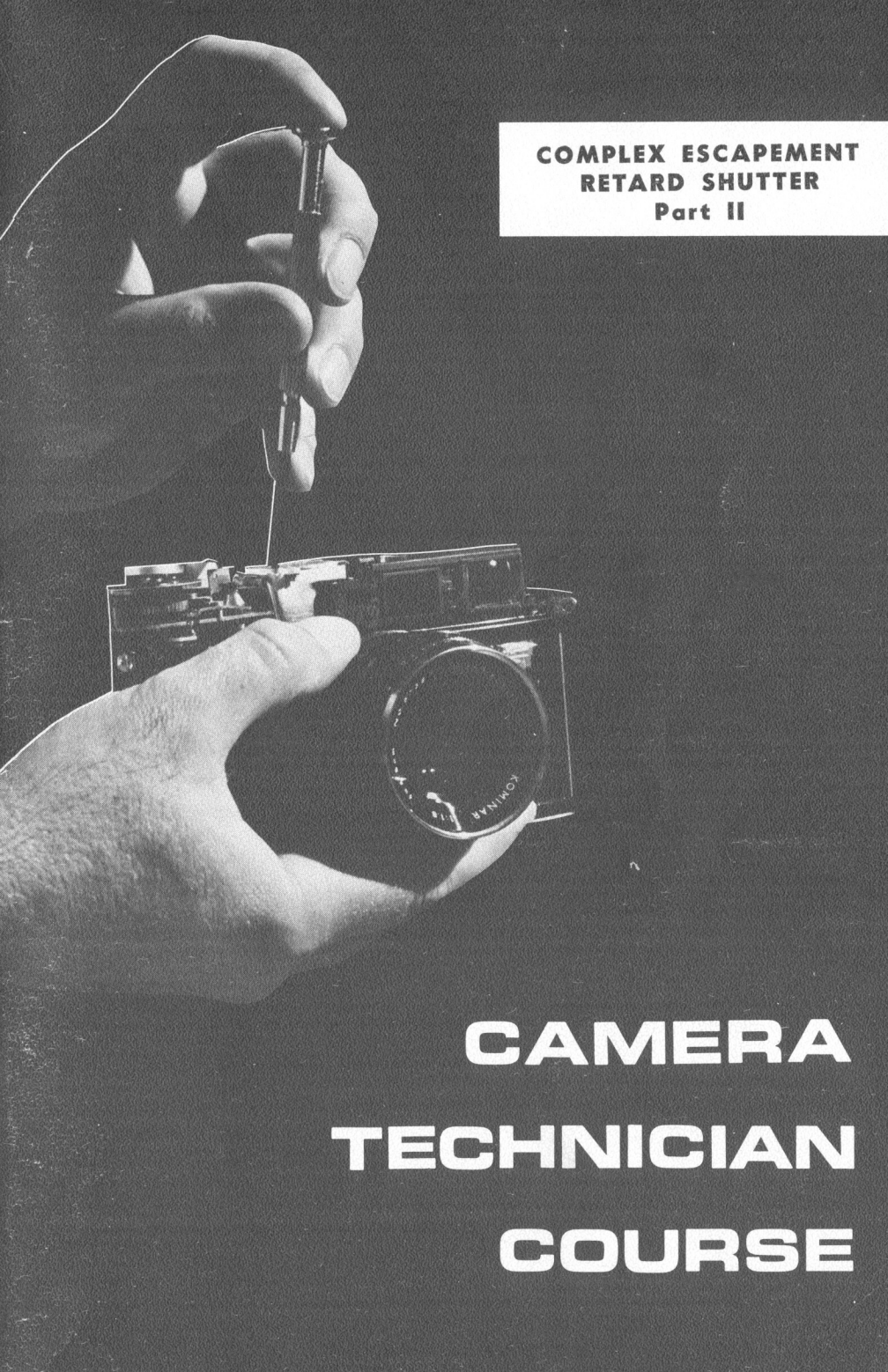
COMPLEX ESCAPEMENT
RETARD SHUTTER
Part II
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CONTENTS

COMPLEX ESCAPEMENT RETARD SHUTTER
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COMPLEX ESCAPEMENT RETARD SHUTTER

Part II

"V" AND "M" DELAYED ACTIONS

You have seen how a delayed-action mechanism may be built into a shutter to act either as a self timer or as a sync delay. For example, the Supermatic and the Prontor 500 LK each have a delayed-action escapement for a self timer; while the Flash Supermatic uses a similar mechanism to provide "M" or "F" sync delay. In many cases, however, both delay mechanisms are designed into one shutter.

When a shutter has both a self timer and a sync delay mechanism, the shutter calibrations **"V" and "M"** are normally used to distinguish between the two actions. At the "V" setting, a delayed-action mechanism is used as a self timer (the letter "V" is taken from the German word for self timer). The "M" calibration means an "M"-sync delay which synchronizes the shutter to an "M"-type flashbulb. In addition, these shutters also have an "X" calibration—here, the sync contacts are closed when the blades have reached the full-open position.

Remember, the main difference between the "V" delayed-action mechanism (self timer) and the "M"-sync delay mechanism is the actual length of delay time (the time after the shutter is released before the blades start to open). The "V" delayed action uses an escapement which prevents the shutter blades from opening for several seconds after the shutter has been released (usually from 8 to 12 seconds). When the blades do open to make the exposure, "X" sync is provided; that is, the flash is fired as soon as the blades reach the full-open position.

The "M"-sync delay mechanism may also be an escapement using a star wheel and pallet. However, the gear train is shortened so the actual delay time is only a few milliseconds. The star wheel, turning against the pallet, may be the only gear in the "M"-sync delay escapement.

Since the required delay for "M" sync is so brief, a simple geared inertia retard is often used rather than an escapement. You will recall that an "M"-type flashbulb needs a fraction of a second to reach its maximum light output. The "M"-sync delay mechanism prevents the shutter blades from opening for this split second after the flash contacts have closed.

"X" sync, on the other hand, requires no additional delay mechanism. A contact is simply closed to fire the flash when the blades are fully open. This contact always closes at the same time during shutter operation — regardless of the sync setting.

There are two basic ways that both a "V" delayed action and an "M"-sync delay can be built into one shutter. The most common method is to use two separate retards: one for the "V" delayed action and the other for the "M"-sync delay. In these shutters you may find three different retard mechanisms: the delayed-action escapement ("V"), the "M"-sync delay mechanism, and the speeds escapement (the escapement that controls the shutter speeds).

The other method is to use one escapement for both the "V" and "M" delays. This escapement is capable of delivering two different delay times. For the "V" action, the full escapement gear train is used to delay the blade opening. When the "M" sync is selected, a clutch arrangement disengages part of the gear train—including the star wheel and pallet. The delayed-action escapement then acts as an inertia retard (because the star wheel and pallet are disengaged) to provide the brief "M"-sync delay.

As you study the shutters having both "M" and "V" actions, you will notice one part which is common to each design. This is the **MXV selector ring** which is used to set the desired delay time: "M," "X" or "V." If the shutter uses two separate escapements for "V" and "M," the position of the MXV selector ring determines which of the two will be used to delay the blade opening. If the shutter uses one escapement for both actions, the MXV selector ring controls the escapement's running time. You will see both designs in this lesson.

THE PRONTOR SVS

The Prontor SVS is a good example of a shutter using one escapement to provide either an "M"-sync delay or a "V" delayed action. The running time of the delayed-action escapement is determined by the setting of the MXV selector ring.

In *Camera Mechanisms Manual* #276 you learned that there are two types of delayed-action designs found in Gauthier shutters: one in which the delayed action is tensioned with a manual setting motion, and a second in which the delayed action is automatically tensioned whenever the shutter is cocked. Remember, the Prontor 500 LK, which you studied earlier, uses the first type. The delayed-action setting lever in the Prontor 500 LK passes through the side of the shutter. The second type, in which the delayed action is automatically tensioned, is used in the Prontor SVS.

Regardless of the MXV selector ring setting, the delayed action in the Prontor SVS is always tensioned during the shutter cocking cycle. This is done by coupling the main lever to the first gear segment in the delayed-action escapement, as you will soon see.

Except for the delayed-action escapement, you are already familiar with most of the shutter operation in the Prontor SVS. This is a typical Gauthier shutter, almost identical in design to the Vario and the Prontor 500 LK. Therefore, it is now only necessary to examine the dual-purpose delayed-action escapement—how it is automatically tensioned when the shutter is cocked and how its delay time may be varied for either "M" or "V" action.

Remove the scalloped retaining ring, cover plate, and speed cam in

the same manner as with other Gauthier shutters. This reveals the working parts of the shutter.

Probably the only parts which now appear unfamiliar are the two coupled levers reaching from the delayed-action escapement to a point just above the main lever, Fig. 1. (There are several versions of the Prontor SVS shutter—a good understanding of the 00 size model illustrated should enable you to handle any deviations you will encounter.) The two levers are the **delayed-action setting lever** and the **transfer lever.** These parts link the main lever's cocking rotation to the delayed-action escapement.

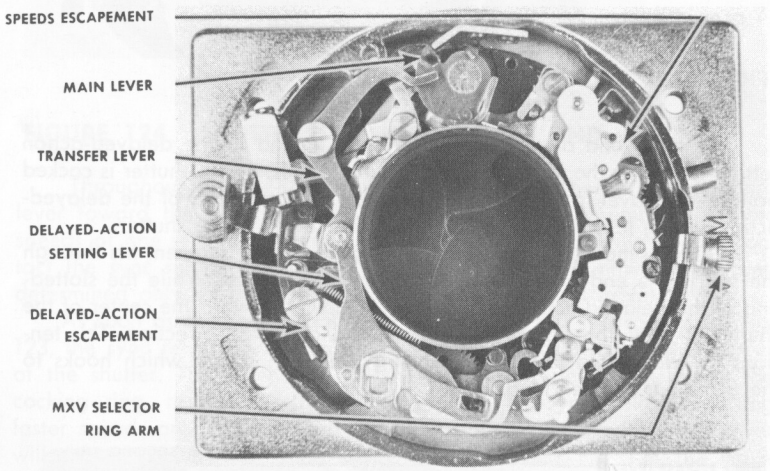


FIGURE 1

Notice the stud on top of the main lever, Fig. 1. One side of this stud (the side facing the transfer lever) is straight, while the opposite side is sharply sloped.

When the shutter is cocked, the main lever is turned in a counter-clockwise direction to tension the mainspring. During this travel, the main lever stud contacts the end of the transfer lever, Fig. 2. Now, as the main lever continues its rotation to the cocked position it moves this end of the transfer lever toward the center of the shutter.

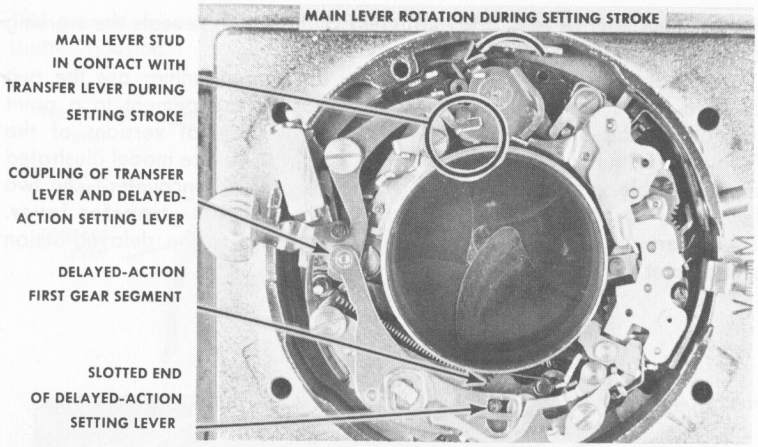


FIGURE 2

The other end of the transfer lever is hinged to the delayed-action setting lever—at the point shown in figure 2. Thus, as the shutter is cocked both levers travel in a "see-saw" motion. The slotted end of the delayed-action setting lever then moves toward the center of the shutter.

A pin on the top of the delayed-action first gear segment fits through the slot in the end of the delayed-action setting lever. While the slotted-end of the delayed-action setting lever is moving toward the center of the shutter, it turns the first gear segment in a clockwise direction. This tensions the delayed-action **drive spring**, the long spring which hooks to the first gear segment, Fig. 3.

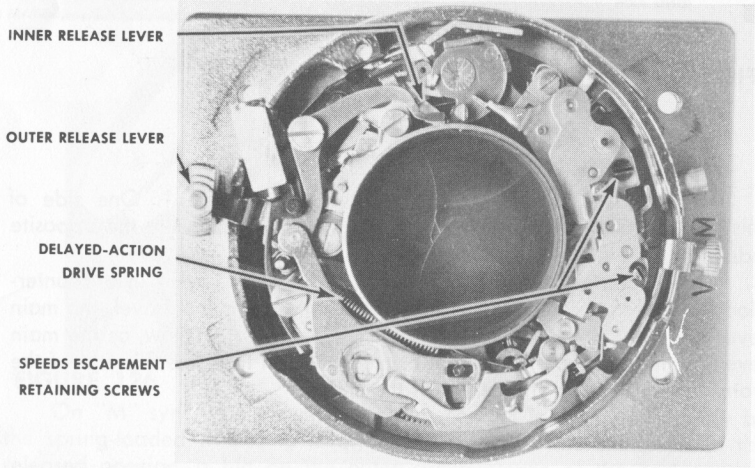


FIGURE 3 **SHUTTER COCKED**

At the end of the cocking cycle, the delayed-action escapement is latched to keep the drive spring tensioned. Now, the main lever moves past the transfer lever and is held in the cocked position by the inner release lever, Fig. 3. (The inner release lever is not clearly visible in these illustrations, but it functions in the same manner as in other Gauthier shutters you have studied.)

You will notice that the MXV selector ring is set to "X." Actually, the MXV selector ring could just as well have been set to "M." The cocking action of the delayed-action escapement remains exactly the same in either case. (As you will later see, however, the shutter must be in the cocked position before it can be set to "V.")

When the shutter is tripped, the outer release lever moves the inner release lever out of engagement with the main lever. However, before the blade operating ring can travel far enough to open the shutter blades the drive spring must pull the delayed-action first gear segment back to its starting position. This operation is quite similar to the manually-cocked Prontor delayed action which you previously studied.

The speeds escapement may be removed to more easily observe the blocking and releasing operations of the delayed action. Remove the two retaining screws, Fig. 3, and lift out the speeds escapement as a complete unit.

As the delayed-action setting lever moves to the cocked position, it carries a **catch lever** into the path of the "winged" blade operating ring stud, Fig. 4. One end of the catch lever sits within the U-shaped curvature of the delayed-action setting lever—the other end of the catch lever pivots at the end of the delayed-action escapement. Thus, the catch lever always moves with the delayed-action setting lever. (Remember, in the Prontor 500 LK the winged blade operating ring stud is blocked by the first gear segment for the duration of the delay. In the Prontor SVS, the catch lever serves this purpose.)

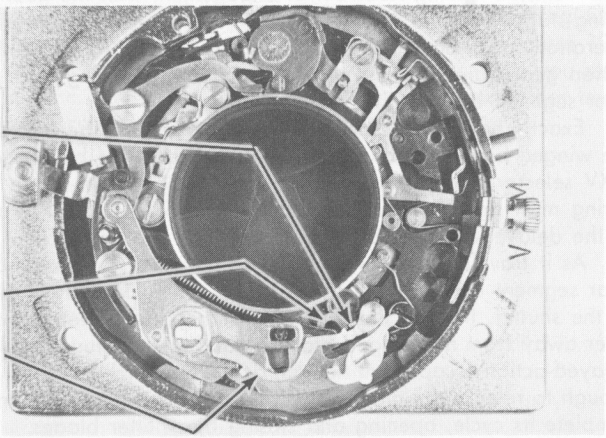


FIGURE 4

In figure 5 the MXV selector ring has been set to "V" and the shutter has been released. Here again the action is exactly the same on "M" or "X." However, as you will recall, the "V" setting provides the maximum delay, so the operation may be more easily observed. Notice in figure 5 that the blade operating ring has traveled only a slight distance and has been arrested by the catch lever. Before the blades can open to make the exposure, the catch lever must be moved out of the blade operating ring's path.

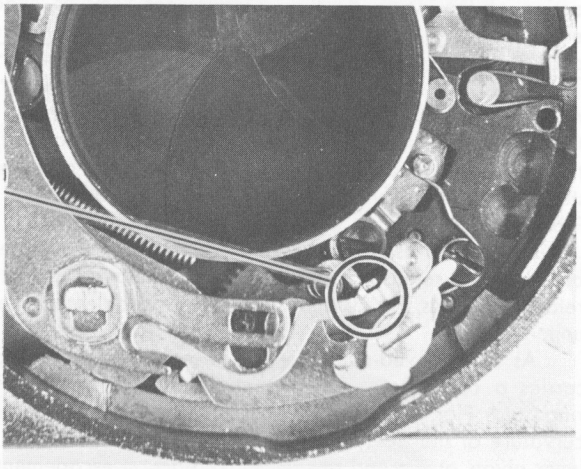


FIGURE 5 DURING DELAYED-ACTION CYCLE

This slight rotation of the blade operating ring is necessary to release the delayed-action escapement. That is, the winged blade operating ring stud kicks the locking lever out of engagement with the gear train before being stopped by the catch lever. (The locking lever is almost identical in operation to its counterpart in the Prontor 500 LK.) Since the delayed-action gear train is now free to turn, the drive spring may pull the first gear segment back to the rest position.

Exactly how long it takes for the catch lever to be pulled away from the winged blade operating ring stud is determined by the setting of the MXV selector ring. If the shutter is set to "V," as in figure 5, the drive spring must turn the first gear segment against the full retarding effect of the delayed-action escapement.

As it travels in a counterclockwise direction, the delayed-action first gear segment carries the delayed-action setting lever toward the outside of the shutter. In turn, the delayed-action setting lever moves the catch lever away from the winged blade operating ring stud. Finally, when the delayed-action escapement has run down, the catch lever has traveled far enough to release the blade operating ring. This allows the main lever to complete its cycle, opening and closing the shutter blades.

Remember, the stud on top of the main lever is angled on one side.

Thus, as the main lever returns to its rest position the stud passes underneath the transfer lever. Now, the stud is in place to pick up the transfer lever on the next cocking cycle.

Virtually the same action occurs when the MXV selector ring is set to "M" or "X." However, the retard now given the first gear segment is so slight that the entire sequence takes place in a fraction of a second. The travel of the first gear segment is speeded up by disengaging the pallet and star wheel in the delayed-action escapement at the "M" and "X" settings. Consequently, the delayed-action escapement (now acting as the sync delay mechanism) is just a geared inertia retard.

To see how the MXV selector ring disengages the star wheel and pallet at the "M" and "X" settings, the delayed-action escapement must be removed.

Three screws hold the delayed-action escapement and linkage in place. **DO NOT**, however, remove the screw at the pallet end of the delayed-action escapement (the screw which also secures the speed cam detent), Fig. 6 Once the delayed-action escapement has been taken out of the shutter, this will be the only screw which holds the mechanism together.

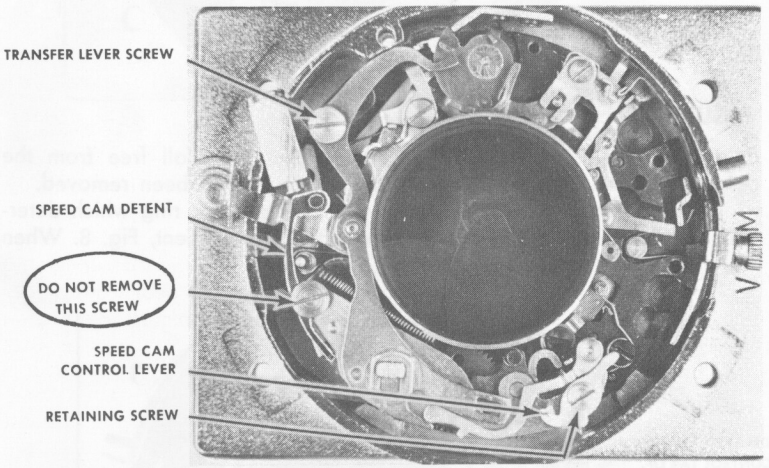


FIGURE 6

If the screw is removed, the two escapement plates will separate—then, a painstaking reassembly and timing procedure is required to return the gears to their proper positions.

First, take out the shoulder screw and washer at the pivot point of the transfer lever, Fig. 6. Next, remove the screw at the first gear segment end of the delayed-action escapement. (The latter screw also holds the speed cam control lever which disengages the star wheel from the speeds escapement at the two fastest speeds—this control lever has nothing to do with the operation of the delayed action.)

Reach under the speed cam detent with your tweezers and disconnect the coiled end of the delayed-action drive spring from the mechanism plate post. Now, slide the drive spring toward the first gear segment until its hooked end is disconnected, and lift the spring out of the shutter.

The third screw holding the delayed-action escapement can be seen from the pallet end, Fig. 7. Remove this screw and lift out the complete

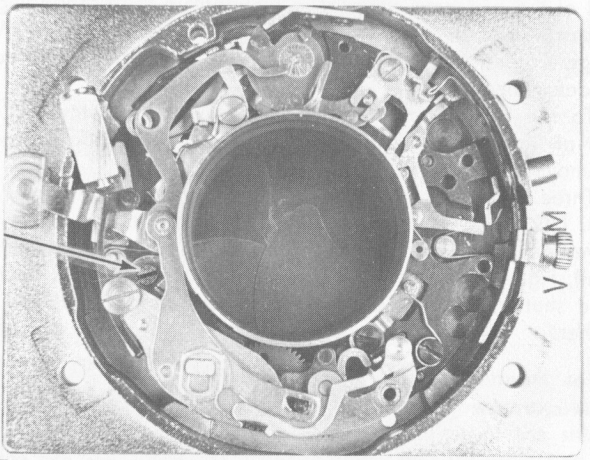


FIGURE 7

delayed-action escapement. The transfer lever may fall free from the delayed-action setting lever once the escapement has been removed.

You can now locate the tab on the MXV selector ring which determines the running time of the delayed-action escapement, Fig. 8. When

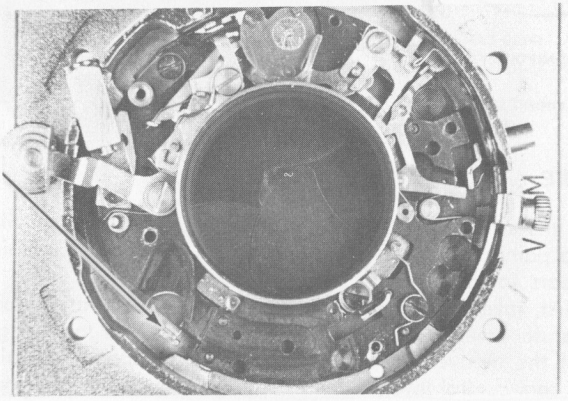


FIGURE 8

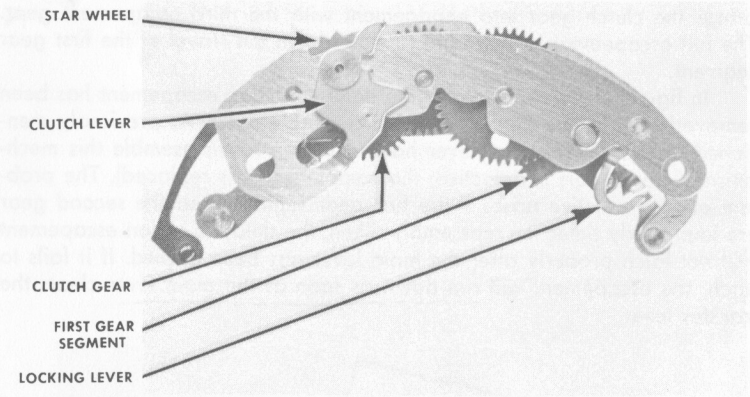


FIGURE 9

the MXV selector ring is set at either "M" or "X," this tab presses against one end of a spring-loaded clutch lever on the bottom of the delayed-action escapement, Fig. 9. The clutch gear which engages the star wheel is mounted on the clutch lever.

At the "M" and "X" settings, the MXV selector ring tab holds the clutch lever against its spring tension, as simulated in figure 10. This pushes the clutch gear out of engagement with the first portion of the gear train. Thus, the first gear segment has to turn only against the retard provided by the second and third gears in the escapement.

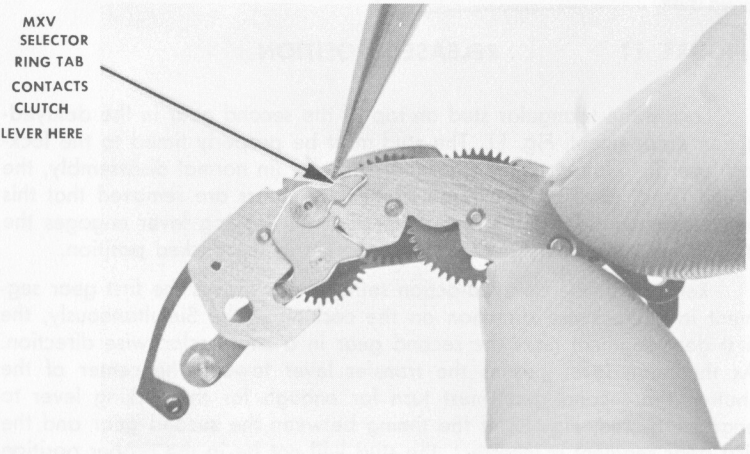


FIGURE 10

When the shutter is set to "V" the tab on the MXV selector ring moves away from the clutch lever. Now, the spring-loaded clutch lever

brings the clutch gear into engagement with the third escapement gear. The full escapement is then used to slow down the travel of the first gear segment.

In figure 11 the top plate of the delayed-action escapement has been removed so that you may see the parts more clearly. As previously mentioned, you will probably never have occasion to disassemble this mechanism (when a part is defective, the complete unit is replaced). The problem of such practice arises if the first gear segment and the second gear are improperly timed on reassembly. Then, the delayed-action escapement will not latch properly after the main lever has been cocked. If it fails to latch, the escapement will run down as soon as the main lever clears the transfer lever.

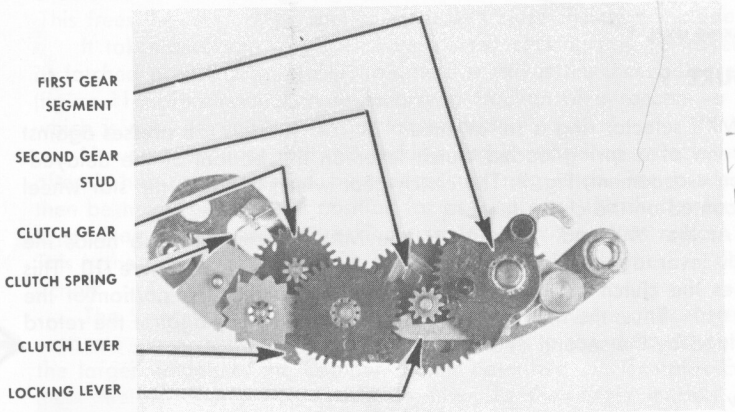


FIGURE 11 RELEASED POSITION

Locate the triangular stud on top of the second gear in the delayed-action escapement, Fig. 11. The stud must be properly timed to the locking lever in relation to the first gear segment (in normal disassembly, the timing is not disturbed—it is only when the gears are removed that this becomes a consideration). This is because the locking lever engages the stud to hold the delayed-action escapement in the cocked position.

