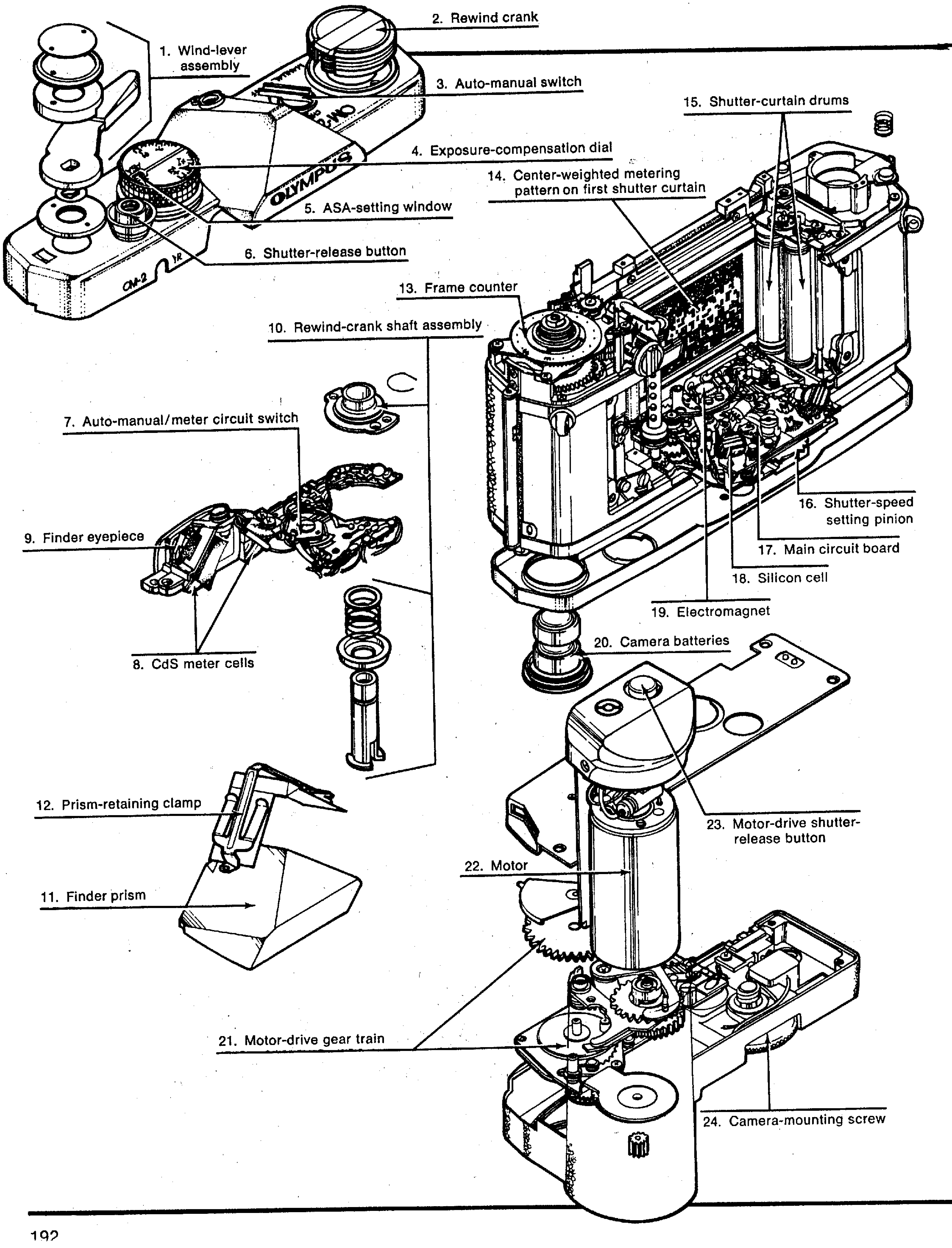
INSIDE YOUR CAMERA: OLYMPUS OM-2



How do you squeeze the world's most sophisticated auto-exposure system into an OM-1-sized body? With advanced electronics, refined mechanics and lots of new-fashioned ingenuity.

If you had to list the five most technically innovative 35mm single-lens reflex cameras in history, you'd have to include the Olympus OM-2. Why the OM-2? That's a good question. After all, its outside dimensions are identical to those of the OM-1, its direct predecessor, and its shape is so similar its difficult to tell the two models apart without looking at their top plates. Operationally, the sole difference between the OM-2 and its elder brother is the former's automatic-exposure control, which in itself, is hardly unusual these days. However, you're getting warm when you bring up the subject of exposure, for the Olympus OM-2's control system is unique and unparalleled. In short, the OM-2 is the only SLR that can read the light directly from the film surface and then automatically set the exposure accordingly. All others measure the light from the finder screen or by means of cells placed behind (or under) the rapid-return mirror. Are you aware of the implications of this system of direct light reading off the film surface? It means that the correct exposure is being determined *as it's being made*, not before the time of exposure, as all other through-lens-metering cameras have done up 'till now. This eliminates the need for elaborate memory-hold devices that store predetermined exposure information until the moment it's needed. From the user's point of view, such a direct reading method provides inherent metering advantages over an unusually broad range of photographic applications, including photomacrography, photomicroscopy, duplicate-making, copying or completely automated electronic flash photography.

Before we get into the OM-2's specifics, let's tip our hat to the Olympus design team led by Y. Maitani for their successful creation of this highly complex machine. At the same time, let's pay our respects to the many innovative Japanese engineers from other companies whose components and know-how contributed directly to the OM-2's production. As usual, we'll concentrate on the camera's most important and unique areas, skipping other self-explanatory points.

