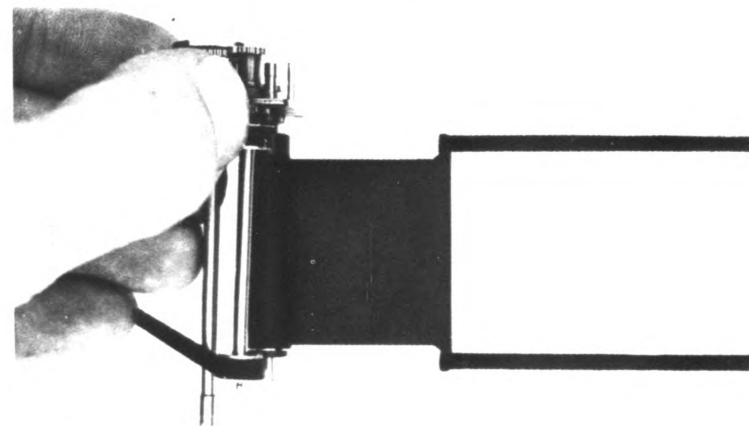


Figure 80

Depress the release rod and hold the closing-curtain latch in engagement with the lug atop the closing-curtain wind gear.

Release the opening curtain and check the position of the closing curtain — the edge of the closing-curtain bar should align with your scribe mark. If it doesn't, you apparently didn't get the curtain cemented in the proper position. Or perhaps you disturbed the timing between the closing-curtain wind gear and the closing-curtain winding-roller pinion. In that case, you'll have to remove the wind-gear assembly and the setscrew that holds the closing-curtain winding roller to the pinion shaft. Lift the pinion shaft (watching out for the ball bearings) and change the timing between the pinion and the closing-curtain wind gear.

That's the only way to adjust the closing curtain. But, as we've mentioned, you might be able to adjust the opening curtain without disassembly. Check the curtain overlap as you draw the curtains to the tensioned position; remember, the closing curtain should overlap the opening curtain by $\frac{3}{4}$ bar. If the overlap isn't correct, there're at least three alternatives. For one, you can loosen the upper tape roller and change the gear timing. Or you can pull the opening-curtain tapes loose and recement them in different positions.

The third technique — the one we found to be the most convenient — is to simply remove the screws holding the wind-gear assembly. Then, lift the wind-gear assembly high enough to disengage the opening-curtain winding roller from its lower bearing. There may now be enough play in the opening-curtain winding roller to disengage the gears — just tilt the opening-curtain winding roller until you can disengage its pinion from the opening-curtain wind gear. And turn the opening-curtain winding roller in one direction or the other to change the gear timing.

To check the parallelism of the curtains, use the sides of the focal-plane aperture as your straightedges. Watch the back of the focal-plane aperture and turn the closing-curtain winding roller with your finger. Turn the closing-curtain winding roller until the closing curtain just enters the aperture. Now, examine the fine slit formed between the edge of the closing-curtain bar and the edge of the focal-plane aperture, Fig. 83.