Remember, the delayed-action setting lever moves the first gear segment in a clockwise direction on the cocking cycle. Simultaneously, the first gear segment turns the second gear in a counterclockwise direction. As the main lever pushes the transfer lever toward the center of the shutter, the second gear must turn far enough for the locking lever to engage its stud, Fig. 12. If the timing between the second gear and the first gear segment is incorrect, the stud will not be in the proper position at the end of the setting stroke. Thus, the locking lever will be unable to latch the delayed-action escapement in the cocked position.

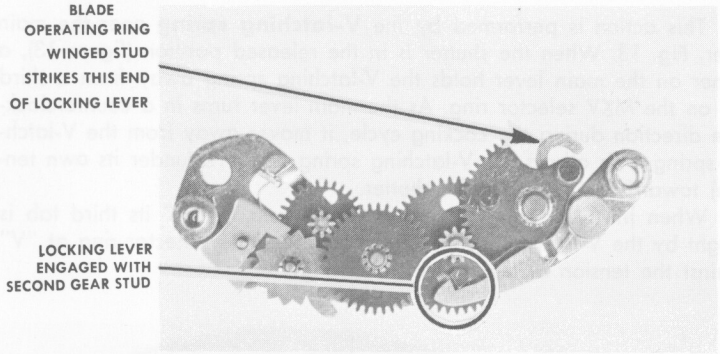


FIGURE 12 **COCKED POSITION**

When the shutter is released, the winged blade operating ring stud kicks the locking lever out of engagement with the second gear stud. This allows the delayed-action escapement to run down while the blade operating ring is restrained by the catch lever.

As a safety feature, the MXV selector ring will not remain at "V" until the shutter has been cocked. If the MXV selector ring is turned to the "V" position with the shutter released, a spring immediately returns it to the "X" setting. This **safety spring** hooks to another tab on the MXV selector ring, Fig. 13.

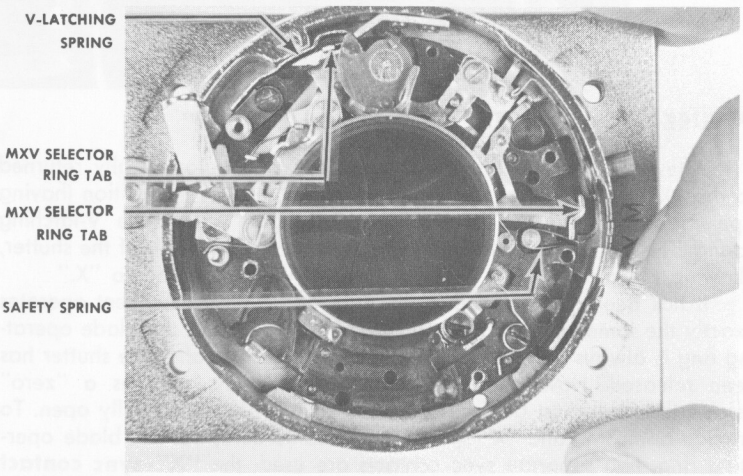


FIGURE 13 **SHUTTER RELEASED**

The safety spring tends to hold the MXV selector ring in a counterclockwise direction. Moving the MXV selector ring to "V" tensions the safety spring, as shown in figure 13. Thus, for the MXV selector ring to remain at "V" it must be latched against the tension of the safety spring.

This action is performed by the **V-latching spring** near the main lever, Fig. 13. When the shutter is in the released position (figure 13), a corner on the main lever holds the V-latching spring away from a third tab on the MXV selector ring. As the main lever turns in a counterclockwise direction during the cocking cycle, it moves away from the V-latching spring. This allows the V-latching spring to move (under its own tension) toward the center of the shutter.

When the MXV selector ring is now turned to "V," its third tab is caught by the V-latching spring. This holds the MXV selector ring at "V" against the tension of the safety spring, Fig. 14.

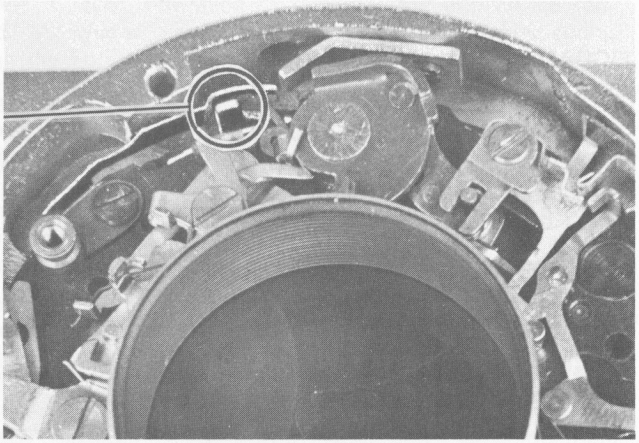


FIGURE 14 SHUTTER COCKED, SET TO "V"

After the exposure, the MXV selector ring is automatically returned to the "X" setting. When the main lever reaches its rest position (having opened and closed the shutter blades) it again strikes the V-latching spring. This pushes the V-latching spring toward the outside of the shutter, allowing the safety spring to return the MXV selector ring to "X."

It has been mentioned that the delayed-action escapement operates exactly the same way on both "M" and "X" sync. Thus, the blade operating ring is always delayed for a fraction of a second after the shutter has been released. However, you know that "X" sync requires a "zero" delay—the flash must be fired when the shutter blades are fully open. To provide both "M" and "X" sync with the same delay for the blade operating ring, two separate sync contacts are used: the **"X"-sync contact** and the **"M"-sync contact.**

Both the "X"- and "M"-sync contacts are near the leaf lever, Fig. 15. You will probably recognize the "X"-sync contact arrangement from a previous lesson—this is exactly the same design used in the Vario shutter. That is, the **contact closing cam** straddles a stud on the blade operating ring (the stud which is engaged by the leaf lever). By the time the

blades have reached the full-open position, the blade operating ring has moved the contact closing cam far enough to press the "X"-sync contact against the terminal strip on the shutter housing, as shown in figure 15.

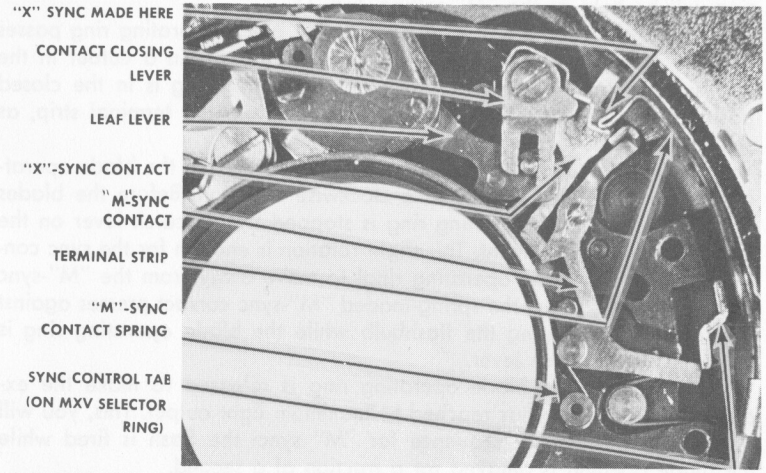


FIGURE 15 **SHUTTER SET TO "X"**

The operation of the "M"-sync contact, however, is quite different from anything you have previously seen. A light torsion spring hooks to a stud on the "M"-sync contact. This spring, shown in figures 15 and 16, tends to move the "M"-sync contact toward the same terminal strip that is used for "X" sync. Thus, the "M"-sync contact must be held against its spring tension until the proper time for flash ignition. This is done by the **sync control stud** on the blade operating ring, Fig. 16.

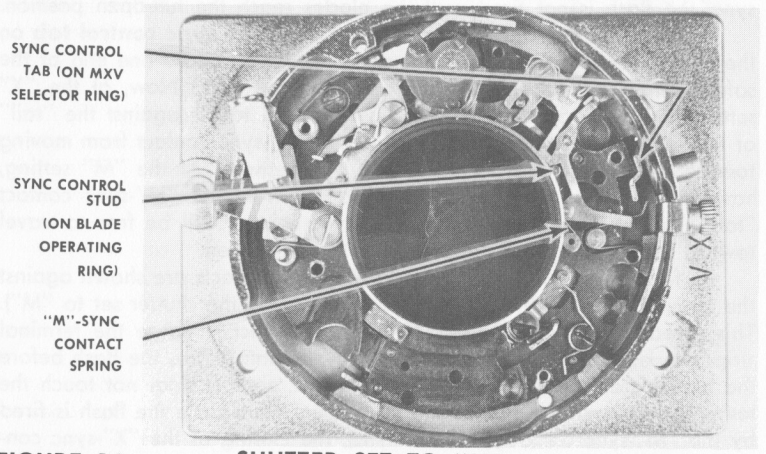


FIGURE 16 **SHUTTER SET TO "M"**

To set the shutter to "M" sync, pull the knob on the MXV selector ring away from the shutter. Now, turn the MXV selector ring to the "M" position. When its spring-loaded knob is allowed to return, the MXV selector ring will be held at the "M" setting, Fig. 16.

Notice that the sync control stud on the blade operating ring passes through a slot in the mechanism plate and rides within a cutout in the "M"-sync contact. As long as the blade operating ring is in the closed position, it holds the "M"-sync contact away from the terminal strip, as shown in figure 16.

Assume now that the shutter has been released and the blade operating ring has traveled slightly in a clockwise direction. Before the blades can open, the blade operating ring is stopped by the catch lever on the delayed-action escapement. This slight rotation is enough for the sync control stud (on the blade operating ring) to move away from the "M"-sync contact. Consequently, the spring-loaded "M"-sync contact presses against the terminal strip, firing the flashbulb while the blade operating ring is still held by the catch lever.

By the time the blade operating ring is released to make the exposure, the flashbulb has reached its maximum light output. This, you will recall, is the necessary sequence for "M" sync: the flash is fired while the blade opening is delayed for a fraction of a second.

When the blade operating ring returns to the closed position, the sync control stud again strikes the "M"-sync contact. This forces the "M"-sync contact away from the terminal strip (against its spring tension).

On "X" sync, the "M"-sync contact must not be allowed to move against the terminal strip. If the "M"-sync contact were not restrained on "X" sync, it would always fire the flash before the blades start to open, providing "M" sync. However, with the "M"-sync contact blocked out of action, only the "X"-sync contact will come against the terminal strip to fire the flash. Thus, even though the blade opening is delayed on "X" sync, the flash is not fired until the blades reach the full-open position.

Refer again to figures 15 and 16 and locate the **sync control tab** on the MXV selector ring. (This is the same tab which hooks one end of the safety spring, a feature you saw earlier in this text.) Now, at the "X" setting in figure 15 notice that the sync control tab is against the "tail" of the "M"-sync contact. This prevents the "M"-sync contact from moving toward the terminal strip on "X" and "V" settings. At the "M" setting, however, the sync control tab moves away from the "M"-sync contact "tail," Fig. 16. Consequently, the "M"-sync contact will be free to travel toward the terminal strip when the shutter is released.

In figure 17, both the "X"- and "M"-sync contacts are shown against the terminal strip (with the blades fully open and the shutter set to "M"). This reveals that on "M" sync both sync contacts engage the terminal strip. However, remember that the "M"-sync contact fires the flash before the blades start to open—while the "X"-sync contact does not touch the terminal strip until the blades are fully open. Thus, since the flash is fired by the "M"-sync contact (on "M" sync), the closing of the "X"-sync contact has no effect.

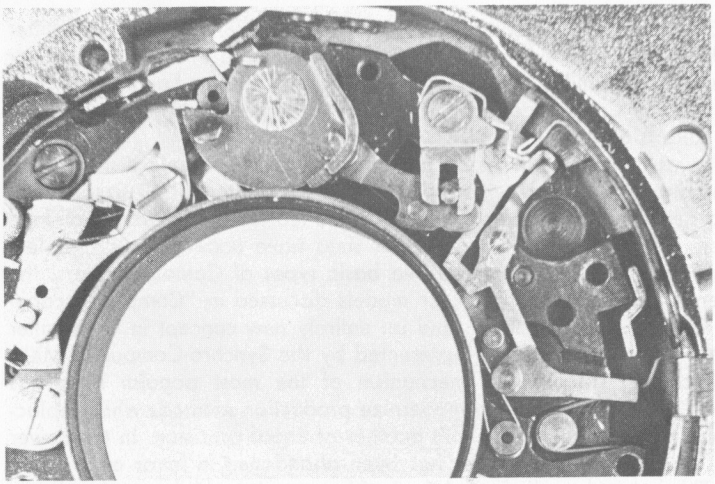


FIGURE 17

THE SYNCHRO-COMPUR 00-MXV

In the Prontor SVS you saw how one escapement is used to provide either an "M" sync delay or a "V" delayed action. The Synchro-Compur 00-MXV, Fig. 18, uses two separate escapement mechanisms for these functions. Thus, you will find three different escapements in this shutter: one for the "V" delayed action, one for the "M" sync delay, and a third for the shutter speeds.

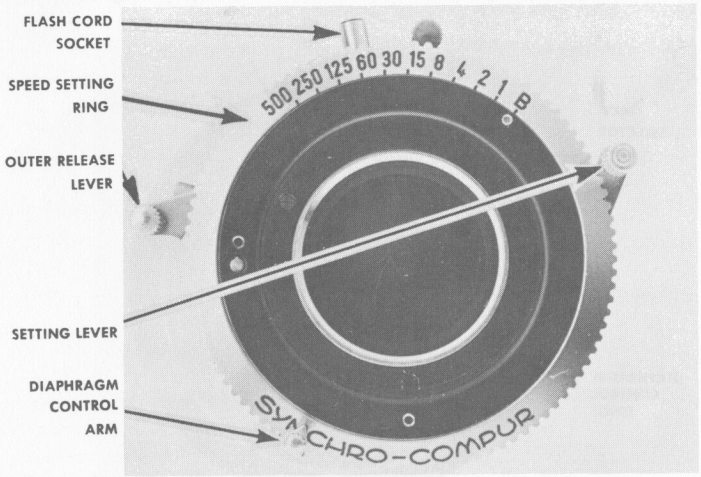


FIGURE 18 SYNCHRO-COMPUR 00-MXV

Since the Synchro-Compur 00-MXV is quite different from any shutter you have seen in previous lessons, it will be covered in detail. Except for the name and similar external appearance, this shutter has little in common with the Compur design you studied in the lesson, "Complex Escapement Retard Shutter—Part I."

It was noted in that lesson that the operating principle distinguished by the ring-type main lever is found in Compur shutters of all sizes. While the larger Compurs have retained the same features which you examined earlier, current models in the smaller sizes have undergone a complete design change. Now, there are two basic types of Compur shutters: the conventional design in the larger models discussed in "Complex Escapement Retard Shutter—Part I"; and an entirely new concept in the smaller models. The latter design is represented by the Synchro-Compur 00-MXV.

Changing the internal mechanism of the most popular sizes has allowed the manufacturer to modernize production methods while replacing one high-quality shutter with another of equal precision. In the newer style, the ring-type main lever has been abandoned in favor of a rotary cam. This in turn has eliminated the leaf lever and the high-speed spring—the cam-type main lever now employed drives the blade operating ring in both the opening and closing directions, achieving a fastest speed of 1/500 second without the benefit of an auxiliary spring.

In this text we will examine the externally set and released Synchro-Compur 00-MXV. The same shutter is often adapted to be cocked and released by the camera controls. Although this requires a few changes in the design, the operating principle remains the same as in the shutter you will now study.

Notice that the MXV selector ring encircles the back of the shutter, Fig. 19. This ring may be turned to the desired delay setting calibrated

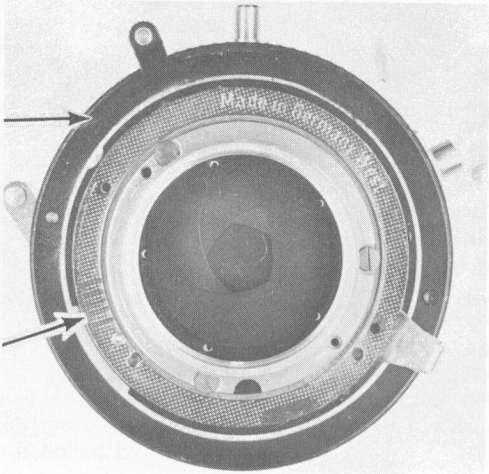


FIGURE 19

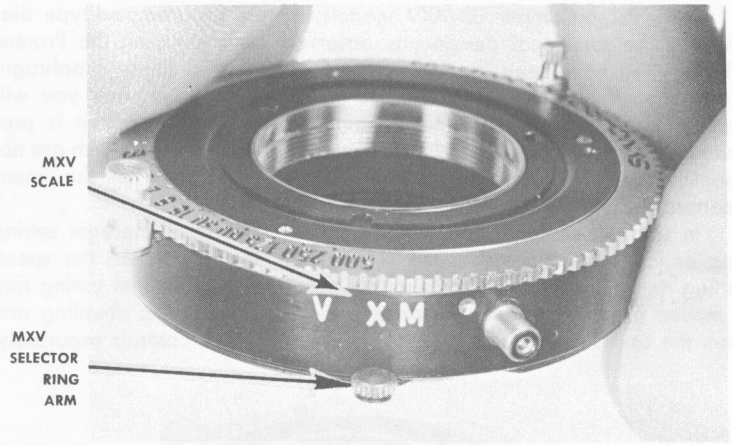


FIGURE 20

on the side of the shutter, Fig. 20. However, **do not attempt to turn the MXV selector ring to the "V" setting unless the shutter is in the cocked position.** Because of a blocking arrangement which you will later observe, the MXV selector ring is prevented from turning to "V" if the shutter is in the released position. Attempting to force the MXV selector ring to this setting without cocking the shutter will damage the internal parts.

At this time, cock the shutter by turning the setting lever, Fig. 18, in a clockwise direction until it stops. Then allow the setting lever to return to its rest position. Next, turn the MXV selector ring to the "V" setting. This action simultaneously cocks the delayed-action escapement. Release the shutter by depressing the outer release lever, also shown in figure 18. The blades will now remain closed for the time it takes the delayed-action escapement to run down, a period of from eight to ten seconds.

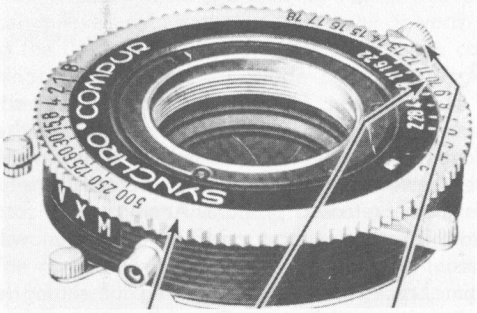
When the MXV selector ring is set to "M," the blade opening is delayed through another escapement. As you know, the "M" delay is very brief—just a fraction of a second. This slight delay allows an "M"-type flashbulb to reach its peak light output before the blades open. Unlike the Flash Supermatic which also provides this feature, no separate setting motion is required—the sync delay mechanism is automatically tensioned whenever the shutter is cocked.

Moving the MXV selector ring to the "X" position locks out part of the sync delay mechanism. Consequently, the contact will be made when the blades are fully open for "X" sync. This is the proper setting for electronic flash at all speeds and for small flashbulbs or flashcubes at 1/30 second or slower.

Different shutter speeds are selected by turning the speed setting ring, Fig. 18. Because a step-type speed cam is used, the desired speed should be set with the shutter in the released position. Once the shutter has been cocked, moving the speed cam may damage the control studs in the speeds escapement.

All Synchro-Compur 00-MXV models use the programmed-type diaphragm, the same leaf design you observed while studying the Prontor 500 LK. You have seen the necessity of providing a linear diaphragm scale when the shutter is coupled to an exposure meter, and you will later examine one of the Synchro-Compur 00-MXV models that is programmed to a match-needle system. However, even versions which are not coupled to an exposure meter can still take advantage of the linear aperture settings.

In some of these models, a coupling arm on the diaphragm setting ring engages the knurled speed setting ring, Fig. 21. When the speed setting ring is turned to select a shutter speed, the diaphragm setting ring is moved in corresponding increments. By disengaging the coupling arm from the speed setting ring, you can position the two controls separately.



COURTESY FRIEDR. DECKEL

FIGURE 21

For example, if the exposure needed is f/8 and 1/250 second, individually select this combination of settings. Should an action shot later require the fastest shutter speed under the same lighting conditions, you need only turn the speed setting ring to 1/500 second. This will simultaneously change the aperture to f/5.6, retaining the correct exposure. When this system is used, the speed setting ring is calibrated in light values. Although the Synchro-Compur 00-MXV shown in figure 18 (and in the following disassembly) does not couple the two setting controls, it still uses the programmed-style diaphragm leaves.

DISASSEMBLY OF THE SYNCHRO-COMPUR 00-MXV

After removing the shutter from the camera, unscrew the front and rear lens cells. Remove the diaphragm control arm by taking out its screw, Fig. 22.

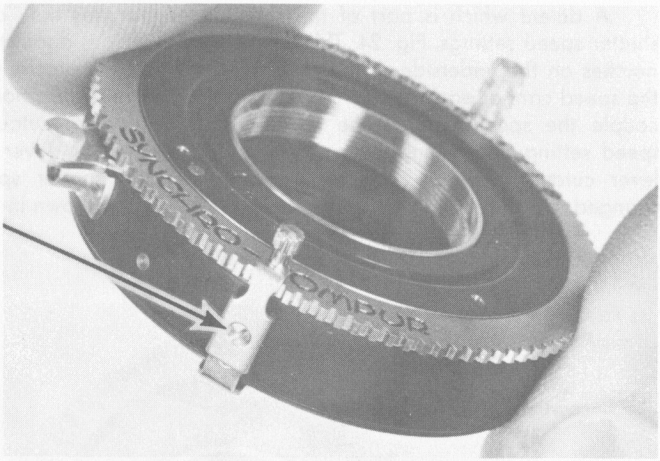


FIGURE 22

The cover plate is held to the shutter by a notched retaining ring, Fig. 23. The three notches in the retaining ring permit close adjustment of the speed cam tension with respect to seven screw holes on the cover plate. Once the **lock screw**, Fig. 23, has been removed, the retaining ring can be turned in either direction until another notch aligns with a screw hole. This will either increase or decrease the speed cam tension, depending on which direction you turn the retaining ring.

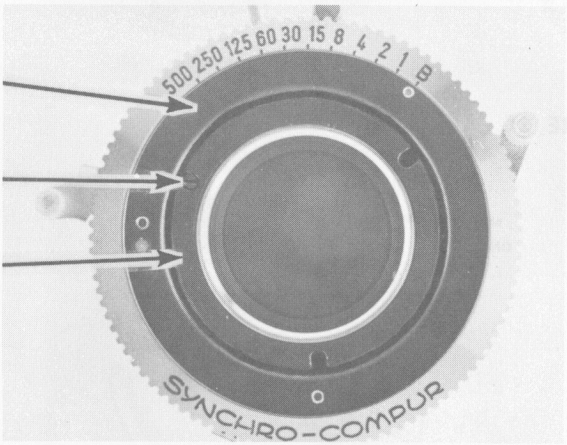


FIGURE 23

Make a mental note of the amount of speed cam tension before you disassemble the cover plate. Now, take out the lock screw and unscrew the retaining ring in a counterclockwise direction. Set the retaining ring in your parts tray and carefully lift off the cover plate.

A detent which is part of the speed cam provides the "click-stop" shutter speed settings, Fig. 24. This detent normally rides against a row of notches on the underside of the cover plate, Fig. 25, to precisely position the speed cam at each setting. The detent has one other function: it helps couple the speed cam to the speed setting ring. Two cutouts in the speed setting ring engage the detent and a second tab (over the bulb lever cutout) to rotate the speed cam when the shutter speeds are changed. Lift the speed setting ring from the shutter as shown in figure 26.

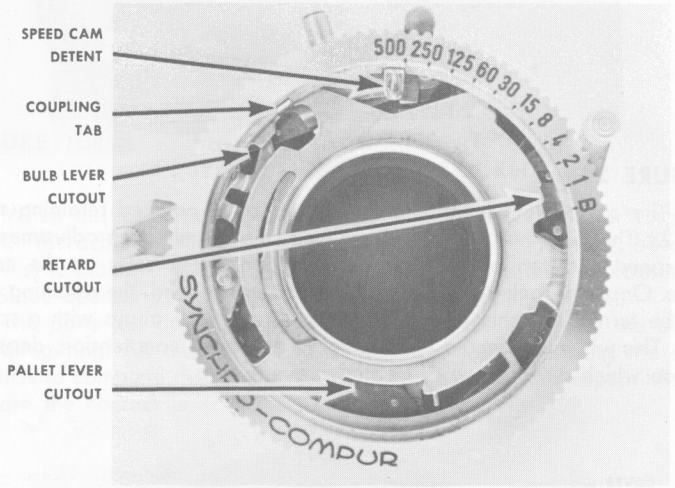


FIGURE 24

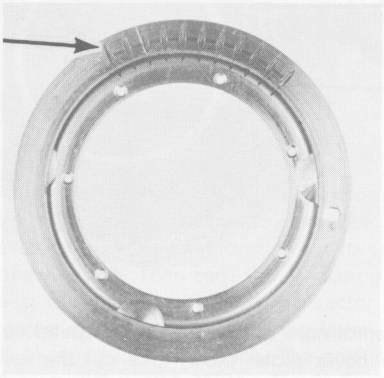


FIGURE 25

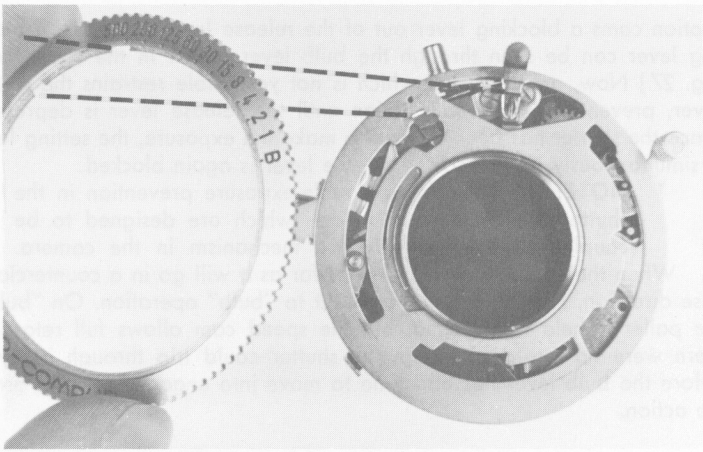


FIGURE 26

Like the Compur-Rapid studied in "Complex Escapement Retard Shutter—Part I" the Synchro-Compur 00-MXV is not conveniently set and released once the speed cam has been removed. You can, however, observe many of the design characteristics through the cutouts in the top of the speed cam.

Since the model illustrated is set and released manually by external controls, the double-exposure prevention mechanism is built into the shutter. That is, it is impossible to depress the release lever without first cocking the shutter. Also, a repeated stroke of the setting lever is similarly prevented until the shutter is released.

Cock the shutter by advancing the setting lever in a clockwise direction, Fig. 27, and allow it to return under spring tension. This setting

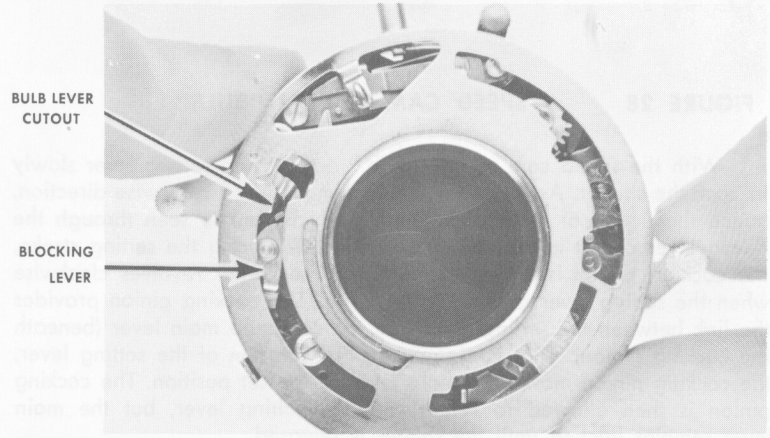


FIGURE 27

motion cams a blocking lever out of the release lever's path. (The blocking lever can be seen through the bulb lever cutout in the speed cam, Fig. 27.) Now, another lever which is not yet visible restrains the setting lever, preventing a second rotation until the release lever is depressed. Once the shutter has been tripped to make the exposure, the setting lever is simultaneously freed and the release lever is again blocked.