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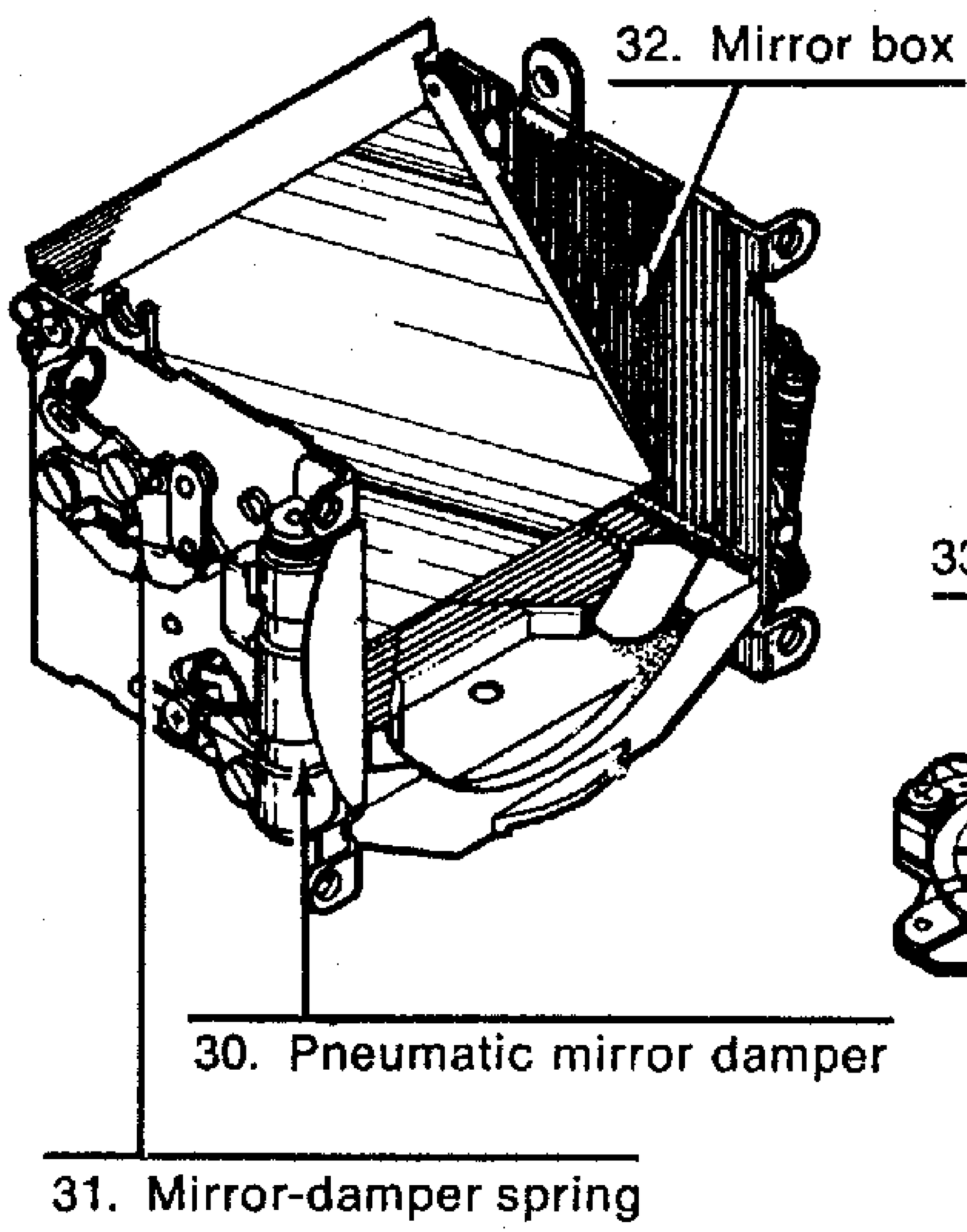