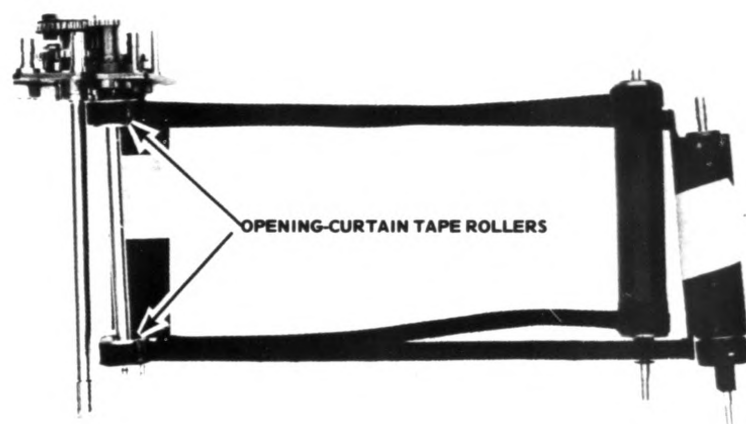


Figure 81

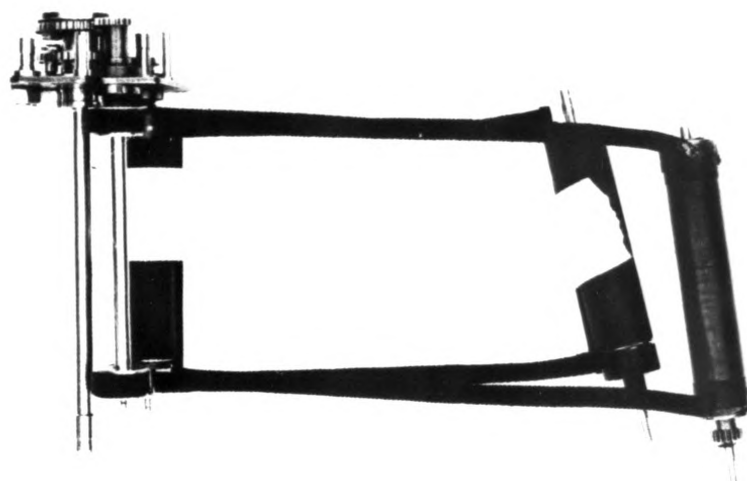


Figure 82

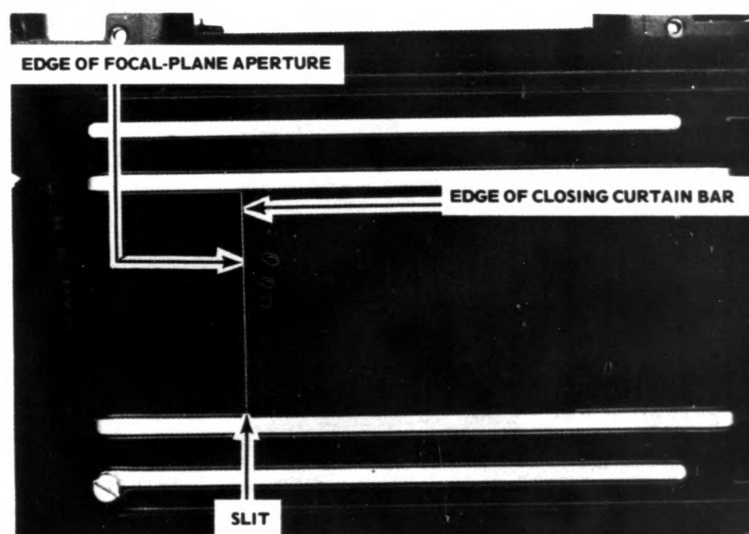


Figure 83

Holding the camera to a light source makes it pretty easy to judge the slit for uniformity. Is the slit uniform in width? Or does it taper from one end to the other?

Check the parallelism of the opening curtain by first turning the opening-curtain wind gear to the fully tensioned position. Then, hold the closing-curtain winding roller with your finger to prevent the closing curtain from entering the focal-plane aperture. And allow the opening-curtain wind gear to turn slowly in the release direction — until the opening curtain just enters the aperture.

You can now check to see that the opening-curtain bar is parallel to the edge of the focal-plane aperture. If either curtain is slightly out of parallel, it's possible to make minor adjustments by shimming the tapes. Cut a small chunk of the tape from the old curtains to use as your shim.

For example, say that the closing curtain is slightly out of parallel; perhaps the slit in Fig. 83 is wider at the top than at the bottom. You can then place your shimming tape at the top of the closing-curtain take-up roller — right behind the point where the curtain tape cements to the roller. Allow the closing-curtain tape to hold the shimming tape in position as you recheck the parallelism. If the slit's now parallel, cement the shimming tape in position. But if the slit's still not parallel, use either a larger or a smaller chunk of shimming tape.

Adding the tape causes the take-up roller to pull the top of the curtain bar a little further. In effect, you've increased the diameter of the take-up roller's top end. You could get the same result by decreasing the diameter at the bottom of the take-up roller; just cut a little off the end of the lower tape (where it cements to the take-up roller). Whether you cut or shim may depend on the amount of curtain overlap.

Curtain-Travel Times in the F-1

Once you've reassembled the winding mechanism, you can set the curtain-travel times. Canon's specification for the curtain-travel time is 12.5 to 13.5 milliseconds edge to edge. Or, using the National Camera Travel-Time Masks, set the travel time in the range of 11.5 to 12.5 milliseconds.

Timing the Mirror-Return Gear

Time the mirror-return gear before replacing the mirror-cage/front-plate assembly. Just remove the disengaging link from the mirror-return-gear shaft. You can then lift the mirror-return gear high enough to clear the closing-curtain winding-roller pinion.