NOTE: The need for a double-exposure prevention in the shutter is eliminated in models which are designed to be coupled to the film advance mechanism in the camera.

When the speed cam is turned as far as it will go in a counterclockwise direction, Fig. 28, the shutter is set to "bulb" operation. On "bulb," the pallet is held disengaged, but the speed cam allows full retard. If there were no retard provided, the shutter could trip through its cycle before the bulb lever has had time to move into engagement and arrest the action.

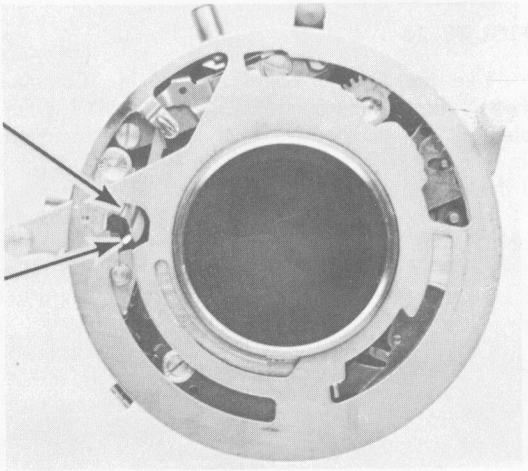


FIGURE 28 **SPEED CAM SET ON "BULB"**

With the speed cam set on "bulb," actuate the setting lever slowly to cock the shutter. As the setting lever is moved in a clockwise direction, notice the action of the cocking pinion which can be seen through the retard lever cutout in the speed cam, Fig. 29. During the setting stroke, the cocking pinion is turned counterclockwise, yet it revolves clockwise when the setting lever is allowed to return. This cocking pinion provides the link between the setting lever and the cam-type main lever (beneath the cocking pinion). That is, during the first rotation of the setting lever, the cocking pinion moves the main lever to the set position. The cocking pinion is then allowed to return with the setting lever, but the main lever remains latched until the shutter is released.

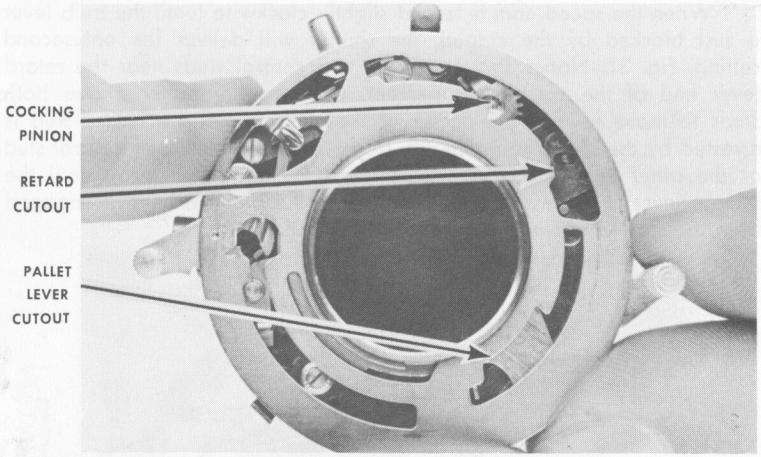


FIGURE 29

Trip the shutter while observing the parts which are visible through the speed cam cutout around the detent, Fig. 30. When the outer release lever is depressed, its "foot" contacts the inner release lever. This pushes the inner release lever out of engagement with the main lever to trip the shutter. The blades will remain in the open position (because of the arresting action of the bulb lever) as long as the outer release lever is held depressed. When the outer release lever is allowed to return under spring tension, its second "foot," visible through the bulb lever cutout, Fig. 28, picks up the bulb lever and permits the blades to close.

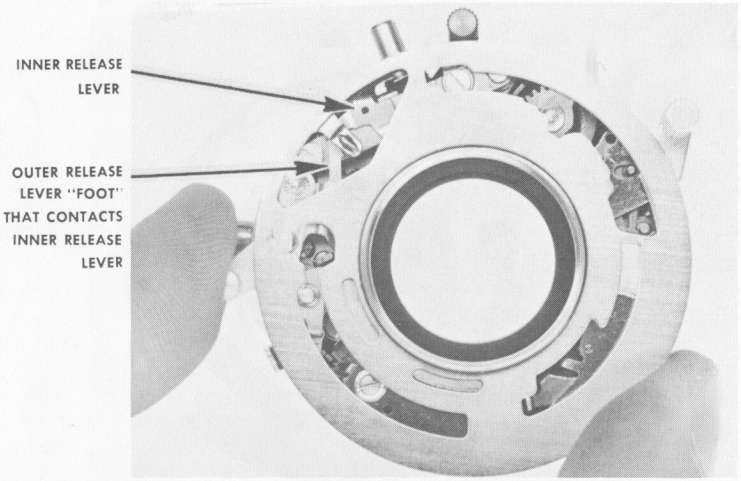


FIGURE 30

When the speed cam is turned slightly clockwise (until the bulb lever is just blocked by the cutout), the shutter will deliver the one-second setting, Fig. 31. Notice that there are two control studs near the retard lever end of the speeds escapement. Cocking the shutter allows both studs to move toward the center of the shutter until the larger stud is arrested by the speed cam, Fig. 32. However, the pallet lever control stud at the other end of the escapement is not allowed to move until the release lever is depressed. This reveals that the pallet is held disengaged from the star wheel until the shutter is tripped.

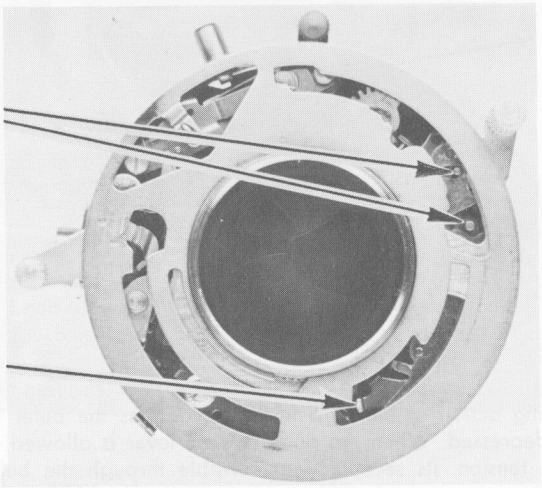


FIGURE 31 SPEED CAM SET AT ONE SECOND (SHUTTER RELASED)

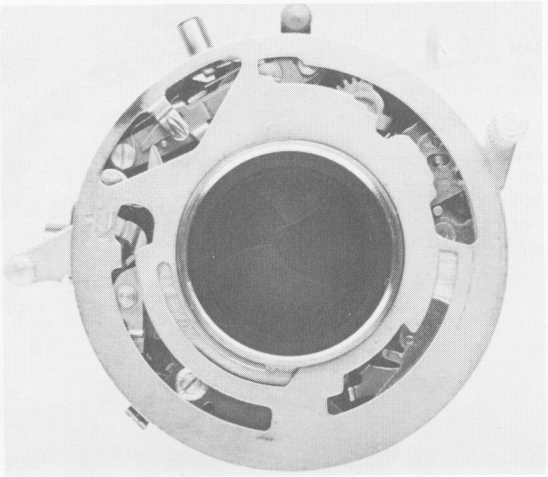


FIGURE 32 SPEED CAM SET AT ONE SECOND (SHUTTER COCKED)

Releasing the shutter allows the pallet lever control stud to move toward the center of the shutter, bringing the pallet against the star wheel, Fig. 33. As you release the shutter on the one-second setting, observe the action of the pallet lever control stud—moving in just before the blades open and out again as soon as the blades close. This control is provided by the blade operating ring, as you will later see.

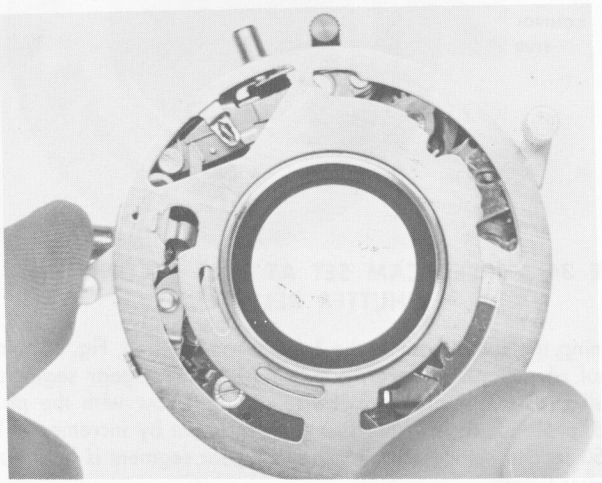


FIGURE 33 DURING ONE-SECOND EXPOSURE

The larger stud at the retard lever end of the speeds escapement is part of the **first gear segment**, while the smaller stud controls the retard lever itself. When the shutter is released on the one-second setting, the main lever strikes the retard lever. In turn, the retard lever moves the first gear segment through the escapement. Also, the retard lever kicks an inertia weight within the escapement.

At the one-second setting, both the first gear segment and the retard lever have maximum movement with the pallet engaged. Turning the speed cam clockwise shortens the shutter speeds by progressively limiting the amount the first gear segment can move toward the center of the shutter. Finally, at the 1/15 second setting, Fig. 34, the first gear segment is permitted only a minimum stroke. As yet, neither the pallet lever nor the retard lever has been restricted.

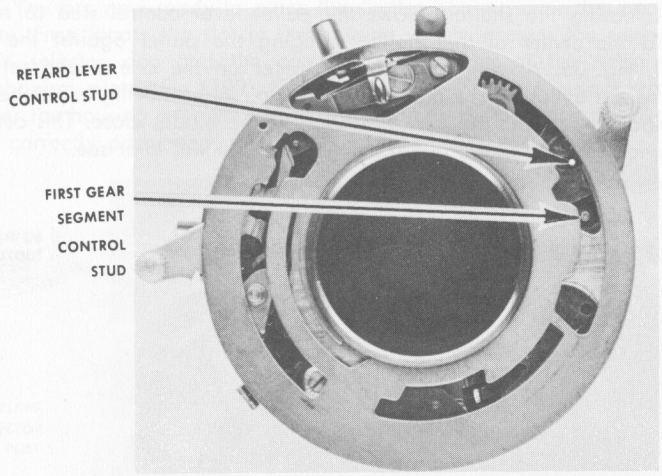


FIGURE 34 SPEED CAM SET AT 1/15 SECOND (SHUTTER RELEASED)

Turning the speed cam to the 1/30 second setting, Fig. 35, blocks the pallet out of action. However. notice that the first gear segment again has a full stroke. Continued clockwise rotation, now with the pallet disengaged, proceeds to limit the first gear segment by increments. Then, at the 1/250 second setting, Fig. 36, the first gear segment is held out of the retard lever's path.

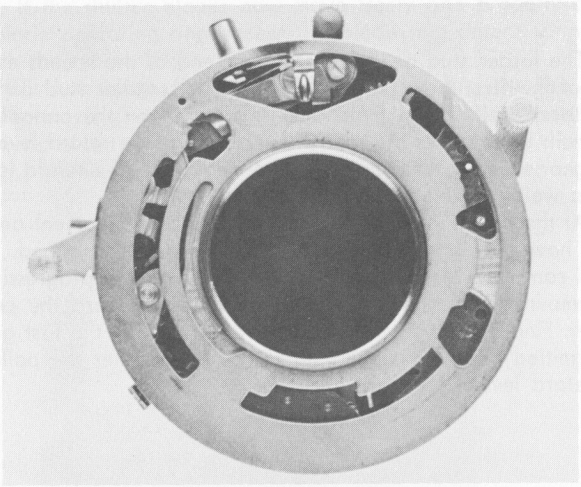


FIGURE 35 SPEED CAM SET AT 1/30 SECOND (SHUTTER RELEASED)

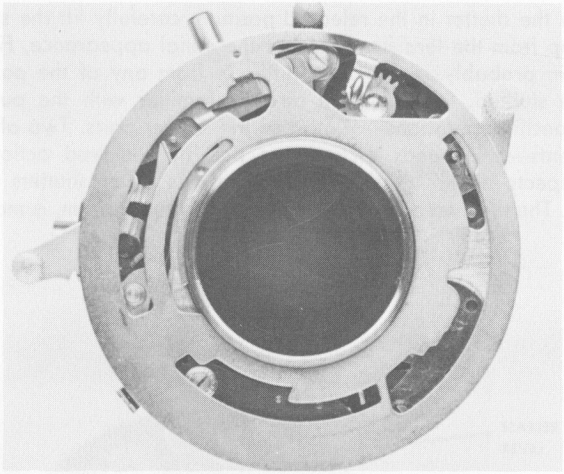


FIGURE 36 SPEED CAM SET AT 1/250 SECOND (SHUTTER RELEASED)

Now, the retard lever cannot actuate the first gear segment. Thus, the main lever is retarded only slightly as the retard lever strikes the inertia weight. At the 1/500 second setting, Fig. 37, the retard lever is finally engaged by the speed cam and held away from the main lever. Since at this setting there is nothing to obstruct the main lever's rotation, the shutter operates at its fastest speed.

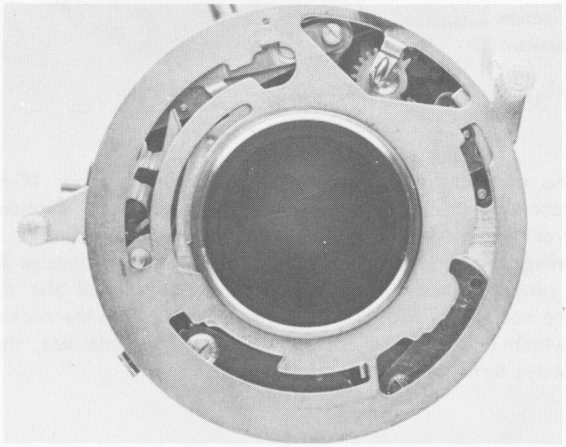


FIGURE 37 SPEED CAM SET AT 1/500 SECOND (SHUTTER RELEASED)

With the shutter in the released position, carefully lift the speed cam straight up from the lens flange. From the initial appearance, Fig. 38, the mechanism probably seems quite different from any of the past shutters you have studied. Still, you are already familiar with the purposes—if not the specific operations—of most of the shutter parts. Two of the three escapements—the speeds escapement and the delayed action—are in many respects similar to their counterparts in other shutters you have observed. The third escapement, the sync delay mechanism, is more unique in design.

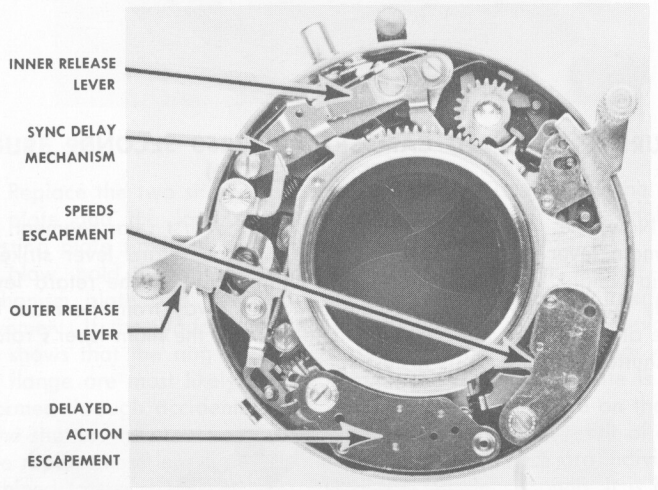


FIGURE 38 **SHUTTER RELEASED**

In one characteristic, however, the Synchro-Compur 00-MXV does bear a resemblance to the older-style Compur-Rapid. Notice that the setting lever is an extension of a ring encircling the lens flange. This is the **cocking ring**, Fig. 39, which has several important functions in the shutter.

First among these duties is the actual setting of the main lever through the cocking pinion. Locate the row of teeth on the cocking pinion, Fig. 39, which engages the cocking ring. As you can see, the cocking pinion always turns with the cocking ring.

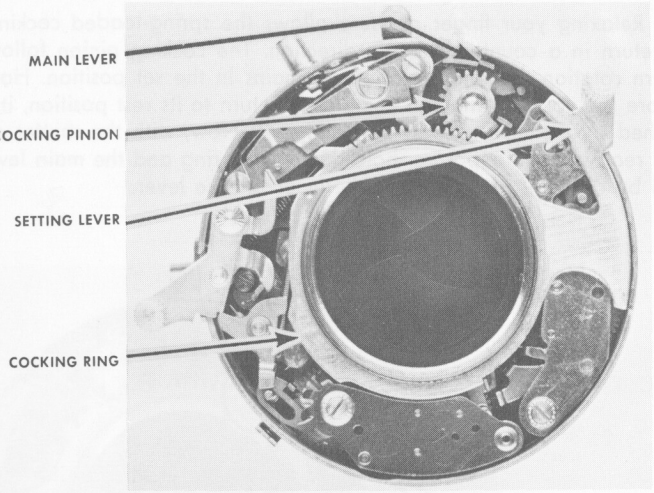


FIGURE 39 **SHUTTER RELEASED**

To operate the shutter with the speed cam removed, you must hold the cocking ring down as it rotates. This is to prevent the cocking ring from riding up on the lens flange. Now, set the shutter by turning the cocking ring in a clockwise direction, Fig. 40. During this movement, a downward-projecting lug on the cocking pinion contacts the vertical tab on the main lever (the cam beneath the cocking pinion). Thus, during the setting stroke, the main lever is moved in a counterclockwise direction until it is latched by the inner release lever. The mainspring (between the cocking pinion and the main lever) is now tensioned.

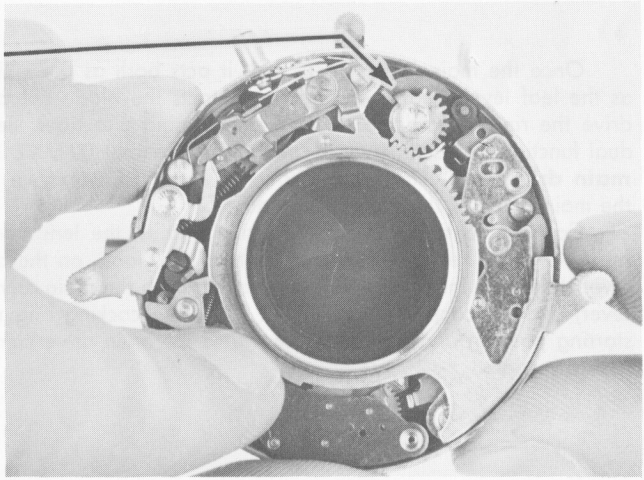


FIGURE 40

Relaxing your finger pressure allows the spring-loaded cocking ring to return in a counterclockwise direction. The cocking pinion follows the return rotation, but the main lever remains in the set position. However, before the cocking ring can completely return to its rest position, it too is latched by the inner release lever, Fig. 41. Now, with the shutter cocked and ready for an exposure, both the cocking ring and the main lever are held by different projections of the inner release lever.

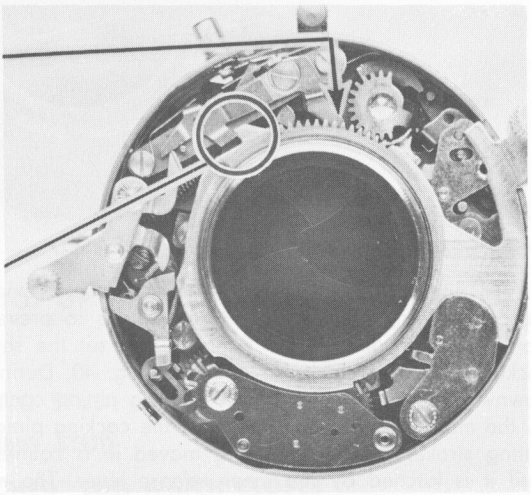


FIGURE 41 **SHUTTER COCKED**

Once the main lever is released, it acts both as the main lever and as the leaf lever. That is, it directly contacts the blade operating ring to drive the ring in both the opening and closing directions. Because of its dual function, the main lever in the Synchro-Compur 00-MXV is termed the **main drive cam.** Thus, throughout the rest of this text we will refer to the main lever as the main drive cam.

Continue to retain the cocking ring against the lens flange and depress the outer release lever. Notice that the "foot" on the outer release lever strikes the inner release lever, freeing both the main drive cam (main lever) and the cocking ring, Fig. 42. Now, the cocking ring returns to its starting position and the mainspring turns the main drive cam in a clockwise direction.

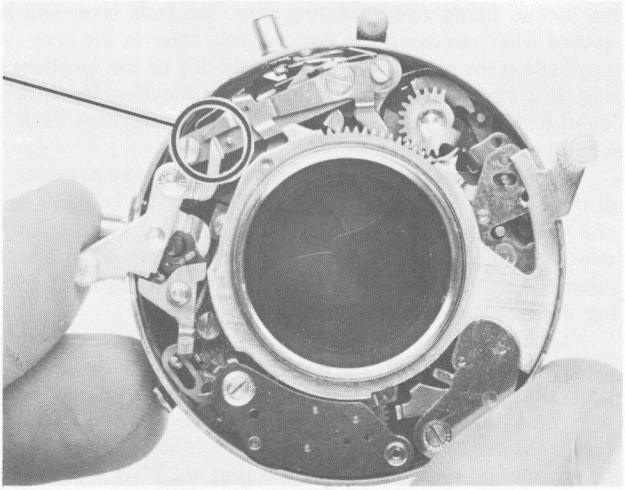


FIGURE 42 SHUTTER COCKED — JUST BEFORE RELEASE

As it begins its rotation, the main drive cam picks up a stud on the blade operating ring to open the blades. After reaching the full-open position, the main drive cam contacts a second stud on the blade operating ring to close the blades. Therefore, although the main drive cam turns in a continuous clockwise direction upon release, it drives the blade operating ring both counterclockwise (to open) and clockwise (to close).

The action just described is presently obscured by the cocking pinion. In fact, much of the shutter operation is difficult to fully comprehend at this time because the parts are hidden from view. Unfortunately, once you have disassembled the shutter far enough to see these parts, you can no longer operate the mechanism in the normal manner. Thus, you should try to gain a general understanding now—later in the text, you will see all the parts and simulate their actions. Then, the operation will become clear.

Since the speed cam has been removed, the shutter will now deliver "bulb" operation with full retard. Before the main drive cam reaches the stud on the blade operating ring to close the blades, it strikes the retard lever. This slows the rotation of the main drive cam while the shutter blades are in the full-open position.

After the main drive cam has run through the retard, the bulb lever arrests the shutter action. This operation differs from past shutters you have studied in that **the bulb lever blocks the blade operating ring** when the blades are fully open. On the "bulb" setting, a downward-projecting tab on the bulb lever obstructs the blade operating ring's rotation as long as the outer release lever is held depressed. When the outer release lever is allowed to return, it pulls the bulb lever out of engagement. This permits the main drive cam to close the blades through

the second blade operating ring stud. The bulb lever will be more easily studied after removing the cocking ring later in the text.

Setting the main drive cam is only one of the functions of the cocking ring. It is also responsible for movng the blocking lever, releasing the delayed action, and cocking the sync delay mechanism. Each of these duties will be examined in turn.

As previously mentioned, the blocking lever prevents the movement of the outer release lever until the shutter is cocked. Besides this function, you will recall the blocking lever also prevents you from moving the MXV selector ring to the "V" (delayed action) setting when the shutter is in the released position. This is simply to lessen the chances of accidentally cocking the delayed-action escapement.

Locate the post which extends through the mechanism plate and passes into the slot in the **delayed-action setting lever**, Fig. 43. This post, part of the MXV selector ring, is the direct means of cocking the delayed-action escapement. The MXV selector ring can be moved clockwise from the "M" (figure 44) to the "X" (figure 45) setting, but the additional rotation necessary to set the ring to "V" is prevented when the post contacts the blocking lever.

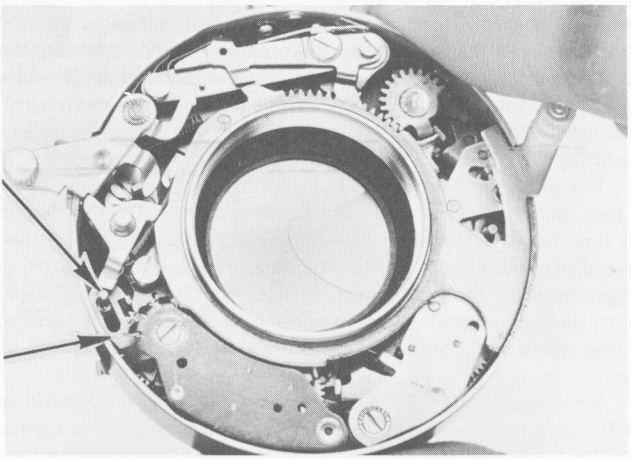


FIGURE 43

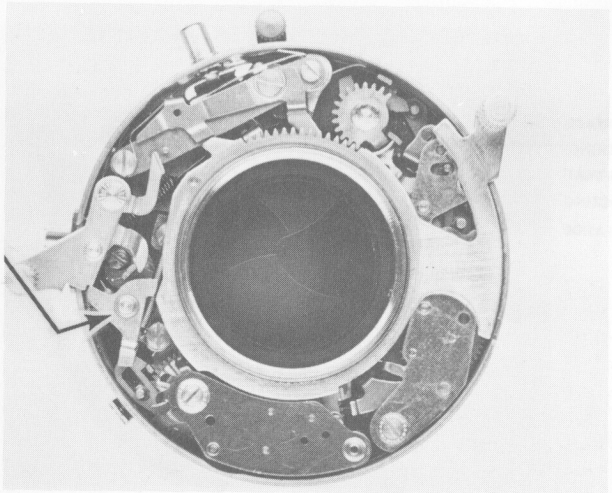


FIGURE 44 **MXV SELECTOR RING SET AT "M" SYNC**

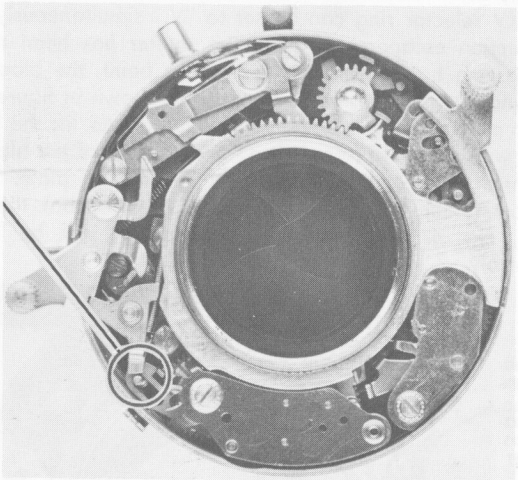


FIGURE 45 **MXV SELECTOR RING SET AT "X" SYNC**

Remember, in the set position the cocking ring is held a few degrees short of its starting point by the inner release lever. This brings a cam surface on the cocking ring's outer edge directly against the blocking lever, swinging it out of the respective paths of the outer release lever and of the MXV selector ring post, Fig. 46.