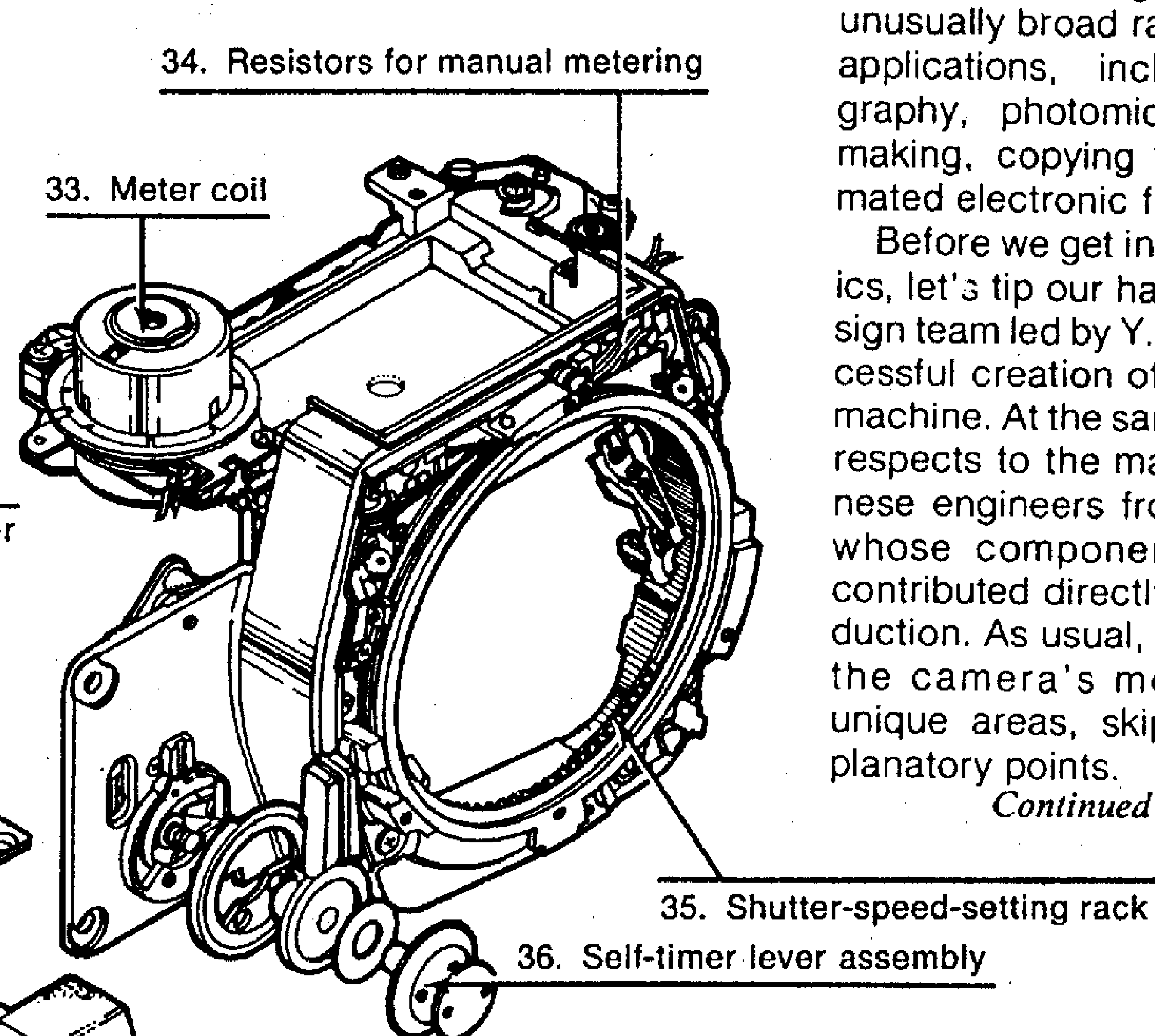

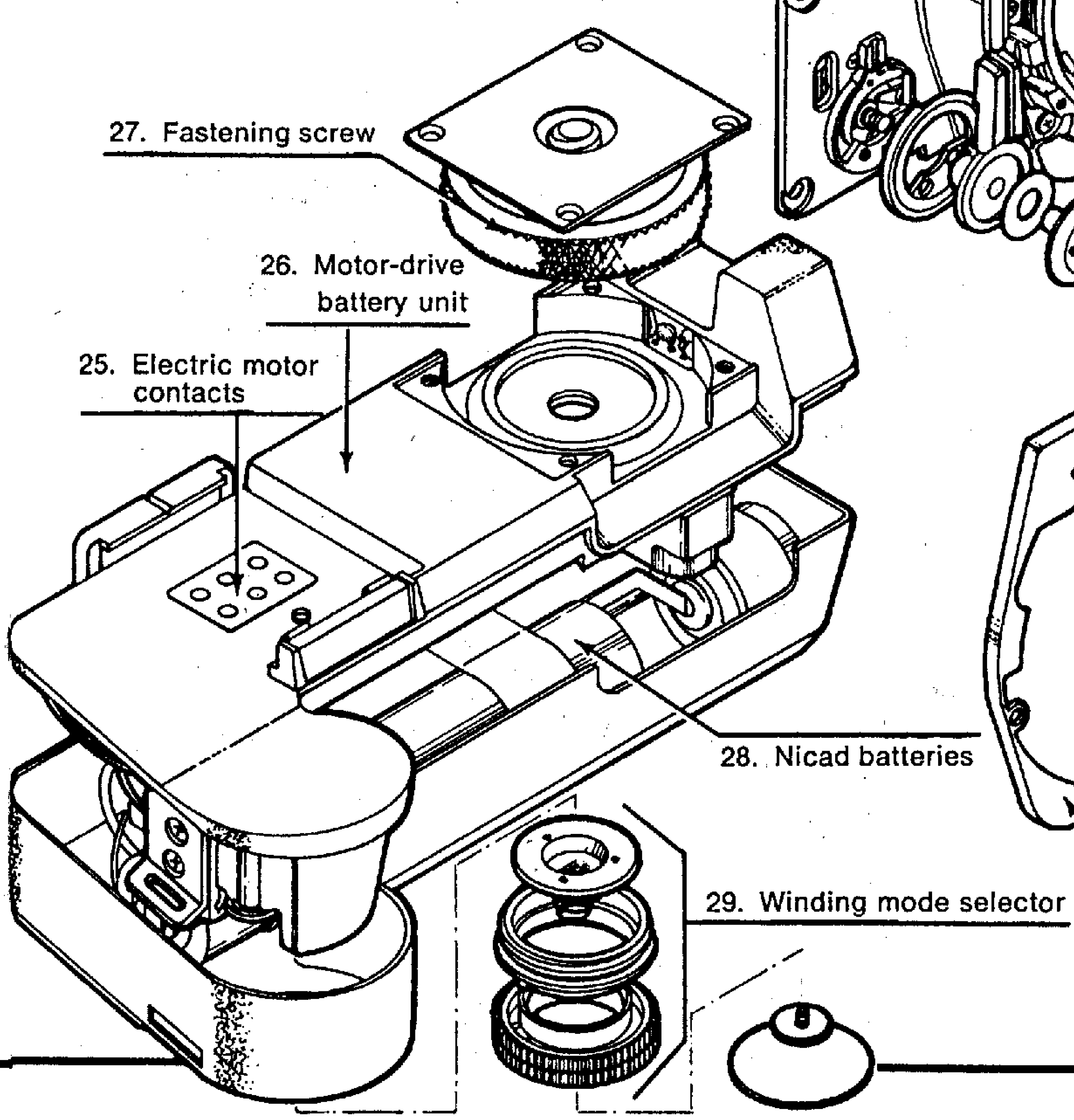

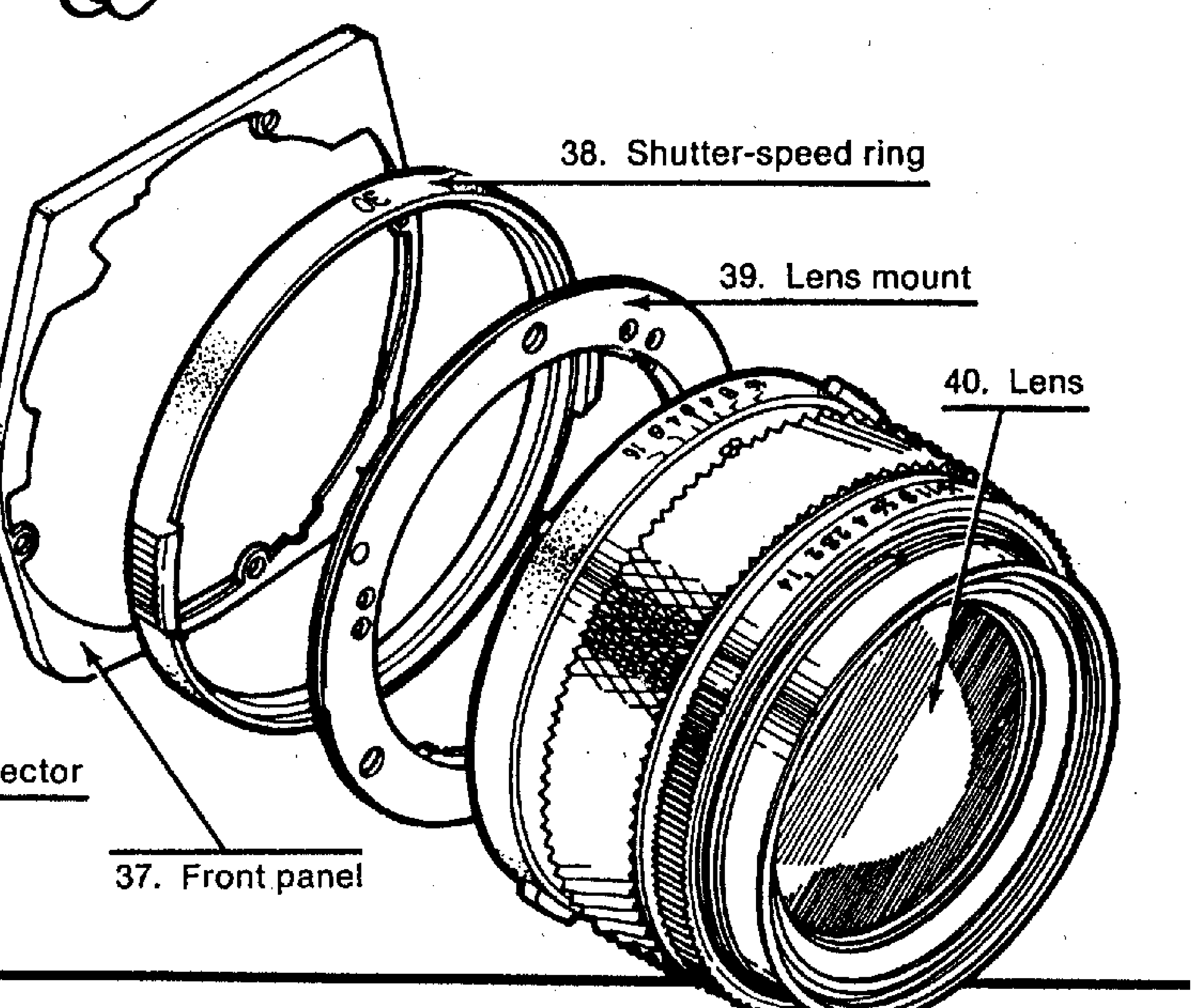

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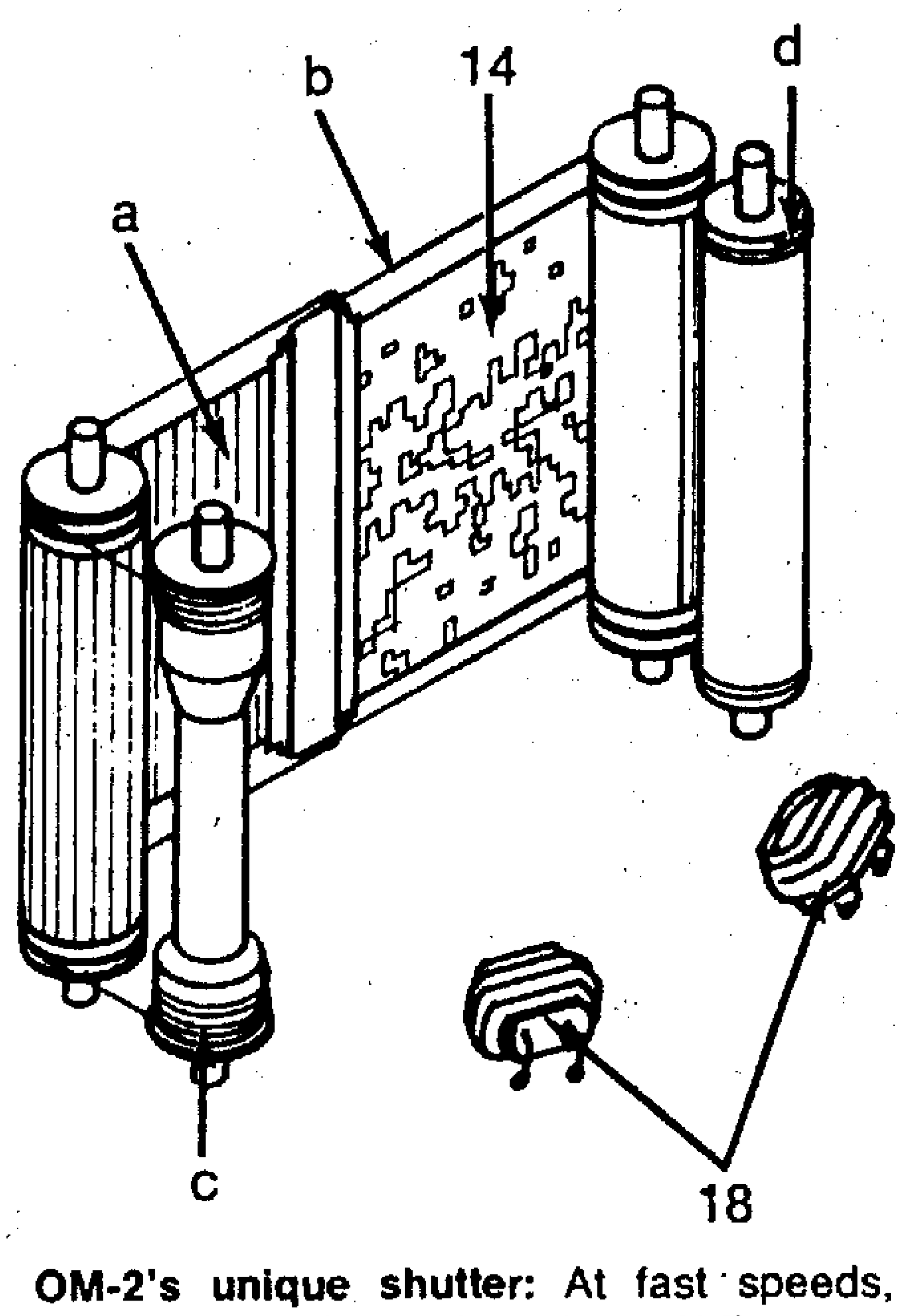
3. Auto-manual switch. This little device does much more than its name implies. In the auto-exposure mode, two silicon cells in the exposure-control circuits work automatically, providing the proper shutter speed for the aperture selected (i.e., aperture-preferred system). Simultaneously, two additional CdS cells offer a continuous shutter-speed indication, reading it out in the finder by means of a needle pointing to a vertical shutter-speed scale. When you set the switch to manual, the automatic exposure circuit's silicon cells are shut off and only the separate CdS meter circuit operates. Also, the shutter-speed scale in the finder retracts, displaying only match-needle pincers. Even more interesting is the "OFF" meter mode, where no information is visible in the finder and the needle remains stationary at the bottom, left-hand corner of the screen. However, if you press the shutter-release button with the OM-2 turned off, the shutter still provides the proper speed automatically (between 1/30 and 1/1000 sec.) so that, in most cases, you will get a good exposure even if you fire the camera accidentally!