Fig. 84 shows Canon's specification for the mirror-return-gear timing. Here, the shutter is in the released position. When you then replace the disengaging link, the stud on the disengaging link should be positioned as shown in Fig. 68.

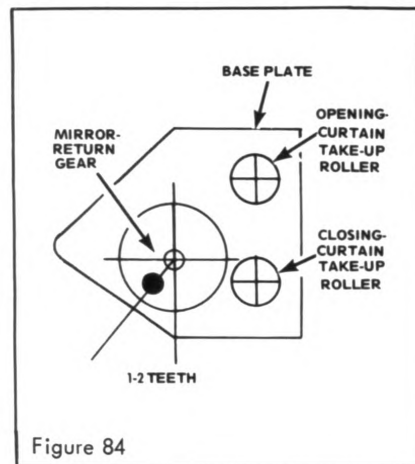


Figure 84

Disassembly of the Counter-Actuating Mechanism

You normally won't have to remove the counter-actuating parts. But if you get a camera with a broken take-up spool, you will have to pull the main-wind shaft. And that means you'll have to remove the counter-drive lever, Fig. 85. In Fig. 85, we've also

removed the pallet-disengaging lever, the X-contact-closing lever, and the opening-curtain-brake assembly.

Notice that the counter-drive lever carries a shaft with two pinions. The upper pinion engages the counter gear (remaining with the counter-

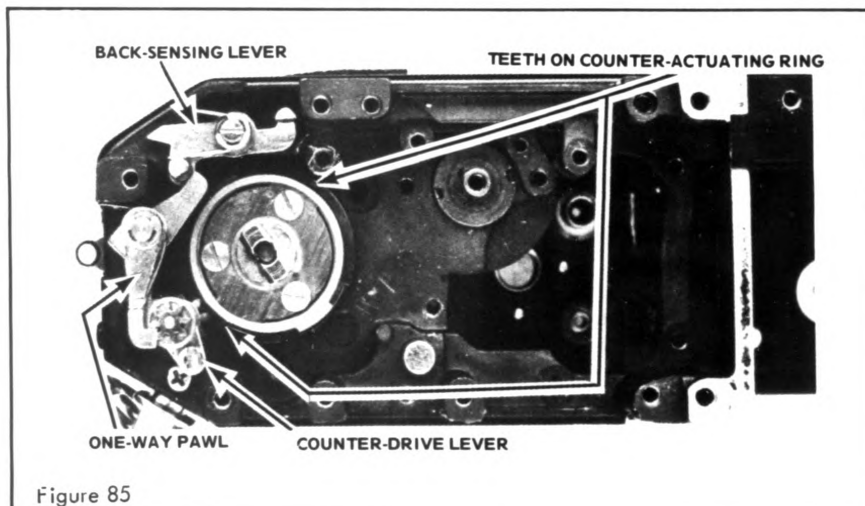


Figure 85

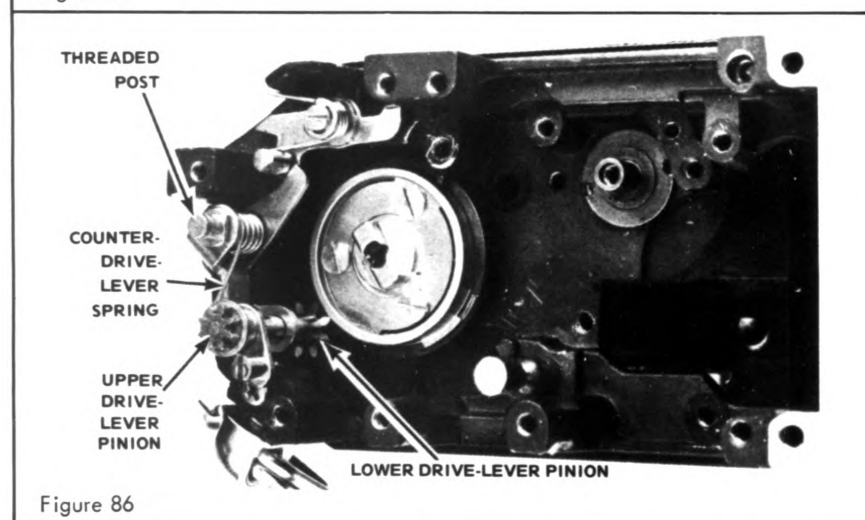


Figure 86

mechanism plate). The lower pinion sits alongside the main-wind shaft.