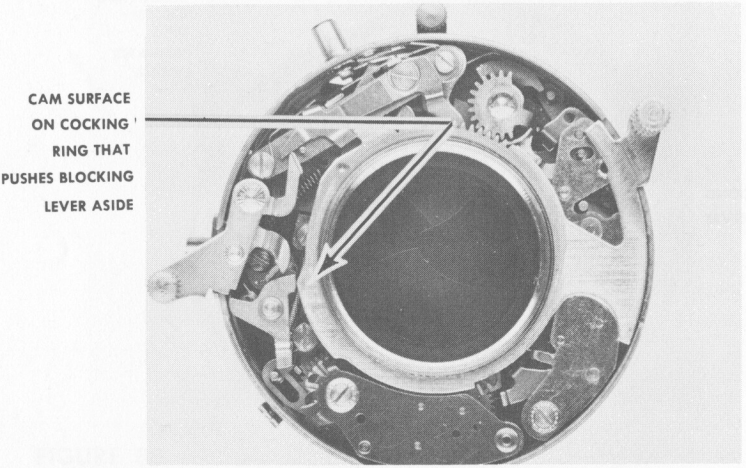


FIGURE 46 SHUTTER COCKED

The outer release lever can now be depressed to trip the shutter. Also, the MXV selector ring can be set to "V," simultaneously cocking the delayed-action escapement. Once the shutter has been released and the cocking ring has returned to its starting point, the blocking lever moves back under spring tension to the position shown in figure 45.

To more clearly observe the delayed action, lift the blocking lever together with its spring (secured to the underside of the blocking lever shaft) straight up and off the post on the mechanism plate. The smaller post, adjacent to the blocking lever post, serves to hook the free end of the spring, Fig. 47. The exact spring location will be described during reassembly.

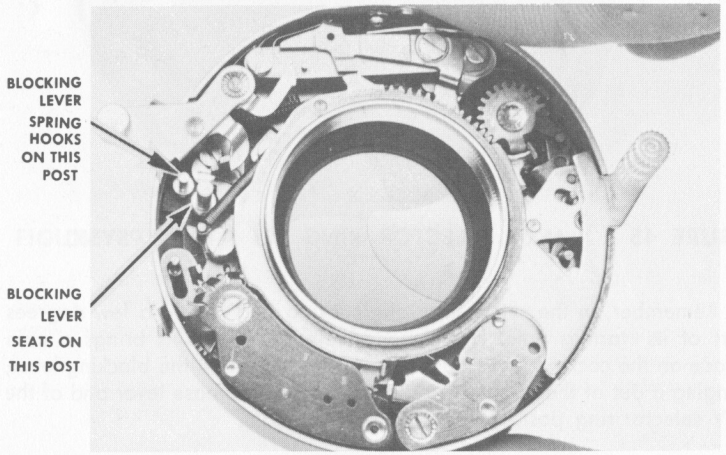


FIGURE 47

Now, set the shutter and move the MXV selector ring to the "V" setting. This action cocks the delayed-action escapement. As the MXV selector ring is turned to the "V" position, its post (the same post which you observed with respect to the blocking lever) pulls the delayed-action setting lever against a one-way clutch to tension the internal **drive spring**, Fig. 48. (The drive spring is inside the delayed-action escapement and is not yet visible.)

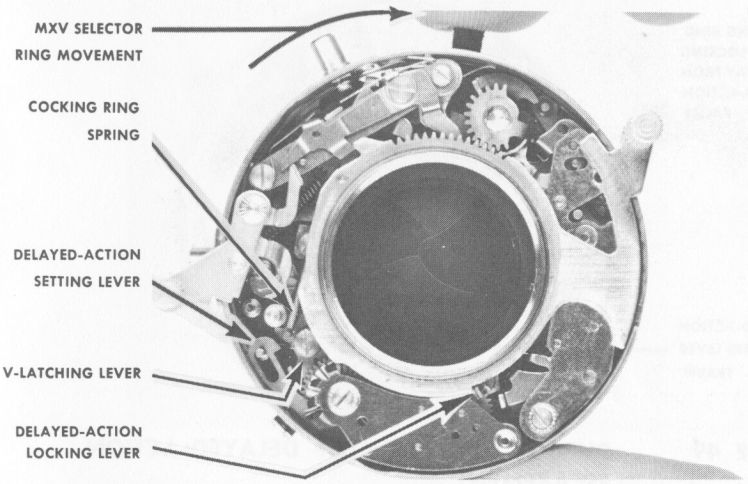


FIGURE 48 **SHUTTER COCKED**

At the same time, the delayed-action setting lever releases the **V-latching lever**, Fig. 48. This lever then moves under spring tension toward the center of the shutter. The V-latching lever is under the bulb lever and is difficult to see at this time. A vertical post on the V-latching lever serves to hook the cocking ring spring—it is this spring that moves the V-latching lever toward the center of the shutter.

Although the drive spring is now tensioned, the delayed-action escapement cannot as yet run down. This is because the delayed-action pallet is blocked and cannot vibrate. Whenever the cocking ring is rotated clockwise on the setting stroke, it releases the **locking lever**, Fig. 48. The spring-loaded locking lever then moves into the delayed-action escapement where it engages the pallet.

Summarizing these actions, the shutter has been cocked, the MXV selector ring is in the "V" position (having set the delayed-action escapement), the V-latching lever has been moved toward the center of the shutter, and the cocking ring is held by the inner release lever, Fig. 48. Since the inner release lever prevents the cocking ring from returning all the way to its starting position, the locking lever remains engaged with the delayed-action pallet.

You can now depress the outer release lever to trip the shutter. As

you know, this frees the cocking ring. When it returns to its rest position, the cocking ring pulls the locking lever away from the delayed-action pallet, Fig. 49. Thus freed, the escapement runs down as the drive spring turns the delayed-action first gear/one-way clutch.

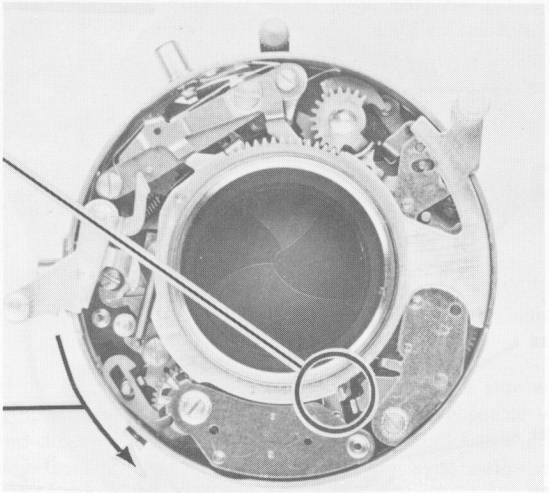


FIGURE 49 **DURING OPERATION OF DELAYED-ACTION ESCAPEMENT**

Simultaneously, the inner release lever frees the main drive cam which begins its clockwise rotation. However, the main drive cam cannot open the shutter blades **because the blade operating ring is blocked.** When the V-latching lever moved toward the center of the shutter, it came directly into the path of a lug on the blade operating ring. This blocks the blade operating ring before the blades are allowed to open.

It takes between 8 and 10 seconds for the delayed-action escapement to pull the delayed-action setting lever back to its starting position. During this period, the shutter blades remain closed. Finally, when the escapement has run down, the hooked end of the delayed-action setting lever catches the vertical tab on the V-latching lever. This pulls the V-latching lever out of engagement with the blade operating ring, Fig. 50. The main drive cam now completes its cycle, opening and closing the shutter blades.

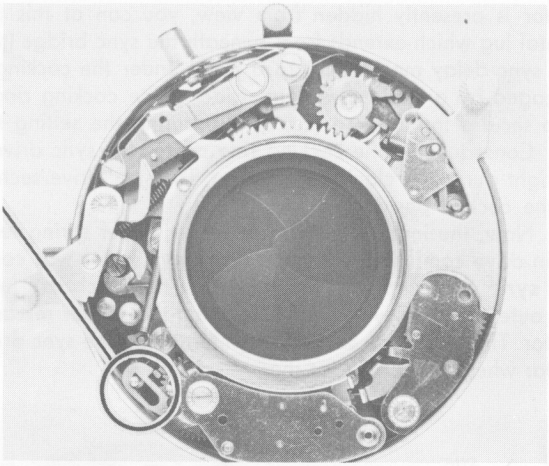


FIGURE 50 **SHUTTER RELEASED**

There is one more important duty of the cocking ring: **the setting of the sync delay mechanism.** This action is performed every time the shutter is cocked, regardless of the position of the MXV selector ring.

The sync delay mechanism must be cocked before the main drive cam can be latched by the inner release lever. In the released position, the **sync drive sector** (under the sync bridge) holds the inner release lever away from the main drive cam, Fig. 51. Although most of the sync drive

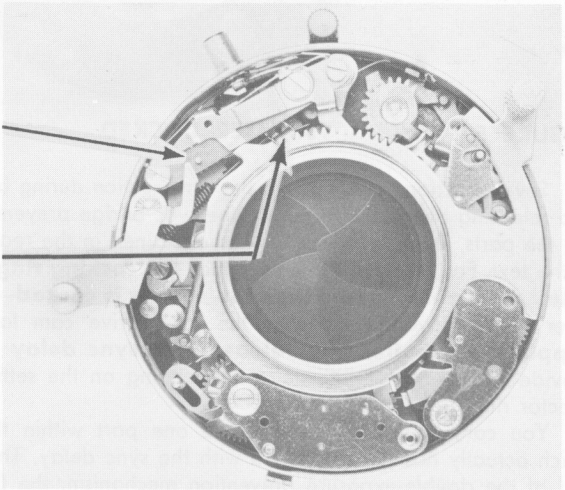


FIGURE 51 **SHUTTER RELEASED**

sector is presently hidden from view, you can at this time see its horizontal lug which extends from beneath the sync bridge (the plate covering the sync delay mechanism) to a point under the cocking ring. This lug is engaged by a stud on the underside of the cocking ring (the stud which also secures the cocking ring spring) during the setting stroke.

Consequently, the cocking ring moves the sync drive sector from left to right during its clockwise rotation. The sync drive sector is then latched in the cocked position.

Now, the inner release lever moves under spring tension toward the main drive cam. Also, when the sync drive sector was cocked, it tensioned the **sync drive spring**, the heavy spring which can just be seen under the outer release lever, Fig 52. Tripping the shutter releases the sync drive sector. The sync drive sector is then turned by the sync drive spring against a star wheel and pallet for the "M" delay.

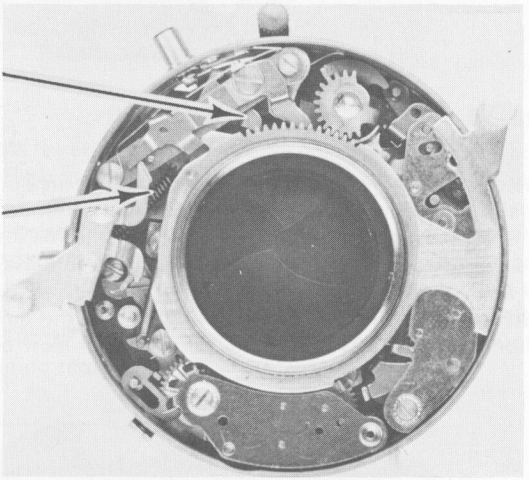


FIGURE 52 **SHUTTER COCKED**

Several actions occur within the sync section during both the cocking and releasing of the shutter. Since the sync bridge prevents you from seeing the parts, this mechanism will be explained in the reassembly portion of the text. For now, just remember that **the cocking ring sets the sync delay mechanism every time the shutter is cocked**—this permits the inner release lever to move to the main drive cam latching position. **Tripping the shutter also releases the sync delay mechanism** to provide either "M" or "X" delay (depending on the setting of the MXV selector ring).

You can, however, now observe one part within the sync section which actually has nothing to do with the sync delay. This is the second half of the double-exposure prevention mechanism, the first part having been performed by the blocking lever. You will recall that it is impossible

to rotate the cocking ring a second time after the shutter has been set. The repeated stroke is prevented by the **cocking lock** attached to the top of the sync drive sector.

When the sync drive sector is moved to the set position, it carries the cocking lock into the path of the cocking ring, Fig. 53. As the cocking ring then returns in a counterclockwise direction, the stud on its underside pushes the cocking lock out of its way. Now, the spring-loaded cocking lock moves back toward the center of the shutter. If a repeated clockwise rotation is attempted, the cocking lock will block the stud on the underside of the cocking ring. Once the shutter has been tripped, the sync drive sector carries the cocking lock into the sync section where it cannot interfere with the next setting stroke.

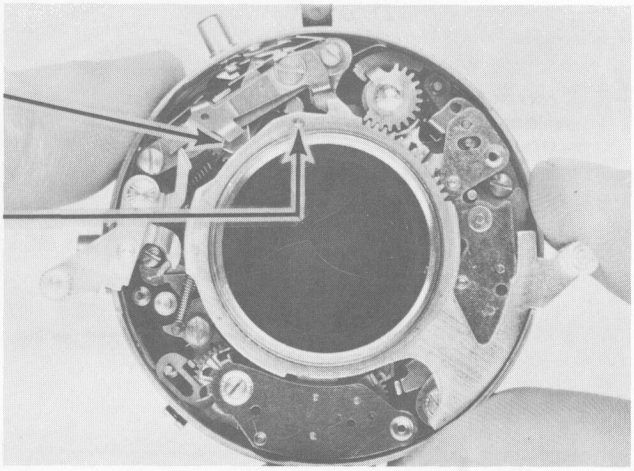


FIGURE 53

In summary, this is the sequence of the cocking ring's functions in the shutter:

1. During its initial setting rotation, the cocking ring releases the delayed-action locking lever and begins turning the cocking pinion.
2. Just before the main drive cam has been moved to the set position, the cocking ring engages the sync drive sector to cock the sync delay mechanism.
3. The cocking ring then returns in a counterclockwise direction until it is latched by the inner release lever—slightly short of its starting position.
4. Releasing the shutter permits the cocking ring to complete its counterclockwise rotation, finally pulling the locking lever out of engagement with the delayed-action pallet.

You should operate the shutter several times before proceeding with

the disassembly. When you feel you have a good understanding of the actions just described, lift off the cocking ring together with its spring, Fig. 54. Once the cocking ring has been raised clear of the shutter, the spring will slide easily off its post on the V-latching lever. From the underside of the cocking ring, notice the stud which secures the tension spring and contacts both the sync drive sector and the cocking lock, Fig. 55.

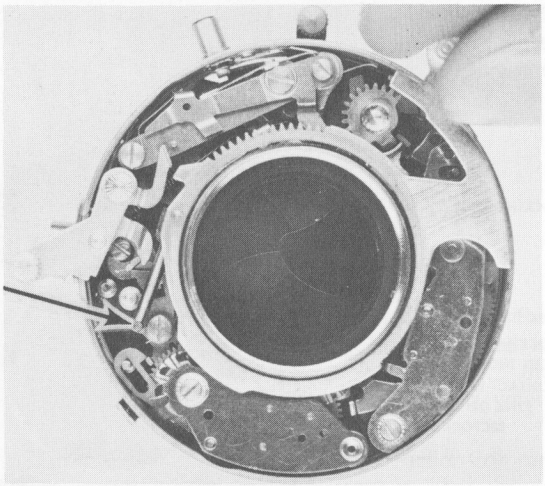


FIGURE 54

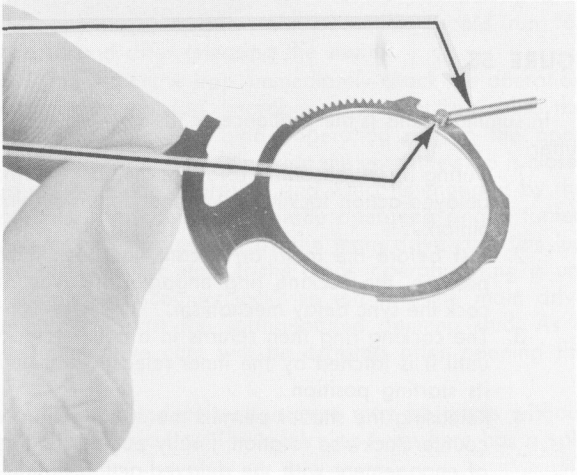


FIGURE 55

The action of the bulb lever can now be seen more clearly. To set the shutter with the cocking ring removed, first cock the sync drive sector by moving it from left to right with a screwdriver, Fig. 56. Then, **carefully** turn the main drive cam until it is latched by the inner release lever, Fg. 57. Remember, the sync delay mechanism must be cocked before the inner release lever can latch the main drive cam.

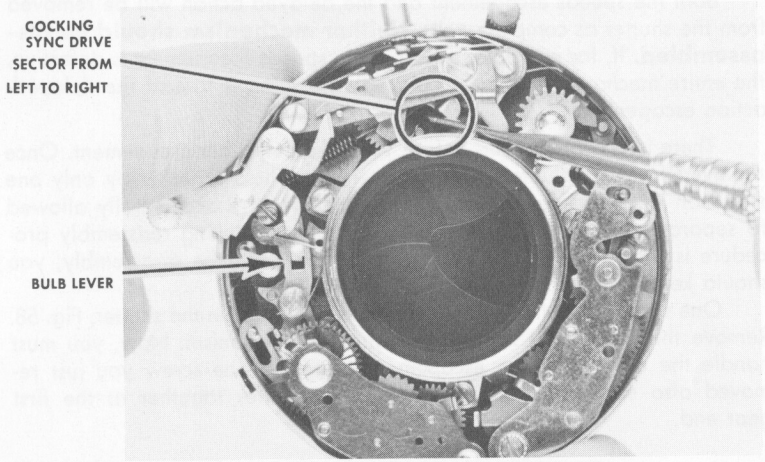


FIGURE 56

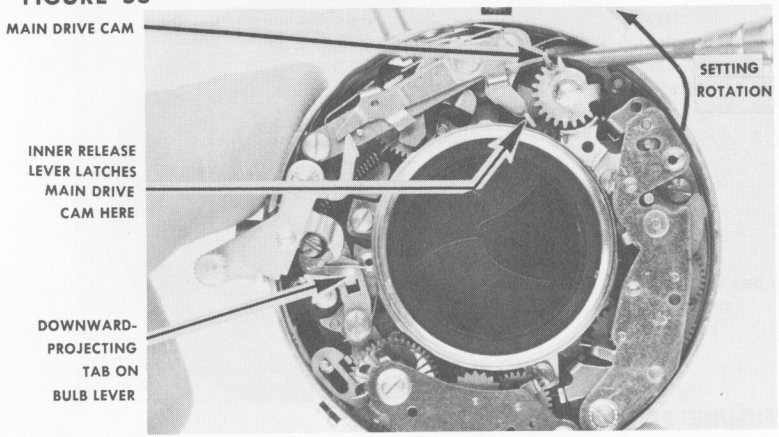


FIGURE 57

Trip the shutter and hold the outer release lever depressed. The outer release lever disengages the inner release lever from the main drive cam and allows the bulb lever to move in toward the center of the shutter. Now, the main drive cam rotates the blade operating ring in a counter-

clockwise direction to open the blades. As soon as the main drive cam contacts the stud to close the blades, the blade operating ring is arrested by the downward-projecting tab on the bulb lever, Fig. 57. This holds the blades open for as long as you keep the outer release lever depressed. When the outer release lever is allowed to return, it pulls the bulb lever out of engagement with the blade operating ring.

Both the speeds escapement and the delayed action will be removed from the shutter as complete units. **Neither mechanism should be disassembled.** If, for example, a part in the speeds escapement is defective, the entire mechanism must be replaced. The same is true of the delayed-action escapement.

There is one precaution before you take out either escapement. Once removed from the shutter, each escapement is held together by only one screw on its underside. If the escapement plates are accidentally allowed to separate, the gears will be dislocated. A painstaking reassembly procedure is then required. As you continue now with the disassembly, you should keep this precaution in mind.

One screw holds the delayed-action escapement in the shutter, Fig. 58. Remove this screw and lift out the complete mechanism. Now, you must handle the delayed-action escapement carefully—the screw you just removed also serves to hold the escapement plates together at the first gear end.

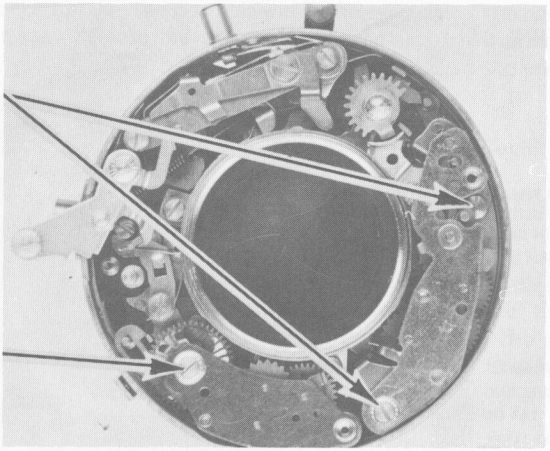


FIGURE 58

From the edge of the delayed-action escapement, Fig. 59, locate the drive spring above the first gear/one-way clutch. Also, notice that the delayed-action setting lever hooks directly to the one-way clutch spring. When the delayed-action setting lever is pulled away from the escapement, the one-way clutch spring simply rides over a series of slanted notches on the top of the first gear. Then, when the first gear is rotated

counterclockwise by the drive spring, one of the notches "grabs" the free end of the one-way clutch spring. As it turns, the first gear carries the delayed- action setting lever toward the escapement.

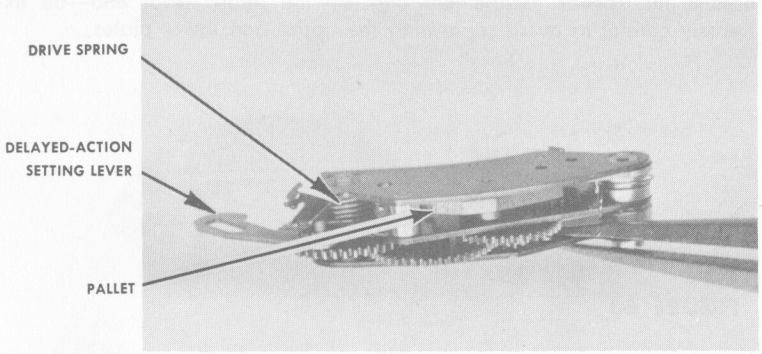


FIGURE 59

You can simulate the action of the delayed-action escapement at this time to more clearly understand its operation. Hold one finger on either end of the first gear to prevent the escapement plates from separating. Now, pull the delayed-action setting lever away from the escapement to tension the drive spring—this is normally done by the post on the MXV selector ring while the shutter is being set to "V." Next, pull the locking lever away from the pallet—this, you will recall, is the function of the cocking ring. Since the pallet is now free to vibrate, the drive spring turns the first gear in the release direction.

The next part we will remove is the speeds escapement. Normally, you would disassemble the main drive cam before taking out the speeds escapement. However, removing the speeds escapement first will allow you to study the action of the main drive cam more thoroughly.

The speeds escapement is held to the mechanism plate by two screws, Fig. 58. Notice that the first gear segment is now partially covering the retaining screw at the retard lever end. Cocking the shutter would allow the first gear segment to move to the ready position, uncovering this screw. However, as you have seen, it is difficult to cock the shutter after removing the cocking ring. Thus, be very careful while loosening the retaining screw at the retard lever end to avoid damaging the first gear segment with your screwdriver. Take out both screws and lift the speeds escapement from the shutter.

You can now see the advantage of removing the main drive cam first. The first gear segment could then move to its ready position and uncover the retaining screw. After you have studied the action of the main drive cam later in the text, you should reassemble the shutter and try this order of disassembly for practice.

The long retaining screw you just removed from the pallet lever end of the speeds escapement also serves to hold the escapement plates to-

gether. With the escapement out of the shutter, the plates are secured only at the retard lever end. From the bottom of the escapement, locate the single screw holding the mechanism together, Fig. 60. You should now handle the speeds escapement only by the retard lever end—be extremely careful to avoid separating the upper and lower plates.

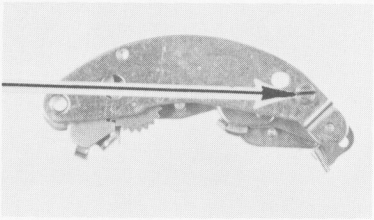


FIGURE 60

From the retard lever end of the speeds escapement, identify the inertia weight and the first gear segment, Fig. 61. Although both parts are on the same post, they move independently when kicked by the retard lever. As you have seen, the speed cam selects the escapement running time by altering the movement of the first gear segment. The inertia weight, however, travels the same distance on every setting (except 1/500 second when the retard lever is held away from the main drive cam).

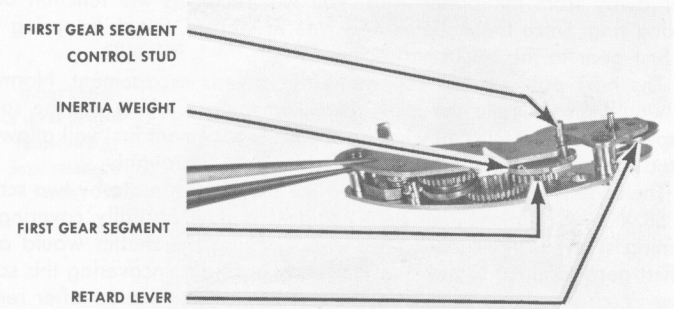


FIGURE 61

At the other end of the speeds escapement, locate the downward-projecting tab on the pallet control lever, Fig. 62. Once the escapement is installed in the shutter, this tab presses against a lug on the blade operating ring to hold the pallet disengaged. As soon as the blade operating ring begins its counterclockwise rotation to open the blades, its lug moves away from the pallet control lever tab. The pallet control lever is then allowed to move under spring tension toward the center of the shutter, bringing the pallet into engagement with the star wheel.

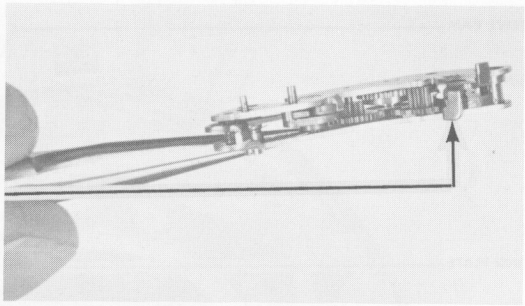


FIGURE 62

Next, lift the cocking pinion out of the main drive cam bushing, Fig. 63. The torsion-type mainspring is now visible. Notice that the lower end of the mainspring passes into a hole in the main drive cam, while the upper end hooks to the arresting plate, Fig. 64. Besides securing the top end of the mainspring, the arresting plate also serves to limit the clockwise rotation of the main drive cam.