Why not below 1/30? Conceivably, the shutter release could be pressed with the camera in the gadget bag and the shutter would then remain open, draining the batteries quite rapidly. This switch, one of the few we've seen that works even when it's off, reflects the designer's philosophy that picture taking opportunities arise regardless of the position of the meter switch, and the camera should work properly any time you need it. To conserve battery power, the switch must shut off energy-consuming circuits without interrupting camera operation. Remarkably, this has all been achieved and the only inconvenience you might encounter is that you do not know how fast a shutter speed you're using when the camera's turned off!

Since the auto-exposure silicon cell circuit doesn't switch on until you actually press the shutter release, the automatic-exposure-control system doesn't consume any more power than is actually needed for exposure control. On the other hand, the CdS circuit used for manual exposure control (and for viewfinder shutter-speed readouts) does require some accommodation time to achieve exposure accuracy because of the well-known CdS memory effect. Therefore, it has to be switched on beforehand, thereby consuming a little more power than is actually needed.

8. CdS meter cells. Since the OM-2 doesn't have an exposure memory system like other auto-exposure cameras (a "during-the-exposure metering" camera doesn't require one), there would be no way of providing an instant shutter-speed indication without some sort of backup system. Olympus decided to have the shutter-speed readout visible whenever the photographer wants to see it, and a continuously variable analog indication by means of a meter needle is one of the best ways of doing so. However, in consequence, the readout in the finder might be slightly different from the actual shutter speed set by the auto-exposure control circuit, since the silicon cells primarily provide a center-weighted reading from the film plane while the CdS cells provide an averaging reading off the focusing screen. In practice, of course, the OM-2's shutter-speed readouts provide a good approximation of the actual auto-exposure shutter speed. They've got to, because the CdS part of the meter system is used for manual exposure determination in the match-needle mode. And since match-needle metering usually takes a few seconds, the CdS memory lag poses no operational problems.

14. Center-weighted metering pattern. The center-weighted metering pattern on the OM-2's first shutter curtain (14 below) is unique to this camera. As we mentioned, this camera determines the exposure by metering reflected light from the film surface. But there are a number of complications. To understand them better, let's take a look at the simplified drawing below. Since the OM-2 is a focal-plane shutter camera, only a narrow slit formed between the two shutter curtains scans across the film at shutter speeds faster than 1/60 sec. Obviously, this means that the meter cells can't possibly read the light reflected from the entire film frame at once. Furthermore, at such speeds, the second shutter curtain must start traveling before the first shutter curtain opens fully, and the precise timing of the second curtain's release must be determined by the meter circuit almost immediately after the first curtain has started moving. So, at this point in time, the silicon meter cells (18) only see the surface of the first shutter curtain. The Olympus design-