The **counter-actuating ring** encircles the main-wind shaft, Fig. 85. There are two teeth on the counter-actuating ring, one on each side. One or the other of these teeth engages the lower drive-lever pinion during each cocking cycle. And that turns the upper drive-lever pinion to advance the counter dial one film-frame calibration.

A one-way pawl sitting on top of the counter-drive lever prevents the counter from turning in the reverse direction. The one-way pawl permits the upper drive-lever pinion to turn clockwise (as seen from the top). But the return spring on the counter dial can't turn the drive-lever pinion in a counterclockwise direction — the one-way pawl engages the pinion to prevent reverse rotation.

Opening the camera back allows the spring-loaded back-sensing lever, Fig. 85, to swing counterclockwise. Then, the back-sensing lever pushes the counter-drive lever away from the counter gear — the spring on the back-sensing lever just overpowers the spring on the counter-drive lever. As a result, the spring-loaded counter dial snaps back to the starting position.

There's really no need to remove the back-sensing lever (although we have done so in some of the illustrations). But we will take out the counter-drive lever to clear the main-wind shaft. First, unhook the spring from the side of the one-way pawl. Lift out the one-way pawl, the washer, and the spring.

Next, unhook the spring from the side of the counter-drive lever. Unscrew the threaded post, Fig. 86, and lift out the counter-drive lever with its spring.

Removing the Main-Wind Shaft and the Take-Up Spool

You now have a clearer view of the one-way clutch built into the main-wind shaft, Fig. 87. Fig. 88 shows the one-way clutch after removing the clutch-cover plate. Normally, you won't have to disassemble this mechanism — the main-wind shaft and the one-way clutch come out of the camera as a unit. But if you have to replace a part, you'll have to disassemble the one-way clutch; parts are supplied individually.

To remove the main-wind shaft, first take out the screw holding the motor-drive wind cam, Fig. 89.