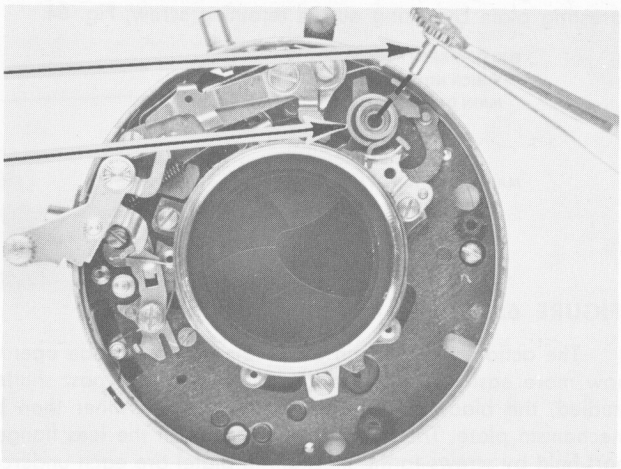


FIGURE 63

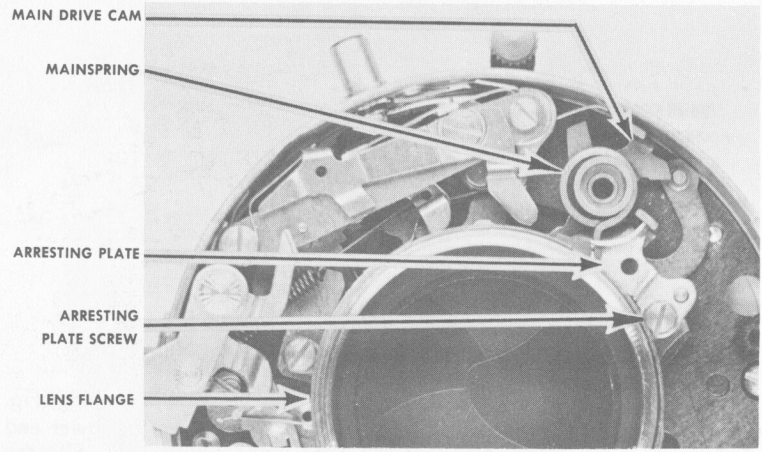


FIGURE 64

Unhook the top end of the mainspring from the arresting plate and allow the spring to unwind in a counterclockwise direction. Now, lift the mainspring, Fig. 65, out of its hole in the main drive cam. Remove the arresting plate by taking out its retaining screw, Fig. 64.

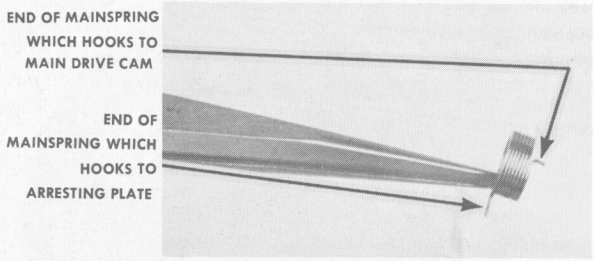


FIGURE 65

The actions of the main drive cam and the blade operating ring are now more easily observed and analyzed. Unlike past shutters you have studied, the blade operating ring sits above—rather than beneath—the mechanism plate. The three mounting lugs on the lens flange (a separate part held by screws to the mechanism plate) are each undercut to provide clearance and act as guides for the blade operating ring. In order to contact the various shutter parts, the blade operating ring has several lugs and projections extending from beneath the lens flange. Because of its unique position, the blade operating ring can be removed without separating the mechanism plate from the housing—often a definite advantage, as you will later see.

Rotate the main drive cam in a counterclockwise direction to the set position, Fig. 66. Near the end of this travel, the main drive cam passes over a spring-loaded stud on the blade operating ring, Fig. 67. The stud

moves down, allowing the main drive cam to pass, and then "jumps up" under spring tension (a flat spring is riveted to the underside of the blade operating ring and is not yet visible).

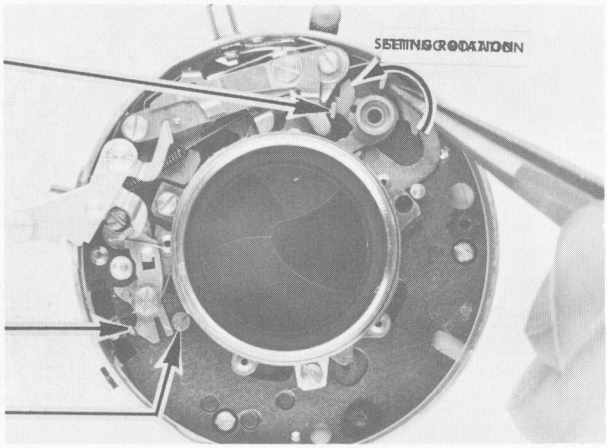


FIGURE 66

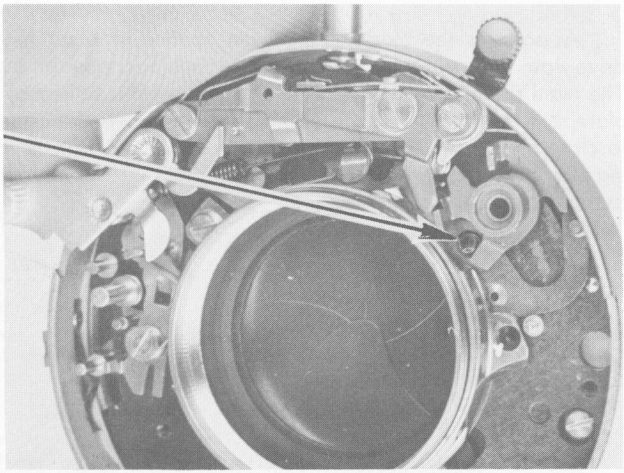


FIGURE 67

When the main drive cam is released, it is turned (by the mainspring) in a clockwise direction, Fig. 68. A horizontal lug on the main drive cam immediately picks up the spring-loaded stud, moving the blade operating ring counterclockwise to open the blades. (Note: When manually opening the blades once the delayed-action escapement has been removed, make sure that the visible end of the V-latching lever is against the stop screw on the mechanism plate, Fig. 66. If it has moved away from the stop, the V-latching lever will block the blade operating ring. These parts will be explained later in the text.)

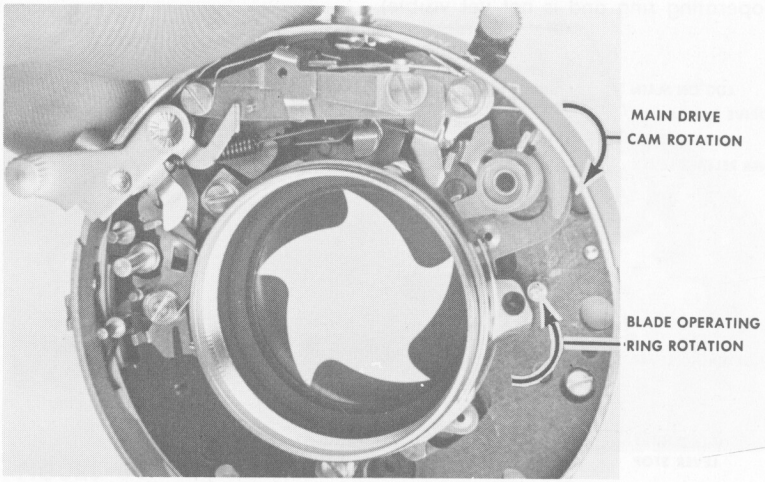


FIGURE 68

As soon as the blades have been opened, another lug on the main drive cam contacts a second stud on the blade operating ring, Fig. 69. The main drive cam continues its rotation until it is halted by the arresting plate, but now it carries the blade operating ring in the opposite direction to close the blades. The stud on the hooked section of the blade operating ring then acts as the **closing stud**, while the spring-loaded stud acts as the **opening stud.**

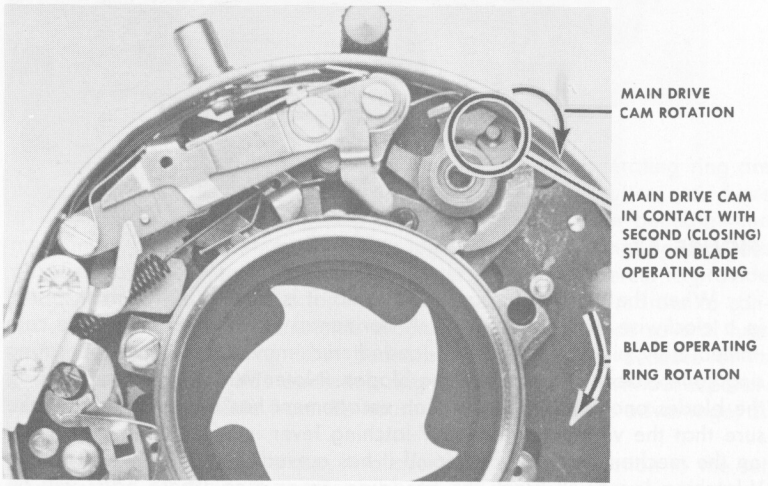


FIGURE 69

Using your tweezers, lift the main drive cam out of the shutter. The purpose of each lug on the main drive cam is pointed out in figure 70.

The outer release lever, together with its spring, can also be removed at this time. Rotate the outer release lever from side to side while lifting it out of its bushing, Fig. 71.

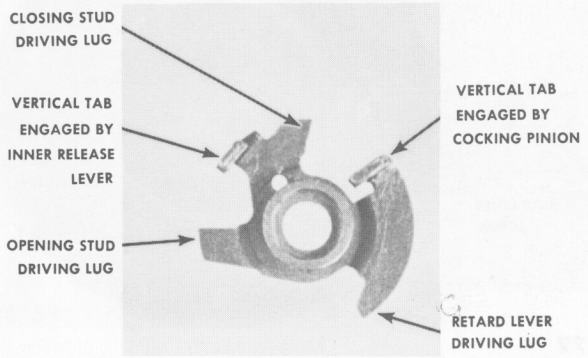


FIGURE 70

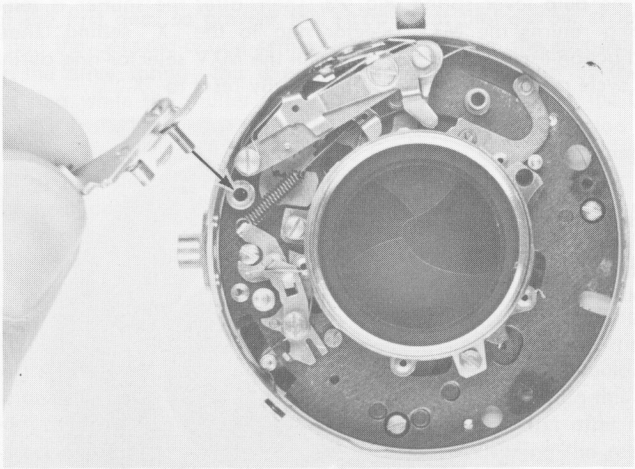


FIGURE 71

Now, carefully examine the position of the bulb lever spring, Fig. 72. Different Synchro-Compur 00-MXV models will vary in this area of the shutter. In the model illustrated, the newer-style bulb lever spring is used. Notice that this one spring serves two purposes: **it moves the bulb lever toward the center of the shutter and it returns the MXV selector ring from the "V" position.**

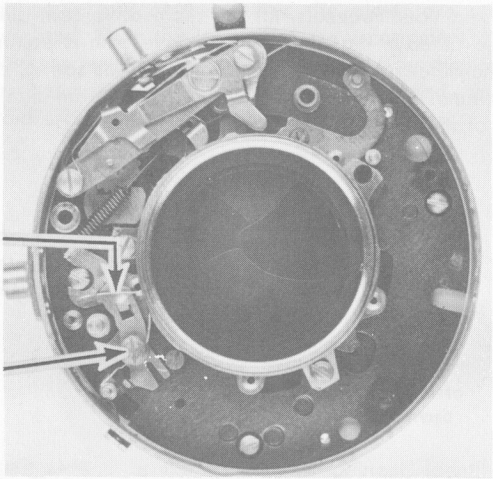


FIGURE 72

When the MXV selector ring is set to "V," its post contacts the short end of the bulb lever spring, Fig. 73. Then, after the shutter is released, the spring returns the MXV selector ring to the "X" setting. Thus, the delayed-action escapement does not pull the MXV selector ring during the release cycle and the shutter is automatically reset to "X."

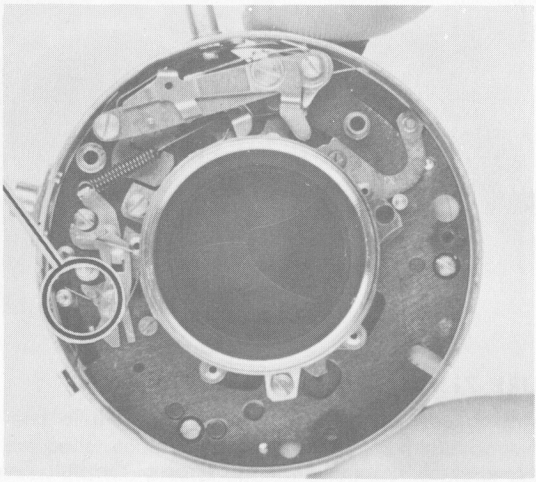


FIGURE 73

Earlier Synchro-Compur 00-MXV models use two springs for these functions. Both the original and the modified types are shown in figure 74. Notice that the newer style has eliminated the separate spring for the bulb lever.

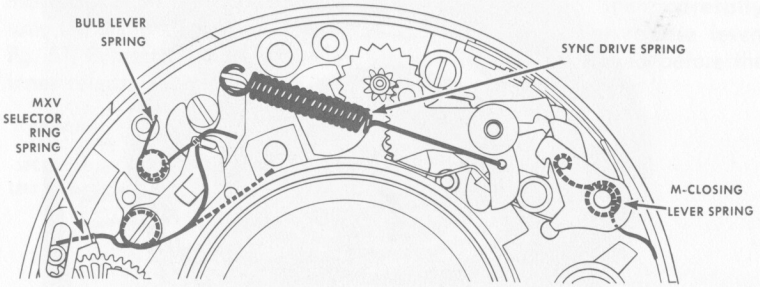


FIGURE 74

COURTESY EASTMAN KODAK

THE OLD AND NEW STYLE SPRINGS ARE POSITIONED AS INDICATED. THE LONG END OF THE OLD SPRING RESTS AGAINST THE LENS FLANGE, AS SHOWN BY THE BROKEN LINE. THE LONG END OF THE NEW SPRING IS FORMED TO THE BULB LEVER, AS SHOWN BY THE SOLID LINE. THE NEW STYLE SPRING ELIMINATES THE BULB LEVER SPRING.

Let's now examine the operation of the MXV selector ring more closely. Since the sync delay mechanism is in the released position, the MXV selector ring can be moved freely to its three settings. Locate the **detent spring** on the inside of the shutter housing which holds the MXV selector ring at either the "M" or the "X" setting, Fig. 75. When the MXV selector ring is turned to "V," it moves away from the detent spring and tensions the short end of the bulb lever spring, as seen earlier in figure 73. This spring immediately returns the MXV selector ring to the "X" setting—**unless the sync delay mechanism is cocked.**

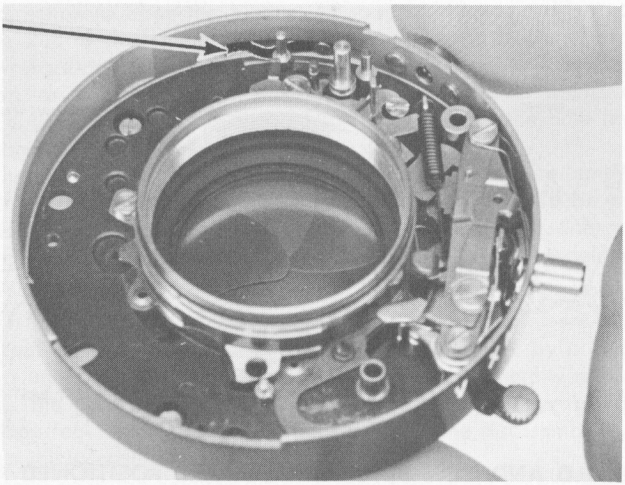


FIGURE 75

Simulate the action of the cocking ring by moving the sync drive sector from left to right. Now, the sync delay mechanism is cocked and the MXV selector ring will remain in place when set to "V." (The MXV selector ring is locked in the "V" position within the sync delay mechanism, as you will later see.) Release the sync delay mechanism by rotating the blade operating ring counterclockwise. This action simultaneously releases the MXV selector ring, allowing the short end of the bulb lever spring to snap the ring back to the "X" setting.

The shutter blades are now open and the long end of the bulb lever spring has moved the bulb lever toward the center of the shutter. In this position, the turned-down tab on the underside of the bulb lever engages the blade operating ring to prevent clockwise rotation.

To close the blades, hold the bulb lever toward the outside of the shutter, Fig. 76, and turn the blade operating ring clockwise. From this you can see that **the blade operating ring releases the sync delay mechanism when it turns to open the blades; and that the sync delay mechanism locks the MXV selector ring when the latter is set on "V."**

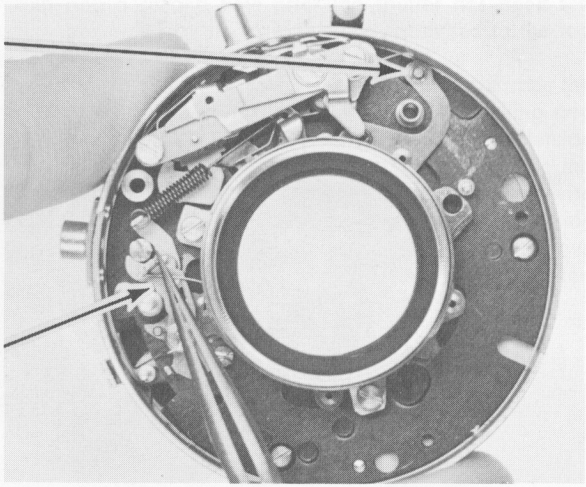


FIGURE 76

Set the MXV selector ring to "M" and take out the bulb lever by removing its spring and screw—the bulb lever spring will remain seated on the screw. The operation of the V-latching lever can now be more clearly understood, Fig. 77. Once freed by the delayed-action setting lever, the V-latching lever is pulled by the cocking ring spring. One end of the V-latching lever then moves away from the stop while the other end comes against a lug on the blade operating ring, Fig. 78. This, you will recall, prevents the blades from opening during the delayed-action cycle.

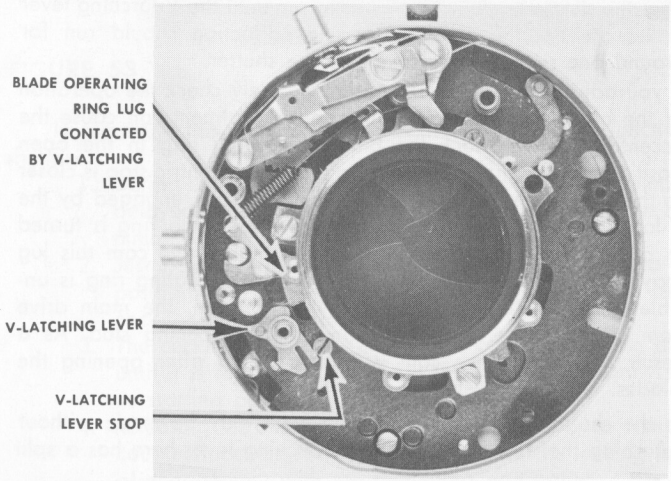


FIGURE 77

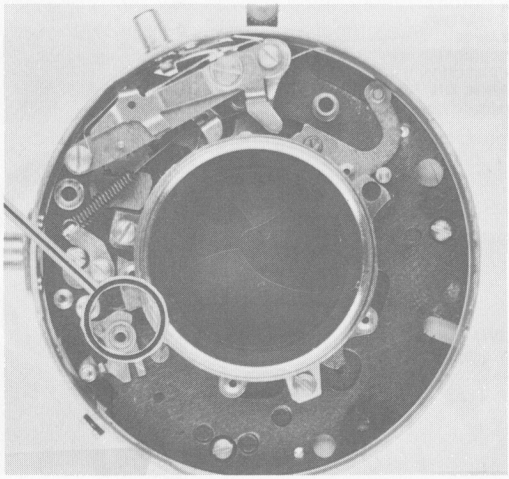


FIGURE 78

CAUTION: DO NOT turn the V-latching lever stop, Fig. 77. This stop is an eccentric. In some models, the eccentric is used to adjust the position of the V-latching lever in relation to the delayed-action setting lever—it should not be disturbed unless such adjustment is necessary.

The eccentric stop regulates the time the delayed action can run after it has allowed the shutter to release. That is, after the V-latching lever has been disengaged from the blade operating ring, the delayed action continues to run until the V-latching lever strikes the eccentric stop. The delayed action should run for around one second after releasing the shutter.

If you adjust the eccentric stop, immediately check the operation of the blade operating ring. Improper adjustment can cause the eccentric stop to block the blade operating ring in the open position. To visualize this, imagine that the eccentric stop is closer to the lug on the blade operating ring which is engaged by the V-latching lever. Now, when the blade operating ring is turned in a counterclockwise direction by the main drive cam this lug may strike the eccentric stop. If the blade operating ring is unable to complete its counterclockwise rotation, the main drive cam cannot move past the spring-loaded opening stud. As a result, the main drive cam will be arrested after opening the blades.

In the shutter illustrated, this adjustment may be made without disturbing the eccentric stop.The V-latching lever here has a split

"tail" which may be reformed. Carefully bending the section of the tail that contacts the eccentric stop will alter the time the delayed action continues to run after releasing the shutter.

There are two more eccentrics in the shutter which should not be turned during disassembly. One is located on the mechanism plate within the U-shaped curvature of the sync drive spring **hooking plate**, Fig. 79. This eccentric is used to adjust the "M"-sync delay by varying the tension on the sync drive spring. The "M" sync should provide a delay of 16½ milliseconds between the closing of the contacts and the point at which the shutter aperture is one-half open. The delay time is altered, if necessary, by first loosening the hooking plate screw and then turning the eccentric to either increase or decrease the sync drive spring tension. To shorten the delay, increase the spring tension—to lengthen the delay, decrease the spring tension.

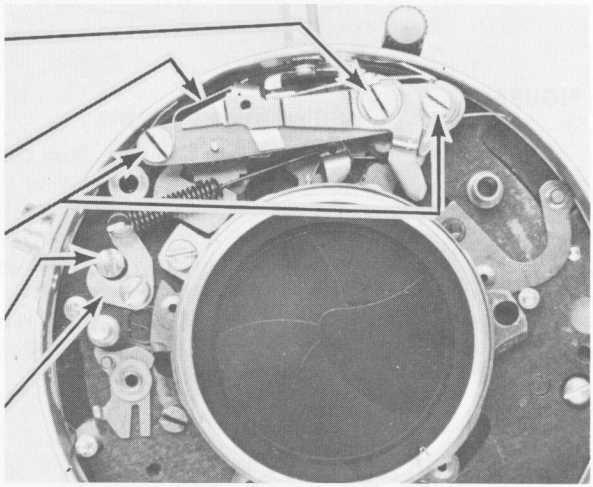


FIGURE 79

The final eccentric is located at the pivot point of the inner release lever, Fig. 79. This eccentric should never need adjustment during routine cleaning or service. However, if either the sync bridge (to which the inner release lever is permanently attached) or the main drive cam has been replaced with a new part, check the setting action. As soon as the opening stud on the blade operating ring "jumps up" at the end of the setting stroke, the inner release lever should engage the main drive cam to prevent any return rotation. That is, the latching of the main drive cam and the "jumping up" of the opening stud should occur simultaneously. The eccentric may be adjusted to control the time at which the inner release lever engages the main drive cam.

To disassemble the sync delay mechanism, first disconnect the inner release lever spring and remove the two screws at the extreme ends of

the sync bridge, Fig. 79. Notice that the sync bridge screw which holds the inner release lever spring is a shoulder screw. Take out the inner release lever spring and then carefully lift off the sync bridge, Fig. 80.

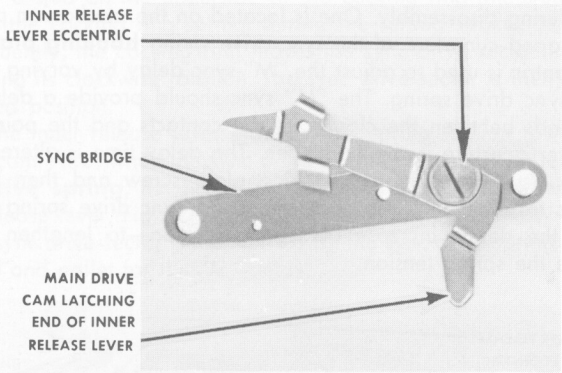


FIGURE 80

The **contact lever**, Fig. 81, completes the flash circuit on both "M" and "X" sync. Since it always engages the grounding strip on the inside of the shutter housing, the contact lever completes the flash circuit when it touches the terminal strip on the flash cord socket. The remaining parts now seen in the sync delay mechanism are responsible both for providing the sync delay and for moving the contact lever. As you remove the sync parts, note their names and the disassembly procedure. Since it is necessary to understand the functions of the lower parts first, the operation will be explained during reassembly.

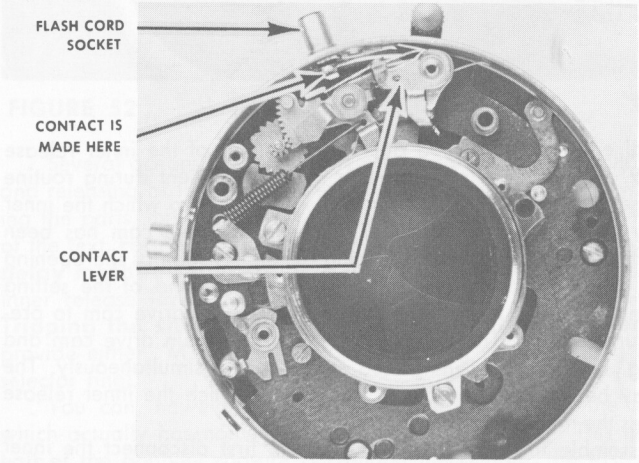


FIGURE 81

Using your tweezers, lift off the contact lever and locate the grounding strip, Fig. 82. The next part to remove is the spring-loaded **M-closing lever**, also pointed out in figure 82. This is best done with your tweezers, holding the tweezers vertically and grasping the M-closing lever on two sides, Fig. 83. Turn the tweezers slightly counterclockwise to compress the grounding strip flat against the wall of the shutter housing. Now, lift the M-closing lever straight up and out of the shutter.

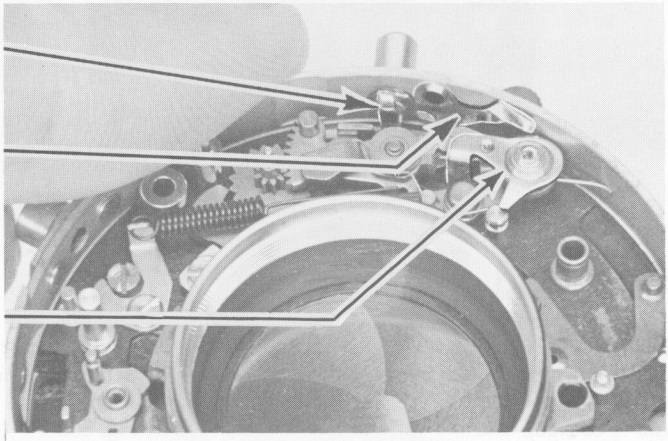


FIGURE 82

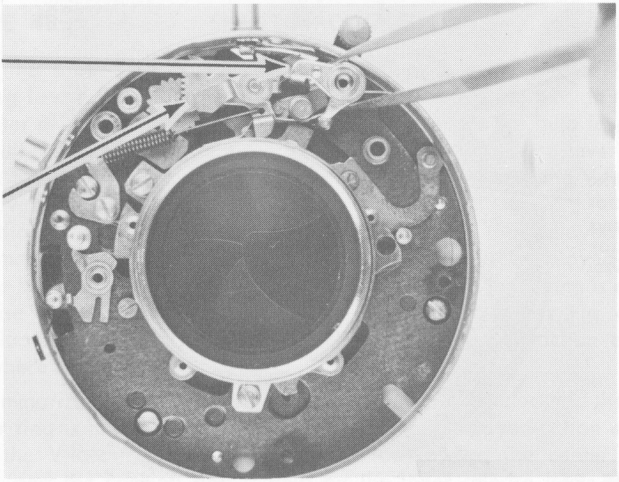


FIGURE 83

Slip both points of your tweezers into the loop of the sync drive spring, placing one point on either side of the hooking plate, Fig. 84. Lift the sync drive spring clear of the hooking plate and out of the shutter.