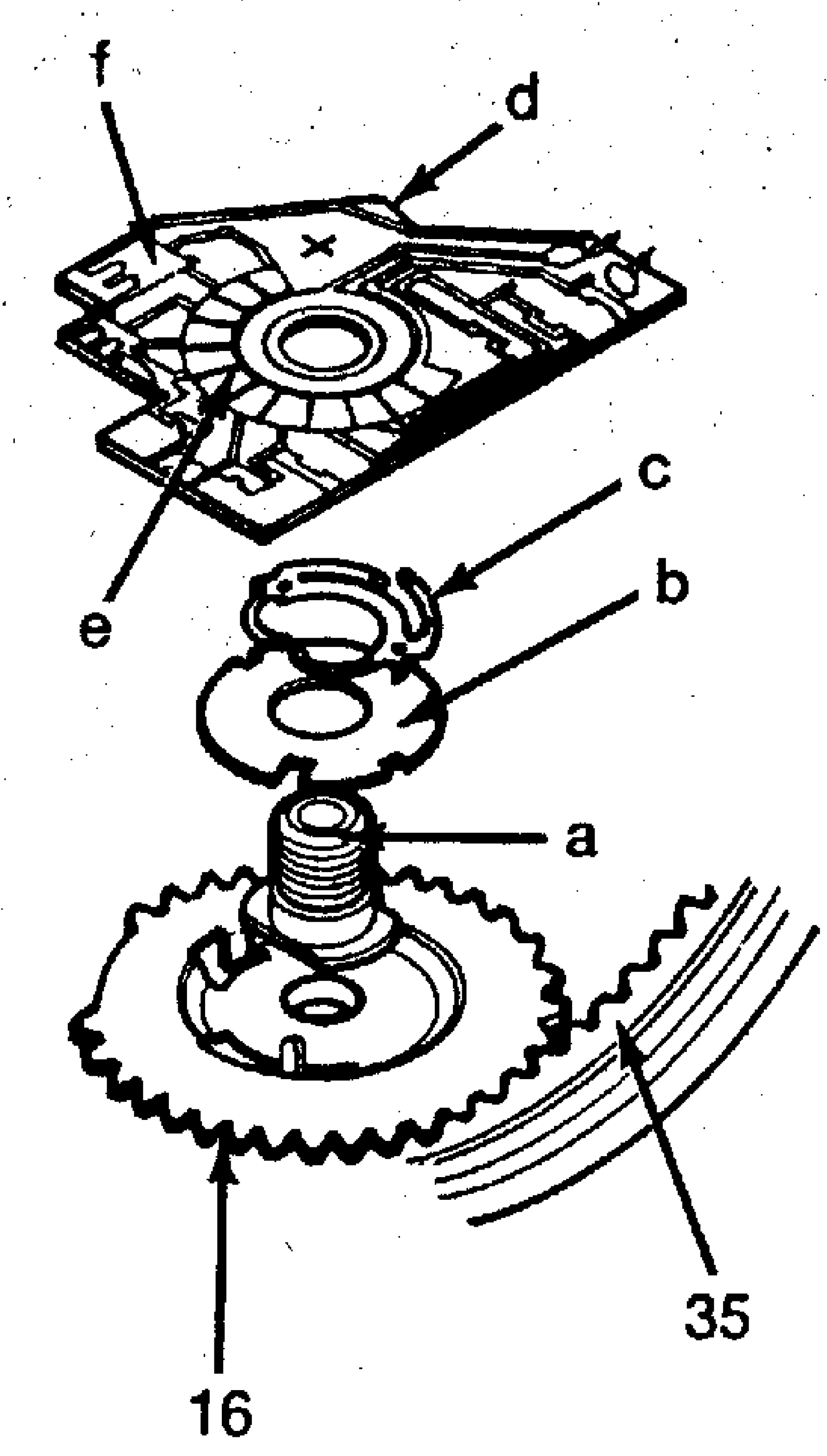
OM-2's unique shutter: At fast speeds, cells (18) read curtain pattern (14).

ers' approach in making a virtue of this necessity is truly brilliant. Since the advantages of center-weighted metering in high-brightness and high-contrast lighting situations was already well known, Olympus simply spattered the first shutter curtain with a special computer-designed pattern that assured that readings off it would be center weighted. In combination with a condenser lens on each silicon cell, the metering is strongly center weighted at speeds of 1/60 sec. and faster. As speeds get slower and slower, the meter cells read more of the light reflected directly from the film surface, and the condenser lens over each cell assures that the metering pattern is less center weighted.

15. Shutter-curtain drums. As long as we're dealing with the shutter curtain, let's examine the shutter-curtain mechanism in somewhat greater depth by referring to the simplified drawing on page 172.

The OM-2's shutter mechanism is descended directly from the OM-1—it's a four-drum system which uses a pair of rubberized-cloth curtains. Mechanically, its design is quite conventional except that it employs string to pull the curtains (instead of the cloth ribbons traditionally used in Leica-type focal-plane shutters) in order to keep the shutter mechanism as vertically compact as possible. The string itself (b) is interesting. It is not a single thread, nor does it consist of twisted strands like an ordinary rope. This is because a single cord is not sufficiently flexible, and twisted threads aren't suitable because of their spiral movements at high speed. After a long search for a suitable material, Olympus settled on a woven nylon thread with four to six Tetron core threads in it. It measures 0.32mm in diameter. Use of this shutter-curtain thread has become widespread in a very short time, and it's now used in many compact cameras, including the Contax RTS and the Mamiya's new NC 1000.

The most important trick camera designers must learn if they're going to employ shutters using this type of thread is how to wind the thread on the drums in an orderly fashion without overlapping strands or the spiral becoming too loose. Needless to say, the thickness and surface finish of the drums, the diameter of the pulley (c) and the width of the groove are just some of the factors affecting the shutter's performance.