CLUTCH-COVER PLATE

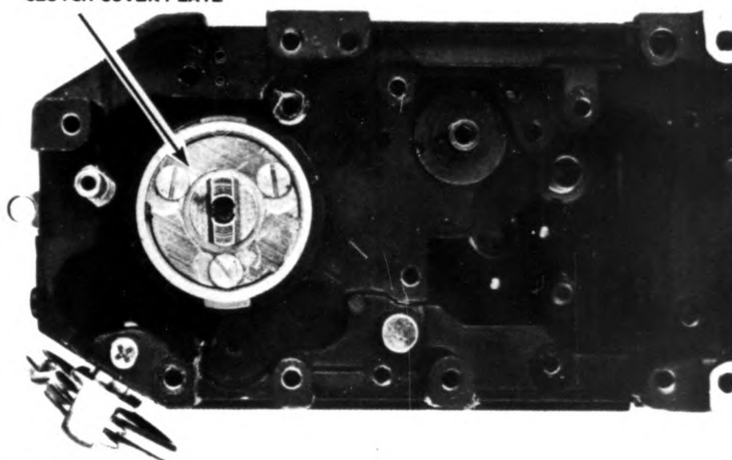


Figure 87

CLUTCH CAM

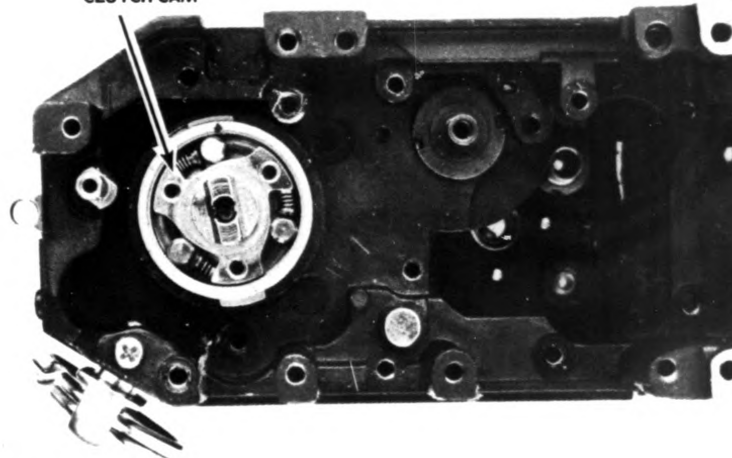


Figure 88

SCREW HOLDING MOTOR-DRIVE WIND CAM MAIN WIND GEAR

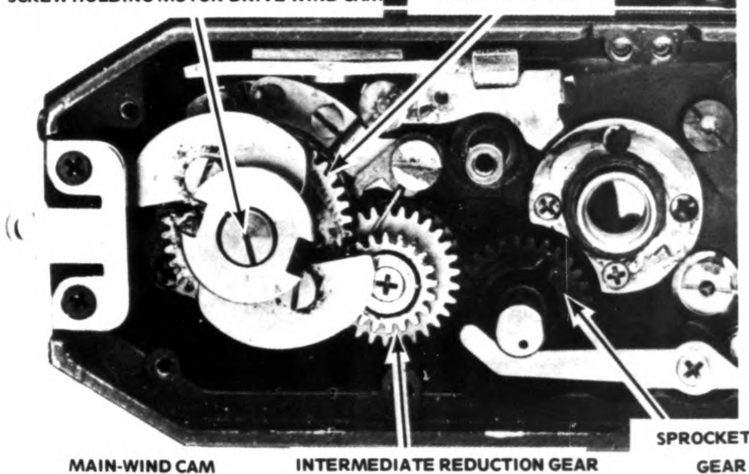


Figure 89

UPPER BALL
RACE FOR MAIN-
WIND SHAFT

BEARING PLATE FOR
TAKE-UP SPOOL

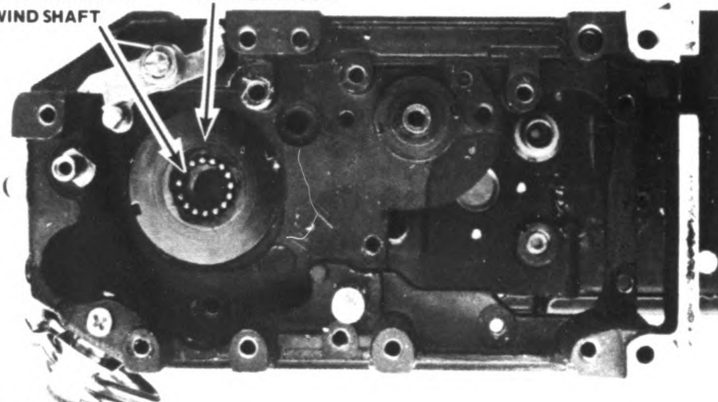


Figure 90

SPROCKET BEARING PLATE

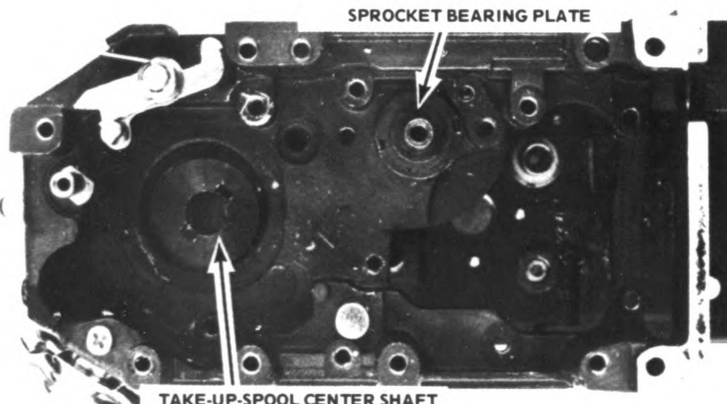


Figure 91

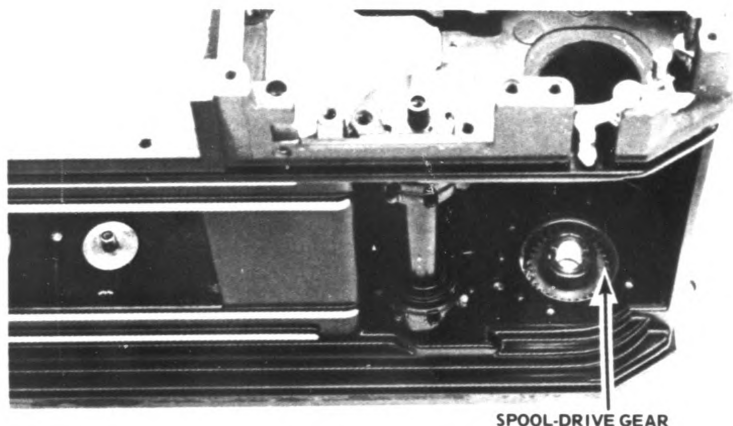


Figure 92

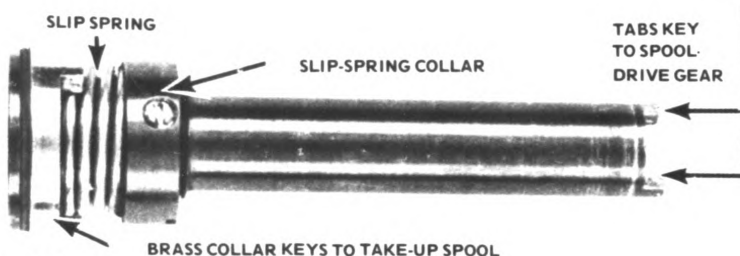


Figure 93

(That's not easy. Although the screw has a right-hand thread, it's locked in place with a locking agent. A little acetone helps.) Hold the top of the main-wind shaft — just to keep the main-wind shaft in place — and lift off the motor-drive wind cam.

From here, proceed with caution — there are tiny ball bearings (1mm and all loose) under the main-wind gear and under the top end of the main-wind shaft. Lift off the main-wind-cam/main-wind-gear assembly and remove the 15 individual balls. Then, pull out the main-wind shaft, toward the top of the camera, and remove the 15 balls from the upper ball race, Fig. 90. There's a grease lubricant on both ball races. So the balls may remain in their tracks or they may stick to the main-wind gear and to the main-wind shaft.

The remaining route to the take-up spool is pretty easy. Just unscrew the bearing plate at the top of the camera, Fig. 90. Then, lift off the brass washer that sits on top of the take-up spool. Fig. 91 shows the center shaft that passes through the take-up spool to the bottom of the camera; two downward-projecting lugs on the center shaft engage two notches in the take-up spool. Lift out the center shaft. And slide out the take-up spool toward the back of the camera.

There's now a loose gear at the bottom of the camera — the **spool-drive gear**, Fig. 92. The two slots in the spool-drive gear receive the tabs at the bottom of the center shaft, Fig. 93.

Notice that the slip spring for the take-up spool remains on the center shaft, Fig. 93. It's quite convenient to adjust the amount of pressure applied by the spring. Just loosen the locking setscrew passing through the side of the slip-spring collar. Then, turn the threaded slip-spring collar from the bottom — clockwise unscrews the collar to relax the pressure, counter-clockwise to increase the pressure.