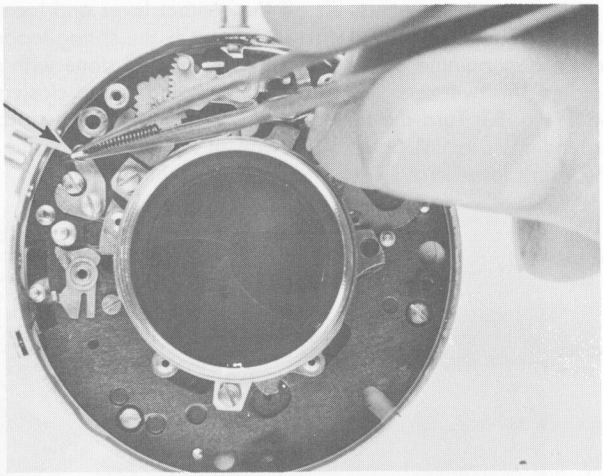


FIGURE 84

Next, lift off the sync drive sector, Fig. 83, and then the star wheel, Fig. 85. You can now clearly see the pin on the sync drive sector which contacts the turned-down tab on the inner release lever (holding the inner release lever away from the main drive cam until the sync delay mechanism is cocked), and the spring-loaded cocking lock, Fig. 86.

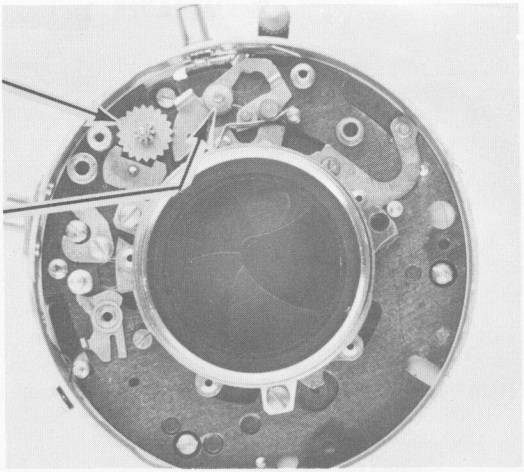


FIGURE 85

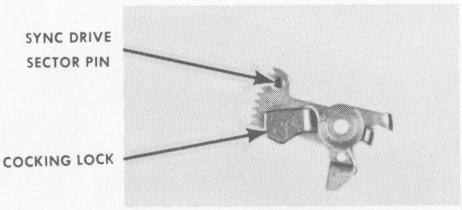


FIGURE 86

A fine spring serves to move both the **M-sync blade ring latch** and the **sector latch** toward the center of the shutter, Fig. 87. This is the **latch spring** which seats on the post for the M-sync blade ring latch. To remove the latch spring, first disconnect its shorter end from the stud on the sector latch. Then, lift the latch spring out of the shutter.

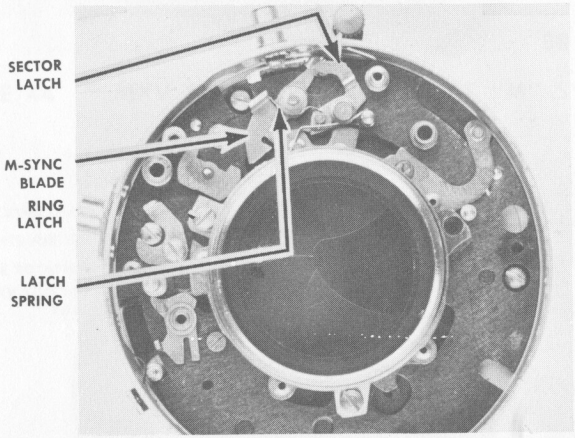


FIGURE 87

The three sync parts remaining on the mechanism plate—the M-sync blade ring latch, the sector latch, and the pallet—are riveted in position and cannot be removed. Now that the disassembly of the sync delay mechanism has been completed, turn over the shutter to remove the mechanism plate.

First, take out the three diaphragm setting ring retaining screws, Fig. 88. Now, lift off the diaphragm setting ring and the spacer, Fig. 89. Notice that the spacer is bowed upward, providing a spring action against the diaphragm setting ring to hold the selected f/stop. The spacer contours are keyed to the shape of the housing, making the correct position on reassembly obvious. Next, lift out the MXV selector ring, Fig. 90.

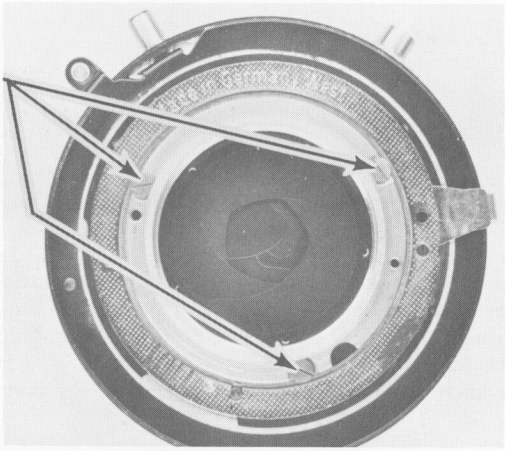


FIGURE 88

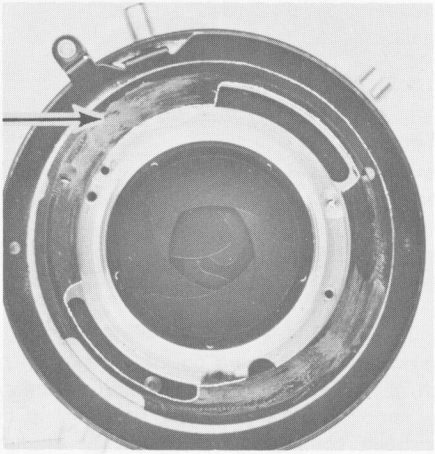


FIGURE 89

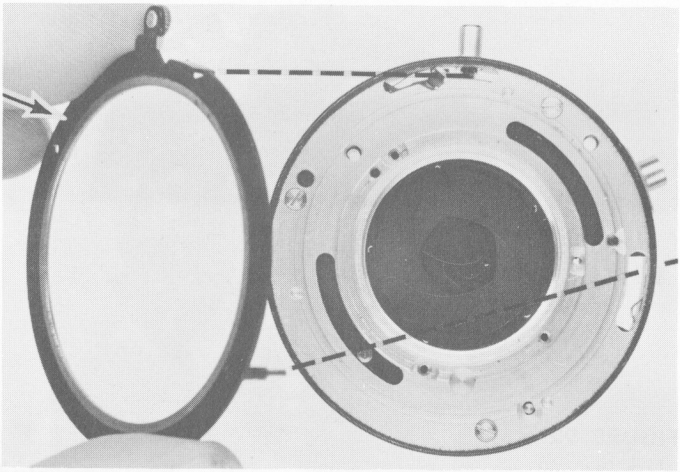


FIGURE 90

Take out the three shutter housing mounting screws, Fig. 91, and lift the housing from the mechanism plate. Before inverting the mechanism plate, carefully remove the five shutter blades, Fig. 92. The diaphragm, remaining in the shutter housing, should not be disassembled unless maintenance or replacement is indicated. (If it is necessary to disassemble the diaphragm, refer to the appropriate section in Hat Com **Manual** #276 covering the Prontor 500 LK—the only difference in the Compur installation is that the "tails" of the leaves point to your left.)

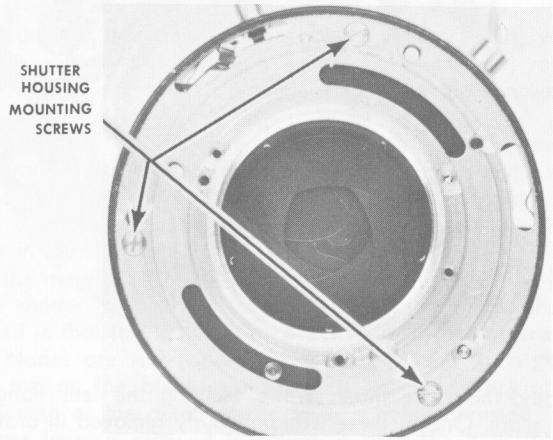


FIGURE 91

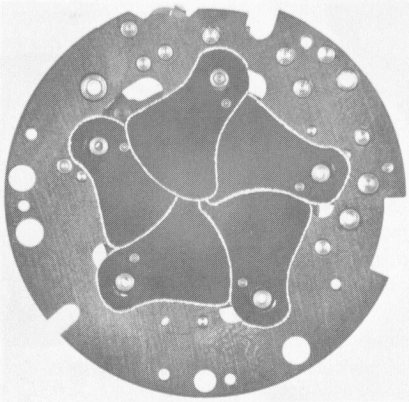


FIGURE 92

From the front of the mechanism plate, locate the **blade ring detent spring** which sits over the sector latch post and engages a pin on the blade operating ring, Fig. 93. This spring acts as a detent for the blade operating ring; that is, it tends to hold the blade operating ring in either the open or closed position. Remove the blade ring detent spring by prying its short end up and clear of the two posts between which it is situated. Now, lift the blade ring detent spring off the sector latch post.

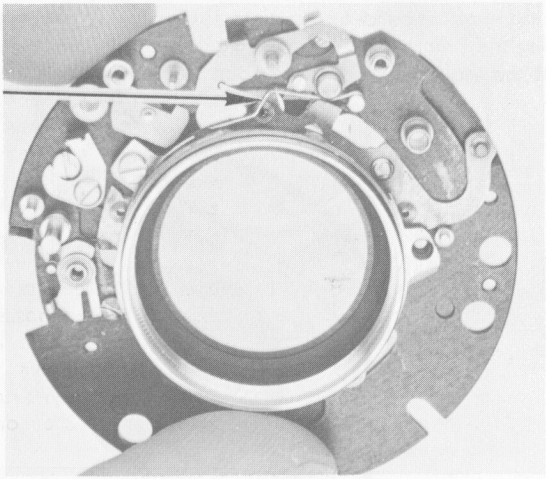


FIGURE 93

Normally, there are three screws securing the lens flange to the mechanism plate. One of these was previously removed in order to take out the arresting plate. Remove the two remaining screws, Fig. 94, and lift off the lens flange and the blade operating ring.

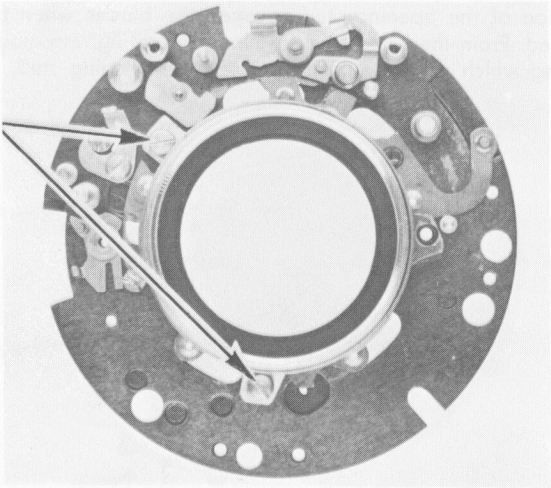


FIGURE 94

An examination of the blade operating ring will now reveal its many design features, Fig. 95. Each lug and notch has a distinct and important purpose in the shutter. So far, you have observed the following duties of the blade operating ring:

1. It carries the five shutter blades.
2. Its opening stud is engaged by the main drive cam to open the blades.
3. Its closing stud is engaged by the main drive cam to close the blades.
4. It disengages the pallet in the speeds escapement.
5. It is contacted by the bulb lever to hold the blades open on "bulb."
6. It is contacted by the V-latching lever to prevent the blades from opening on "V."
7. It is contacted by the blade ring detent spring to keep the blades in either the open or the closed position.

There are also three additional functions which you will see later:

1. It both moves and retains the contact lever.
2. It disengages the sector latch from the sync drive sector.
3. It is held by the M-sync blade ring latch on "M" sync to provide the "M" delay.

As you study the blade operating ring, pay particular attention to the spring-loaded opening stud. The opening stud is sloped on one side to allow the main drive cam to pass on the setting stroke. This, you will recall, pushes the stud down against its spring tension. As soon as the main drive cam has cleared the opening stud, the flat spring forces the opening stud to "jump up." The main drive cam then strikes the straight

section of the opening stud to open the blades when the shutter is released. From the bottom of the blade operating ring, you can see the flat spring which provides the tension for the opening stud, Fig. 96.

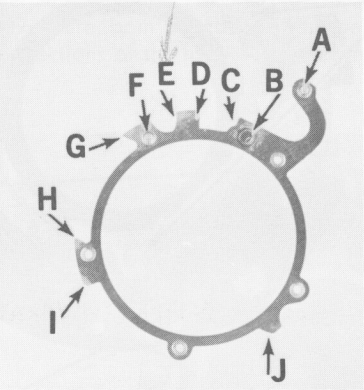


FIGURE 95 TOP OF BLADE OPERATING RING

A — CLOSING STUD
B — OPENING STUD
C — "NOTCHED" LUG WHICH CLOSES CONTACT LEVER FOR "X" SYNC
D — LUG WHICH HOLDS CONTACT LEVER AWAY FROM TERMINAL STRIP
E — LUG WHICH OPERATES SECTOR LATCH
F — PIN FOR BLADE RING DETENT SPRING
G — LUG ENGAGED BY M-SYNC BLADE RING LATCH
H — LUG ENGAGED BY BULB LEVER
I — LUG ENGAGED BY V-LATCHING LEVER
J — LUG WHICH OPERATES PALLET CONTROL LEVER

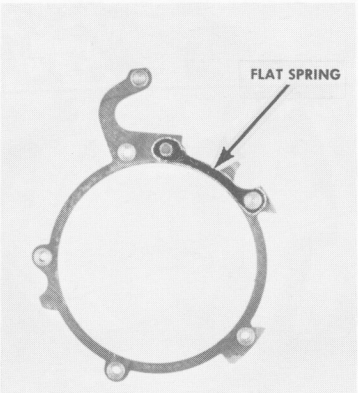


FIGURE 96 UNDERSIDE OF BLADE OPERATING RING

REASSEMBLY OF THE SYNCHRO-COMPUR 00-MXV

NOTE: There are several points of critical lubrication in the Synchro-Compur 00-MXV which will be noted as the parts are installed. One general purpose grease, moly-lube (molybdenum disulfide in grease), which is available from National Camera supply, is excellent for every lubrication point. Use only a minimum amount of moly-lube at places noted in the following text. A light "film" of lubrication at each contact point will be sufficient. Excessive grease will eventually work its way to the blades, causing a failure within a short time.

Examine the blade operating ring to see that the spring-loaded opening stud moves freely. If the stud binds against the edge of its hole in the ring, the complete blade operating ring should be replaced. Such damage usually results when the operator cocks the shutter a number of times during the release cycle (such as during a one-second exposure). This places a sidewise pressure on the stud which can deform or shift the spring enough to allow binding. If this is the case, the shutter can "run through" without opening the blades.

If the blade operating ring is in good condition, seat it in position on the mechanism plate with its "hook" between the main drive cam bushing and the arresting plate post, Fig. 97. Next, place the lens flange over the blade operating ring so the three screw holes align. Of the three screws which secure the lens flange, one (the first one you removed) is slightly longer than the other two—the long screw will go at the arresting plate position.

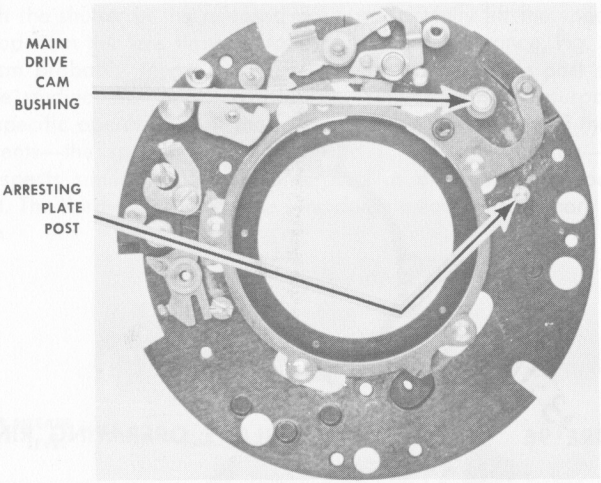


FIGURE 97

Replace the two short lens flange screws first. Then install the arresting plate and the long screw. While tightening the screw, hold the arresting plate firmly against the lens flange.

Now, hold the M-sync blade ring latch toward the outside of the mechanism plate and check the blade operating ring for freedom of movement. If the blade operating ring binds, and subsequent examination shows that the ring itself is not defective, the mounting lugs on the lens flange are most likely bent. Although the mechanism plate is rarely deformed through accidental dropping or excessive pressure on the front of the shutter, the mounting lugs are frequently bent as a result of abuse. Since replacement lens flanges cannot be obtained (these are individually machined to the shutter with respect to the rear lens mount), it is best in such cases to replace the entire shutter. (Note: Two other parts, the mechanism plate and the shutter housing, are also individually matched and cannot be obtained as replacements for this or any other shutter—replacing these parts would disturb the critical interlens distance.)

After assuring the freedom of the blade operating ring, install the blade ring detent spring. To avoid distortion, fit the long end of the spring first. Then, position the short end between the two posts with the aid of a screwdriver.

LUBE: Before proceeding with the reassembly, **lubricate the blade ring detent spring where it contacts the blade operating ring.** (Remember, use a minimum amount of molylube.)

Test the operation of the blade ring detent spring by moving the blade operating ring from the open to the closed position. Just before the blade operating ring reaches the end of its closing rotation, the blade ring detent spring should force it the rest of the way with a "snap."

Prior to installing the shutter blades, rotate the blade operating ring to the open position (that is, with the inside of the "hook" which carries the closing stud firmly against the main drive cam bushing—the position shown in figure 98). Now, turn over the mechanism plate and seat the first shutter blade next to the main drive cam bushing, Fig. 99. The remaining blades are replaced in counterclockwise rotation.

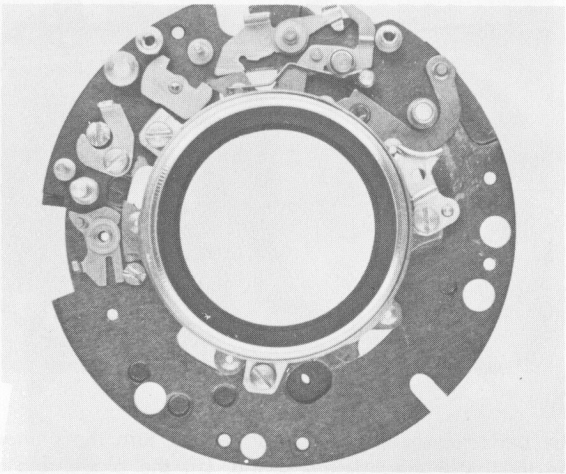


FIGURE 98

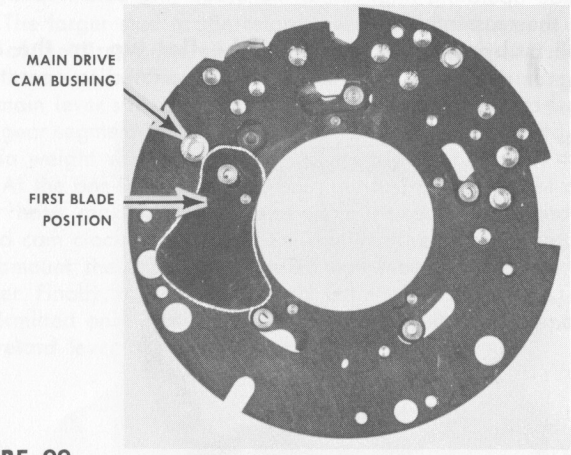


FIGURE 99

You are now ready to place the shutter housing over the mechanism plate. First, locate the slot in the housing which receives the post on the MXV selector ring and the corresponding cutout at the edge of the mechanism plate, Fig. 100. Aligning the slot with the cutout, carefully lower the housing over the inverted mechanism plate. Once the two parts are correctly positioned, replace the three screws.

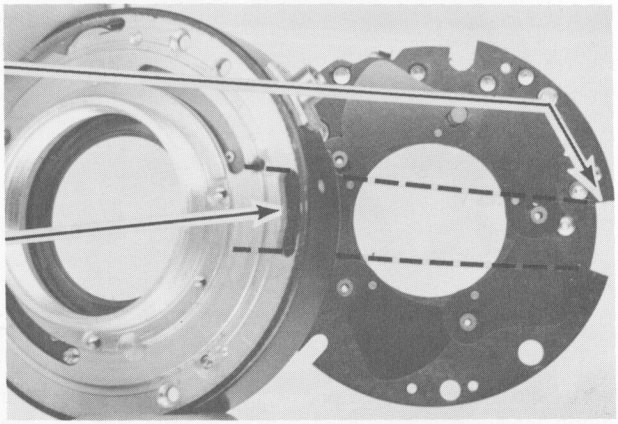


FIGURE 100

To test the performance of the shutter blades, turn the shutter over and disengage the blade ring detent spring. Lift the blade ring detent spring just high enough to clear the pin and rest its long end against the lens flange. If the shutter blades now move freely and properly as you move the blade operating ring, reseat the blade ring detent spring and proceed with the reassembly.

LUBE: Lubricate the inside of the flat lug on the MXV selector ring—the inside of this lug is serrated to operate the M-sync blade ring latch, Fig. 101.

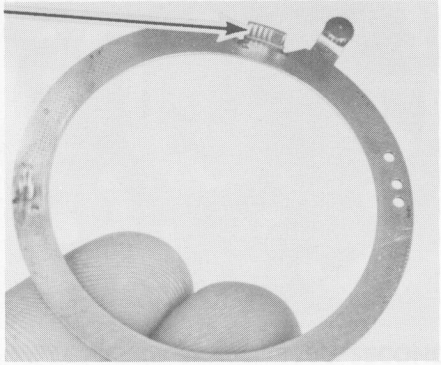


FIGURE 101

Working from the back of the shutter, replace the MXV selector ring. The serrated lug passes into the housing slot under the flash cord socket and clockwise of the end of the M-sync blade ring latch. Next, fit the spacer on the back of the shutter housing and seat the diaphragm setting ring with its oval hole over the pin on the diaphragm control ring. Replace the three diaphragm setting ring screws and test the operation.

REASSEMBLY AND OPERATION OF THE SYNC DELAY MECHANISM

Since it is difficult to observe and fully understand the operation of the sync delay mechanism when it is assembled, the functions of the individual parts will be explained during installation. The reason the operation may at first seem complex is that several actions occur simultaneously.

Keep in mind that the sync delay mechanism provides a choice of two actions with one set of parts: "M" sync (firing the flash and then delaying the shutter opening until the flashbulb can reach its peak); and "X" sync (firing the flash when the blades are fully open). Once you are familiar with the individual operations of the components, the complete cycle of the sync delay mechanism will be more easily understood. Therefore, you should carefully study the action of each part as it is installed.

First, rotate the MXV selector ring as far as it will go in a counterclockwise direction as seen from the front of the shutter. Next, seat the latch spring over its post—hook the long end of the latch spring behind the tab on the M-sync blade ring latch and hook the short end on the sector latch stud.

Both the M-sync blade ring latch and the sector latch are now in the positions they would normally assume with the sync delay mechanism cocked and the shutter set on "M," Fig. 102. Notice that if the blade operating ring is allowed to travel a slight distance in a counterclockwise direction, it will be arrested by the hooked end of the M-sync blade ring latch. This movement will not be enough to open the blades.

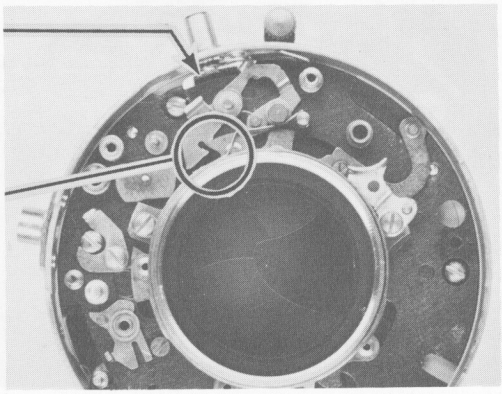


FIGURE 102 MXV SELECTOR RING AT "M"

To simulate this action, turn the blade operating ring in a counter-clockwise direction until it is stopped by the M-sync blade ring latch, Fig. 103. You can now see that before the blade operating ring can be rotated to open the blades, the M-sync blade ring latch must be moved aside, Fig. 104. This is how the blade operating ring is restrained on "M" sync, allowing the flashbulb to reach its maximum light output.

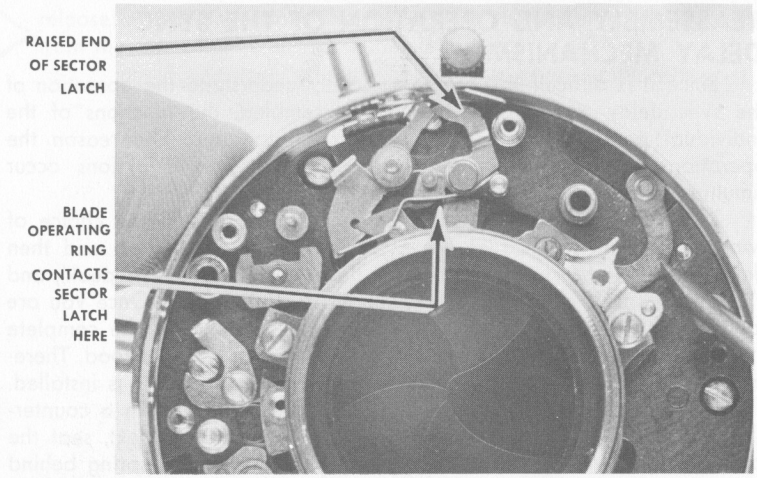


FIGURE 103

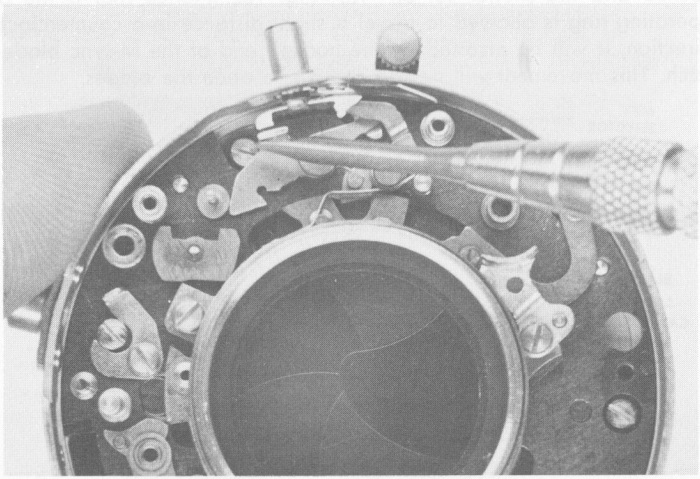


FIGURE 104

One other important function takes place during the initial movement of the blade operating ring. Refer again to figure 103 and locate the lug on the blade operating ring that contacts the sector latch. As the blade operating ring begins its counterclockwise rotation, it moves the raised end of the sector latch toward the outside of the shutter. You will soon see how this action releases the sync delay mechanism to free the blade operating ring.