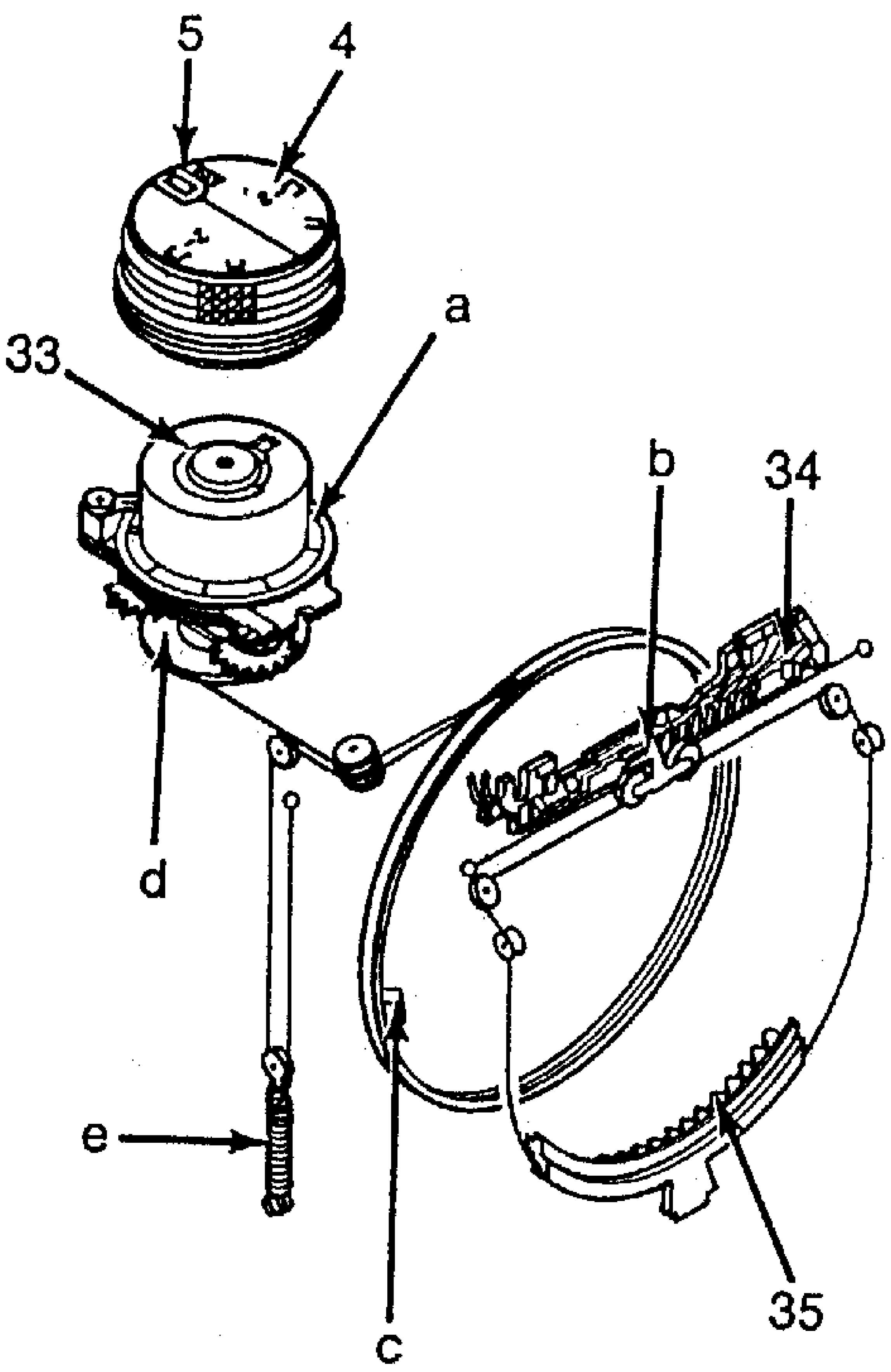


Electro-mechanical interface: Circuits above set speed-control gear (16) below via spider-like contact brush (c).

16. Shutter-speed setting pinion. As you switch the exposure mode to manual, the main circuit (17) is shut off and you must set your desired shutter speed on the shutter-speed setting ring (38). This shutter-speed ring (38) is directly affixed to another ring along with the shutter-speed-setting rack, which, in turn, relays information to this pinion. As you can see in the simplified drawing on page 198, the shaft of pinion (a) holds an insulator (b), as well as a gold-plated, spiderlike spring which works as an electric contact brush (c). The brush (c) slides along the gold-plated electric contacts (e) which are imbedded in the fiber-glass board (d), along with electric resistors (f) visible at the corners of the board. Those resistors actually control the manual speed set on the shutter-speed ring (38). For visual clarity the contacts and the resistors are shown affixed to the top of the board, but in actuality, these electronic elements are located at the bottom of the board.

Incidentally, even when you've selected the manual mode, the timing of the second shutter-curtain release is controlled by the same main circuit board (17) used for automatic exposures.

Skipping the motor-drive unit for the time being, let's examine this manual metering system next.



Exposure-control system: On manual or auto, f/stop, shutter speed are keyed in.

34. Resistors for manual metering. With other cameras, when the shutter-speed setting pinion selects a resistor that controls a certain shutter speed, this same resistor is also used to provide the proper amount of meter-needle deflection for match-needle metering. This isn't so with the OM-2. As we've pointed out, in the manual mode a pair of CdS cells determine the reading and the silicon cells that read the film or first shutter curtain are inoperative. Those two distinct types of cells must use separate circuits because silicon cells are current generators whereas CdS cells are current modulators. The impedance requirements of both types of circuit are also different.

Therefore, there are separate circuit boards (7) and separate resistors (34). As you turn the shutter-speed dial (35)—the ring with the rack—a thread situated around this ring pulls a set of brushes on wheels over the resistor contacts. The brushes and contacts are all gold plated, and the contacts themselves are connected by a set of ceramic resistors. These resistors also connect with the meter circuit (7), the CdS cells (8), the meter coil (33) and with the ASA-setting resistor [(a) in the simplified drawing].

You can now understand how the shutter speed is related to the meter-needle deflection but you still don't know how the set lens aperture is relayed to the match-needle metering system. Here's how.