Removing the Sprocket

To remove the sprocket, unscrew the second bearing plate at the top of the camera, Fig. 91. Lift out the washer and the compression spring for the rewind-button shaft — both parts sit under the sprocket bearing plate.

Next, locate the two clearance holes in the side of the sprocket — there's a screw visible through each hole, Fig. 94. Both screws thread into the rewind-button shaft.

The lower screw engages one of four lugs on top of the sprocket gear. As the sprocket gear turns, it engages the screwhead to rotate the rewind-button shaft. The upper screw through the rewind-button shaft then comes against the side of the sprocket clearance slot. So the rewind-button shaft turns the sprocket in the same direction.

Take out both screws shown in Fig. 94. Then, slide out the rewind-button shaft and remove the sprocket from the back of the camera. Fig. 95 shows the lugs on top of the sprocket gear that engage the lower screwhead in Fig. 94. The piece with the four lugs shown in Fig. 95 threads into the sprocket gear at the bottom of the camera.

As with other 35mm cameras, the proper timing on the sprocket places a pair of sprocket teeth pointing directly to the back of the camera. Time the sprocket before replacing the main-wind-cam/main-wind-gear assembly. First, turn the sprocket until one tooth at the top of the sprocket and one tooth at the bottom point to the camera back. Then, replace the main-wind-cam/main-wind-gear assembly in the position shown in Fig. 66.

Probably the only remaining part you may wish to remove for cleaning purposes is the intermediate reduction gear, Fig. 89. But be careful — the intermediate reduction gear runs on 22 small (1mm) ball bearings, 11 on top and 11 on bottom. The two ball races contribute to the F-1's satin wind stroke. So a thorough repair on the wind mechanism may require pulling the intermediate reduction gear (as well as the main-wind shaft) to clean the ball bearings and relubricate the races with a light-grease lubricant.