When the MXV selector ring is set on "X," Fig. 105, its serrated lug contacts the M-sync blade ring latch. This holds the M-sync blade ring latch against its spring tension away from the blade operating ring. Now, you can rotate the blade operating ring without interference to open the blades. Thus, since the blade operating ring is no longer restrained, there is no delay. In fact, the M-sync blade ring latch is the only part directly affected by the MXV selector ring when the sync delay setting is changed.

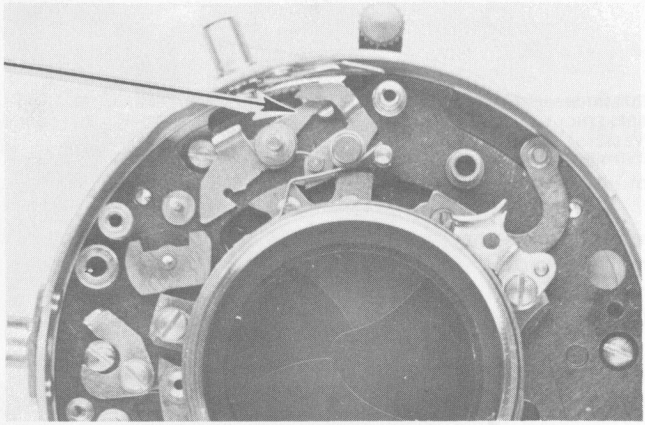


FIGURE 105 MXV SELECTOR RING AT "X"

Notice that the teeth on the MXV selector ring's serrated lug slant in one direction. This allows the MXV selector ring to be turned freely in a clockwise direction (from "M" to "X" to "V"). However, when the sync delay mechanism is in the cocked position, the M-sync blade ring latch will engage the teeth on the serrated lug and prevent counterclockwise rotation. Thus, to turn the MXV selector ring counterclockwise, you must now hold the M-sync blade ring latch away from the serrated lug, as in figure 104.

If the bulb lever and its spring were in place, the short end of this spring would move the MXV selector ring counterclockwise when the shutter is released on the "V" setting. Until the shutter is tripped, the MXV selector ring is held when set to "V" by the M-sync blade ring latch. Releasing the shutter allows the sync drive sector to move the M-sync blade ring latch away from the serrated lug, permitting the spring to return the MXV selector ring to the "X" position. Further reassembly will clarify this action.

LUBE: Points which can be lubricated at this time are the blade operating ring lugs which contact the sector latch and the M-sync blade ring latch.

Set the MXV selector ring to "X" and slip the star wheel over its post. Shift the position of the pallet slightly to permit the star wheel to drop into place. Next, start the sync drive sector in position with its teeth engaging the star wheel pinion. Hold the raised end of the sector latch toward the outside of the shutter while seating the sync drive sector against the base of the post over the M-sync blade ring latch.

You can now study the operation of the sync drive sector. Earlier, you learned that the cocking ring moves the sync drive sector on the setting stroke. **The sync drive sector is then latched in the cocked position by the raised end of the sector latch.** This is shown in figure 106 with the MXV selector ring set to "M."

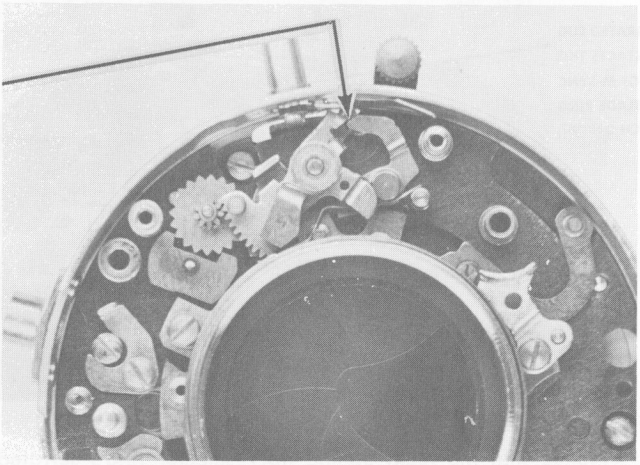


FIGURE 106 MXV SELECTOR RING AT "M"

As you have seen, moving the blade operating ring until it is arrested by the M-sync blade ring latch pushes the sector latch aside, Fig. 107. This releases the sync drive sector. The sync drive sector is then turned by the sync drive spring (not yet installed) against the star wheel and pallet. Finally, the sync drive sector strikes the vertical tab on the M-sync blade ring latch, Fig. 107. Thus, the M-sync blade ring latch is pushed out of engagement with the blade operating ring, allowing the blades to open and close.

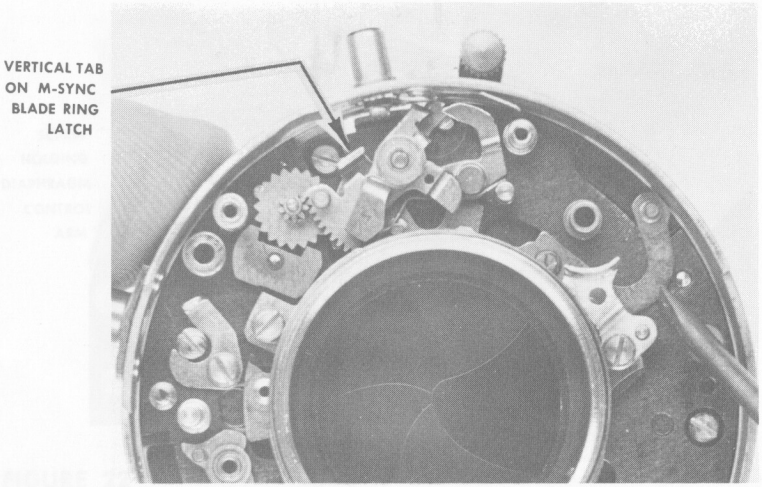


FIGURE 107 MXV SELECTOR RING AT "M"

LUBE: Apply moly-lube to the end of the sector latch that engages the sync drive sector. This is one of the most critical lubrication points in the shutter. If the latching point is dry, the blade operating ring may not be able to disengage the sector latch from the sync drive sector. Consequently, the shutter blades will not open and the shutter will "hang up." A burr on either the sector latch or on the sync drive sector can also cause this malfunction.

Before replacing the sync drive spring, hold the sector latch aside and move the sync drive sector to its released position (until it contacts the vertical tab on the M-sync blade ring latch). Now, insert the turned-down end of the sync drive spring into the hole on top of the sync drive sector. Grasping the opposite end with your tweezers, stretch the spring until you can hang the loop over the stud on the hooking plate.

The operation of the sync drive sector can now be simulated. First, move the sync drive sector from left to right, until it is held by the sector latch, Fig. 108. This is normally done by the cocking ring on the setting stroke. The sync drive spring is thus tensioned and the hooked end of the M-sync blade ring latch is allowed to move toward the center of the shutter (at the "M" setting). Next, slowly rotate the blade operating ring counterclockwise. Remember, this pushes the sector latch aside to free the sync drive sector.

The time it takes for the sync drive sector to disengage the M-sync blade ring latch provides the "M" delay. This time is so brief that you will scarcely feel any resistance as you move the blade operating ring to open the blades. Still, the slight interference is sufficient to allow the flash-bulb to reach its peak intensity.

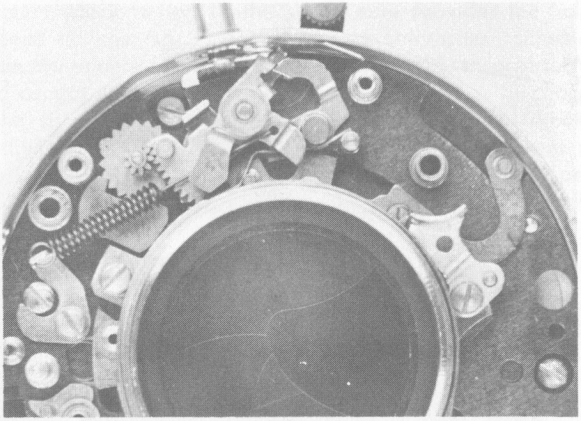


FIGURE 108 MXV SELECTOR RING AT "M," SYNC DRIVE SECTOR COCKED

When this performance is repeated with the MXV selector ring set to "X," the action of the sync drive sector is the same. However, because the M-sync blade ring latch is held out of play by the MXV selector ring, the blade operating ring moves unrestricted to its open position.

The parts just described provide the necessary delay for the blade operating ring. All that is now needed is a means of closing the sync contacts to complete the flash circuit. The two components responsible for this are the contact lever and the M-closing lever, Fig. 109.

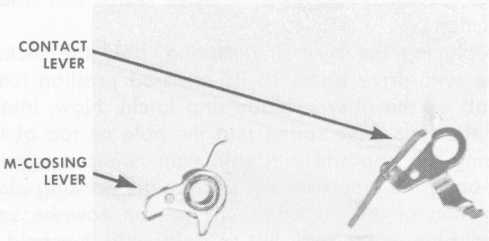


FIGURE 109

Cock the sync drive sector and replace the M-closing lever, being careful not to bend the adjacent grounding strip on the shutter housing. Hold the M-closing lever with your finger and swing its spring into place against the inside of the housing. Then seat the M-closing lever fully with its downward-projecting tab to the inside of the sector latch, Fig. 110.

The downward-projecting tab on the M-closing lever, Fig. 110, is now against one end of the M-sync blade ring latch. The position of the M-sync blade ring latch, as determined by the MXV selector ring, also permits or prevents the movement of the M-closing lever. At the "M" setting, the

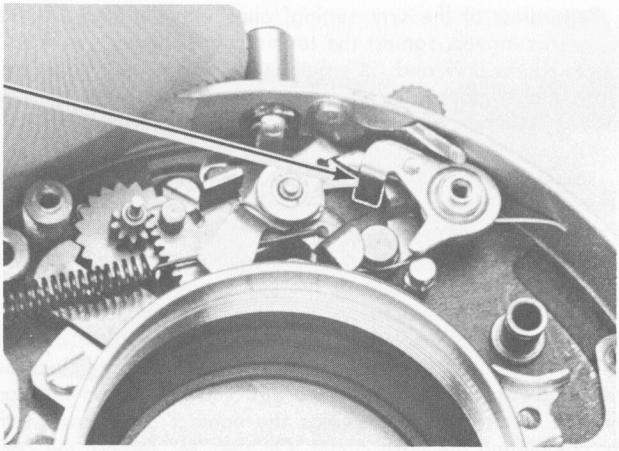


FIGURE 110

M-closing lever is allowed to move toward the outside of the shutter when the sync drive sector is cocked. In the "X" position, the M-closing lever is held toward the center of the shutter by the M-sync blade ring latch. Therefore, **the only time that the M-closing lever has any effect in the operation is when the shutter is set on "M" sync.**

Release the sync delay mechanism by disengaging the sector latch. Now, seat the contact lever over the M-closing lever, Fig. 111. Notice in this figure that the horizontal lug on the M-closing lever hooks behind the downward-projecting lug on the contact lever.

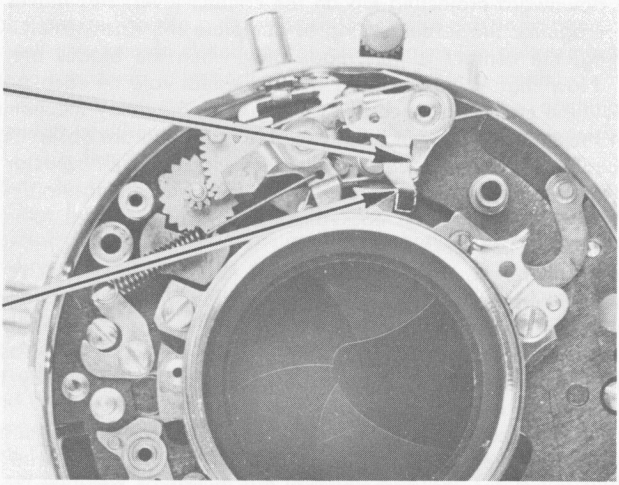


FIGURE 111 MXV SELECTOR RING AT "M"

Regardless of the sync setting, once the shutter is released the contact lever is moved against the terminal strip to fire the flash. The difference between "M" and "X" sync is only in the part which is used to actuate the contact lever. This movement is effected by the M-closing lever on "M" sync and by the blade operating ring on "X" sync.

As you have seen, with the sync delay mechanism cocked at the "M" setting, the M-closing lever tends to move toward the outside of the shutter under spring tension. With the contact lever in place, however, this movement is prevented. Notice that the downward-projecting lug on the contact lever is against a milled section of the blade operating ring, Fig. 111. Therefore, as long as the blade operating ring is in its extreme clockwise position, it prevents the movement of the contact lever. The contact lever in turn holds the M-closing lever against its spring tension.

Once the blade operating ring begins its counterclockwise rotation, it moves away from the downward-projecting lug on the contact lever. Now, the M-closing lever swings the contact lever toward the terminal strip, completing the flash circuit. On the "M" setting, the contact is thus made at the initial movement of the blade operating ring—that is, as soon as the contact lever is freed.

Moving the MXV selector ring to the "X" setting causes the M-sync blade ring latch to pivot—the hooked end swings away from the blade operating ring and the opposite end moves the M-closing lever toward the center of the shutter. When the blade operating ring now begins its counterclockwise rotation, the M-closing lever cannot move to actuate the contact lever. The contact lever is held away from the terminal strip (by the spring action of the grounding strip) until the blade operating ring has reached the full-open position.

At the end of its opening rotation, the blade operating ring strikes the downward-projecting lug on the contact lever. This moves the contact lever against the terminal strip to complete the flash circuit. On the "X" setting, the contact is thus made only when the blades are fully open.

Now that you have seen the individual role of each part, you can follow the entire sequence of events in the sync delay mechanism. Assume that the shutter has been fully assembled and you are observing the action through the sync bridge. We will start with the MXV selector ring set to "M" and the sync delay mechanism in the released position.

When the shutter is cocked, the sync drive sector is moved from left to right (by the cocking ring) until it is engaged by the sector latch. During this travel, the sync drive sector tensions the sync drive spring and frees the M-sync blade ring latch. Now, the M-sync blade ring latch can pivot, one end moving into the path of the blade operating ring while the other end moves away from the M-closing lever. The M-closing lever is still not free to move, however, because it is restrained by the contact lever (which, in turn, is held by the blade operating ring).

Upon releasing the shutter, the blade operating ring turns until it is arrested by the M-sync blade ring latch. During this initial travel, the blade operating ring accomplishes two things: it frees the contact lever and it disengages the sector latch. Now, the M-closing lever moves the

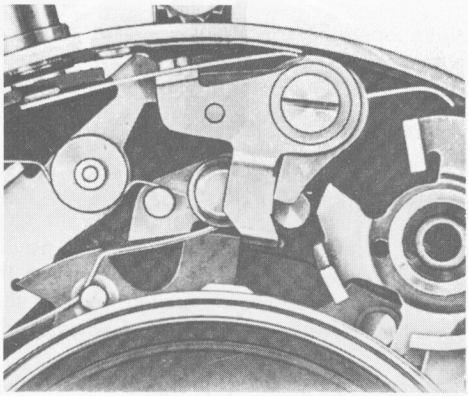


FIGURE 112 SYNC DRIVE SECTOR REMOVED FOR CLARITY
COURTESY FRIEDR. DECKEL

contact lever against the terminal strip to fire the flash, Fig. 112.

Simultaneously, the sync drive sector begins turning against the star wheel and pallet. At the end of its travel, the sync drive sector kicks the M-sync blade ring latch out of engagement with the blade operating ring. This permits the blades to open and close.

As the M-sync blade ring latch is moved back to its starting position, it forces the M-closing lever away from the contact lever. The spring action of the grounding strip then moves the contact lever away from the terminal strip. Thus, the flash has been fired a fraction of a second before the blades are allowed to open, providing "M" delay.

Next, visualize the sequence of events on "X" sync. Moving the MXV selector ring to "X" blocks the M-closing lever through the M-sync blade ring latch. In this position, the M-closing lever cannot actuate the contact lever. Instead, the blade operating ring strikes the downward-projecting lug on the contact lever to close the circuit when the blades have reached the full-open position, Fig. 113.

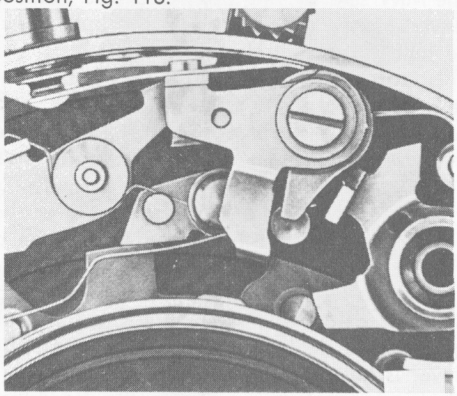


FIGURE 113 SYNC DRIVE SECTOR REMOVED FOR CLARITY
COURTESY FRIEDR. DECKEL

Since the blade operating ring always actuates the contact lever when the blades are open, the contact is made twice on "M" sync: first by the M-closing lever and then by the blade operating ring, each in turn moving the contact lever against the terminal strip. Of course, on "M" sync the first contact (through the M-closing lever) fires the flashbulb, so the second contact has no effect.

After you have thoroughly familiarized yourself with the operation of the sync delay mechanism, install the sync bridge. While seating the sync bridge, align the star wheel pivot with its hole and position the inner release lever tab behind (toward the housing) the stud on the sync drive sector. When the sync bridge is properly seated, replace the two screws (remember, the shoulder screw goes at the star wheel end of the sync bridge).

Next, place the inner release lever spring over the shoulder screw on the sync bridge. Fit the short end of the spring against the inside of the shutter housing and the long end in its notch on the inner release lever.

LUBE: Lubricate the horizontal lug on the sync drive sector where it is contacted by the cocking ring.

When the shutter blades are closed, the distance between the contact strip on the contact lever and the terminal strip on the flash cord socket should be .5mm (.020"). This gap is measured in the "M" position, and corrected, if necessary, by reforming the strip on the contact lever.

LUBE: Lubricate two points on the V-latching lever: the section which blocks the blade operating ring and the side of the vertical tab which is contacted by the delayed-action setting lever. Also, lubricate the detent spring on the side of the shutter housing and the turned-down tab on the bulb lever which engages the blade operating ring.

Next, seat the bulb lever over the shoulder of the V-latching lever post and replace its spring and screw. Fit the short end of the bulb lever spring behind the MXV selector ring post, clockwise of the vertical tab on the V-latching lever. Hook the long end of the bulb lever spring within its notch on the bulb lever control stud.

LUBE: Lubricate the vertical bulb lever stud at the points contacted by the speed cam and by the outer release lever. Also, place a slight amount of moly-lube on a few of the notches above the delayed-action first gear.

Install the delayed-action escapement in a partially cocked position, fitting the slot in the delayed-action setting lever over the post on the MXV selector ring. Make sure that the hooked end of the delayed-action setting lever is clockwise of the vertical tab on the V-latching lever. When the escapement is fully seated, replace the retaining screw. Now, hold the locking lever away from the delayed-action pallet with your tweezers—this permits the delayed-action escapement to run down until the V-latching lever is halted by the eccentric stop.

There is only one precaution in replacing the speeds escapement: the pallet control lever tab must be positioned to the outside of the blade

operating ring to allow proper seating. After you have aligned the two screw holes, use your tweezers to push the pallet control lever toward the outside of the shutter. When the speeds escapement is flush with the mechanism plate, replace its two retaining screws.

You will notice that when the two screws are loose the retard lever end of the speeds escapement can be moved in a slight arc; that is, the retard lever end may be positioned either closer to or farther from the lens flange. In the older-style Compur discussed in "Complex Escapement Retard Shutter—Part 1," you will recall that both ends of the speeds escapement can be shifted slightly to allow fine adjustment of the shutter speeds. This is similar in the Synchro-Compur 00-MXV except that only the retard lever end of the speeds escapement is moved. For now, position the speeds escapement so that the retard lever end is approximately at the center of its adjustment and tighten the screws. You will later see how the escapement is precisely located for the proper shutter speeds.

LUBE: Lubricate the inside of the main drive cam which slips over the post on the mechanism plate.

Install the main drive cam with the lug which contacts the blade operating ring opening stud pointing toward the lens flange, Fig. 114. Lower the main drive cam over its post, turning as necessary to clear the retard lever. Then, rotate the main drive cam in a clockwise direction until it is stopped by the arresting plate.

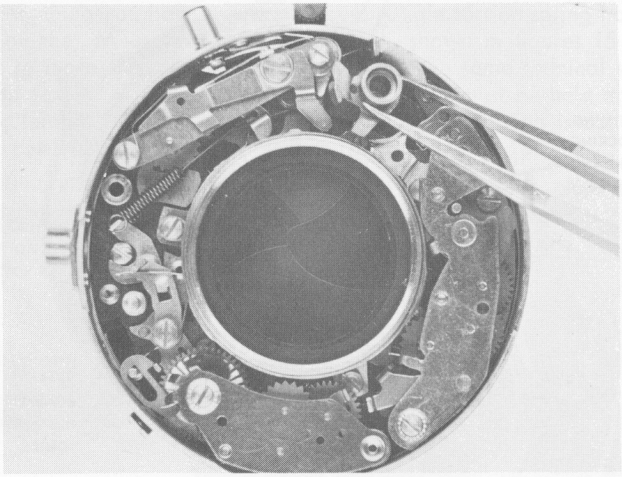


FIGURE 114

LUBE: Lubricate the main drive cam lugs on the edges which contact the opening stud, the closing stud, and the retard lever. Also, lubricate the end of the inner release lever which latches the main drive cam.

Next, insert the lower end of the mainspring into the hole in the

main drive cam. Holding your finger over the top of the mainspring, use your tweezers to swing the upper end into its notch behind the arresting plate.

LUBE: Place a light film of moly-lube on the inner circumference of the cocking ring and at the blocking lever and inner release lever contact points on the outer circumference. Also, apply a slight amount of moly-lube to the cocking pinion shaft.

As previously mentioned, the free end of the cocking ring spring hooks on the V-latching lever's round post. Fit the spring loop within the groove on this post while placing the cocking ring over the lens flange. Now, rotate the cocking ring slightly in a clockwise direction until it is fully seated on the lens flange. Make sure that the delayed-action locking lever is alongside (not underneath) the outer circumference of the cocking ring.

To replace the outer release lever, position its lower "foot" to the inside of the bulb lever control stud and start its post into the bushing. Using your tweezers, fit the spring inside the shutter housing while pushing the outer release lever down into place.

Replace the cocking pinion with its turned-down tab adjacent to the arc of the arresting plate. Engage the first tooth of the cocking pinion with the first tooth-slot in the cocking ring, Fig. 115.

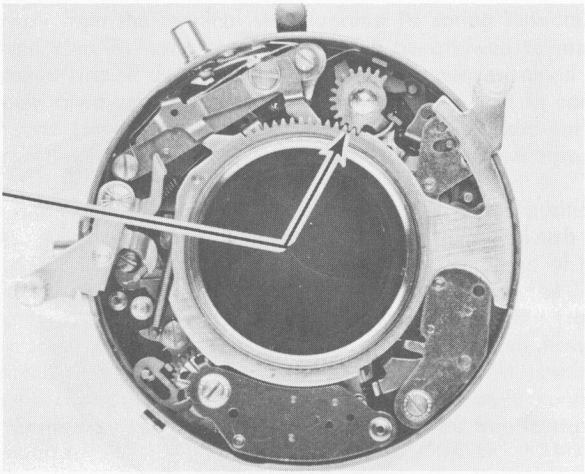


FIGURE 115

While holding the cocking ring against the lens flange, test the setting operation. If the main drive cam is not moved far enough to be latched by the inner release lever during the cocking cycle, the timing between the cocking pinion and the cocking ring is incorrect. In this event, lift the cocking pinion until it clears the cocking ring and retime the parts as previously described.

Replacing the blocking lever is a rather tricky procedure which may require a little practice. Start the blocking lever over its post with the end which arrests the MXV selector ring against the inside of the shutter housing. Now, carefully reach under the blocking lever with your tweezers and grasp the free end of the blocking lever spring. Pull this end of the spring toward the center of the shutter until you can hook it against the inside of the small post. Once the spring is properly located, swing the blocking lever counterclockwise while gently lowering it into position.

Now, orient the speed cam on the lens flange so the bulb lever cutout is over the blocking lever pivot post. Turn the speed cam as far as it will go in a counterclockwise direction, to the "bulb" setting, while seating it in place.

The shutter speeds can be tested and adjusted at this time. A fair degree of accuracy may be obtained by using a visual test which is similar in principle to that described in "Complex Escapement Retard Shutter—Part I" for the older-style Compur. With the retard lever end of the speeds escapement positioned at the midpoint of its adjustment, you should now be able to see a difference in exposure between 1/15 second and 1/30 second.

Set the speed cam to 1/15 second (figure 34) and trip the shutter while closely watching the action of the shutter blades. Next, operate the shutter with the speed cam set to 1/30 second (figure 35). The exposure delivered at 1/15 second should be visibly slower than that obtained on 1/30 second. However, if you cannot see a difference—or if 1/30 second appears slower than 1/15 second—remove the speed cam and loosen the two escapement screws. Now, using the pallet lever end as a pivot point, move the retard lever end of the escapement slightly toward the lens flange. This will increase the depth of engagement between the retard lever and the main drive cam. After tightening the two screws, replace the speed cam and again visually check 1/15 second and 1/30 second. Repeat this procedure until you can detect a slower exposure at 1/15 second than at 1/30 second.

More precise adjustment is possible if an electronic speed tester, such as a Motion Analyzer, is available. After making your visual checks, set the speed cam to 1/15 second and test the exposure on the electronic instrument. If the 1/15 second is either too slow or too fast, you can position the retard lever end of the speeds escapement in the same manner as has been described for the visual adjustment. (For a slower exposure, move the retard lever end toward the lens flange—for a faster exposure, move the retard lever end toward the outside of the shutter housing.) Once you have found the correct position for the retard lever end of the speeds escapement, tighten the two retaining screws.

If the shutter is clean and in good operating condition, correcting the 1/15 second exposure should also adjust the remaining shutter speeds. The two retard control studs have both been adjusted at the factory to correct the entire speed range—the first gear segment control stud is bent to time the 1/15 scond exposure and the retard lever control stud is bent to time the 1/500 second exposure. However, it should never be necessary

for you to bend these studs—in fact, such practice is extremely dangerous. Repeated stud bending will result in breakage, requiring that the complete unit be replaced. Still, you should thoroughly check the remaining speeds to assure that the shutter is functioning properly.

You will learn more about exposure adjustment and testing methods in a later lesson. At this time, your main concern should be the visual timing procedure which has been discussed for the Synchro-Compur 00-MXV. Normally, the flash synchronization could also be checked after installing the speed cam. However, like the shutter speed adjustments, testing flash synchronization is a special subject which will be covered in a series of later lessons. For now, just remember that in the Synchro-Compur 00-MXV "X" sync is adjusted by reforming the strip on the contact lever; and "M" sync is corrected by changing the sync drive spring tension through the hooking plate eccentric.

Next, reinstall the speed cam and replace the speed setting ring—key the two inside cutouts on the speed setting ring to the matching tabs on the speed cam. If you cleaned the cover plate, lightly lubricate the detent slots on its underside with moly-lube. Then, seat the cover plate in position with its oblong hole over the blocking lever post in the shutter.

Screw on the retaining ring, turning it down until the speed cam has the desired tension. (The amount of tension on the speed cam will vary according to the camera in which the shutter is used. For example, in Rolleiflex cameras the cover plate is left quite loose so the speed cam may rotate freely. This is necessary because the shutter controls are coupled to additional setting knobs on the front of the camera.) Next, rotate the retaining ring until the nearest hole for the lock screw is within one of the notches. Finally, replace the lock screw to hold the retaining ring adjustment. Complete the reassembly by replacing the diaphragm control arm with its screw.