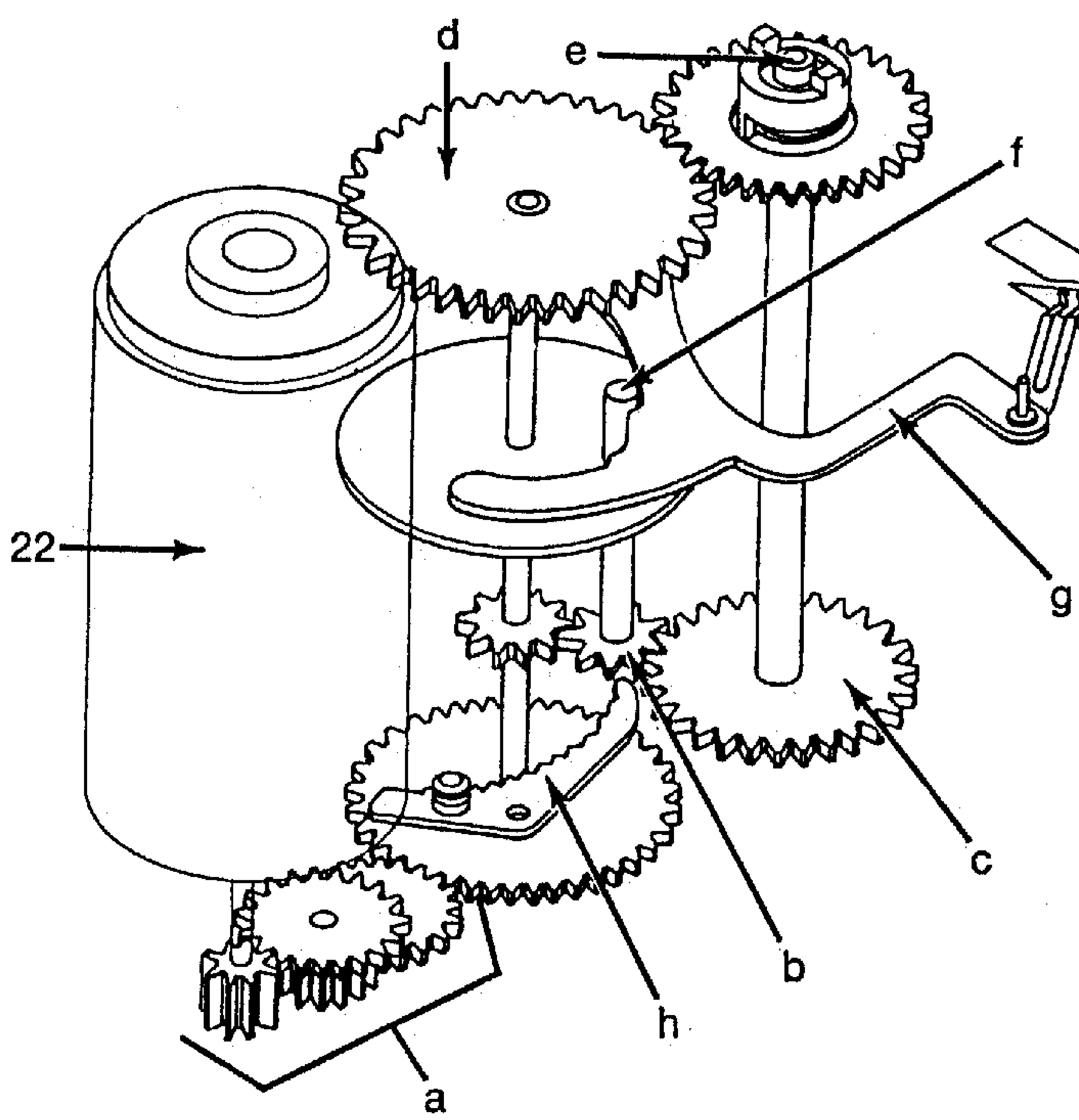
There is a protrusion, or tab, on the back of each lens that turns along with the aperture-setting ring. This tab contacts an angled pin (c) inside the lens mount of the camera body. As you turn the aperture ring, a ring connected to this pin rotates along with the tab on the lens and maintains the pin-to-tab-contact by means of tension supplied by springs (e). One end of the thread connected to the shutter-speed dial is affixed to wheel (d), at the right under the meter coil, and transfers the rotation of the ring and rack to the meter coil. This way the meter needle moves physically as the aperture changes. Now let's turn to the motor drive.

21. Motor drive gear train. In the main drawing on page 192, notice that the gear train is quite flat and the entire winding mechanism is extremely compact. As soon as an exposure is complete, the motor begins to work (actually it doesn't really—it needs a little help from a crescent-shaped gear see (h) in drawing above.) The rotation of the motor is transferred through gears (a) to the large gear behind them, reducing the overall turning speed. There is a large, flat wheel above this large gear, and there's a planetary gear directly underneath it. This large, flat wheel and the large gear above it are directly connected to the movement of the main shaft only by slight friction (by the way, in this simplified drawing all the shafts have been extended tremendously to clarify the spearation between each laterally moving part).

The planetary gear turns counterclockwise and pushes the wheel clockwise. But when the top of the shaft of the planetary gear hooks up with the first protrusion on switch lever (g), the wheel stops and the planetary gear engages with a gear at the bottom of the winding shaft (e) and drives the winding shaft. When the film has been advanced and the shutter cocking complete, the winding shaft stops, and the planetary gear and its shaft begin to rotate, pushing against the protrusion on lever (g). Lever (g) is now pushed outward by the rotation of the planetary gear and the electric brush on its right end slides off the circuit switch and turns the motor off. Now the planetary gear shaft is caught by the second protrusion on the switch lever and the planetary gear disengages from gear (c). The disengaged planetary gear is then caught by the top of the crescent-shaped gear which pushes the planetary gear in a clockwise direction. But the gear is stopped by the second protrusion of the lever so it can't move.

As the exposure is completed, a crescent-shaped lever seen in the main drawing directly under the switch lever and right above the crescent-shaped gear pushes the planetary gear shaft inward and hooks the shaft off the second protrusion. But this movement is too small to switch in the electric brush, and without motor power, the planetary gear cannot turn or spin. Here's another role for the crescent-shaped gear: once the planetary gear has been hooked off the second protrusion and is free to spin, the crescent gear's teeth push it to the left by means of its strong spring. This induces the planetary gear to rotate, and as the planetary gear turns, lever (g) slides inward, and the electric brush re-engages the contact switch to turn the motor on.

We have, so far, omitted explaining the function of gear (d) and its counterpart. These are balancing gears which are not driven by the shafts, but serve to stabilize the winding shaft (e), preventing it from moving laterally.



Inside OM-2's motor: Explanation of gear train operation begins above.