Conclusions on the F-1

We're especially grateful to Canon for the F-1 used in researching this **Craftsman** story. It takes a long time to do the work involved and to prepare illustrations, review and verify copy. Manufacturers who supply these cameras for our work receive not only our grateful acknowledgement but the gratitude of thousands of readers who add this information to their libraries.

Like most professional-quality SLR's, the F-1 is a pleasure to service. There are just a couple of drawbacks to trouble the technician. One is the lack of variable-resistor adjustments

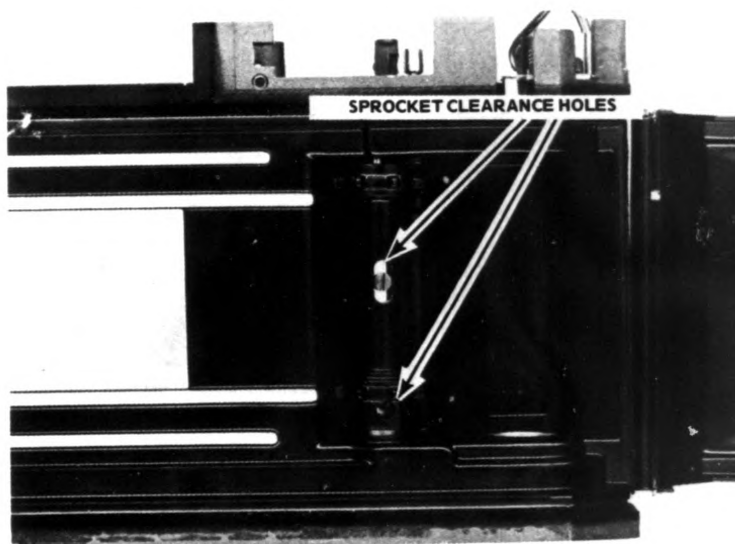


Figure 94

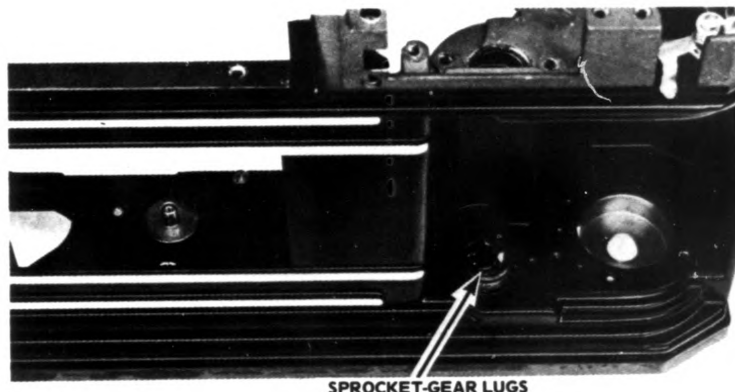


Figure 95

in the exposure-meter system. The other is only a drawback when you're trying to replace the curtains — that's the riveted wind-gear assembly.

On the other hand, the ample shutter-speed-adjustment points allow the conscientious technician to be as fussy as he wants. That pallet adjustment is great — an eccentric rather than the normal stop bar you have to bend. And the worm-and-worm-gear arrangement is the most precise and convenient of tension-setting systems. We're also fond of the simple linkage system for the exposure-meter coupling; it's both easy to disassemble and straightforward to time.

All those loose ball bearings — both in the curtain mechanism and in the transport mechanism — can be frustrating (especially when one pops out of the tweezers). They do tend to slow down a routine cleaning and lubrication. But they also spell

quality, as evidenced by the smooth operation of the wind stroke and the silent glide of the curtains. Even if you don't normally stock parts, you might consider a ball-bearing assortment — or at least a few spares in the common 1mm size.

The quality of Canon engineering and the quality of Canon optics make the F-1 a strong entry in the 35mm photographic-system competition. Pros will appreciate the exposure-meter system that stays in the body as they change finders, the convenience of the breechlock lens mount, and the full-aperture metering.

No doubt the heft, the professional "feel," the attractive all-black finish, and the "Canon" name attract the prestige-seeking amateur as well as the versatility-seeking pro. As you might expect, the price reflects both the quality and the prestige — the F-1 sells for under (but not by much) \$700.