> **NOTE:** A complete disassembly of the shutter as has just been described is not always necessary for routine cleaning purposes. In some cameras, such as Rolleiflex models with cross-coupled exposure meters, the mere process of removing the shutter from the camera can be quite time-consuming. Usually, when the shutter malfunctions because of dirt, cleaning the blade operating ring will correct the trouble. The shutter can then be left on the camera and opened up from the front. The lens flange, blade operating ring, and other parts on the mechanism plate can subsequently be taken out for cleaning. However, if the blades themselves are dirty the shutter must be removed from the camera and disassembled.

THE SEIKOSHA 00-SLV

You will encounter many shutters of different makes that closely resemble either the Compur or the Prontor in operating design. The Seikosha shutter, found on many Japanese cameras, is based on the Compur design. Early models followed the Compur design using the ring-type main lever; new Seikosha models, such as the one you will now study, are based on the Synchro-Compur 00-MXV design.

Notice that with the speed cam removed the Seikosha SLV, Fig. 116, closely resembles the Synchro-Compur 00-MXV which you have just studied. The cocking ring encircling the lens flange, the cocking pinion, and the main drive cam are quite similar to their Compur counterparts. However, the "M"-sync delay mechanism and the "V" delayed-action escapement are unique to the Seikosha shutter. Therefore, we will now concentrate on these two mechanisms.

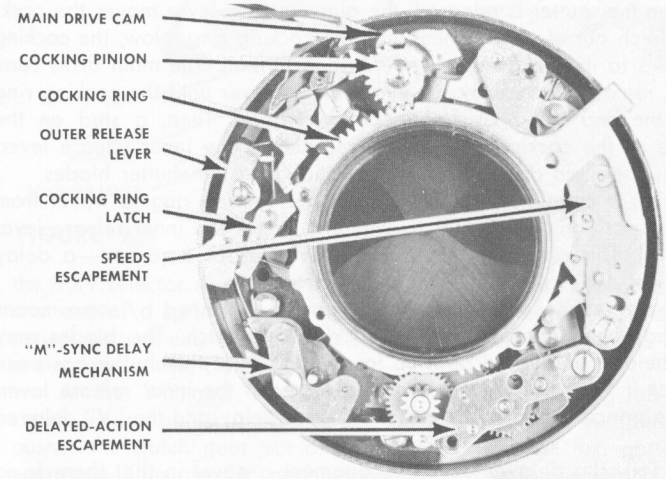


FIGURE 116

To set the shutter, the cocking ring, Fig. 116, is turned in a clockwise direction. Unlike the Synchro-Compur 00-MXV, however, the cocking ring

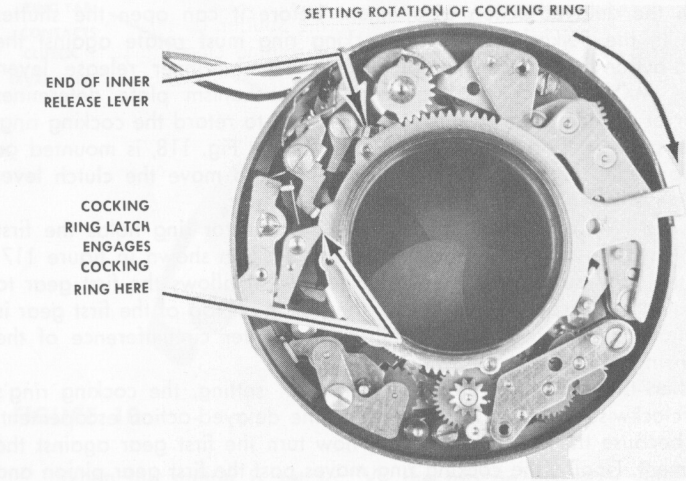


FIGURE 117

does not return in the opposite direction until the shutter is released. Instead, the Seikosha's cocking ring is locked at the end of its clockwise rotation by the cocking ring latch, Fig. 117.

During the setting (clockwise) rotation of the cocking ring, the main drive cam is turned counterclockwise by the cocking pinion. Finally, just before the cocking ring is engaged by the cocking ring latch, the main drive cam is locked in the set position by the inner release lever.

When the shutter is released, the outer release lever moves the cocking ring latch out of engagement with the cocking ring. Now, the cocking ring returns to its rest position under spring tension. The main drive cam, however, remains latched by the inner release lever until the cocking ring reaches the end of its counterclockwise rotation. Then, a stud on the underside of the cocking ring strikes one end of the inner release lever. This frees the main drive cam to open and close the shutter blades.

It takes a certain length of time for the cocking ring to travel from its latched position (figure 117) to where it strikes the inner release lever (figure 116). This revolution takes only a fraction of a second—a delay which is not noticeable by visual observation.

However, suppose that the cocking ring is restrained by some means after it has been released by the cocking ring latch. The blades may then be held in the closed position for as long after the shutter has been tripped as it takes for the cocking ring to reach the inner release lever. This is the principle behind both the "M"-sync delay and the "V" delayed action.

The Seikosha delayed-action escapement is novel in that there is no separate drive spring. In theory, this is similar to the delayed action in the larger models of the Compur shutter described in "Complex Escapement Retard Shutter—Part I." Remember, in the larger models of the Compur with delayed action, the ring-type main lever must pull its way through the delayed-action escapement before it can open the shutter blades. In the Seikosha SLV, the cocking ring must rotate against the delayed-action escapement before it reaches the inner release lever.

The MXV selector ring beneath the mechanism plate determines whether or not the delayed action is permitted to retard the cocking ring. The first gear of the delayed-action escapement, Fig. 118, is mounted on a spring-loaded clutch lever. This spring tends to move the clutch lever and the first gear toward the center of the shutter.

At the "M" and "X" settings, the MXV selector ring holds the first gear toward the outside of the shutter, the position shown in figure 117. When the MXV selector ring is turned to "V," it allows the first gear to move toward the cocking ring. Now, the pinion on top of the first gear is in position to engage the five teeth on the outer circumference of the cocking ring, Fig. 118.

When the shutter is released at the "V" setting, the cocking ring's counterclockwise rotation is opposed by the delayed-action escapement. This is because the cocking ring must now turn the first gear against the escapement. Finally, the cocking ring moves past the first gear pinion and continues its release rotation until it strikes the inner release lever.

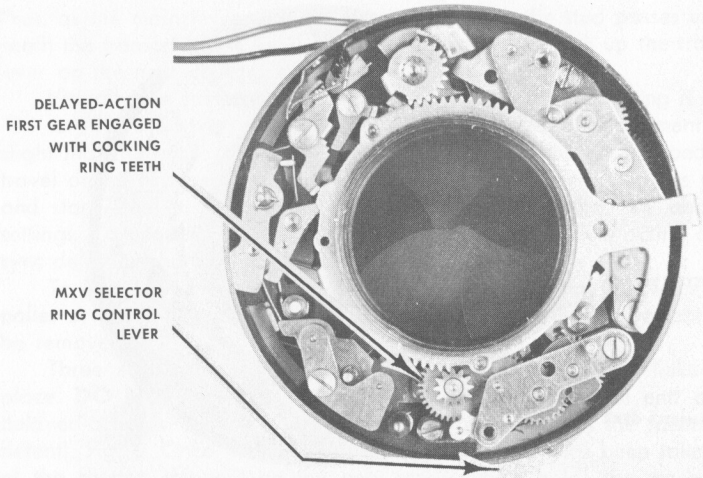


FIGURE 118 SHUTTER COCKED, SET TO "V"

Unlike many shutters, the Seikosha SLV can be cocked when the MXV selector ring is set to "V." The five teeth on the outer circumference of the cocking ring slant in one direction. If the cocking ring is turned in a clockwise direction when the shutter is set on "V," the teeth merely push the first gear against its spring tension toward the outside of the shutter. The teeth will not "grab" the first gear pinion unless the cocking ring is turning in a counterclockwise direction.

The "M"-sync delay is also provided by restraining the cocking ring before it can reach the inner release lever. Actually, there is a certain amount of delay just in the time it takes for the cocking ring to travel from its latched position to the inner release lever. This delay time may be lengthened by the "M"-sync delay mechanism, Fig. 116.

Since the "M"-sync delay is so brief, the "M"-sync delay mechanism is simply an inertia retard with two parts: the sync retard lever and a single inertia gear, Fig. 119.

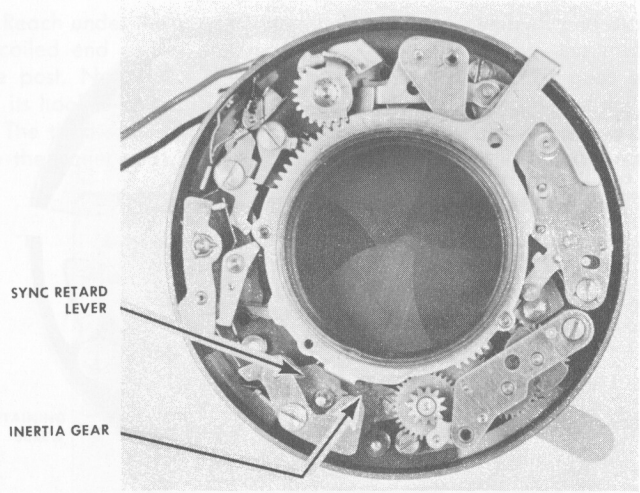


FIGURE 119 SHUTTER RELEASED, SET ON "M"

To examine the operation of the "M"-sync delay mechanism, set the MXV selector ring to "M" and cock the shutter. Now, the spring-loaded sync retard lever moves all the way toward the center of the shutter, Fig. 120 When the cocking ring is released, its downward-projecting tab, Fig. 121, strikes the sync retard lever. This slows the rotation of the cocking ring for a fraction of a second as the sync retard lever turns against the inertia gear.

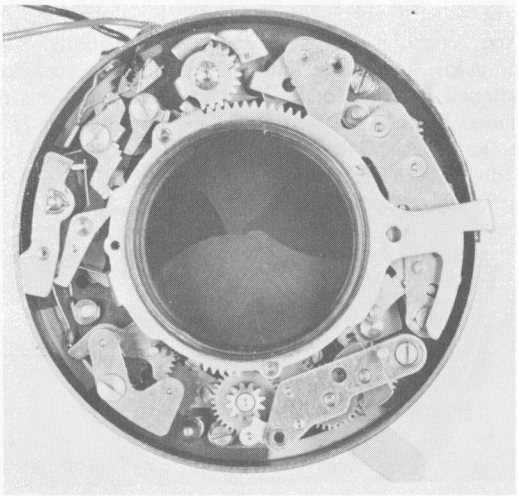


FIGURE 120 SHUTTER COCKED, SET ON "M"

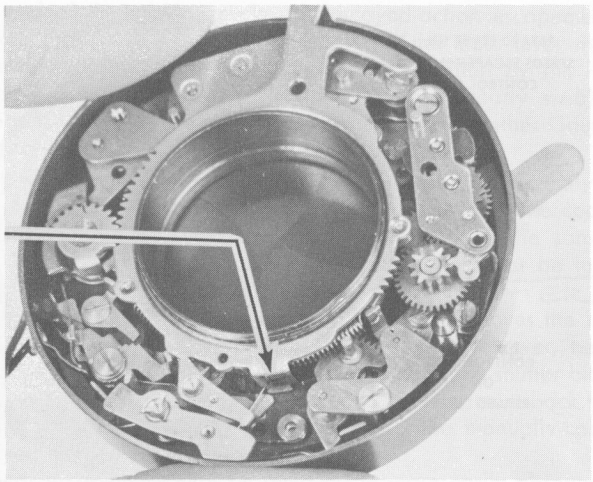


FIGURE 121 SHUTTER COCKED, SET ON "M"

You can see that the amount of "M"-sync delay depends on how far the sync retard lever is allowed to move toward the center of the shutter. Maximum delay results if the sync retard lever is permitted its full depth of engagement with the cocking ring. On the other hand, a minimum delay results if the sync retard lever is completely restrained so it cannot move toward the center of the shutter. In the latter case, the delay time depends only on how long it takes for the cocking ring to travel from the set to the released position.

Of all the shutters you have encountered thus far in your course, the Seikosha SLV is the first which actually does vary the "M" delay. The shutter speed setting determines the length of the "M"-sync delay time.

The shutter speed cam selects both the shutter speed (running time of the speeds escapement) and the "M"-sync delay time. In figures 122, 123 and 124 the speed cam has been temporarily replaced so you may see how this is done. Notice that the stud on top of the sync retard lever now rides within a control slot in the speed cam, Fig. 122.

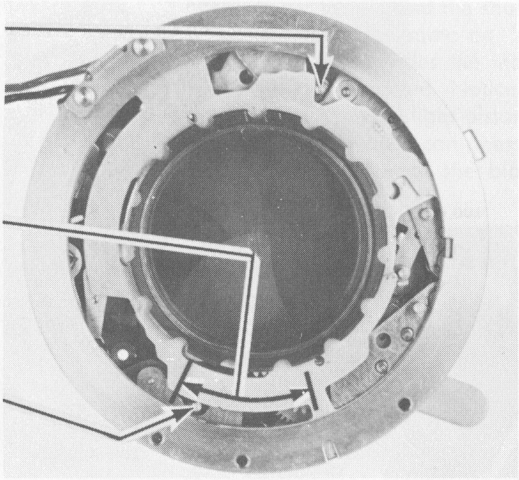


FIGURE 122

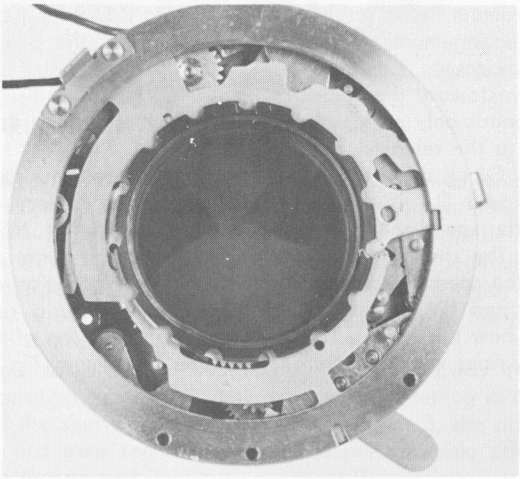


FIGURE 123 SHUTTER SET TO 1/60 SECOND

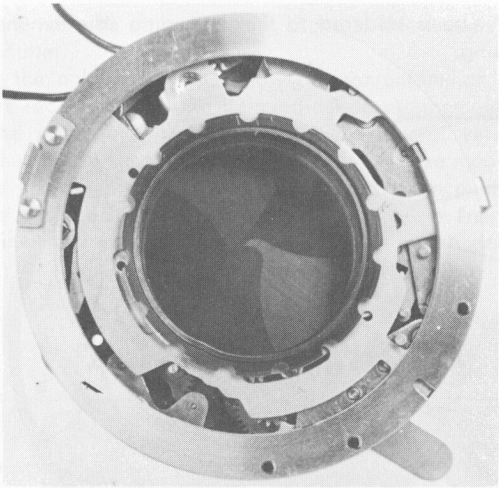


FIGURE 124 SHUTTER SET TO 1/500 SECOND

Throughout the slow-speed range, the speed cam holds the sync retard lever toward the outside of the shutter, Fig. 122. Consequently, at the speeds of one second through 1/30 second the cocking ring cannot contact the sync retard lever. The "M" delay is thus its minimum amount, determined only by the distance the cocking ring must travel.

As soon as the speed cam is turned to the 1/60 second setting, Fig. 123, the sync retard lever is allowed to move slightly toward the center of the shutter. This is enough for the sync retard lever to engage the cocking ring, resulting in a slightly longer "M"-sync delay. Selecting faster speeds progressively increases the depth that the sync retard lever will engage the cocking ring—until at 1/500 second, Fig. 124, the maximum delay is provided.

Later in your course you will study in detail the reasons behind varying the "M"-sync delay according to the shutter speed. This discussion is intended only as an introduction to a more extensive presentation on the subject of flash synchronization in coming lessons. For now, just remember that the sync delay can be altered by the speed cam according to the shutter speed. Ideally, perfect synchronization at the faster speeds requires a longer "M"-sync delay to use the maximum light output from the flashbulb. You have seen how this is provided in the Seikosha SLV.

One set of flash contacts is used in the Seikosha for both "X" and "M" sync. On "M" sync, the contacts close as the cocking ring begins its rotation—before the blades can open to make the exposure. For "X" sync, contact closure is prevented until the blades reach the full-open position.

Locate the flash contacts and their operating parts on the mechanism plate near the main drive cam, Fig. 125. The insulated terminal strip (to which the "hot" sync wire is connected) is riveted to the mechanism plate.

The ground wire is soldered to the grounding strip on the inside of the shutter housing.

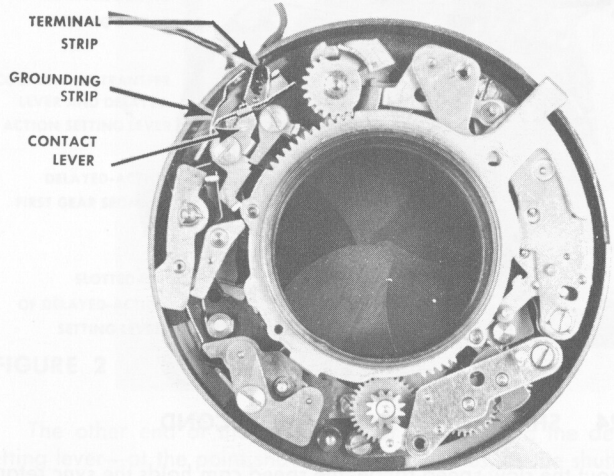


FIGURE 125

The grounding strip provides spring tension and electrical ground for the contact lever. Thus, when the contact lever is pressed against the terminal strip, Fig. 126, completing the circuit, the flash is fired.

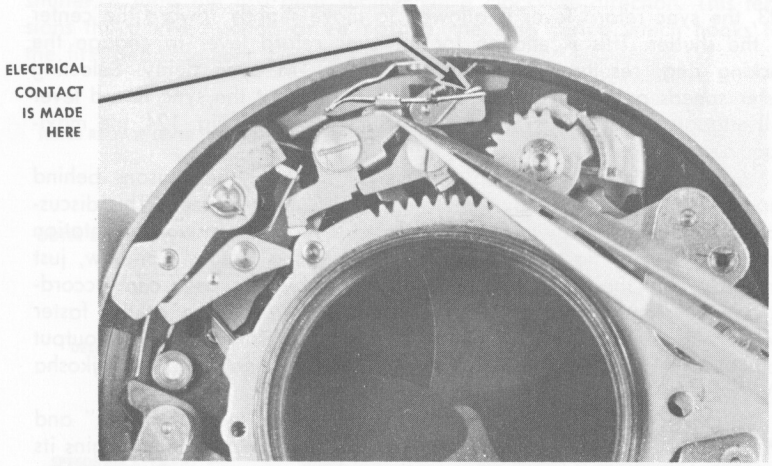


FIGURE 126

On "M" sync, this movement of the contact lever is carried out by the spring-loaded M-closing lever, Fig. 127. When the shutter is in the released position, a lug on the outer circumference of the cocking ring comes against a tab on the M-closing lever—this holds the M-closing lever

against its spring tension, Fig. 128. In turn, the contact lever is held away from the terminal strip by the spring action of the grounding strip. The grounding strip keeps the downward-projecting lug on the contact lever firmly against the M-closing lever.

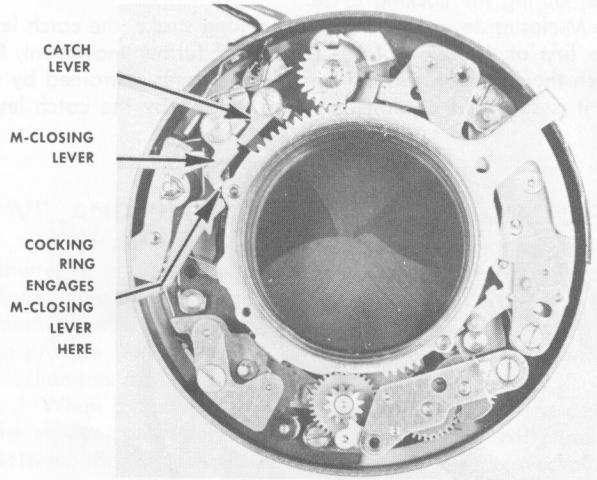


FIGURE 127

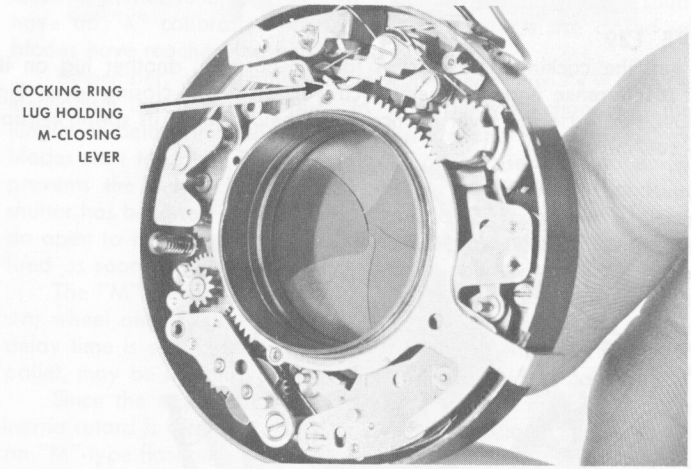


FIGURE 128

Notice that there are two notches on the M-closing lever. Each notch is engaged at the proper time by the spring-loaded catch lever, Fig. 127. As the cocking ring begins its clockwise rotation on the setting stroke, its lug moves away from the tab on the M-closing lever. Were it not for the

catch lever, this would free the M-closing lever. The M-closing lever could then move under spring tension and press the contact lever against the terminal strip. Of course, such action would fire the flash when the shutter is cocked. Thus, the catch lever prevents the movement of the M-closing lever during the cocking cycle.

Once the M-closing lever is freed on the setting stroke, the catch lever drops into the first of the two notches to prevent further movement, Fig. 129. Now, even though the M-closing lever is no longer restrained by the cocking ring, it is still held against its spring tension by the catch lever.

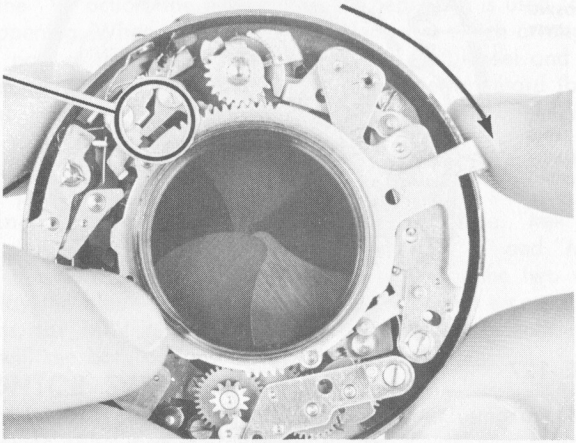


FIGURE 129

When the cocking ring reaches the set position, another lug on its outer circumference engages the vertical tab on the M-closing lever, Fig. 130. Now, the M-closing lever is once again held against its spring tension by the cocking ring.

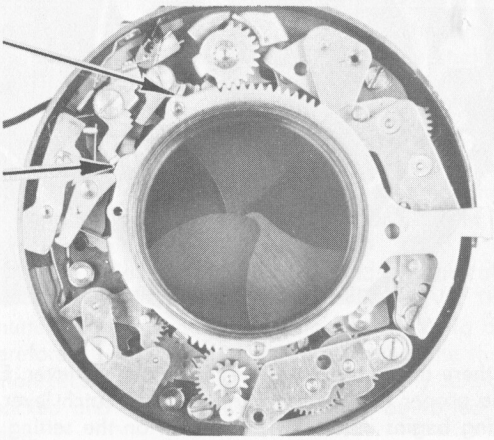


FIGURE 130 **SHUTTER COCKED**

Besides restraining the M-closing lever, the cocking ring also strikes the catch lever at the end of its clockwise rotation. Notice that the same cocking ring lug which formerly engaged the M-closing lever (in the released position, Fig. 127) now engages the catch lever, Fig. 130. This pulls the catch lever out of the first notch in the M-closing lever and aligns it with the second notch.

In figure 130 you can see the slight distance the M-closing lever must travel before it is arrested by the catch lever (the distance between the catch lever and the second notch in the M-closing lever). This movement is enough to close the contacts on "M" sync.

Assume now that the cocking ring has been released and has started its counterclockwise rotation. Before reaching the sync retard lever, the cocking ring frees the M-closing lever. Thus, the M-closing lever moves under spring tension until it is once again arrested by the catch lever—this time the catch lever engages the second notch in the M-closing lever. The M-closing lever simultaneously presses the contact lever against the terminal strip, firing the flash, Fig. 131. When the cocking ring reaches the end of its counterclockwise rotation, it both trips the inner release lever and pulls the M-closing lever away from the terminal strip.

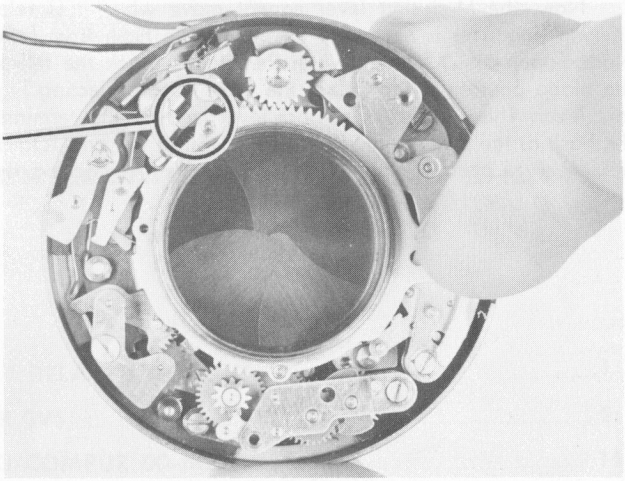


FIGURE 131

Turning the MXV selector ring to "X" does two things: both the M-closing lever and the sync retard lever are blocked out of action. One tab on the MXV selector ring is moved against the tail of the sync retard lever, Fig. 132. This holds the sync retard lever away from the cocking ring. Simultaneously, another tab on the MXV selector ring moves against the M-closing lever (visible underneath the grounding strip in figure 132).

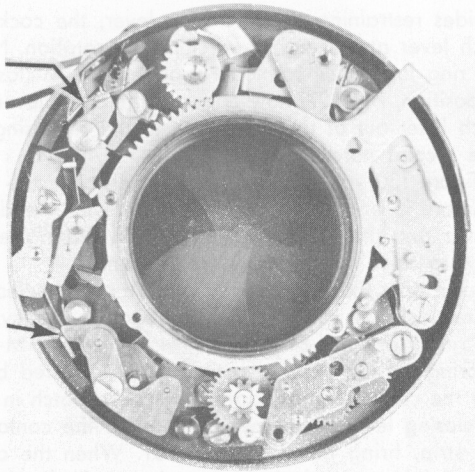


FIGURE 132 SHUTTER SET TO "X"

Now, the M-closing lever cannot move when it is released by the cocking ring. This is necessary to prevent the flash from firing before the blades open on "X" sync. When the blades reach the full-open position, the blade operating ring strikes the downward-projecting lug on the contact lever. This forces the contact lever against the terminal strip, firing the flash at the proper time for "X" sync. Since the sync retard lever is also held out of action, it cannot interfere with the cocking ring's rotation.

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